REDFISH PASS SAND SEARCH AND BORROW AREA DESIGN

Project No. 1745001138

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(Final)

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Executive Summary

APTIM completed the 2019 Inlet Management Study of Redfish Pass and Adjacent Beaches as an update to the original Redfish Pass Inlet Management Plan (CPE, 1995) to address natural and anthropogenic changes that have occurred since completion of the 1995 study. The study has been submitted to the Florida Department of Environmental Protection (FDEP) for review and formulation of the State's adopted inlet management plan. The results of the study suggested that the plan to manage the inlet should include dredging the Redfish Pass ebb shoal and placing the material on the adjacent beaches in an effort to balance the sediment budget and utilizing the ebb shoal as a sand source. In the interest of identifying beach quality sand within these areas, in 2020 APTIM conducted a comprehensive geophysical and geotechnical sand search for Redfish Pass. This sand search included a desktop study as well as geophysical, geotechnical and cultural resource surveys to collect information to characterize the sediment source for use in the design and permitting of a borrow area.

Based on samples collected from Sanibel Island and Captiva Island in 2010 and 2013, the material that was targeted for the borrow area design was fine- to medium-grained quartz sand, with trace fines (<5%).

A single borrow area (Redfish Pass Borrow Area I) was developed. The horizontal and vertical extents of the borrow area containing beach compatible sediment were designed based on various parameters. The horizontal extent was determined by the vibracore's area of influence (500 ft. radius buffer). The design cut geometry took into account the use of a cutterhead dredge. The vertical extents of the borrow area were determined from the vibracore material, a minimum of two feet above non-compatible sediment and a minimum of two feet above the bottom of the core (if applicable). The borrow area water depth ranges from approximately -5.0 ft. to -20.0 ft NAVD88 on the shoal and will require the use of a cutterhead dredge due to shallow depths in and around the borrow area design.

The center of the borrow area is located approximately 3,700 ft. southwest of FDEP monument R-084. No potential cultural resources were identified in the vicinity of the borrow area. The final borrow area has five cut elevations ranging from -15.0 ft. to -18.0 ft. NAVD88. The total borrow area volume was calculated to be approximately 716,200 cy, consisting of predominantly fine- to medium-grained quartz sand with trace fines (<2%) and trace to some shell hash, fragments and whole shells. Composite statistics indicate that the borrow area has a mean grain size of 0.34mm and a wet Munsell Color Value between 6 and 7.

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List of Acronyms

CEPD	Captiva Erosion Prevention District
CPE	Coastal Planning & Engineering, Inc.
FDEP	Florida Department of Environmental Protection
FWC	Florida Fish and Wildlife Conservation Commission
GIS	Geographic Information System
NGS	National Geodetic Survey
NOAA	National Oceanic and Atmospheric Administration
PSM	Professional Survey Mapper
ROSSI	Regional Offshore Sand Source Inventory
RTK GPS	Real Time Kinematic Global Positioning System
SHPO	State Historic Preservation Office
TBM	Temporary Benchmark
USFWS	U.S. Fish and Wildlife Service
VRS	Virtual Reference Station

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Introduction

Redfish Pass is a natural inlet that separates the barrier islands of North Captiva Island (to the north) and Captiva Island (to the south) and connects Pine Island Sound and the Gulf of Mexico (Figure 1). Redfish Pass interrupts the natural alongshore sediment transport from North Captiva Island to Captiva Island and traps sand within the shoal complex. The shoal has been growing since the formation of the Pass in 1921.

APTIM completed the 2019 Inlet Management Study of Redfish Pass and Adjacent Beaches as an update to the original Redfish Pass Inlet Management Plan (CPE, 1995) to address natural and anthropogenic changes that have occurred since completion of the 1995 study. The 2019 study has been submitted to the Florida Department of Environmental Protection (FDEP) for review and formulation of the State's adopted inlet management plan. The results of the study suggest that the plan to manage the inlet should include dredging the Redfish Pass ebb shoal and placing the material on the adjacent beaches in an effort to balance the sediment budget and utilizing the ebb shoal as a sand source.

Modeling conducted as part of the 2019 Inlet Management study suggests that areas of the Redfish Pass ebb shoal can be mined without affecting the adjacent beaches. Therefore, in the interest of identifying beach quality sand within these areas, APTIM conducted a comprehensive geophysical and geotechnical sand search for Redfish Pass. This sand search included a desktop study as well as geophysical, geotechnical and cultural resource surveys in order to collect information to characterize the sediment source for use in the design and permitting of a borrow area.

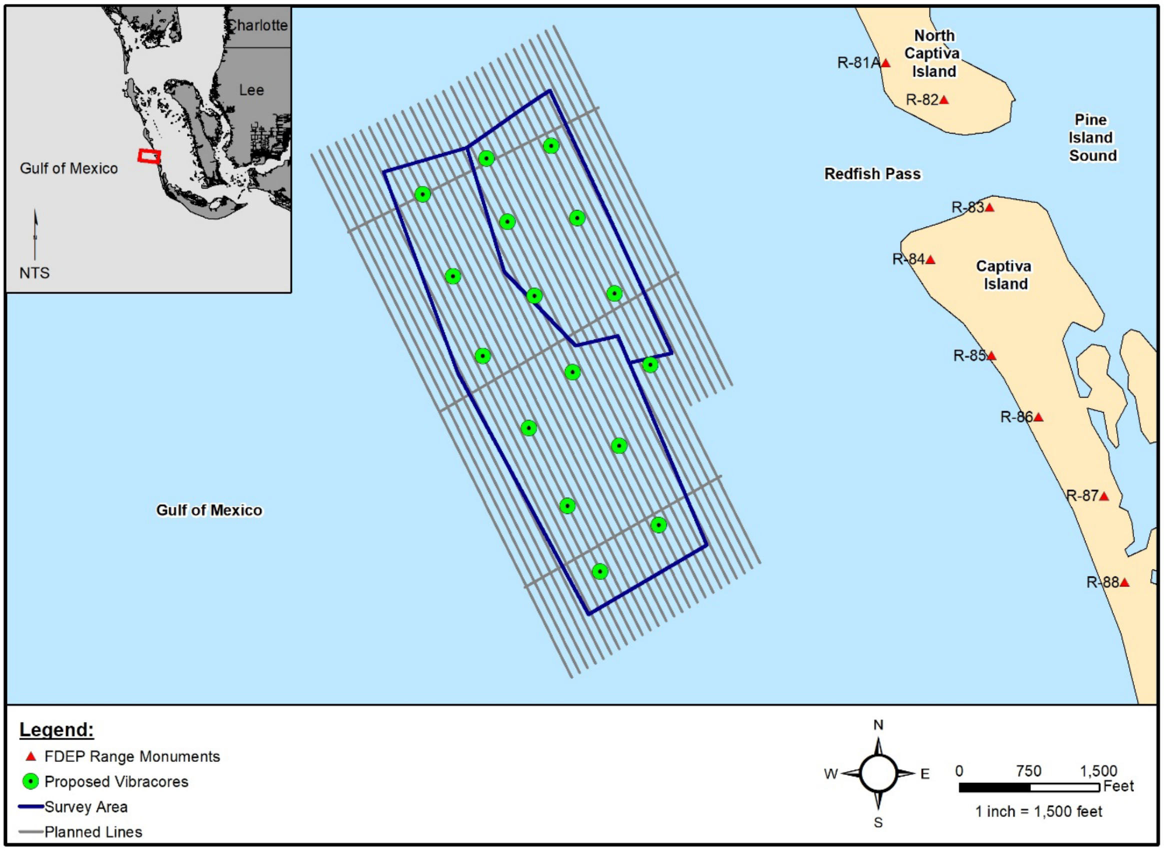


Figure 1. Project location map.

Investigation Sequencing

A systematic approach to marine sand searches has been developed over the years by the APTIM's Coastal Geology and Geomatics team (e.g. Finkl, Khalil and Andrews, 1997; Finkl, Andrews and Benedet, 2003; Finkl, Benedet and Andrews, 2005). This approach has been modified to apply to any marine sediment investigation, including clay. In a comprehensive marine sand search, APTIM typically divides the investigation into three (3) sequential phases (Figure 2). This phased approach can be modified to meet the scope of the investigation and accommodate the level of work previously performed. Regardless of the phases executed during a sand search, the APTIM investigation sequencing is preserved in order to maintain efficiency and completeness to provide confident results.

Phase I investigations typically consist of a comprehensive review of the recipient beach/project area and sediment resources offshore of the project area. This desktop study examines previously collected information within the geologic context of the investigation area in order to identify features having the highest potential of containing project-compatible sand. The geological background of the area is assessed to identify the geomorphic features that may contain material suitable for the project. Information related to previously investigated areas, potential sand resources and borrow areas, is compiled and related back to the geomorphic features. Geophysical and geotechnical data previously collected within these areas, as well as any reports discussing the findings, are then reviewed. Marine hazards (known cultural resources, critical habitat etc.) are also compiled and evaluated. Based on this analysis, deposits potentially containing project-compatible material are identified. The results of Phase I are used to define the areas that will be surveyed during Phase II investigations.

Phase II investigations usually consist of reconnaissance level geophysical and geotechnical surveys. A joint geophysical investigation (typically collecting seismic reflection profiles, sidescan sonar images, magnetometer and bathymetric data) is conducted at reconnaissance line spacing to assess the thickness of potential sand resources. The wide reconnaissance line spacing is designed to cover large expanses of seafloor. Therefore, the data coverage achieved during Phase II investigations may not be sufficient to develop a detailed sand thickness (isopach) map. The geophysical data collected during this phase are used to design a vibracore investigation plan. Vibracores are collected to determine the sediment characteristics within the areas identified through remote sensing. Typically, a limited number of cores are collected to ground-truth each potential sand resource. Sand resources within the investigation area are then analyzed using Geographic Information System (GIS) procedures that integrate the seismic reflection profile and vibracore data to provide an estimate of deposit thickness and sedimentary characteristics. Beach samples may also be collected from the project area during this phase to characterize the project area/existing beach in terms of grain size, color and composition (i.e. how well the potential borrow area sediment matches the existing material in the project area). The Phase II results are reviewed within the context of beach/project compatibility to identify potential resource areas that will undergo design level investigations during Phase III.

Phase III typically consists of design level geotechnical and geophysical investigations, a cultural resource investigation, and borrow area design. A joint seismic, sidescan sonar, magnetometer and bathymetric survey is conducted within the potential sand resource area(s). The data collected are used to identify possible cultural or environmental resources for avoidance and to develop isopach (sediment thickness) maps for borrow area design. These results are also used to target areas for additional vibracoring. In order to conform to standard geological and engineering practice, fulfill permitting requirements, and conduct geophysical and geotechnical surveys in an expeditious manner, vibracores are collected to provide a maximum spacing of 1000 ft. (industry standard spacing) within the potential resource area. Preliminary borrow area boundaries and excavation depths are developed from the data collected during the Phase I, II and III investigations.

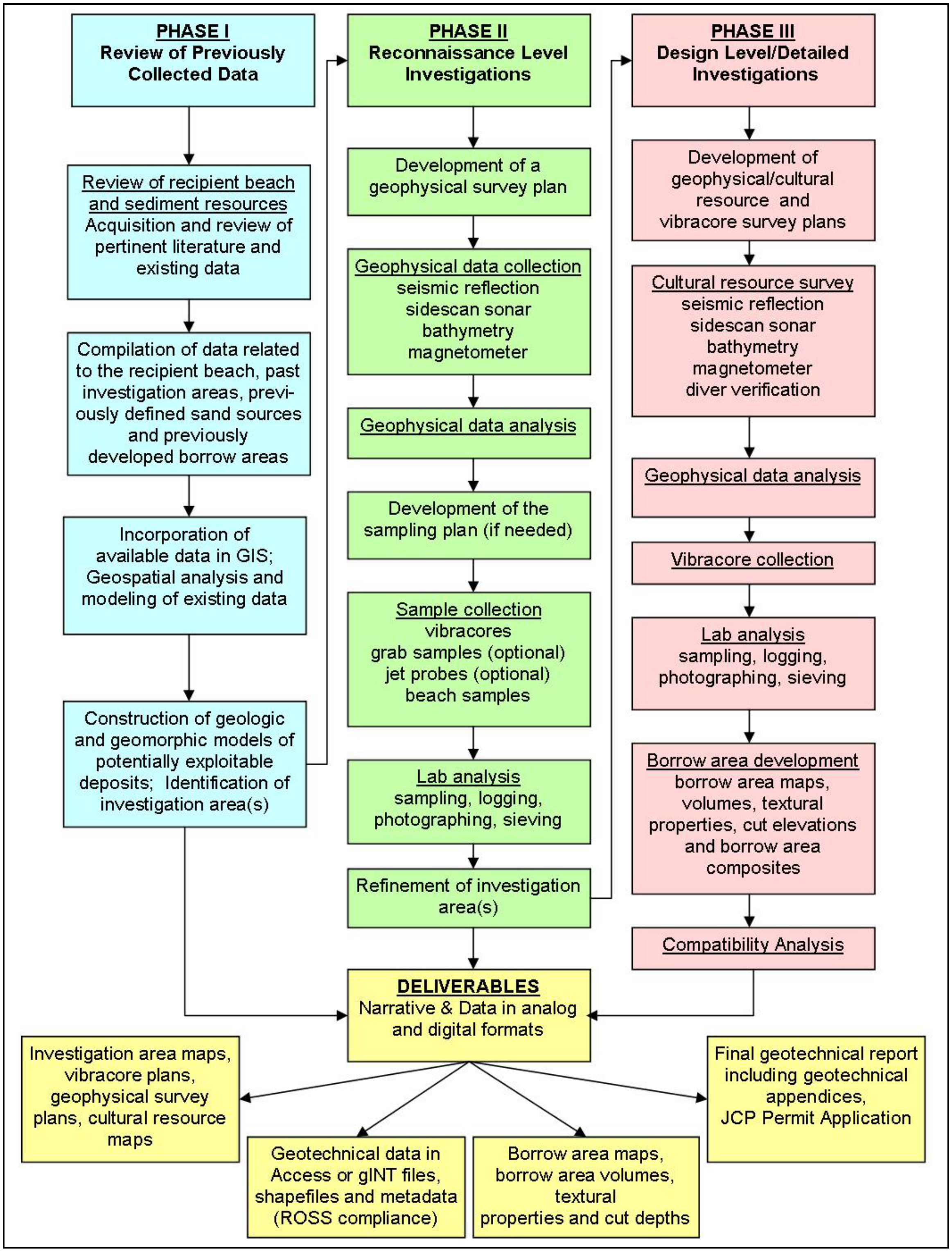


Figure 2. Flow diagram showing the general investigation sequence followed by APTIM during a typical marine sand search investigation.

A final cultural resource investigation is required to permit borrow areas for use. During this investigation, additional geophysical data are collected within the borrow area to achieve a total combined line spacing of 30 m (approximately 98 ft.). A qualified marine archaeologist who meets the standards set forth by the Secretary of the United States Department of the Interior is required to be on the survey vessel at all times during the cultural resource investigation. The geophysical data are then used to identify any cultural resources, submerged hazards or any other features that would affect borrow area delineation and dredging activities. Based on the results of the cultural resource investigation, the marine archaeologist compiles a report that includes recommendations for buffers around any potentially significant magnetic anomalies. The final borrow area design is then modified to take the recommended buffers into account.

During this sand search investigation for Redfish Pass, APTIM conducted a Phase I desktop study, compiled historic data on the Redfish Pass ebb shoal and the surrounding area and delineated a survey area suitable for the requirements of the project. Due to the size of the area being investigated Phases II and III (reconnaissance and design geophysical and geotechnical (vibracore) data collection) were conducted concurrently, followed by the borrow area design.

Phase I Investigations

During the Phase I investigation, APTIM researchers conducted archival literature studies of the inner continental shelf area, with a focus on the ebb shoal offshore Redfish Pass. Past investigation areas, previously identified sand sources and developed borrow areas and previously collected geotechnical and geophysical data were compiled for the recipient beach. This information was brought into a GIS framework, was analyzed within the geologic context of the continental shelf area in order to identify potentially beach-compatible sand resources for further investigation. The information and data compiled during the Phase I investigation is discussed below.

Geological Background

Developing an understanding of the geologic setting of a project area is an important part of the Phase I investigations because it provides contextual information that sets limits to potential sand resources. A description of the regional geologic setting defines the framework bedrock seafloor surfaces and the sediments that sit on them. The nature of sedimentary deposits determines sand quality, distribution, and its potential use for beach nourishment. It is thus necessary to understand the general continental shelf environments because the distribution of beach-quality sands on the seabed is not random, but spatially organized.

Much of the subsurface of Florida consists of layers of limestone that form a relatively flat-topped structure known as the Florida Platform (Bryan *et al*., 2008) (Figure 3). The Florida Platform, which includes both submerged continental shelf and subaerial land areas, extends southward from the North American continental land mass and separates the Atlantic Ocean from the Gulf of Mexico. The Florida Platform was constructed undersea as calcium carbonate (remains of various sea organisms) was deposited on underlying bedrock (Bryan *et al*., 2008).

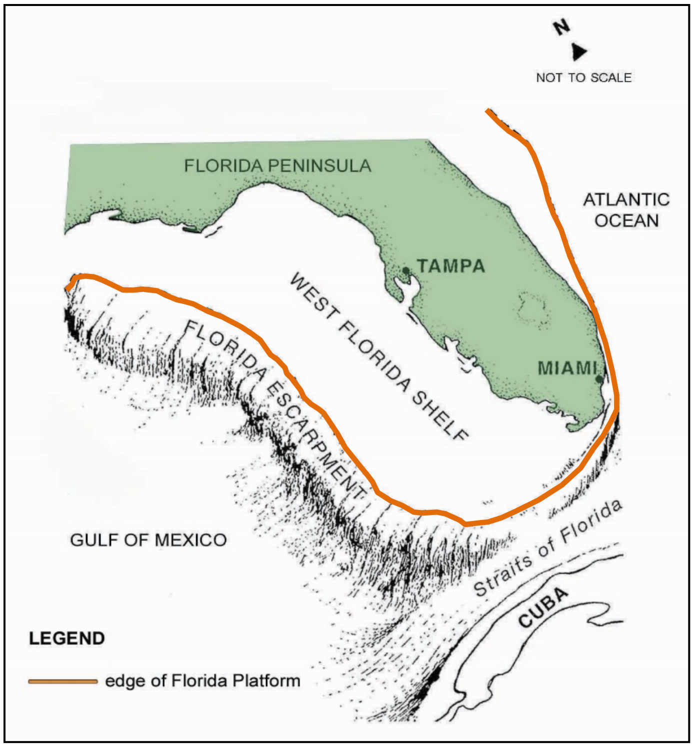


Figure 3. Oblique view of the Florida Platform, which comprises the perimeter landmass and Atlantic and Gulf continental shelves. The study area lies on the description of where study area falls relative to the figure above (modified from Bryan et al., 2008).

The Florida Peninsula is the subaerially exposed part of the Florida Platform and forms the eastern rim of the Gulf of Mexico Basin. It was constructed between the middle Jurassic (180 MYA) and the late Miocene (5 MYA) and is comprised of a thick sedimentary sequence predominantly composed of carbonates and anhydrites. During the initial evolution of the Florida Peninsula, sediments began to cover late Triassic to early Jurassic (c. 205 MYA) mafic volcanic suites that make up the crystalline basement rocks (White, 1970; Winston, 1971). Development of the thick sedimentary cover that makes up the Florida Peninsula was also associated with the early Jurassic embayment of the Gulf of Mexico basin, with its center of deposition passing through the southern archipelago and paralleling the west coast, (Winston, 1992). During the same time or during a later emergence, there appears to have been a tilting of the plateau along its longitudinal axis causing a partial submergence of the west coast and uplift of the east coast, partly accounting for the wide estuaries and offshore channels found along the west coast of Florida.

The Florida Peninsula is the portion of the state of Florida that lies above sea level (Figure 3). It represents the exposed platform. More than half of the Florida Platform remains submerged beneath the Gulf of Mexico and a minor portion submerged beneath the Atlantic Ocean (Bryan *et al*., 2008). Since the early Jurassic, the extent of exposed platform varied. More of the platform was exposed during times of low sea level. At the height of the Pleistocene (1.8 MYA to 10,000 YA) Great Ice Age, the exposed peninsula was twice as wide as it is presently (Bryan *et al*., 2008). During times of high sea level (i.e. during the Cretaceous when the sea reached some of its highest levels), most of the platform was submerged. During the Paleocene and Eocene (65 MYA to 34

MYA), the platform remained completely submerged under a shallow tropical sea 500-miles long and 400-miles wide. This warm, clear water environment was similar to the modern Bahama Banks in that the sediments produced were almost entirely calcium carbonate (Chen, 1965). During such times of submergence, approximately 4000 ft. (in north central Florida) to 20,000 ft. (in southernmost Florida) of carbonate and marine sediments were deposited, which eventually lithified to create the limestone formations that presently underlie Florida. The pronounced eustatic sea-level lowstand that occurred during the late Oligocene and early Miocene in response to a global cooling trend, and which was one of the most rapid and extreme drops in the world sea level (see, for example, discussions in Finkl and Fairbridge, 1979; Fairbridge and Finkl, 1980), had a profound influence on marine carbonate rocks in Florida. Lowered sea levels exposed carbonate sequences to non-marine phreatic and vadose hydrologic conditions, while at the same time inducing erosion. Surface runoff physically and chemically eroded early Oligocene carbonates to produce subdued karst topography of the type described by Sweeting (1973) and White (1988). Extensive groundwater dissolution created cavern systems in Eocene and older rocks, which were precursors to the karst terrain that later developed. Neogene marine transgressions buried and infilled many of the caverns with fine-grained sediments that were reduced from calcareous platform rocks or accumulated as a result of eolian processes. These infilling sediments sometimes included concentrations of marine and non-marine vertebrate fossils (Randazzo, 1997) that significantly increased particle size. Dissolution of carbonate rocks on the Florida platform caused notable changes in rock fabric that were accompanied by the development of different types of pore spaces. Moldic, vugh, and interparticle pore types are the most common and give the carbonates a honeycomb or labyrinth habit to produce porous, sharp-edged, and irregular surfaces. Extensive dissolution created larger cavities such as caves and caverns as well as sinkholes and solution pits (*e.g.* Sweeting, 1973; Randazzo, 1997; White, 1988). When eroded by marine processes, the carbonate rocks of the porous and solution-holed seafloor produce gravel-sized fragments that are commonly washed up on beaches after storms (Hine *et al.*, 1998).

The underlying antecedent topography of the Tertiary Period (2–65 MYA) limestone surfaces, as well as their hardground exposures, significantly influence the orientation and geographic location of Holocene (last 10,000 years) barrier islands and sand ridges along the west coast of Florida, as discussed by Evans *et al.* (1985) and Hine *et al.* (1986). Coastal orientation is generally NW-SE along the southwest coast of Florida (Figure 4). However, there are major offsets at Indian Rocks (Pinellas County), Sanibel Island (Lee County) and Cape Romano (Collier County). The underlying pre-Quaternary (1.8 MYA) surface is composed of irregular karstic limestones that partially control barrier island development, position, and tidal inlet opening (Evans *et al.* (1985); Gibeaut and Davis, 1988; Stapor e*t al.* 1991). The present coastal barrier islands likely formed close to their present location during the latest, relatively stable, stages of the Holocene transgression approximately 4000 to 5000 years ago (Bland, 1985, Davis, 1997, Evans *et al.*, 1985). Historic shoreline data for recently evolved coastal barrier islands and stratigraphic data based on core logs from older barrier islands indicate that they formed in response to a gentle wave climate that transported sediments onshore to shallow water where they shoaled upward to intertidal and supratidal levels (Locker *et al.*, 2003).

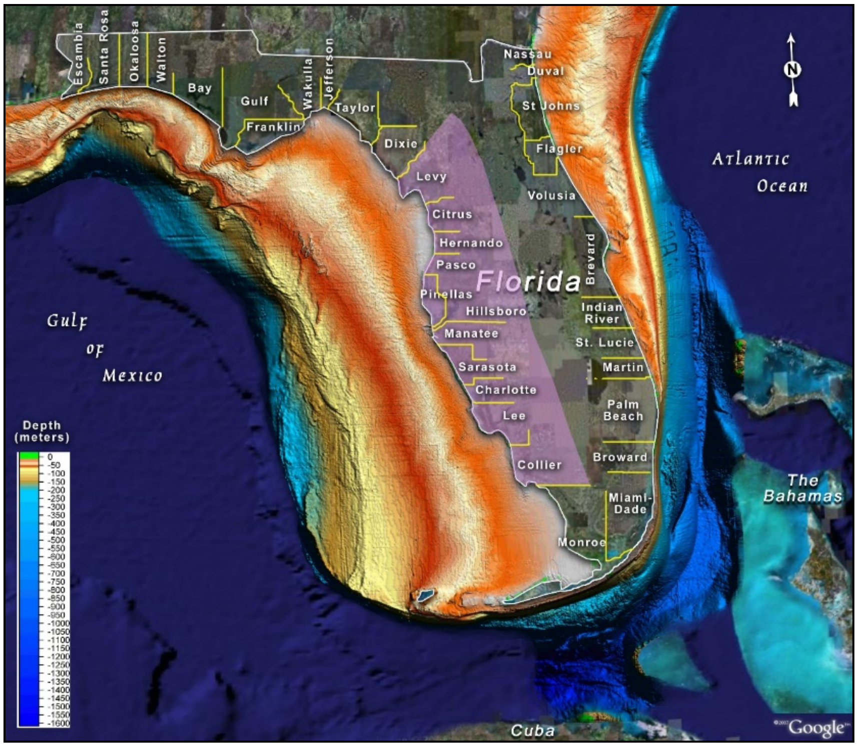


Figure 4. West coast of Florida.

West Coast Potential Sand Resources

The type of sand resource that is targeted during a sand search investigation largely depends on the geologic framework in the area of investigation. A preliminary inventory of sand resources has been developed based on the interpretation of bathymetric Digital Elevation Models (DEMs) (Finkl et al., 2008).

Potential sand resources on the continental shelf off the west Gulf coast of Florida have been mapped. The area that has been mapped spans about 300 miles alongshore Dixie County on the southern margin of the Big Bend to southern Collier County on the northwest flank of Florida Bay. Morphosedimentary bodies in this sand resource zone include sand flats in the form of shoreface-attached sand sheets, ebb-tidal delta complexes, and ridge fields. The ebb-tidal delta complexes are associated with major estuaries (*e.g.* Tampa Bay, Caloosahatchee River) but are of limited areal extent. Shoreface-attached sand sheets are also of relatively minor areal extent. Ridge fields occur farther offshore and are interspersed by rock platform – sand sheet complexes. Generally, beach quality sands on the west coast of Florida tend to be located in bathymetric highs or ridges.

Sand Flats

Various types of sand flats (*e.g.* sheets, blankets) extend from the surf zone to offshore exposures of bedrock (hardground) or the beginning of sand ridge fields. They are of limited extent on the West Florida Shelf (WFS) because this coast is sediment starved and there are extensive nearshore hardgrounds (bedrock exposures). Shoreface sands, which occur at relatively shallow depths (*i.e*. 10 ft to 26 ft), are generally thin and discontinuous along the coast. They have been exploited to advantage for beach nourishment projects. Although rare, there are some sand deposits that blanket shallow (10 ft to 33 ft) waters that may be explored for coastal restoration. Nearshore sedimentary covers are, however, more common offshore barrier islands that lie adjacent to major tide-dominated inlet systems. Shelf cross-sections by Locker *et al*. (2003) show, for example, that nearshore sand blankets 3 ft to 13 ft in thickness occur offshore Anclote Key, Mullet Key, Treasure Island, and Anna Maria Island (interpreted as remnants of the Tampa Bay ebb-tidal delta). Based on their interpretations, it is reasonable to assume that these kinds of nearshore sand bodies may also occur offshore Gasparilla Island and Cayo Costa (remnants of the Boca Grande - Charlotte Harbor ebb-tidal shoal).

Ebb-Tidal Deltas

There are 34 inlets along the west coast of Florida (*e.g*. Dean and O'Brien, 1987; Finkl, 1994; Davis, 1997). These inlets constitute an important source of clean sand for beach nourishment. Ebb-tidal shoals accumulate sediments that are transported by alongshore currents in the surf zone. These high energy conditions result in the accumulation of sediment that is devoid of fines and organic materials, which makes the material suitable for beach nourishment.

Most of these inlets have been modified by engineering works including maintenance dredging to improve navigation conditions, sand extraction for beach restoration, and stabilization by coastal structures, inlet opening and closure, *etc*. Even though tide range is relatively small (less than 3 ft), low wave energy and large back bay (lagoonal) areas contribute to the opening and maintenance of tidal inlets. Additionally, low wave energy facilitates build up and maintenance of large ebb-tidal shoals that store large volumes of sand (Hine *et al*., 1986).

Many of the large ebb-tidal shoals in the area (*e.g.* those offshore Tampa Bay mouth and the entrance to Charlotte Harbor) are tide-dominated and store large volumes of sand that is not significantly influenced by waves (Davis, 1997: Davis *et al.,* 2003). Due to the nature of these large tide-dominated sand bodies, they are poor sediment bypassers and constitute permanent sinks of littoral drift sediments. On the other hand, shoals offshore small tidal inlets with smaller tidal prisms are predominantly wave-influenced and are better sediment bypassers (*e.g.* Johns Pass, Midnight Pass - the latter is currently closed). These inlets have well-developed flood-tidal shoals and relatively unstable cross-sectional areas when compared to their large tide-dominated counterparts.

The volume of sand stored in the ebb shoals associated with the 34 west coast tidal inlets was quantified by Hine *et al*. (1986) and Dean and O'Brien (1987), who also estimated the impacts of the inlets on coastal sediment budgets. This work was updated with site-specific inlet management plans and consulting reports by Balsillie and Clark (2001). Their methods of estimating ebb-tidal shoal volumes included aerial photograph interpretation, inspection of historical maps, analysis of documents, field investigations (bathymetric data), and literature reviews.

Sand Ridges

Sand ridges generally occur in water depths from 26 ft to 66 ft and are associated with modern shelf processes and relict geological and geomorphological controls (*e.g.* bedrock slope). The ridges off the southwest coast may be associated with cuspate forelands and sedimentary headlands or with reworked paleo-ebb tidal shoals and barriers. The ridges are obliquely oriented to the coast, although shore parallel and shore transverse ridges occur in restricted locations.

Multiple sand ridge fields occupy different parts of the West Florida Shelf. Although the sand ridges display similarities, there are notable differences in orientation, morphology, and composition. Due to limited thickness (3 ft to 8 ft) of some of the ridges first explored, it was initially thought that sand ridges offshore the southwest Gulf coast could not provide sufficient volumes to support projected beach nourishment requirements. Today, however, exploitation of thinner ridges is feasible using hopper dredges that are designed to dredge long shallow cuts. Stratigraphically, the sand ridges are separated from the underlying Tertiary carbonate strata by a Holocene ravinement surface (Twichell *et al*., 2003). The top of the oldest unit, the present hard rock seafloor, is Miocene to early Pliocene Hawthorn Group (Arcadia, Peace River and Tamiami formations). Depressions in these bedrock (hardbottom) units, which are related to karst topography, contain some Pleistocene strata immediately below the ravinement surface cut during the Holocene marine transgression. The youngest units are ridge sediments, which are generally late Holocene in age (Twichell *et al.,* 2003). The ravinement surface separating ridge sands from older deposits is flat lying with a thin discontinuous veneer of sediments in troughs between ridges. The flatness of the surface suggests that there has been minimal erosion of trough floors during the Holocene rise in sea level.

The sand ridges are generally shoreface-detached (except for transverse ridges located offshore of Anna Maria Island) and sediment starved. They are mostly part of an active seafloor environment, although there may be truncated remnants that are now buried. Evidence suggesting that these are active sand bodies includes: (1) relatively young ^{14}C dates (< 1,600 YBP) from foraminifera in the shallow subsurface (6 ft below seafloor), (2) sediment textural boundaries and development of small bedforms in an area of constant and extensive bioturbation, (3) morphological asymmetry of sand ridges, and (4) exceedance of critical threshold velocity of sediment transport (based on current meter data) (Harrison *et al*., 2003) by storm-induced bottom flow. Compositionally, the sand ridges contain a mixed siliciclastic - carbonate sand facies that dominates the surface and shallow subsurface (to -6 ft) (Edwards *et al*., 2003). The carbonate content ranges from 7.1% to 51.8%, with the remainder being quartz. Mean grain size ranges from 0.09mm to 0.8mm.

Theories accounting for the modern formation of seabed sand ridges account for the interactions between waves, currents and sediments. Numerous theories have been suggested to explain ridge formation offshore from sedimentary headlands (*e.g*. Duane *et al*., 1972) and shoreline re-orientations such as Sand Key and Sanibel Island. Dyer and Huntley (1999) classified these types of features as "headland banks" or "en echelon banks" that formed along the retreat paths of headlands and spit growth. These researchers describe this type of bank formation in terms of spit growth and subsequent spit detachment from the headland as the coastline retreats. The effects of currents and wave gradients can subsequently reshape and fragment these features to form multiple ridge systems. Independent from evolutionary mechanisms, once a bed disturbance (sand ridge) is formed, the stability theories of Huthnance (1982) may help explain growth and maintenance even if the forces that originally generated the banks are no longer operative. Huthnance (1982) explained the growth and realignment of ridges by combining effects of cross-bank and along-bank flows (current refraction and bed friction). According to his theory, the along-crest component of currents will be reduced by the influence of friction-refraction turning the current vectors toward the ridge crest. In a cross-bank scheme, the flow speed is reduced on the downstream side of the bank due to friction over the ridge, thus inducing sediment to fall on the ridge area. For the West Florida Shelf ridges, recent current meter data indicates that the critical threshold velocity of sediment transport is frequently exceeded (Harrison *et al*., 2003), so that these sand ridges and bedforms are influenced by modern storm-induced bottom flows. The same authors (Harrison *et al*., 2003) also invoked the stability principles of Huthnance (1982) to explain sand ridge growth. Other sedimentary ridges, occurring offshore of straight shorelines may have different genesis and control mechanisms as indicated by their different geomorphology and stratigraphy. The ridges offshore Collier County, for example, exhibit stratigraphic sequences that resemble paleo inlet ebb-tidal shoal environments. That is, their genesis may be linked to the inlet retreat path model described by McBride and Moslow (1991). Because ebb-shoals along this coast are relatively small and sediment supply is meager, the ridges are thinner and have less lateral extent than those described by McBride and Moslow (1991). They do, however, contain a sedimentary package that describes a succession of bay-shoal sediments rich in shells and silt overlain by relatively clean, re-worked beach-marine sands on the top sequences.

The **Anclote Ridge Field** (Finkl *et al*., 2007), which contains about 32 x 10^5 hectares (1236 square miles), lies offshore southern Pasco and northern Pinellas counties on the northern portion of the west-central Florida coast. These well-developed ridges range up to 0.6 miles wide and 9 miles in length. Their slightly variable azimuths average about 290° 3 to 12 miles from shore.

The **Sand Key Ridge Field** (Finkl *et al*., 2007), containing about 27 x 10^5 hectares (1042 square miles) and lying offshore from the Indian Rocks headland in Pinellas County, contains well-developed sand waves that range up to 1 mile by 10 km long by 13 ft high. Nearshore ridges have an average azimuth of about 330° whereas those farther offshore average about 310° (Edwards *et al*., 2003; Harrison *et al*., 2003).

The **Sarasota Ridge Field** (Finkl *et al*., 2007), containing approximately 94 x 10^5 hectares (3629 square miles) and lying offshore the lengths of Manatee and Sarasota counties, is the most extensive ridge field on the west-central coast. This large ridge field is comprised by poorly developed sand waves that are interspersed by extensive hardgrounds. The sand waves range up to 2 miles wide by 6 miles long by 13 ft high with variable azimuths ranging from 200° to 230°. Calcium carbonate content on the southeast side of the ridges ranges from 20% to 60% (Twichell *et al*., 2003).

The well-developed **Manasota Ridge Field** (Finkl *et al*., 2007), containing about 30 x 10^5 hectares (1158 square miles) and lying offshore the boundary between Sarasota and Charlotte counties, contains well-developed ridges that range up to 0.6 miles wide by 3.7 miles long. The ridges have an average azimuth of about 345° about 2 miles to 8 miles offshore (Finkl *et al*., 2006).

The **Captiva Ridge Field** (Finkl *et al*., 2007), comprising about 31 x 10^5 hectares (1197 square miles), contains well-developed ridges that range up to 0.8 miles in width by 4 miles in length. Their average azimuth is about 345° 3 miles to 16 miles from shore (Finkl *et al*., 2006).

The **Collier Ridge Field** (Finkl *et al*., 2007), lying offshore Collier County and containing about 22 x 10^5 ha (849 square miles), displays well-developed sand ridges that range up to 0.6 miles wide by 3.1 miles long. The average azimuth is about 240° 5 miles to 12 miles from shore. There may be additional ridges closer to shore.

Desktop Study

To avoid collecting data in areas where data have recently been collected, APTIM conducted an extensive review of existing geophysical and geotechnical data. Data were compiled from a variety of sources including FDEP's Regional Offshore Sand Source Inventory (ROSSI) and the National Oceanic and Atmospheric Administration (NOAA). APTIM compiled data related to past investigation areas, previously identified sand sources and developed borrow areas as well as previously collected geophysical and geotechnical data. APTIM reviewed existing data for quality and spatial coverage as well as for how current the data are. Based on this evaluation, APTIM developed a survey plan that made the most efficient use of existing data and avoided collecting duplicate data. The final survey plan was then communicated to Captiva Erosion Prevention District (CEPD) before any field activities

Geophysical Data

Bathymetric Data. Existing bathymetric data collected within the vicinity of the proposed investigation area were collected by Coastal Planning & Engineering, Inc. (CPE) between 1990 to 1991 as part of the Captiva Island Beach Maintenance Nourishment Project Phase II Sand Search. LIDAR data collected under the direction of CPE in 2002 and 2006 and under the direction of the U.S. Army Corps of Engineers (USACE) in 2010 and again in 2015. The most recent bathymetric data were collected after Hurricane Matthew in 2016 (Figure 5).

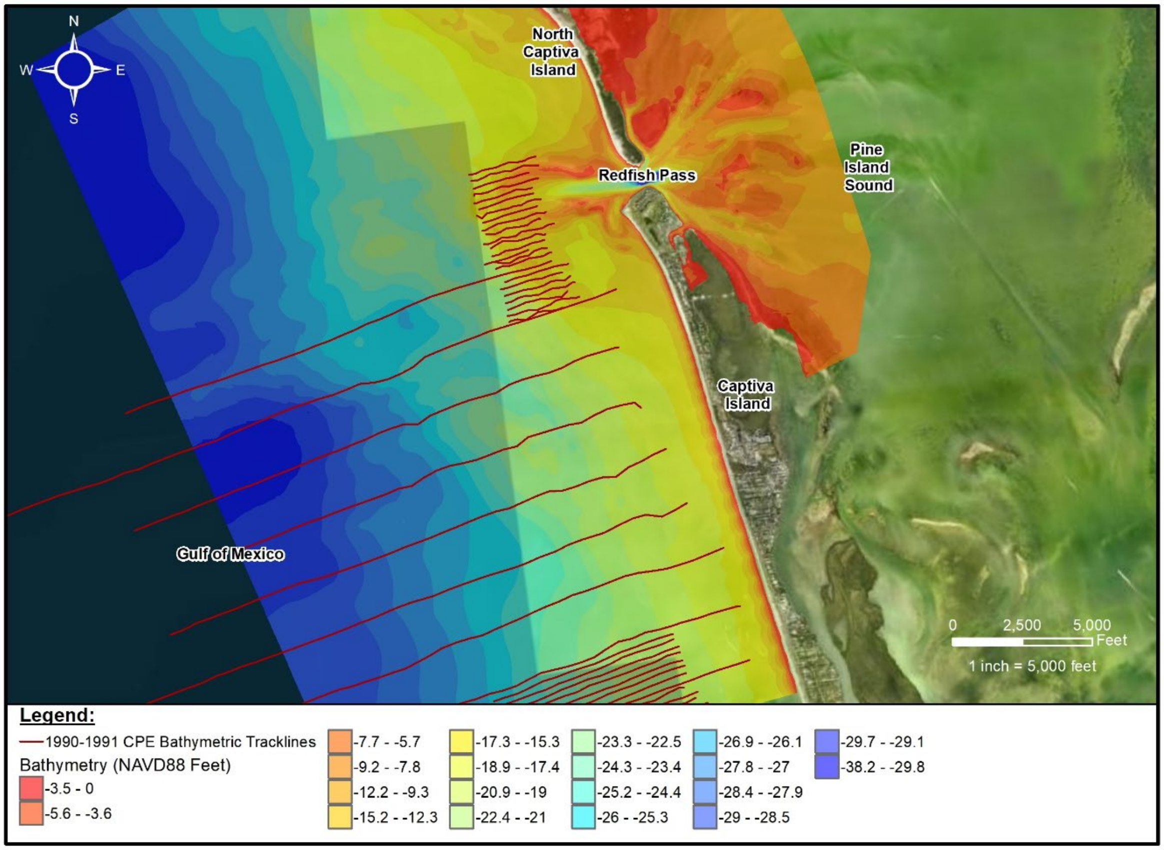


Figure 5. Bathymetric data compiled during the desktop study.

Sub-bottom Profiler Data. Sub-bottom data were collected within the vicinity of the proposed investigation area by CPE between 1990 to 1991 as part of the Captiva Island Beach Maintenance Nourishment Project Phase II Sand Search (Figure 6).

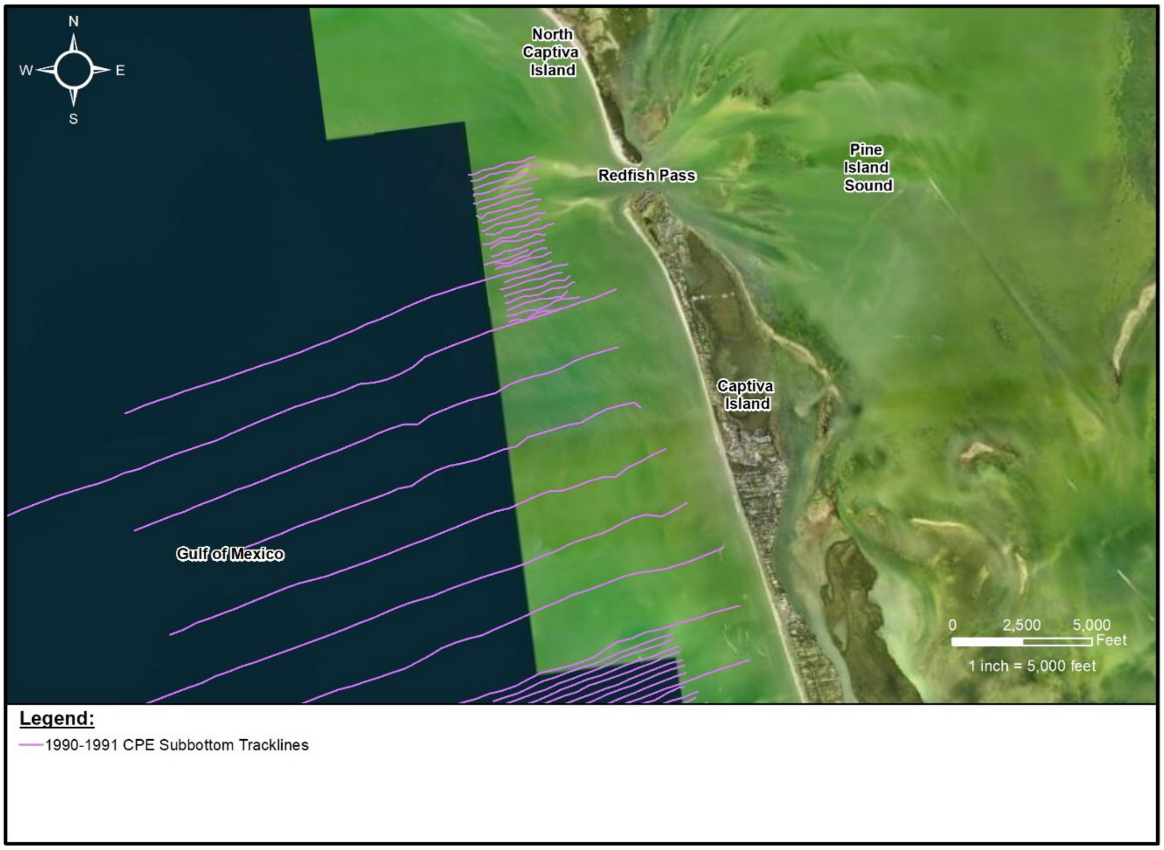


Figure 6. Sub-bottom profile data compiled during the desktop study.

Sidescan Sonar Data. Existing sidescan sonar data collected within the vicinity of the proposed investigation area were collected by CPE in 2011 as part of the Captiva Renourishment project (Figure 7).

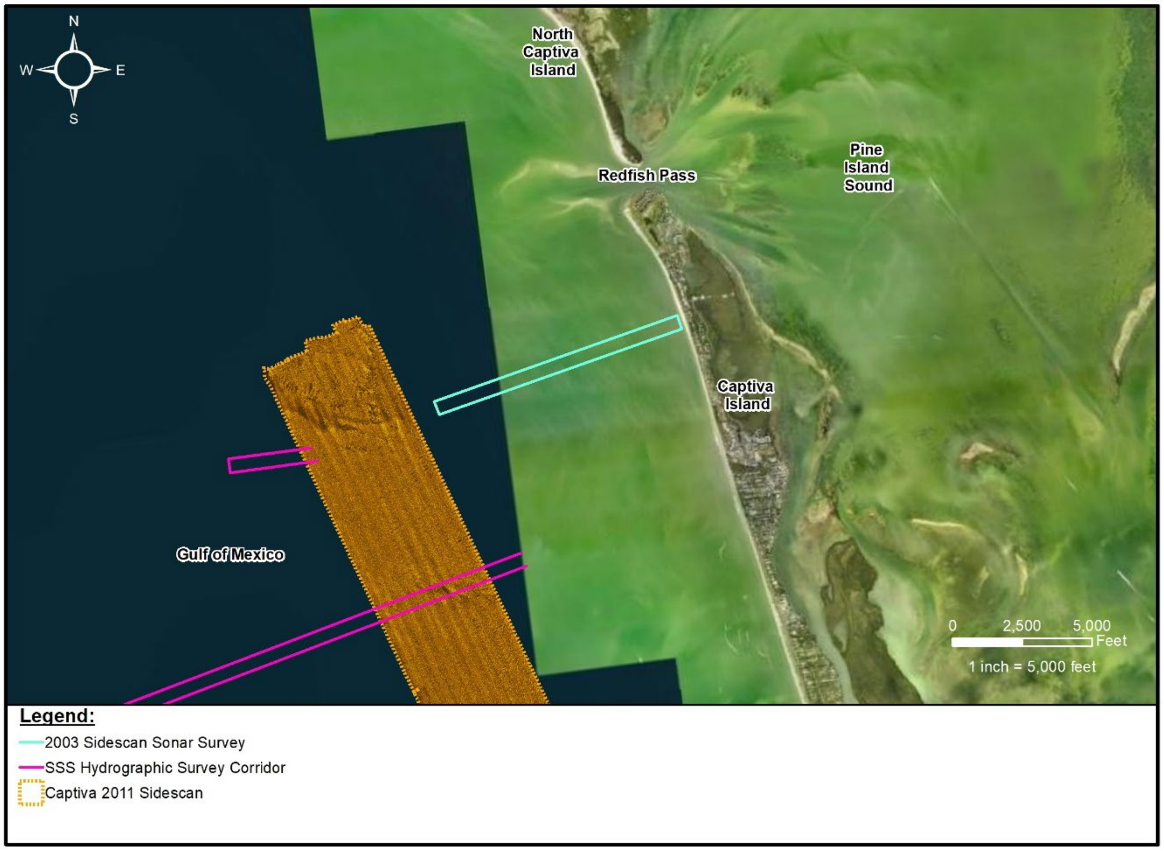


Figure 7. Sidescan sonar data compiled during the desktop study.

Geotechnical Data

Existing sediment sample (core borings, vibracores and jet probes) data collected within the vicinity of the proposed investigation area were compiled from the Regional Offshore Sand Source Inventory (ROSSI) database and CPE (Figure 8). These data include core borings and jet probes collected between 1967 and 2000 (Table 1).

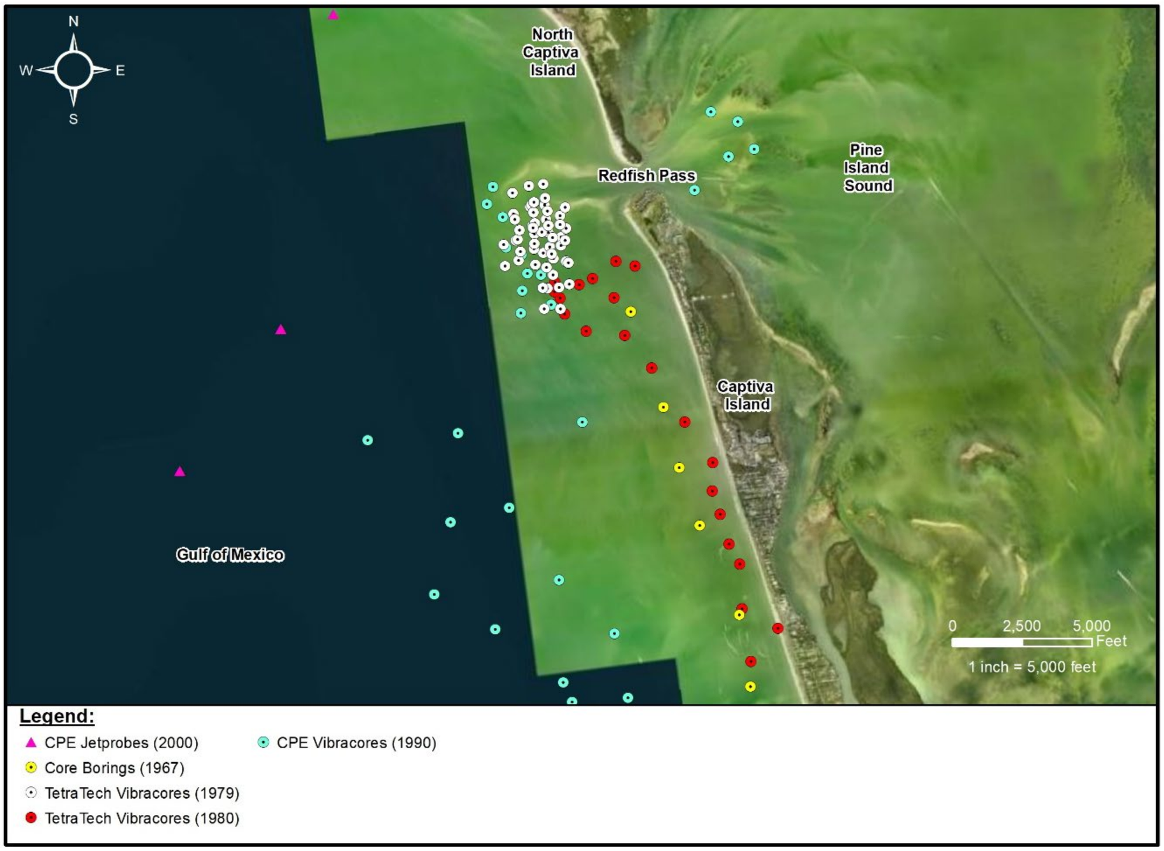


Figure 8. Geotechnical data compiled during the desktop study.

Table 1. Existing Geotechnical Data in the Vicinity of the Study Area.

Project	Year	Contractor	Sample Type	Source
Federal Beach Erosion Control Study for Lee County, FL	1967	Unknown	Core Boring	APTIM Server, ROSSI
South Seas Plantation Beach Improvement Project	1979	TetraTech	Vibracore	APTIM Server, ROSSI
Unknown	1980	TetraTech	Vibracore	APTIM Server
Captiva Island Beach Maintenance Nourishment Project Phase II	1990	CPE	Vibracore	APTIM Server, ROSSI
Captiva and Sanibel Islands Renourishment Project	2000	CPE	Jet Probes	APTIM Server, ROSSI

Existing Borrow Areas

Existing borrow areas were compiled during the desktop study. These borrow areas were obtained from APTIM and ROSSI and are shown in Figure 9 below.

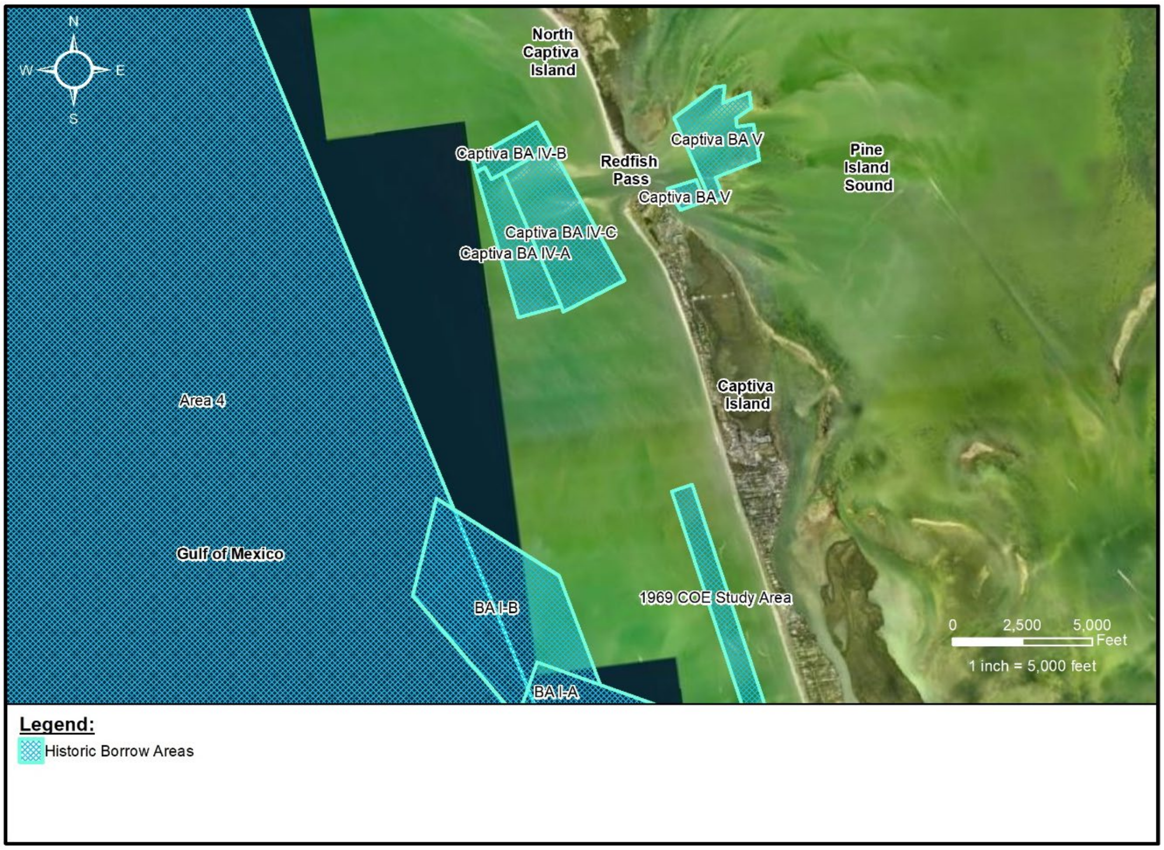


Figure 9. Borrow areas compiled during the desktop study.

Marine Hazard and Resource Data

In addition to previous/historic geologic and geophysical data, marine hazard and resource data were acquired and compiled, reviewed, and incorporated during this phase to be used to further develop the geophysical survey plan. These data are shown in Figure 10 and included infrastructure, benthic resources, and other sensitive/hazard areas for avoidance during survey acquisition.

Artificial Reefs. Artificial reef locations were obtained from the Florida Fish and Wildlife Conservation Commission (FWC) arcGIS REST service at http://atoll.floridamarine.org/arcgis/rest/services/FWC_GIS/OpenData_MarineEco/MapServer**.**

Coastal Barrier Resource System (CBRS). The Federal Emergency Management Agency (FEMA) CBRS Act of 1982 restricts development within the designated system units in an effort to prevent future flood damage and protect the barrier system. These designations are included as part of the analysis tool due to potential restrictions on sediment removal and placement within the federal designated unit as well as funding restrictions. During the development of this tool, the Act was updated for the interpretation of beach nourishment projects. The new interpretation allows for the removal of sand from a CBRS to replenish beaches located within and outside the CBRS, as long as the proposed project is consistent with the purposes of the Act and meets the statutory exception for "nonstructural projects for shoreline stabilization that are designed to mimic, enhance, or restore natural stabilization systems". This change still requires the project manager to be aware of these units and the project may need to be evaluated by federal agencies. The CBRS polygons were obtained from https://www.fws.gov/cbra/metadata.html.

Essential Fish Habitat (EFH). EFHs are defined in the Magnuson-Stevens Act as "...those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The rules promulgated by the National Marine Fisheries Service (NMFS) in 1997 and 2002 further clarify EFH with the following definitions: waters - aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate - sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary - the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and spawning, breeding, feeding, or growth to maturity - stages representing a species' full life cycle. The area defined includes Gulf of Mexico waters and substrates extending from the US/Mexico border to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council from estuarine waters out to depths of over 600 ft. Essential fish habitat data are available through the Gulf Data Atlas at https://gis.ngdc.noaa.gov/arcgis/services.

Spoil Sites. In 1972, Congress enacted the Marine Protection, Research, and Sanctuaries Act (MPRSA, also known as the Ocean Dumping Act) to prohibit the dumping of material into the ocean that would unreasonably degrade or endanger human health or the marine environment. Virtually all material ocean dumped today is dredged material (sediments) removed from the bottom of waterbodies in order to maintain navigation channels and berthing areas. Other materials that are currently ocean disposed include fish wastes, human remains, and vessels. Ocean dumping cannot occur unless a permit is issued under the MPRSA. In the case of dredged material, the decision to issue a permit is made by the U.S. Army Corps of Engineers, using Environmental Protection Agency (EPA) environmental criteria and subject to EPA's concurrence. For all other materials, EPA is the permitting agency. EPA is also responsible for designating recommended ocean dumping sites for all types of materials. The locations of these sites were obtained from https://www.epa.gov/ocean-dumping/ocean-disposal-map.

Seagrass. Seagrass coverage maps were obtained from the FWC ArcGIS REST service at http://atoll.floridamarine.org/arcgis/rest/services/FWC_GIS/OpenData_MarineEco/MapServer.

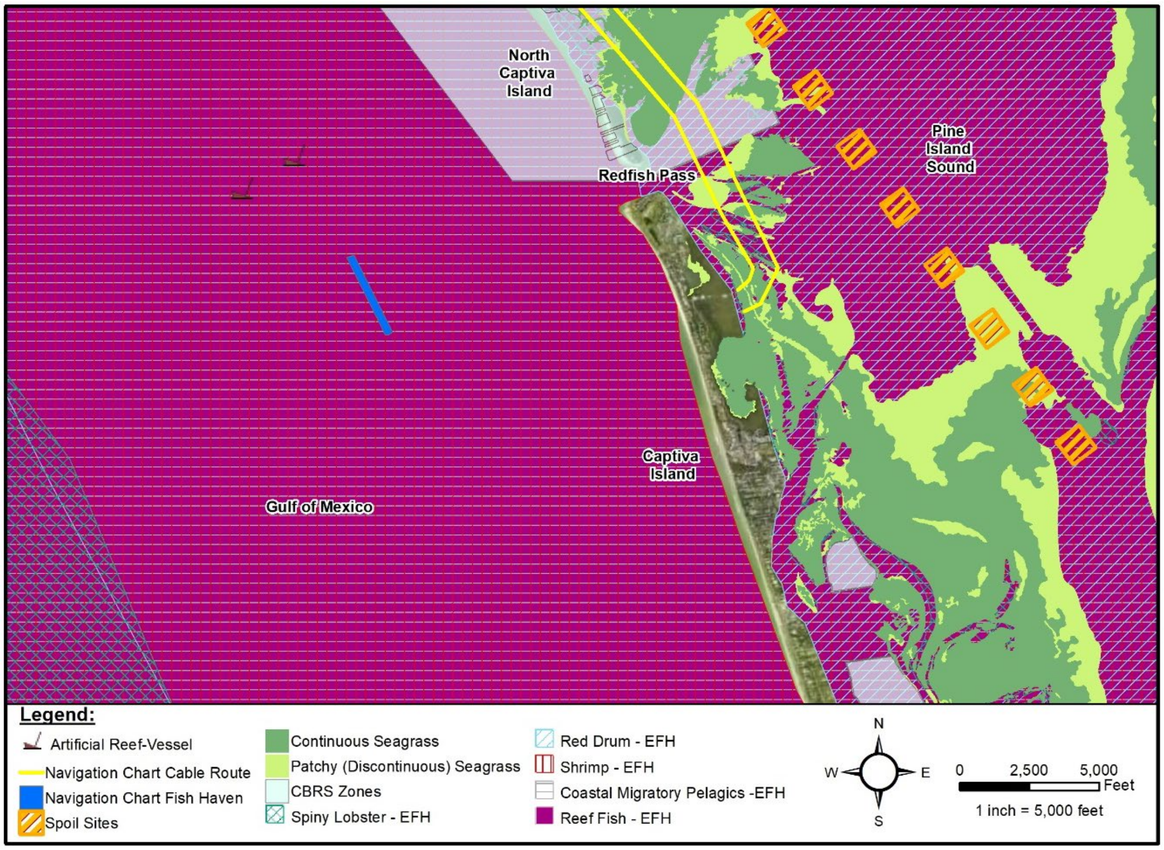


Figure 10. Marine hazard and resource data compiled during the desktop study.

Based on the results of the desktop study, APTIM decided to further investigate Captiva Borrow Area IV. APTIM developed a primary survey plan designed to further investigate this borrow area (Figure 11). An estimated 35 nautical miles of geophysical data (sub-bottom, bathymetry, magnetometer and sidescan sonar) were planned to be collected at 98 ft spacing along with 16 vibracores.

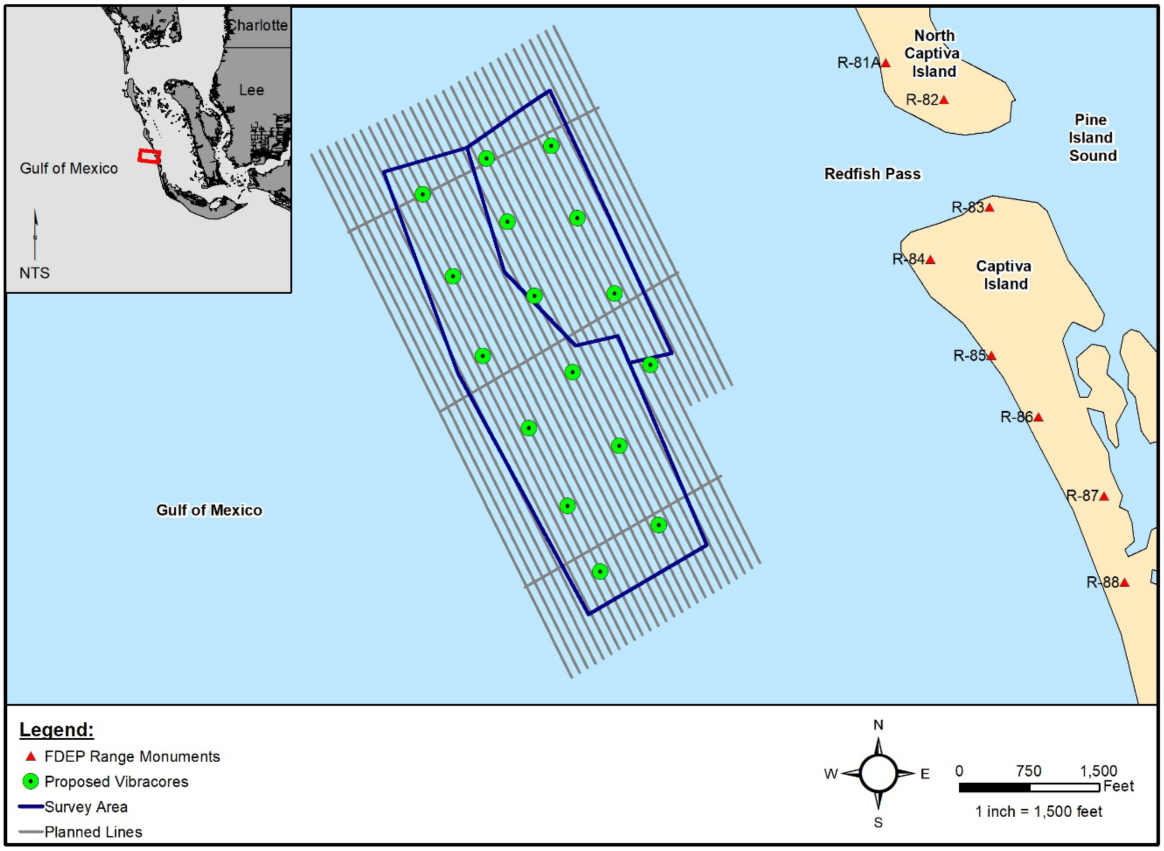


Figure 11. Planned survey lines and vibracores.

Geophysical and Geotechnical Investigations

Investigation Details

During Phase II investigations, APTIM researchers conducted the geophysical and vibracore surveys within the areas identified during Phase I. Between February 14 and February 15, 2020, a concurrent magnetometer, seismic reflection profiling, sidescan sonar and bathymetric survey was conducted off the *R/V Eugenie Clark.* A total of 35 nautical line miles of geophysical data were collected. These data were used to delineate the base of the ebb shoal which were believed to contain accumulations of beach quality sand. During the geophysical survey, data were collected at a 30 m (approximately 98 ft.) line spacing at a cultural resource level industry standard.

In order to satisfy permitting requirements, a cultural resource analysis was conducted prior to the collection of geotechnical samples. During this data review the seismic reflection profiling, sidescan sonar and magnetometer surveys were used to identify potential cultural resources such as artifacts, underwater wrecks, submerged hazards, significant relict landforms or any other features including modern debris that would affect borrow area delineation and dredging activities.

A qualified marine archaeologist was onboard at all times during the cultural resource investigation. Based on the results of the cultural resource investigation, the marine archaeologist recommended cultural resource clearance for the entire investigation area since the analysis did not indicate the presence of potential submerged cultural resources.

The results of the Phase II and III geophysical investigation were used to identify vibracore locations for the geotechnical investigation. A 500 ft. buffer placed around all magnetic anomalies, regardless of potential significance, was incorporated into the vibracore survey plan. Between July 27 and July 28, 2020, 16 vibracores were collected from locations selected based on the analysis of historic data and the results of the geophysical survey. The vibracores were collected to meet the maximum 1,000 ft. industry standard spacing guidelines for permitting. Figure 12 shows the location of the geophysical tracklines and vibracore locations. The geophysical data coupled with analysis of the vibracores was used to determine sediment quality and to ascertain the presence of material unsuitable for dredging and further delineate the borrow area and cut depths.

Figure 12. As-run tracklines and vibracore locations.

The work undertaken during the Phase II, III and cultural resource investigations is summarized in Table 2.

Table 2. Geophysical and geotechnical investigations conducted in 2020.

Total nautical miles surveyed (bathymetric, magnetometer, sub-bottom and sidescan sonar)	**35**
Number of vibracores collected	**16**
Total number of sand subsamples (vibracore) generated and analyzed	**69**
Number of potential borrow areas identified	**1**

Equipment and Methods

Due to the scope and precision required by modern sand search protocols, a wide range of geophysical and geotechnical survey methods are required. The geophysical investigation included bathymetric, sidescan sonar, seismic reflection profiling and magnetometer surveys, determination of sediment composition and thickness via vibracoring and characterization of the existing beach. The geophysical and geotechnical data were collected under the responsible charge of a professional geologist registered in the state of Florida. All bathymetric data collection and survey control/navigation were conducted under the responsible charge of a Professional Surveyor and Mapper (PSM) registered in the state of Florida. The bathymetric, sidescan sonar, seismic reflection profiling and magnetometer surveys were conducted concurrently using the setup illustrated in Figure 13. The collection and processing of this data is described below. The geophysical and geotechnical equipment used during the investigation is listed in Table 3 and described below.

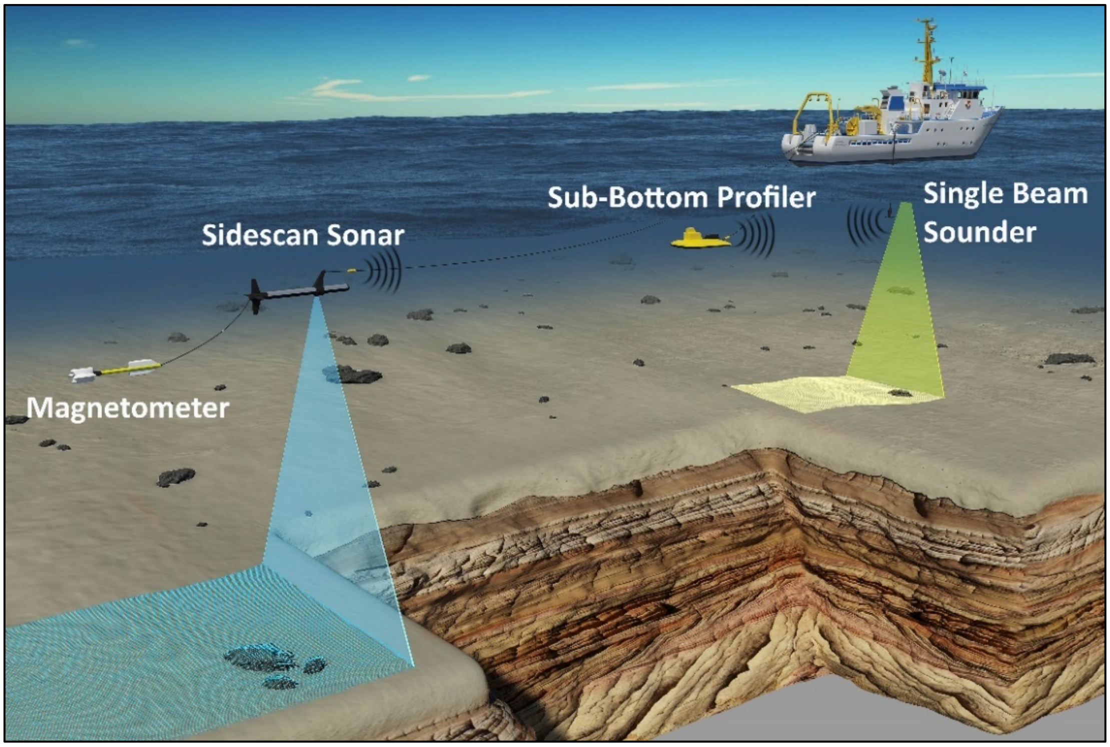


Figure 13. Schematic diagram showing the typical deployment of a joint seismic reflection profile, bathymetric, magnetometer and sidescan sonar survey.

Table 3. Equipment used during the 2020 geophysical and geotechnical investigations.

Equipment Type	Description
Navigation	Trimble 5700 Real Time Kinematic (RTK) Global Positioning System (GPS) interfaced with Hypack Inc.'s Hypack 2019® software
Sounder (Bathymetry)	Odom Hydrographic Systems, Inc. "Hydrotrac II" Hydrographic Echo Sounder
Sub-bottom Profiler (Seismic Reflection)	EdgeTech X-STAR SB-512i Sub-bottom Profiler
Sidescan Sonar	EdgeTech 4125 Sidescan Sonar System
Magnetometer	Geometrics G-882 Digital Cesium Marine Magnetometer interfaced with Hypack Inc.'s Hypack 2019® software
Vibracores	Athena's Mechanical Vibracore

Navigation Systems

Prior to the start of the survey, reconnaissance of the monuments was conducted to confirm that survey control was in place and undisturbed. Real Time Kinematic Global Positioning System (RTK GPS) was used within a virtual reference station (VRS) network to locate and confirm survey control for this project. The horizontal and vertical accuracy of control data meets the accuracy requirements as set forth in the Engineering and Design Hydrographic Surveying Manual (EM 1110-2-1003). In order to achieve required accuracy, the topographic and hydrographic surveys were controlled using second order monuments, specifically L230 and L014 from the National Geodetic Survey (NGS) and BEN IRC, a TBM set by APTIM. Control horizontal and vertical positioning checks were conducted at the beginning and end of each day using at least two 2nd order monuments in the project area. The RTK GPS utilizes statistical methods to ensure accuracy of RTK GPS data remains within the 95% confidence interval. The control check shots were acquired using a minimum of five epochs, which results in a high accuracy location.

Hypack Inc.'s Hypack 2019 ® Data Collection and Processing Program

Navigational, magnetometer, and depth sounder systems were interfaced with an onboard computer, and the data were integrated in real time using Hypack Inc.'s Hypack 2019® software. Hypack 2019® is a state-of-the-art navigation and hydrographic surveying system. The location of the fish tow-point on the vessel in relation to the RTK GPS was measured, recorded and entered into the Hypack 2019® survey program. The length of cable deployed between the tow-point and each towfish was also measured and entered into Hypack 2019®. Hypack 2019® then takes these values and monitors the actual position of each towfish in real time. Online screen graphic displays include the pre-plotted survey lines, the updated boat track across the survey area, adjustable left/right indicator, as well as other positioning information such as boat speed, quality of fix measured by Position Dilution of Precision (PDOP), and line bearing. The digital data is merged with positioning data (RTK GPS), video displayed and recorded to the acquisition computers hard disk for post processing and/or replay.

Bathymetric Survey

The Odom Hydrographic Systems, Inc.'s Hydrotrac, a single frequency portable hydrographic echo sounder, was used to perform the bathymetric survey. The Hydrotrac operates at frequencies of 24, 33, 40, 200, 210, or 340 kHz and is a digital, survey-grade sounder. A 210 kHz transducer was used for the bathymetric survey.

Prior to the start of the survey, a reconnaissance survey of the second order FDEP monuments was conducted to confirm that the survey control was in place and undisturbed. RTK GPS was used to locate and confirm the survey control for this project (Appendix 1). To achieve the required accuracy, the hydrographic survey was controlled using second order FDEP monuments.

Horizontal and vertical RTK GPS positioning checks and sounder calibration were performed periodically throughout the survey (typically at the beginning and end of each survey day). The sounder was calibrated via bar-checks and a sound velocity probe. The DIGIBAR PRO sound velocity meter is used to find the average sound velocity needed to calibrate the Hydrotrac sounder prior to performing the bar-check. Bar checks were performed from a depth of 5 ft. to the maximum depth of the survey area. Analog data showing the results of the bar check calibration is displayed on the sounder charts at 5 ft. increments during descent of the bar.

Real-time navigation software (Hypack), was used to provide navigation to the helm in order to minimize deviation from the online azimuth. This software provides horizontal position to the sounding data allowing real-time review of the data in plan view or cross section format. A Trimble RTK GPS and a TSS Motion Compensator were used onboard the survey vessel to provide instantaneous tide corrections as well as heave, pitch and roll corrections. Soundings were collected at intervals sufficient to provide an accurate depiction of the seafloor. Cross lines (tie lines) were collected to verify survey accuracies.

Upon completion of the field work, data was edited and reduced with APTIM's internal software programs and Hypack 2019®. The observed tide data were compared to local predictions and other regional gauges for verification purposes. The offshore raw digital data were viewed and edited in Hypack 2019®. Digitized data were scanned for noise and compared to the analog record. False soundings were removed, and a comma delimited ASCII file was created and exported.

Seismic Reflection Profile Surveys

"Chirp" sub-bottom seismic-reflection data is used to show sedimentary stratigraphy and identify potential project-compatible sediment resources. The use of chirp sub-bottom data allows common stratigraphic layers to be mapped throughout the study area while determining the thickness and extent of potential project compatible sediment.

An EdgeTech X-STAR SB-512i was used to conduct the seismic reflection profile surveys (Figure 14). The X-STAR Full Spectrum Sonar is a versatile wideband FM sub-bottom profiler that collects digital normal incidence reflection data over many frequency ranges. This instrumentation generates cross-sectional images of the seabed (to a depth of up to 50 ft. in this survey). The X-STAR SB-512i transmits an FM pulse that is linearly swept over a full spectrum frequency range (also called a "chirp pulse"). The tapered waveform spectrum results in images that have virtually constant resolution with depth. The Chirp systems have an advantage over 3.5 kHz and "boomer" systems in sediment delineation because the reflectors are more discrete and less susceptible to ringing from both vessel and ambient noise. The full-wave rectified reflection horizons are cleaner and more distinct than the half-wave rectified reflections produced by older analog systems.

The X-STAR SB-512i, has a single 13" diameter low frequency transducer and a single 6.5" diameter high frequency transducer. The new low frequency transducer provides more low frequency energy at all pulse settings, which allows deeper penetration of seafloor sediments while at the same time providing a high resolution.

Figure 14. EdgeTech X-STAR SB-512i sub-bottom profiling system.

In order to minimize noise related to the survey vessel and sea conditions, the seismic towfish (which operates as both the source and receiver for the sub-bottom system) was deployed and towed behind the research vessel. The sub-bottom system was interfaced with RTK via Hypack 2019® navigational software. The location of the fish tow point (as referenced to the RTK antenna), together with the length of cable deployed from the tow point, were entered into Hypack 2019® in order to account for the fish layback and provide accurate positioning of the seismic fish during the survey. The sub-bottom system was operated by the Discover-SB® software program. At the start of the sub-bottom profiling survey, the sweep frequencies of the outgoing pulse together with the different gain settings available within Discover-SB® were adjusted to obtain the best possible resolution for the survey. The data were continuously bottom-tracked to allow for the application of real-time gain functions in order to have an optimal in-the-field view of the data. Automatic gain control (AGC) was used to normalize the data by strengthening quiet regions/soft returns while simultaneously reducing/eliminating overly strong returns by obtaining a local average at a given point. A time-varying gain (TVG) was used to increase the returning signal over time in order to reduce the effects of signal attenuation.

All sub-bottom data were recorded on the acquisition computer's hard disk and transferred to a USB memory stick and/or portable hard drive at the end of each survey day to back-up raw survey data. Post collection processing of the seismic data was completed using Chesapeake Technology, Inc's SonarWiz 7 software. This software allows the user to apply specific gains and settings in order to produce enhanced sub-bottom imagery that can then be interpreted and digitized for specific stratigraphic facies relevant to the project goals.

Raw .jsf files were imported into SonarWiz 7 and the data were then bottom tracked, gained, and swell filtered. The process of bottom tracking uses the high-amplitude signal associated with the seafloor to map it as the starting point for gains and swells. Swell filtering is a ping averaging function, which allows for the elimination of vertical changes caused from towfish movement produced from changes in sea state. The swell filter was increased or decreased depending on the period and frequency of the sea surface wave conditions and special care was taken not to over-smooth and eliminate features on the seafloor. Automatic Gain Control (AGC) was applied and manipulated to produce a better image (contrasts between low and high return signals) below the seafloor to increase the contrast within the stratigraphy and increase the amplitude of the stratigraphy with depth, accounting for some of the signal attenuation normally associated with sound penetration over time. A blank water column function was also applied to eliminate any features such as schools of fish under the chirp system which produce reflected artifacts within the water column.

Sidescan Sonar Survey

Sidescan data are required to verify the location and extent of unconsolidated sediment and to map ocean bottom features such as benthic habitats, exposed pipelines, cables, underwater wrecks, potential cultural resources, *etc*. The sidescan survey was conducted to identify features that may affect borrow area delineation, introduce hazards to dredging, or adversely impact the environment.

During this sand search investigation an EdgeTech 4125 sidescan sonar system was used (Figure 15). The EdgeTech 4125 sidescan sonar systems uses full-spectrum chirp technology to deliver wide-band, high-energy pulses coupled with high resolution and good signal to noise ratio echo data. The sonar package included a portable configuration with a laptop computer running EdgeTech's Discover® acquisition software and dual frequency towfish running in high definition mode. The sidescan sonar data were merged with positioning data from RTK satellite navigation system via Hypack, video displayed, and recorded to the acquisition computer's hard disk for post processing and/or replay. All sidescan sonar data were collected in the default EdgeTech JSF file format. An EdgeTech 4125 multi-purpose sidescan sonar system consisted of a dual frequency towfish operating at 600/1600 kHz, with maximum range scales of 394 ft (120 m) to either side of the towfish (600 kHz) and 115 ft. (35 m) to either side of the towfish (1600 kHz) was used for the survey area. These range scales are the maximum manufacturer recommended ranges for the frequencies listed above. However, geophysicists in the field based the recorded ranges on the field conditions and may not have utilized the maximum range scales.

Figure 15. EdgeTech 4125 sidescan sonar system.

During the investigations, the sidescan was towed from the survey vessel at a position and depth that limited exposure to sources of interference and provided the best possible record quality. The survey was conducted in such a manner to achieve total bottom coverage within the survey area. The line spacing was set up so that we obtained 100% overlap (*i.e.* all areas of the seafloor were covered twice). The digital sidescan data was merged with positioning data (RTK GPS via Hypack). Position data appeared in the video display and was logged to disk for post processing and/or replay. The acoustic data was recorded digitally.

Sidescan sonar data were processed utilizing Chesapeake Technologies, Inc. SonarWiz 7 software in one project, displaying both the high frequency data and the low frequency data. In the beginning processing stages for the sidescan data, the raw low frequency and high frequency sidescan sonar data are imported into the SonarWiz 7 project. Once the data were imported, they were bottom tracked to remove the water column (nadir) recorded in the data. Bottom tracking is achieved by using an automated bottom tracking routine which determines the first return signal in the data and provides an accurate baseline representation of the seafloor and eliminates the water column from the data. In some cases, manual bottom tracking is necessary when the automated bottom tracking cannot accurately determine the first return in the sidescan sonar record, the processor then manually determines the first return in the data.

Once the data were bottom tracked, they were processed to reduce noise effects (commonly due to the vessel, sea state, or other anthropogenic phenomenon) and enhance the seafloor definition. All of the sidescan sonar data utilized Empirical Gain Normalization (EGN). An empirical gain normalization table was built including all of the sidescan sonar data files. Once the table was built it was applied to all of the sidescan sonar data. EGN is a relatively new gain function that works extremely well in most situations and can be considered a replacement for Beam Angle Correction (BAC). EGN is a function that sums and averages up all of the sonar amplitudes in all pings in a set of sonar files by altitude and range. The amplitude values are summed and averaged by transducer (port and starboard) so there are actually two tables. A given sonar amplitude sample is placed in a grid location based on the geometry of the ping. On the x-axis of the grid is range, and on the y-axis of the grid is altitude. The resulting table is used to work out the beam pattern of a sonar by empirically looking at millions of samples of data.

After processing each line, the data were inspected and interpreted for the location and extent of unconsolidated sediment as well as ocean bottom features such as benthic habitats, exposed pipelines, cables, underwater wrecks, potential cultural resources, etc. Each potential area of interest was identified and marked with either a feature or a contact target.

Magnetometer Survey

High-resolution magnetic remote sensing is needed to identify any metallic objects that could represent a potential cultural resource or hazard to construction. A Geometrics G-882 Digital Cesium Marine Magnetometer, capable of a plus or minus 0.1 gamma resolution, was used to perform a cursory investigation of magnetic anomalies within the potential sediment sources (Figure 16). The purpose of the magnetometer survey was to establish the presence, and subsequent exclusion zones around any potential underwater wrecks, submerged hazards, or any other features that would affect borrow area delineation and dredging activities.

To produce a magnetic record of sufficient resolution, the sensor was deployed and maintained at the water surface due to the shallow water depths. A computer recorder provided a continuous permanent record of the magnetic background and target signatures. Positioning data generated by the navigation system were tied to magnetometer records by regular annotations to facilitate target location and anomaly analysis. Annotations include line number, date and time of start and end of each line, and target identification.

Upon completion of the general magnetometer survey, the data were examined by a marine archaeologist with SEARCH, Inc. (SEARCH), who provided the locations of magnetic anomalies. None of the anomalies were recommended for avoidance during subsequent geotechnical (vibracore) investigations.

Figure 16. Geometrics G-882 Digital Cesium Marine Magnetometer used to investigate magnetic anomalies within the potential sediment source.

Vibracore Survey

Vibracores were collected to obtain continuous physical samples of the material within the potential sand resources. They are used to characterize the physical properties of the material and groundtruth the sub-bottom data. The vibracores were collected within 50 ft. of the as-run survey lines and avoided magnetic anomalies identified during the geophysical investigation.

The vibracores were collected using mechanical vibration. The system was configured to collect undisturbed sediment cores up to 20 ft. in length (Figure 17). Vibracores were collected by Athena Technologies Inc. using Athena's custom designed and built vibracore system deployed from a sampling platform off the *RV Artemis*. Athena's system consists of a generator with a mechanical vibrator attached via cable. The vibrator is attached directly to a 3-inch diameter, galvanized sample barrel. The sample barrel is lowered to the seafloor through a moonpool in the deck of the sampling platform by attaching lengths of drill stem. The vibracore machine is then turned on and the sample barrel is allowed to penetrate until it reaches target depth or refusal.

Figure 17. Athena vibracores collection aboard the *RV Artemis*.

Upon removal of the vibracores, they were measured, labeled, and cut into 5-ft. sections. The cores were then transported to APTIM's laboratory in Boca Raton, Florida. The cores were then split and logged by describing sedimentary properties by layer in terms of layer thickness, color, texture (grain size), composition and presence of clay, silt, gravel, or shell and any other identifying features (Figure 18). Wet Munsell color was determined in accordance with American Society for Testing and Materials (ASTM) Standard Methods Designation D2488-09A for description and identification of soils (visual-manual procedure). The vibracores were digitally photographed against an 18% gray background. This is the standard reference value against which all camera light meters are calibrated. Use of an 18% gray background is preferred by the FDEP as it provides a known reference color. Sediment samples were obtained from irregular intervals based on distinct layers in the sediment sequence. The unsampled half of each core was wrapped in plastic and will be archived for 1 year at an offsite warehouse.

Figure 18. Vibracore logging, sub-sample collection and Munsell color determination being conducted at APTIM's office in Boca Raton, Florida.

Sediment Grain Size (Mechanical) Analysis

The sediment samples were analyzed to determine color and grain size distribution at APTIM's CMEC accredited geotechnical laboratory in Boca Raton, Florida. During sieve analysis, the wet, dry and washed Munsell colors were noted. Sieve analysis of the sediment samples was performed in accordance with the ASTM Standard Methods Designation D6913-17 for particle size analysis of soils. This method covers the quantitative determination of the distribution of sand sized particles. For sediment finer than the No. 230 Sieve (4.0 phi) the ASTM Standard Methods Designation D1140-17 was followed. The fines content is defined as the percentage of material finer than the No. 230 Sieve (4.0 phi, 0.0625 mm). The sieve stack used for mechanical analysis conformed to FDEP sand search guidelines provided in Table 4.

Weights retained on each sieve were recorded cumulatively. Grain size results were entered into the gINT® software program, which computes the mean and median grain size, sorting, silt/clay percentages for each sample using the moment method. All vibracore results are provided in the appendices, including vibracore logs (Appendix 2), vibracore photographs (Appendix 3), sediment sample granularmetric reports (Appendix 4), and sediment sample grain size distribution curves/histograms (Appendix 5).

Table 4. Granularmetric Analysis Mesh Sizes with associated Wentworth Size Class

Sieve Number	Size (phi)	Size (mm)	Wentworth Scale	
3/4	-4.25	19.00	Pebble	Gravel
5/8	-4.00	16.00		
7/16	-3.50	11.20		
5/16	-3.00	8.00		
3 ½	-2.50	5.60		
4	-2.25	4.75		
5	-2.00	4.00		
7	-1.50	2.80	Granule	
10	-1.00	2.00		
14	-0.50	1.40	Very Coarse Sand	Sand
18	0.00	1.00		
25	0.50	0.71	Coarse Sand	
35	1.00	0.50		
45	1.50	0.36	Medium Sand	
60	2.00	0.25		
80	2.50	0.18	Fine Sand	
120	3.00	0.13		
170	3.50	0.09	Very Fine Sand	
200	3.75	0.08		
230	4.00	0.06		

Carbonate Content Determination

Carbonate content was determined by percent weight on 69 vibracore samples using the acid leaching methodology described in Twenhofel and Tyler (1941). Results were entered into the gINT® software program and are displayed on the granularmetric reports and grain size distribution curves and histograms. Carbonate testing results are provided in Appendix 6.

Results and Discussion

During this investigation, design level and cultural resource geophysical and geotechnical investigations were conducted. The results of these investigations are discussed below.

Vibracore Survey

Following the collection and analysis of the geophysical data (sub-bottom, bathymetry, sidescan sonar, magnetometer), a detailed plan to collect 16 vibracores to target the most promising sand resources, while avoiding potential natural resources and magnetic anomalies, was developed. Appendices 2 and 3 contain vibracore logs and photographs. The granularmetric reports and grain size distribution curves/histograms for the samples collected from the vibracores are presented in Appendices 4 and 5, respectively. Vibracores collected by CPE in 1990 for the Captiva Island Beach Maintenance Nourishment Project (Phase II) were also evaluated.

Generally, the vibracores indicate that the uppermost 3 ft. to 10 ft. are predominantly fine-grained quartz sand, with trace fines (<2%) and trace to some shell hash, fragments and whole shells. This material is typically classified as SP (poorly graded sands or gravelly sand with little or no fines) or SW (well graded sands or gravelly sands with little or no fines). The grain sizes ranged from 0.14mm to 0.50mm depending on shell content. The wet Munsell Color Values ranged between 6 and 7. The potentially beach compatible material is underlain by poor material (i.e. material containing greater than 5% silt). Several cores also contained material with >5% retained on the #4 sieve (i.e. high gravel sized shell content). The borrow area was designed to take into account the quality of material indicated by the 1990 and 2020 vibracores.

Based on sediment quality, the 1990 and 2020 vibracores were color coded, where green is the highest quality, yellow is marginal quality, and red is low quality. Only green meets FDEP standards and guidelines. Table 5 lists the criteria for color coding the vibracores.

Table 5. Project specific color coding.

Color	Description
Green	Meets all FDEP guidelines: < 5% silt, <5% retained on the #4 sieve
Yellow	5-10% silt, <5% retained on the #4 sieve
Red	10% silt, <5% retained on the #4 sieve, rock
Orange	>5% retained on the #4 sieve

Sub-bottom Profile Survey

Post-collection processing of the chirp sub-bottom data were completed using Chesapeake Technology, Inc.'s SonarWiz 7 software. This software allows the user to apply specific gains and settings in order to produce enhanced sub-bottom imagery that can then be interpreted and digitized for specific stratigraphic facies relevant to the project goals.

Bottom tracked chirp sub-bottom profile lines were opened to digitally display the recorded subsurface stratigraphy. Using the software's Sonar File Manager, color-coded vibracore descriptions were added directly to the chirp sub-bottom profiles. A project-specific color scheme, based on a stoplight color scale (Table 5), was developed for this project based on the overall sediment composition. Using the color-coded vibracore descriptions as a guide, the chirp sub-bottom stratigraphy was interpreted and the depth of the top of marginal/poor quality material was determined. The stratigraphic reflector that best correlated with this layer was digitized by digitally clicking on the reflector within SonarWiz to create a color-coded boundary. This boundary appears on the subsequent chirp sub-bottom imagery to allow for an easy, visual reference for the boundary between potentially shore protection project compatible material and the marginal to poor quality material. This boundary was used within SonarWiz to compute the thickness of the potentially significant sediment deposit by calculating the thickness between the digitized seafloor and the digitized bottom of significant sediment boundary. Once the seismic data were reviewed in SonarWiz 7, the thickness (.xyz) of the potential beach compatible sediment unit was imported into Surfer 17 and gridded to create an interpolated surface depicting the general trend of significant sediment deposits within the area. This isopach was then imported into ArcMap 10.7 compared to the hydrographic data to determine the correlation between bathymetric highs and the identified sand shoals within the area (if present).

Sub-bottom deliverables include a full digital project of all the sub-bottom imagery viewable and navigable in any standard web browser software program (Appendix 7). To view the coordinates on the sub-bottom web project provided by APTIM, ActiveX needs to be enabled on the user’s computer. To enable ActiveX, open internet explorer, click on “Tools” and select “Internet Options”. Under the “Advanced” tab, scroll to “Security” and select “Allow active content from CDs to run on my computer” and “Allow active content to run in files on My Computer”. ActiveX should now be enabled. You may need to restart your browser for these changes to take effect.

Sidescan Sonar Survey

After processing each line, the data were inspected and interpreted for the location and extent of the ebb shoal sand deposit as well as ocean bottom features such as any benthic habitats, exposed pipelines, cables, underwater wrecks, potential cultural resources, etc. that could be present in the area. Each potential area of interest was identified and marked with either a feature or a contact target. When potential contacts were identified, a point was digitized to provide geographic coordinate information at the contact location for integration into ArcGIS and an image of the contact was produced. All geologic features and sediment boundaries were digitized in SonarWiz 7 by encapsulating the feature into a geographically referenced polygon/polyline shapefile for integration into ArcGIS.

Based on the sidescan imagery, the locations of debris and sands were digitized. Figure 19 shows the extent of the sidescan sonar coverage of the investigation area and the digitized features. The sidescan sonar contact sheets, which are identified on Figure 19 and are presented in Appendix 8, display unknown marine debris, which correlate with magnetic anomalies, as well as unknown (undistinguishable) features. There were also a number of bait-fish schools within the survey area. The sidescan sonar also identified four distinct surface textures within the survey area. The ebb shoal is clearly observed and contains two distinct textures, large sand ripples (Figure 20) with an average period of 10 to 15 ft, oriented northwest/southeast, as well as small sand ripples (Figure 21) with an average period of 1 to 5 ft.

Figure 19. Sidescan sonar contacts and digitized features.

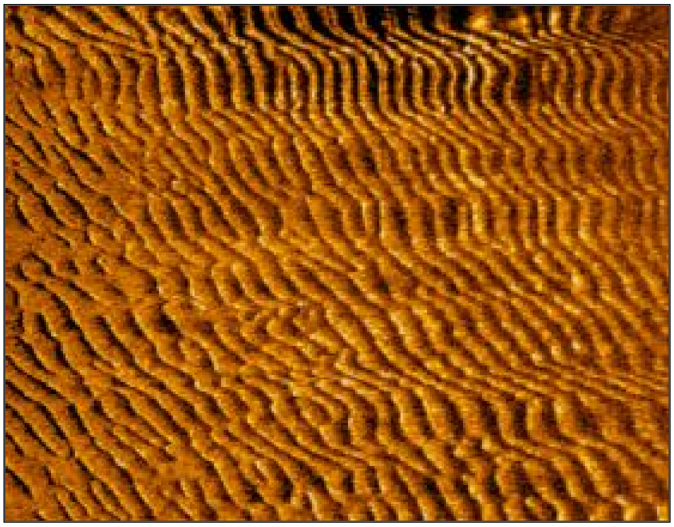


Figure 20. Large sand ripples Line 013.

Figure 21. Small sand ripples Line 021.

Within the survey area sand ripples are only observed on the ebb shoal itself. The rest of the survey area contains two other distinct features, a sand and a coarser sand without any rippling. The coarser sand can be identified in the sidescan sonar mosaic in Figure 19. A total of fourteen (14) sidescan sonar targets were identified throughout the survey area. Most of these targets were observed to be schools of fish, with some unknown debris and an apparent buoy and chain.

While APTIM geologists utilized the backscatter intensity, distribution, and texture to make educated interpretations as to the location of hardbottom and sand distribution, these interpretations are based solely on the acoustic presentation of the sidescan sonar backscatter data and correlation with the seismic sub-bottom data. Additional investigation and ground-truthing are required to confirm the visual acoustic interpretation.

Magnetometer Survey

The magnetometer data were post processed by APTIM's personnel in HYPACK 2019 MagEditor software to identify any potential magnetic anomalies. In order to normalize the magnetic field and select anomalies with the finest data resolution possible, the background magnetic field and background noise were adjusted to negate for diurnal variations. Within MagEditor, the diurnal magnetic readings were duplicated and cropped. The cropped data were then deducted from the original gamma readings to normalize the magnetometer data from any diurnal variations. Anomalies were then selected with the Whole Magnetic Analysis tool, accounting for the distance over ground, time elapsed, the minimum and maximum gamma readings and the total peak to peak gamma readings.

Ferrous items, detected via the magnetometer, are typically associated with an increased gamma intensity reading and seen as monopoles, dipoles and multi-component signals. These varying signals distinguish the anomalies from the natural environment. Anomalies identified throughout the processing and identification phase were then classified based on their magnetic signatures and intensity.

Each survey line was viewed and interpreted in great detail for any magnetic anomalies. Once all magnetic anomalies were identified they were compared (based on proximity, signature and intensity) to any distinguishable features identified in the sidescan sonar and seismic data. Magnetic anomalies are shown in Figure 22.

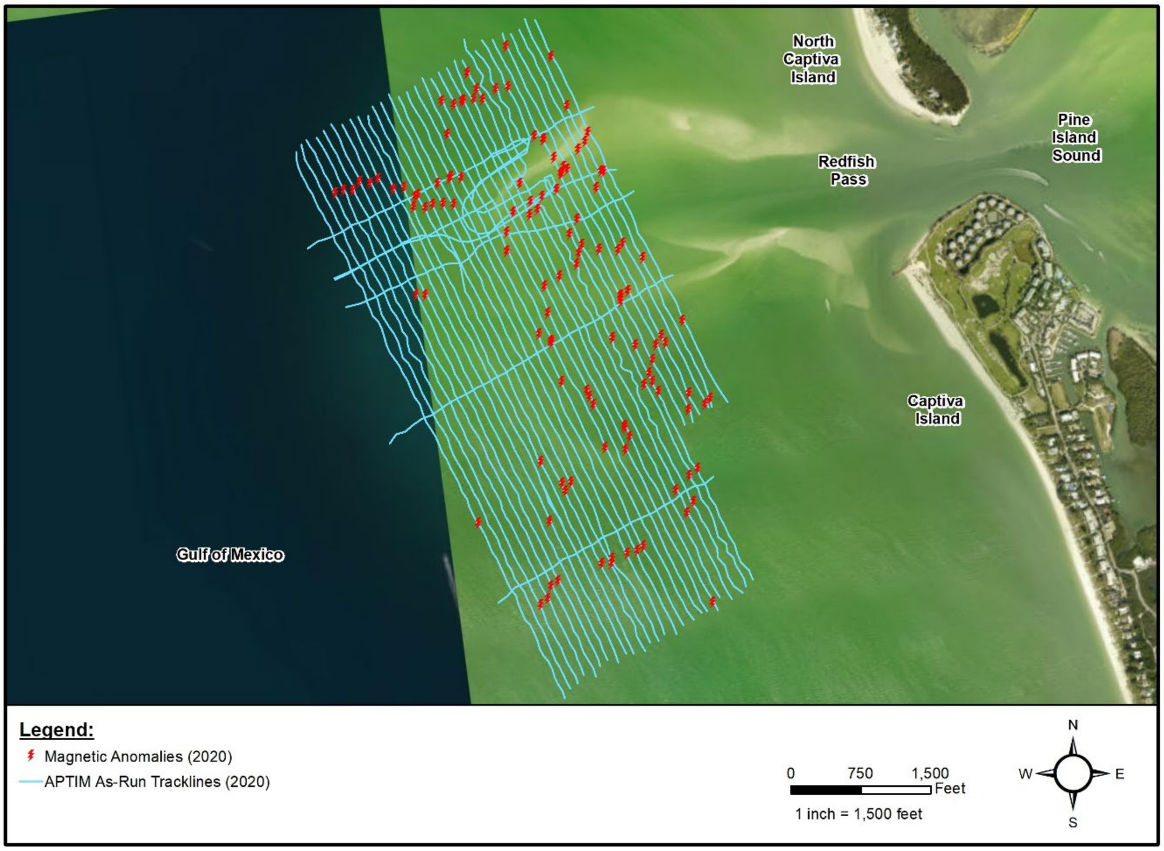


Figure 22. Magnetic anomalies identified during the Redfish Pass survey.

Cultural Resource Assessment

To determine the impact of the project on potentially significant submerged cultural resources, SEARCH carried out a background literature review and supervised a cultural resource investigation of the proposed borrow area. The cultural resource report compiled by SEARCH is provided in Appendix 9. SEARCH's review of background literature indicated that in the vicinity of the proposed borrow area the potential for submerged cultural resources is high due to international, national and regional maritime activities prevalent in the area.

Following the literature review, SEARCH supervised the magnetometer, sidescan sonar and sub-bottom profile survey conducted as part of this study. Analysis of remote sensing data collected during this investigation, identified a total of 40 magnetic anomalies, three sidescan sonar and seismic contacts, however none of these are considered to be potential cultural resource targets and are likely potential debris associated with the pleasure craft and commercial fishing occurring around the navigation inlet.

Borrow Area Design

One final borrow area was designed that contained potentially beach compatible material on the ebb shoal. Any identified potential cultural resources were also avoided in the borrow area design and final volume calculations. The final borrow area design is shown in Figure 23.

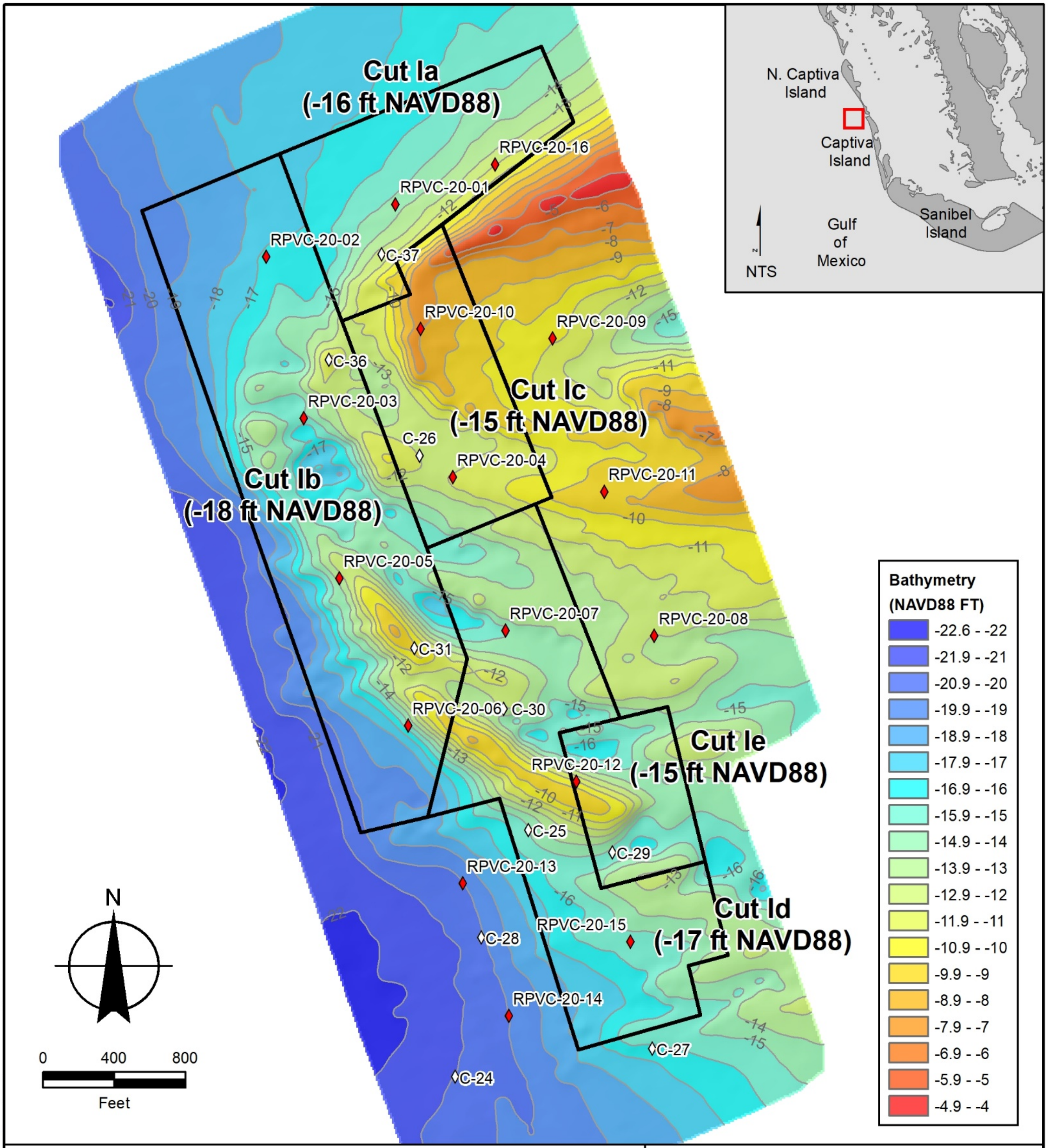
Design Considerations

A detailed review and interpretation of the collected and processed data indicated that there were no benthic habitats of concern or any evidence of prehistoric habitation located within the proposed borrow area. No targets of environmental or cultural concern were identified within the borrow area. Sub-bottom profiling data were reviewed and applied to the borrow area design. A sediment thickness (isopach) map was developed for the borrow area (Figure 24).

Once the beach compatible sediment was delineated, the horizontal and vertical extents of the final borrow area were determined based on various parameters. The horizontal extent was determined by the vibracore's area of influence (500 ft. radius buffer). The vertical extents of the borrow area were determined from the vibracore material, a minimum of 2 ft above non-compatible sediment and a minimum of two feet above the bottom of the core (if applicable). In addition to the 2020 vibracores, vibracores collected by CPE in 2010 were also included in the borrow area design. The borrow area water depth ranges from approximately -5.0 ft. to -20.0 ft. on the shoal and will require the use of a cutterhead dredge due to shallow depths in and around the borrow area design.

Part of the borrow area design process is determining that the sediment included in the final design cuts is compatible with the existing or native beach in terms of grain size, sorting, fines content, and color. Analysis of the beach samples collected in 2010 and 2013 characterize the native beach as fine- to medium-grained quartz sand, with trace fines (<5%), trace shell hash, shell fragments, and whole shells and a high carbonate content.

The center of the borrow area is located approximately 3,700 ft. southwest of FDEP range monument R-084. The final borrow area has five cut elevations ranging from -15.0 ft. to -18.0 ft. NAVD88. The total volume in the borrow area was calculated to be approximately 716,200 cy (Table 6). The material in this borrow area is predominantly fine- to medium grained quartz sand with trace fines (<2%) and trace to some shell hash, fragments and whole shells. This borrow area has a mean grain size of 0.34mm. The wet Munsell Color Values ranged between 6 and 7.



Legend

◊ 1990 CPE Vibracores
♦ 2020 Vibracores
▭ isopachcuts_test
— 2020 Bathymetry Contours

Notes

1. Bathymetry collected by APTIM between January 14, 2020 and January 15, 2020.
2. Vibracores collected by APTIM between July 27, 2020 and July 28, 2020.
3. Vibracores collected by Coastal Planning & Engineering, Inc. between December 20, 1990 and December 27, 1990.

CAPTIVA EROSION PREVENTION DISTRICT
11513 ANDY ROSSE LANE, UNIT 4
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REDFISH PASS SAND SEARCH

FIGURE NUMBER
23

Borrow Area Design

APTIM

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G:\Enterprise\Lee\1745001138_RedfishPass\mxd\FigureX-BA_Design.mxd; Analyst: Beth Forrest; Date: 9/24/2020 11:51:37 AM

iDocs Document No.; Issue Statement; Ver. 0; 24Sep2020

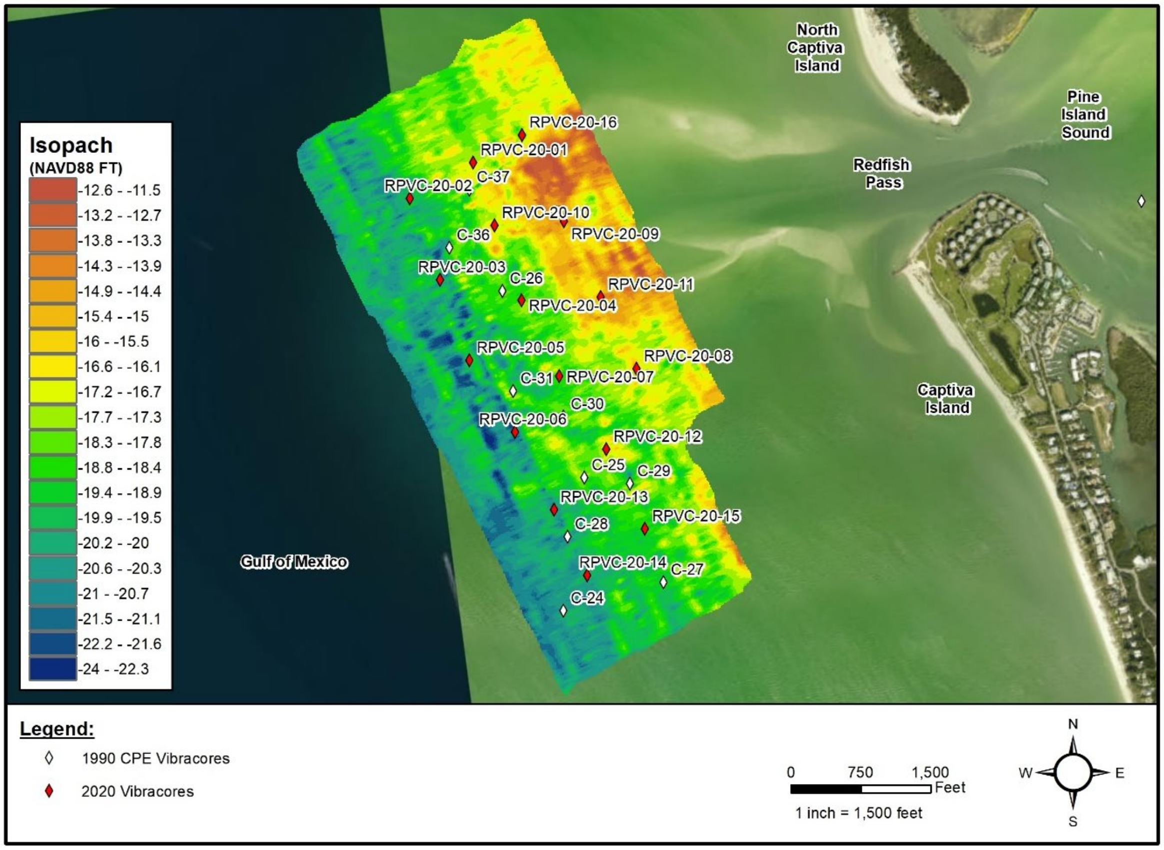

Figure 24. Isopach (sediment thickness map) developed for the borrow area.

Table 6. Redfish Pass Borrow Area I volume summary.

Cut ID	Cut Elevation (ft NAVD88)	Volume (cy)	Average Thickness (ft)
Ia	-16	66,800	1.55
Ib	-18	252,400	2.10
Ic	-15	165,700	4.20
Id	-17	209,700	2.87
Ie	-15	21,600	3.00

It should be noted that vibracores RPVC-20-08, RPVC-20-09 and RPVC-20-11, which are located to the east of the borrow area, were not included in the borrow area design. These cores contained significant thicknesses of sand. However, the material was shelly and did not meet the FDEP gravel requirement that no more than 5% should be retained on the #4 sieve.

It should also be noted that vibracore RPVC-20-10 was included in the borrow area design but was a very short core (recovery of 5.9 ft). As such, it limited the depth to which the cut could be dredged. In future, if additional volume is needed, a jet probe could be collected at this location to assess deepening the cut. A jet probe was not collected because the cut extends only slightly below this core (1.2 ft). The sub-bottom data and surrounding cores support the cut.

Additional volume may also be obtained by further exploring the shelly area to the east of the borrow area. It may also be possible to work with FDEP to reduce the buffer above material that does not meet their guidelines and applying more stringent dredging control.

Composite mean grain size, sorting, percent silt content, percent carbonate content, percent gravel content and wet Munsell Color Value were computed for each vibracore within Redfish Pass Borrow Area I by calculating the weighted average (sample weighted by representative lengths of the sampled layer within the core), and are included in Appendices 15, 16 and 17. The composite statistics for the entire borrow area were compiled by averaging the weighted results for all cores within the lateral and vertical limits of the borrow area as well as cores whose area of influence intersect the borrow area. The grain sizes of the fill materials are based on the geotechnical investigations for the borrow area. The borrow area composite statistics are shown in Table 7.

Table 7. Borrow Area characteristics.

Location	Mean Grain Size[1]		Sorting[1]	Fines[2]	Wet Munsell Color	Carbonate Content	Gravel Content[3]
	(mm)	(phi)	(phi)	(%)	Value	(%)	(%)
Redfish Pass Borrow Area I	0.34	1.56	1.66	1.44	7	41	0.20

[1] Sieve analyses were conducted on all sediment samples in accordance with ASTM Standard Methods Designation D6913-17 for particle size analysis of soils. Grain size data were entered into the gINT® software program, which computes the mean and median grain size, sorting, and silt/clay percentages for each sample using the moment method (Folk, 1974).

[2] Fines content is defined as the percentage of material finer than 0.0625 mm.

[3] Gravel is defined as the percentage of material retained on the #4 sieve.

The borrow area design was evaluated with respect to potential effects on the shoreline. The analysis was performed based on the numerical model results obtained for the alternatives presented in the Inlet Management Study. The effects of the final alternatives assessed in the Inlet Management Study on waves and morphology are restricted to the ebb shoal area and did not reach the coastline in either the simulated average or extreme conditions. The final borrow area cuts were designed within the limits of the footprints evaluated in the Inlet Management Plan modeling study, and the depths were equal or shallower. For this reason, effects on the shoreline are expected to be insignificant, with negligible impacts on wave heights and coastal morphology.

Dredge Plan

The FDEP requires the development of a dredging plan for excavation of borrow area sediments that provides the most efficient utilization of the entire volume of borrow area sediment over the course of initial and subsequent beach nourishment projects. The FDEP requires that borrow area sediment management conserve the beach fill material remaining within the borrow area after completion of each nourishment event.

The Redfish Pass Borrow Area will be dredged in a manner to utilize sediment to the greatest extent practical, and to avoid the loss of sediment which could be used to renourish the beach during future projects. It should be recognized that Contractor equipment selection will influence the ability to practically dredge all the sand within any portion of the borrow area.

Based on the significant quantity of shell in the gravel size range (retained on the # 4 sieve) in the ebb shoal, it is recommended that during dredging the material is screened for shell.

The Contractor will need to excavate within the borrow area uniformly and continuously in order to extract as much material within the area of excavation as practical. The Contractor will complete dredging to the greatest extent practical, as determined by the Engineer. If unsuitable material is encountered or if directed by the Engineer, the Contractor will need to change the location and/or elevation of excavation within the borrow limits, while still adhering to the dredging procedures and order prescribed above.

Data Quality

There are certain limitations that exist when interpreting the vibracore and sub-bottom profiling data. The vibracores are located approximately 1,000 ft. apart, per industry standards, on select sub-bottom profile lines for interpretation of the underlying geology. Vibracores are not located on each individual sub-bottom profile line, therefore the material in each location cannot be confirmed with physical samples. The currently accepted vibracore spacing, coupled with the sub-bottom interpolation, give reasonable assurance for sediment consistency within the borrow area. However, discreet layers of non-compatible material may be present within the borrow area due to possible vertical and horizontal variability in the deposit.

Compatibility Analysis

The compatibility of the sand sources is evaluated according to color, fines content, and grain size. Data from the sieve analyses (grain size distribution curves and granularmetric reports) and vibracore logs are included in the appendices. Composite mean grain size, percent fines content and sorting were computed for each vibracore by calculating the weighted average (sample weighted by representative lengths of the sampled layer within the core), and are included in Appendices 10, 11 and 12. The composite mean grain size, percent fines content and sorting for the entire borrow area were compiled by averaging the weighted results for all vibracores within the lateral and vertical limits of the borrow area. Vibracores collected outside of the borrow area were also included in composite calculations if their area of influence (based on their 500 ft buffer) intersected the borrow area. Historic cores collected by CPE in 1990 were also incorporated into the borrow area design and composite calculations.

Beach samples were not collected during this project. However, to provide an idea of the existing beach, samples collected in 2010 by CPE (CPE, 2010) and post-construction samples collected in 2013 (CB&I-CPE, 2013) were used to determine a potential native beach characterization and a target composite statistic. The grain sizes of the fill materials are based on the geotechnical investigations for the borrow area. The summary results (composites) are shown in Table 8. A full compatibility analysis was not performed, but will be required prior to using this borrow area.

Table 8. Beach and borrow area characteristics.

Borrow Area	Carbonate Content[1]	Visual Shell Content	Mean Grain Size[2]		Sorting[2]	Fines[3]	Wet Munsell Color Value[4]
	(%)	(%)	(mm)	(phi)	(phi)	(%)	
Redfish Pass Borrow Area I	41	36	0.34	1.56	1.66	1.44	7
Captiva Island (R-086 to R-107) (2010 samples)	NA	NA	0.35	1.51	NA	2.44	NA
Captiva Island (R-084.6 to R-109) (2013 samples)	43.65	1.23	0.46	1.12	NA	0.60	NA
Sanibel Island (R-112) (2010 samples)	NA	NA	0.38	1.40	NA	2.21	NA
Sanibel Island (R-110.5 to R-116) (2013 samples)	51.11	2.32	0.52	0.94	NA	0.60	NA

[1] Carbonate content was determined by percent weight on 69 samples using the acid leaching methodology described in Twenhofel and Tyler (1941).
[2] Sieve analyses were conducted on all sediment samples in accordance with ASTM Standard Methods Designation D6913-17 for particle size analysis of soils. Grain size data were entered into the gINT® software program, which computes the mean and median grain size, sorting, and silt/clay percentages for each sample using the moment method (Folk, 1974).
[3] Fines content is defined as the percentage of material finer than 0.0625 mm (F.A.C. 62 B-41.007).
[4] Wet sand colors were evaluated using the Munsell Color system. The Munsell notation for color consists of separate notations for Hue (combination of red, yellow, green, blue, and purple colors), Value (lightness of the sand color) and Chroma.

Color

Wet sand colors are evaluated using the Munsell color system. The Munsell notation for color consists of separate notations for Hue, Value and Chroma, which are combined in that order to form the color designation. Hue indicates the combination of red, yellow, green, blue, and purple colors. Value indicates the lightness of the sand color. A higher number indicates a lighter sand sample. Chroma indicates the intensity of the color. A higher number indicates a more intense color.

Of these parameters, the most important for beach nourishment is Value. Samples were collected from Captiva and Sanibel in 2010 and 2013 but Wet Munsell Color Values were not determined. The fill material exhibits typical wet Munsell Color Values of 6 to 7, with a composite Value of 7.

Carbonate Content

The carbonate content of the existing beaches on Captiva and Sanibel range from 44 to 51%. The carbonate content for Borrow Area I ranges from 3 to 89% with a weighted average of 39%. The carbonate content of the fill materials is similar to the existing beaches.

Fines

In this analysis, fines content is defined as the percentage of material (silt and/or clay) finer than 0.0625mm as defined by F.A.C. 62 B-41.007. The fines content for the borrow areas ranged between 0.86% and 13.13%, with a composite of 1.66%, which is well below the State (FDEP) limit of 5% defined for beach fill projects. The beach samples exhibit an average fines content ranging from 0.60% to 2.44%. The fines contents of the fill materials are similar to the existing beach.

Conclusions

This sand search investigation followed sequential survey procedures developed by APTIM. Historic data were reviewed for the investigation area, and a geophysical and geotechnical survey on the Redfish Pass ebb shoal was conducted to identify a borrow area for use during the next, and future, renourishment events. A total of approximately 35 nautical line miles of geophysical data were collected at a combined line spacing of approximately 98 ft (30 m). Sixteen (16) vibracores were collected from locations selected based on the analysis of historic data. Beach sand samples were not collected during this project to characterize the existing beach and to evaluate compatibility between the beach and potential borrow areas. A compatibility analysis will need to be conducted once a beach placement location has been identified. The geophysical data, coupled with analysis of the vibracores, were used to determine sediment quality and to maximize the amount of suitable volume for dredging.

Based on the data that were collected, borrow area boundaries and excavation elevations were developed. One final borrow area, designated as Redfish Pass Borrow Area I was designed that contained beach compatible material in the Redfish Pass ebb shoal. The center of Redfish Pass Borrow Area I is located approximately 3,700 ft. southwest of FDEP monument R-084. This is a new borrow area designed by APTIM. The final borrow area has five cut elevations ranging from -15.0 ft. to -18.0 ft. NAVD88. The total volume in the borrow area was calculated to be approximately 716,200 cy. The material in this borrow area is predominantly fine- to medium-grained quartz sand with trace fines (<2%) and trace to some shell hash, fragments and whole shells. This borrow area has a mean grain size of 0.34mm. The wet Munsell Color Values range between 6 and 7 with a composite of 7.

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APPENDIX OVERVIEW

Introduction: These appendices contain the geophysical and geotechnical data collected during the Redfish Pass Sand Search Investigation for Lee County, Florida. In 2020 a concurrent geophysical survey was conducted, in which sub-bottom profiling, sidescan sonar, magnetometer, and bathymetric data were collected. In 2020, sixteen (16) vibracores were collected within the investigation and project area. The vibracore data are provided in the form of logs, photographs, granularmetric reports, and grain size distribution curves/histograms. The borrow area data are provided in the form of composite summary tables, granularmetric reports, and grain size distribution curves/histograms.

1) Survey Report

This appendix contains the GPS control information.

2) 2020 APTIM Vibracore Logs

A total of sixteen (16) vibracores are presented here. Laboratory and descriptive information for each vibracore is presented on the log sheets. Unified Soils Classification System terminology is used in the core layer descriptions and key grain size information (mean grain size, fines content and sorting) for each vibracore sample is presented under the *Remarks* column. Multiple layer intervals are sometimes represented by a single sample. The *Box or Sample* column is used to identify the specific sample that represents a specific layer.

3) 2020 APTIM Vibracore Photographs

Photographs of the sixteen (16) vibracores are presented in this appendix.

4) 2020 APTIM Individual Vibracore Granularmetric Reports

This appendix contains individual granularmetric reports for the vibracore samples collected.

5) 2020 APTIM Individual Vibracore Grain Size Distribution Curves/Histograms

This appendix contains individual grain size distribution curves/histograms for the vibracore samples collected.

6) 2020 Carbonate Testing Results

This appendix contains the native beach and vibracore sample carbonate test results.

7) 2020 APTIM Seismic Data (Digital Copy Only)

This appendix includes seismic records collected in the study area. The files are in HTML format and are therefore only included in the digital copy. A map showing the location of the annotated tracklines is also included in this appendix.

8) 2020 APTIM Sidescan Sonar Contact Sheets

Sidescan sonar images of identified targets are presented in this appendix.

9) SHPO Approval Letter and Draft Cultural Resource Investigation Report

The cultural resource investigation report, compiled by SEARCH, and letter from the State Historic Preservation Office (SHPO), approving the report and recommendations, are provided in this appendix.

10) Borrow Area Composite Summary Tables

A series of summary tables are presented in this appendix. These tables are used to calculate and summarize composite data. Composite statistics were calculated based on the vibracore samples that are representative of the material defined within the Delray Beach Borrow Area. Composite data provide the average physical characteristics of the borrow area. An average of the representative layers, weighted by effective length, was calculated for each vibracore, producing the vibracore composite. The vibracore composites were averaged and weighted by effective length to calculate the borrow area composite.

Three table types were produced to display this data. The *Composite Summary* table is a summary of key grain size data for all of the composites. The *Composite Data* table shows the composite data for the borrow area and the supporting composite vibracore data used to calculate the borrow area composite. The *Cumulative Percents and Computed Distributions* table shows the weighted average percent retained on all sieves for the individual samples used to create vibracore composites.

11) Borrow Area Composite Granularmetric Reports

Composite granularmetric reports, corresponding to data presented in the tables in Appendix 10, are included here. Granularmetric reports are presented for the borrow area and each vibracore.

12) Borrow Area Composite Grain Size Distribution Curves/Histograms

Composite grain size distribution curves/ histograms, corresponding to the data presented in the Appendix 10 tables, are included here. Curves and histograms are presented for the borrow area and each vibracore.

APPENDIX 1
SURVEY REPORT

Control Reconnaissance/Establishment/Verification

Prior to the start of the survey, reconnaissance of the monuments was conducted to confirm that survey control was in place and undisturbed. Real Time Kinematic Global Positioning System (RTK GPS) was used within a virtual reference station (VRS) network to locate and confirm survey control for this project. The horizontal and vertical accuracy of control data meets the accuracy requirements as set forth in the Engineering and Design Hydrographic Surveying Manual (EM 1110-2-1003). In order to achieve required accuracy, the topographic and hydrographic surveys were controlled using 2nd order monuments, specifically L230 and L014 from the National Geodetic Survey (NGS) and BEN IRC, a TBM set by APITM. Control Monuments are presented in table X below. Horizontal and vertical positioning checks were conducted at the beginning and end of each day using at least two 2nd order monuments in the project area. The RTK GPS utilizes statistical methods to ensure accuracy of RTK GPS data remains within the 95% confidence interval. The control check shots were acquired using a minimum of five (5) epochs which results in a high accuracy location.

<table>
<tr><th colspan="2">CONTROL MONUMENT USED BY APTIM
JANUARY 2020</th></tr>
<tr><th colspan="2">DATUMS: NAD83/90 / NAVD1988 (U.S. SURVEY FEET)</th></tr>
<tr><td>Designation</td><td>L230</td></tr>
<tr><td>Stamping</td><td>“U.S. COAST & GEODETIC SURVEY 1965 NO 1”</td></tr>
<tr><td>Northing</td><td>780464.89</td></tr>
<tr><td>Easting</td><td>597100.29</td></tr>
<tr><td>Horizontal Root Mean Square Error</td><td>0.07</td></tr>
<tr><td>Elevation</td><td>3.25</td></tr>
<tr><td>Vertical Root Mean Square Error</td><td>0.18</td></tr>
<tr><td>Description</td><td>Being a USCGS disk in concrete and located at the Southwest corner of Castaways Beach & Bay Cottages office building (6460 Sanibel-Captiva Road). Being 45 feet East of Sanibel-Captiva Road centerline. 7.5 feet Southwest of the Southwest corner of the office building and being in the concrete base of the most Westerly rafter.</td></tr>
</table>

CONTROL MONUMENT USED BY APTIM
JANUARY 2020

DATUMS: NAD83/90 / NAVD1988 (U.S. SURVEY FEET)

Designation	L014
Stamping	12-81-A47-2
Northing	802456.46
Easting	591852.51
Horizontal Root Mean Square Error	0.13
Elevation	5.28
Vertical Root Mean Square Error	0..31
Description	Being a Florida Department of Natural Resources disk in a dune 1 foot below the ground's surface and located in the rear of 1056 South Seas Plantation Road. Being approximately 10 feet North of a sand walking path to the beach and 123 feet West of R-88.

CONTROL MONUMENT USED BY APTIM
JANUARY 2020

DATUMS: NAD83/90 / NAVD1988 (U.S. SURVEY FEET)

Designation	Ben IRC
Stamping	Iron rod and cap
Northing	789531.321
Easting	594071
Horizontal Root Mean Square Error	0.10
Elevation	9.262
Vertical Root Mean Square Error	0.22
Description	Iron rod and cap set in the dune vegetation on Captiva Island. Approximately 192 feet east of a beach access located on Captiva Drive, which is directly across the street from the residence located at 16183 Captiva Dr., Captiva, FL 33924.

APPENDIX 2
2020 APTIM VIBRACORE LOGS

Boring Designation RPVC-20-01

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 **OF** 1 **SHEETS**

1. PROJECT
Redfish Pass Sand Search
Lee County, FL

2. BORING DESIGNATION RPVC-20-01

LOCATION COORDINATES (ft) X = 585,775 Y = 807,850

3. DRILLING AGENCY Athena

CONTRACTOR FILE NO.

4. NAME OF DRILLER Neal Wicker

5. DIRECTION OF BORING
☒ VERTICAL
☐ INCLINED

DEG. FROM VERTICAL

BEARING

6. THICKNESS OF OVERBURDEN 0.0 Ft.

7. DEPTH DRILLED INTO ROCK 0.0 Ft.

8. TOTAL DEPTH OF BORING 12.0 Ft.

9. SIZE AND TYPE OF BIT 3.0 In.

10. COORDINATE SYSTEM/DATUM Florida State Plane West

HORIZONTAL NAD 1983

VERTICAL NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL Mechanical
☐ AUTO HAMMER
☐ MANUAL HAMMER

12. TOTAL SAMPLES

DISTURBED 2

UNDISTURBED (UD)

13. TOTAL NUMBER CORE BOXES

14. ELEVATION GROUND WATER

15. DATE BORING

STARTED 07-27-20

COMPLETED 07-27-20

16. ELEVATION TOP OF BORING -14.6 Ft.

17. TOTAL RECOVERY FOR BORING 9.7 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR Sabrina Porto, MSc

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-14.6	0.0					
-18.4	3.8		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, 0.75" shell fragment @ 3.6', light gray (2.5Y-7/1), (SP).		1	Sample #1, Depth = 2.0' Mean (mm): 0.14, Phi Sorting: 0.43 Fines (230): 2.01% (SP)
-19.6	5.0		CLAY, some sand, trace shell fragments, trace shell hash, trace silt, sand distributed in pockets up to 1.0", 0.75" shell fragment @ 4.8', (0.5"x1.0") shell fragment @ 4.9', mottled gray (2.5Y 5/1) and, light gray (2.5Y-7/1), (CL).			
-21.0	6.4		CLAY, little shell hash, trace sand, fine grained, quartz, trace shell fragments, trace silt, trace whole shell, whole shells up to (0.75"x1.0"), (0.75"x2.5") shell hash pocket @ 5.5', (1.0"x2.5") pocket of whole shells @ 6.2', (1.0"x2.5") pocket of shell hash and shell fragments @ 6.3', (0.5"x0.75") shell fragment @ 6.4', gray (5Y-5/1), (CL).			
-22.6	8.0		SAND, fine grained, quartz, trace organics, trace shell fragments, trace shell hash, trace silt, trace whole shell, (0.5"x1.0") shell fragment @ 6.8', (0.5"x0.75") organic pocket @ 7.2', (0.75"x2.5") shell hash pocket @ 7.4', (1.75"x2.0") shell fragment @ 7.9', (1.0"x1.5") whole shell @ 7.6', light gray (2.5Y-7/1), (SW).		2	Sample #2, Depth = 7.0' Mean (mm): 0.27, Phi Sorting: 1.25 Fines (230): 2.53% (SW)
-24.0	9.4		Silty CLAY, little shell fragments, trace sand, fine grained, quartz, trace shell hash, trace whole shell, (1.0"x1.25") whole shell @ 8.2', (0.5"x1.25") shell fragment @ 8.2', (0.5"x0.75") sand pocket @ 8.4', (1.75"x2.5") sand pocket @ 9.2', gray (2.5Y-5/1), (ML).			
-24.3	9.7		Gravely CLAY, trace shell hash, trace silt, gravel component is rock fragments up to 2.25", dark gray (2.5Y-4/1), (GW).			
-26.6	12.0		No Recovery.			
			End of Boring			

Boring Designation RPVC-20-02

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 **OF** 1 **SHEETS**

1. PROJECT
Redfish Pass Sand Search
Lee County, FL

APTIM

2. BORING DESIGNATION RPVC-20-02

LOCATION COORDINATES (ft) X = 585,049 Y = 807,556

3. DRILLING AGENCY Athena

CONTRACTOR FILE NO.

4. NAME OF DRILLER Neal Wicker

5. DIRECTION OF BORING
☒ VERTICAL
☐ INCLINED

DEG. FROM VERTICAL

BEARING

6. THICKNESS OF OVERBURDEN 0.0 Ft.

7. DEPTH DRILLED INTO ROCK 0.0 Ft.

8. TOTAL DEPTH OF BORING 9.8 Ft.

9. SIZE AND TYPE OF BIT 3.0 In.

10. COORDINATE SYSTEM/DATUM Florida State Plane West

HORIZONTAL NAD 1983

VERTICAL NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL Mechanical

☐ AUTO HAMMER
☐ MANUAL HAMMER

12. TOTAL SAMPLES

DISTURBED 2

UNDISTURBED (UD)

13. TOTAL NUMBER CORE BOXES

14. ELEVATION GROUND WATER

15. DATE BORING

STARTED 07-27-20

COMPLETED 07-27-20

16. ELEVATION TOP OF BORING -16.7 Ft.

17. TOTAL RECOVERY FOR BORING 8.1 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR Beth Forrest, PhD

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-16.7	0.0					
-20.1	3.4		SAND, fine grained, quartz, trace shell hash, trace silt, trace whole shell, silt distributed in laminae and pockets up to 0.25", (0.5"x1.0") whole shells @ 0.2' and 2.2', light gray (2.5Y-7/1), (SP).		1	Sample #1, Depth = 1.8' Mean (mm): 0.14, Phi Sorting: 0.64 Fines (230): 4.13% (SP-SM)
-20.9	4.2		SAND, fine grained, quartz, little silt, trace clay, trace shell fragments, trace whole shell, shell fragments up to 0.5", whole shell up to 1.0", clay distributed in pockets up to 1.0", gray (2.5Y-6/1), (SM).		2	Sample #2, Depth = 3.8' Mean (mm): 0.16, Phi Sorting: 1.38 Fines (230): 13.28% (SM)
-22.6	5.9		Clayey SAND, fine grained, quartz, little silt, trace shell fragments, trace shell hash, trace whole shell, shell fragments up to 0.25", (1.0"x1.5") whole shell @ 4.5', olive gray (5Y-5/2), (SC).			
-23.5	6.8		Shelly CLAY, trace sand, trace silt, shell components are shell hash, shell fragments and whole shells up to 1.0", dark gray (2.5Y-4/1), (GC).			
-24.8	8.1		ROCK, little sand, little shell hash, trace clay, trace silt, rock component is rock fragments up to 3.0", gray (2.5Y-5/1), (GW).			
-26.5	9.8		No Recovery.			

End of Boring

0
5
10
15
20
25

REDFISH_PASS_VIBRACORES.GPJ 9/1/20

Boring Designation RPVC-20-03

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Redfish Pass Sand Search
Lee County, FL

2. BORING DESIGNATION: RPVC-20-03
LOCATION COORDINATES (ft): X = 585,257 Y = 806,648

3. DRILLING AGENCY: Athena
CONTRACTOR FILE NO.

4. NAME OF DRILLER: Neal Wicker

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL
BEARING

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 9.8 Ft.

9. SIZE AND TYPE OF BIT: 3.0 In.

10. COORDINATE SYSTEM/DATUM: Florida State Plane West
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Mechanical
☐ AUTO HAMMER
☐ MANUAL HAMMER

12. TOTAL SAMPLES: DISTURBED: 3
UNDISTURBED (UD)

13. TOTAL NUMBER CORE BOXES

14. ELEVATION GROUND WATER

15. DATE BORING: STARTED: 07-27-20
COMPLETED: 07-27-20

16. ELEVATION TOP OF BORING: -15.3 Ft.

17. TOTAL RECOVERY FOR BORING: 8 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Beth Forrest, PhD

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-15.3	0.0					
-16.9	1.6	∴	SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, (1.0"x1.5") shell fragment @ 1.0', light gray (2.5Y-7/1), (SP).		1	Sample #1, Depth = 0.8' Mean (mm): 0.21, Phi Sorting: 0.66 Fines (230): 1.45% (SP)
-18.8	3.5	∴	SAND, fine grained, quartz, trace shell hash, trace silt, light gray (2.5Y-7/1), (SP).		2	Sample #2, Depth = 2.5' Mean (mm): 0.17, Phi Sorting: 0.55 Fines (230): 1.78% (SP)
-21.9	6.6	∴	SAND, fine grained, quartz, trace shell fragments, trace silt, trace whole shell, silt distributed in pockets up to 0.25", 1.0" pocket of shell fragments up to 0.25" @ 5.4', 3 (0.5") whole shells @ 5.5', 5.6' and 6.3', gray (2.5Y-6/1), (SP).		3	Sample #3, Depth = 5.0' Mean (mm): 0.15, Phi Sorting: 0.56 Fines (230): 4.17% (SP)
-22.5	7.2	▨	Shelly SAND, fine grained, quartz, little silt, trace clay, shell components are shell hash and shell fragments up to 1.0", gray (2.5Y-5/1), (SW-SC).			
-23.3	8.0	▨	CLAY, trace sand, fine grained, quartz, trace silt, (2.0"x3.0") rock fragment at bottom of core, gray (2.5Y-5/1), (CL).			
-25.1	9.8		No Recovery.			
			End of Boring			

Boring Designation RPVC-20-04

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Redfish Pass Sand Search
Lee County, FL

APTIM

2. BORING DESIGNATION: RPVC-20-04
LOCATION COORDINATES (ft): X = 586,097 Y = 806,318

3. DRILLING AGENCY: Athena
CONTRACTOR FILE NO.

4. NAME OF DRILLER: Neal Wicker

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL
BEARING

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 13.1 Ft.

9. SIZE AND TYPE OF BIT: 3.0 In.

10. COORDINATE SYSTEM/DATUM: Florida State Plane West
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Mechanical
☐ AUTO HAMMER
☐ MANUAL HAMMER

12. TOTAL SAMPLES: DISTURBED 8
UNDISTURBED (UD)

13. TOTAL NUMBER CORE BOXES

14. ELEVATION GROUND WATER

15. DATE BORING: STARTED 07-27-20
COMPLETED 07-27-20

16. ELEVATION TOP OF BORING: -11.9 Ft.

17. TOTAL RECOVERY FOR BORING: 11 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Sarah Finkle

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-11.9	0.0					
-12.2	0.3		Shelly SAND, fine grained, quartz, trace silt, shell components are shell hash, whole shell and shell fragments up to (0.5"x1.0"), gray (2.5Y-6/1), (SW).		6	
-12.8	0.9		SAND, fine grained, quartz, little shell hash, trace shell fragments, trace silt, trace whole shell, shell fragments up to (0.5"x0.75") and whole shells up to (0.75"x1.0"), gray (2.5Y-6/1), (SW).		7	
-13.9	2.0		Shelly SAND, fine grained, quartz, trace silt, shell components are shell hash, shell fragments up to (0.5'x0.75") and whole shells up to (1.25"x1.5"), light gray (2.5Y-7/1), (SW).		1	
-14.9	3.0		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, trace whole shell, (1.0"x2.0") shell fragment @ 2.0', (0.5"x1.0") whole shell @ 2.5', light gray (2.5Y-7/1), (SW).		2	
-15.4	3.5		Shelly SAND, fine grained, quartz, trace silt, shell components are shell hash and whole shells up to (1.0"x1.25"), gray (5Y-6/1), (SW).		8	
-16.2	4.3		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, trace whole shell, shell fragments up to 0.5", 2.0" pocket of shell hash and whole shells up to (0.5'x1.25") @ 4.1', gray (5Y-6/1), (SW).		3	
-17.9	6.0		SAND, fine grained, quartz, trace shell hash, trace silt, trace whole shell, whole shells up to (0.75"x1.0"), gray (5Y-6/1), (SW-SM).		4	
-19.0	7.1		SAND, fine grained, quartz, little silt, trace shell fragments, trace shell hash, trace whole shell, shell fragments up to (1.0"x1.5"), whole shells up to (0.5"x1.25"), gray (5Y-5/1), (SM).		5	
-22.8	10.9		Clayey SAND, fine grained, quartz, little shell fragments, little shell hash, little whole shell, trace silt, whole shells typically up to 1.0", (2.25"x2.5") shell fragment @ 8.1', (1.75"x2.0") whole shell @ 8.5', gray (5Y-5/1), (GC).			
-22.9	11.0		ROCK, trace silt, rock component is rock fragments up to 3.0", (N-3/1), (GW).			
-25.0	13.1		No Recovery.			

End of Boring

Sample #6, Depth = 0.2'
Mean (mm): 1.03, Phi Sorting: 1.67
Fines (230): 1.28% (SW)
Sample #7, Depth = 0.6'
Mean (mm): 0.55, Phi Sorting: 2.01
Fines (230): 1.85% (SW)
Sample #1, Depth = 1.5'
Mean (mm): 1.02, Phi Sorting: 1.96
Fines (230): 1.39% (SW)
Sample #2, Depth = 2.5'
Mean (mm): 0.24, Phi Sorting: 1.12
Fines (230): 1.93% (SW)
Sample #8, Depth = 3.2'
Mean (mm): 1.03, Phi Sorting: 1.86
Fines (230): 1.31% (SW)
Sample #3, Depth = 3.9'
Mean (mm): 0.24, Phi Sorting: 0.95
Fines (230): 1.69% (SW)
Sample #4, Depth = 5.1'
Mean (mm): 0.16, Phi Sorting: 1.02
Fines (230): 7.67% (SW-SM)
Sample #5, Depth = 6.5'
Mean (mm): 0.30, Phi Sorting: 2.24
Fines (230): 10.23% (SM)

Boring Designation RPVC-20-05

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 **OF** 1 **SHEETS**

1. PROJECT
Redfish Pass Sand Search
Lee County, FL

APTIM

2. BORING DESIGNATION RPVC-20-05

LOCATION COORDINATES (ft) X = 585,458 Y = 805,750

3. DRILLING AGENCY Athena

CONTRACTOR FILE NO.

4. NAME OF DRILLER Neal Wicker

5. DIRECTION OF BORING
☒ **VERTICAL**
☐ **INCLINED**

DEG. FROM VERTICAL

BEARING

6. THICKNESS OF OVERBURDEN 0.0 Ft.

7. DEPTH DRILLED INTO ROCK 0.0 Ft.

8. TOTAL DEPTH OF BORING 14.1 Ft.

9. SIZE AND TYPE OF BIT 3.0 In.

10. COORDINATE SYSTEM/DATUM Florida State Plane West | **HORIZONTAL** NAD 1983 | **VERTICAL** NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL Mechanical
☐ **AUTO HAMMER**
☐ **MANUAL HAMMER**

12. TOTAL SAMPLES | **DISTURBED** 2 | **UNDISTURBED (UD)** 1

13. TOTAL NUMBER CORE BOXES

14. ELEVATION GROUND WATER

15. DATE BORING | **STARTED** 07-27-20 | **COMPLETED** 07-27-20

16. ELEVATION TOP OF BORING -13.5 Ft.

17. TOTAL RECOVERY FOR BORING 12.5 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR Beth Forrest, PhD

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-13.5	0.0					
-20.8	7.3		SAND, fine grained, quartz, trace shell hash, trace silt, trace whole shell, 2.0" shell hash pockets @ 5.1' and 6.3', (0.5"x1.0") whole shell @ 6.9', 2 (0.5") whole shells @ 6.9', light gray (5Y-7/1), (SW).		1	Sample #1, Depth = 3.5' Mean (mm): 0.25, Phi Sorting: 0.86 Fines (230): 1.45% (SW)
-21.5	8.0		SAND, fine grained, quartz, little clay, trace shell hash, trace silt, trace whole shell, whole shells up to 1.0", gray (5Y-5/1), (SC).		2	Sample #2, Depth = 7.6' Mean (mm): 0.20, Phi Sorting: 1.26 Fines (230): 15.76% (SC)
-21.9	8.4		SAND, fine grained, quartz, trace shell hash, trace silt, trace whole shell, 1.0" whole shell @ 8.3', light gray (5Y-7/1), (SW).		1	
-23.3	9.8		Clayey SAND, fine grained, quartz, trace shell hash, trace silt, gray (5Y-5/1), (SC).			
-26.0	12.5		Shelly CLAY, little sand, trace silt, shell components are shell hash, shell fragments up to 1.0" and whole shells up to 2.0", dark gray (2.5Y-4/1), (SC).			
-27.6	14.1		No Recovery.			
			End of Boring			

0
5
10
15
20
25

Boring Designation RPVC-20-06

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Redfish Pass Sand Search
Lee County, FL

APTIM

2. BORING DESIGNATION RPVC-20-06

LOCATION COORDINATES (ft) X = 585,845 Y = 804,924

3. DRILLING AGENCY Athena

CONTRACTOR FILE NO.

4. NAME OF DRILLER Neal Wicker

5. DIRECTION OF BORING
☒ VERTICAL
☐ INCLINED

DEG. FROM VERTICAL

BEARING

6. THICKNESS OF OVERBURDEN 0.0 Ft.

7. DEPTH DRILLED INTO ROCK 0.0 Ft.

8. TOTAL DEPTH OF BORING 12.8 Ft.

9. SIZE AND TYPE OF BIT 3.0 In.

10. COORDINATE SYSTEM/DATUM Florida State Plane West

HORIZONTAL NAD 1983

VERTICAL NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL Mechanical
☐ AUTO HAMMER
☐ MANUAL HAMMER

12. TOTAL SAMPLES

DISTURBED 5

UNDISTURBED (UD)

13. TOTAL NUMBER CORE BOXES

14. ELEVATION GROUND WATER

15. DATE BORING

STARTED 07-27-20

COMPLETED 07-27-20

16. ELEVATION TOP OF BORING -15.2 Ft.

17. TOTAL RECOVERY FOR BORING 10.2 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR Beth Forrest, PhD

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-15.2	0.0					
-16.7	1.5		SAND, fine grained, quartz, trace shell hash, trace silt, gray (2.5Y-6/1), (SP).		1	Sample #1, Depth = 0.8' Mean (mm): 0.16, Phi Sorting: 0.64 Fines (230): 1.72% (SP)
-18.7	3.5		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, (0.25"x0.5") shell fragment @ 2.1', (0.25"x0.75") shell fragment @ 2.3', gray (2.5Y-6/1), (SW).		2	Sample #2, Depth = 2.5' Mean (mm): 0.21, Phi Sorting: 1.06 Fines (230): 2.06% (SW)
-20.7	5.5		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, 0.25" silty pocket @ 5.1', 0.5" silty pocket @ 5.3', (0.5"x0.75") shell fragment @ 5.5', silt increases with depth, light gray (2.5Y-7/1), (SW).		3	Sample #3, Depth = 4.6' Mean (mm): 0.19, Phi Sorting: 0.88 Fines (230): 1.97% (SW)
-23.5	8.3		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, trace whole shell, silt distributed in pockets typically up to 0.5", (0.5"x1.0") whole shell @ 6.2', 1.5" pocket of shell hash, shell fragments and whole shells up to 0.25"@ 6.2', 1.0" pocket of shell hash and shell fragments up to 0.5"@ 7.5', (2.0"x2.5") silt pocket @ 7.6', silt increases with depth, gray (2.5Y-5/1), (SP-SM).		4	Sample #4, Depth = 6.7' Mean (mm): 0.15, Phi Sorting: 0.80 Fines (230): 4.42% (SP-SM)
-25.0	9.8		SAND, fine grained, quartz, some shell hash, little silt, trace clay, trace rock fragments, trace shell fragments, trace whole shell, shell fragments and whole shells up to 1.0", dark gray (2.5Y-4/1), (SM).		5	Sample #5, Depth = 9.1' Mean (mm): 0.37, Phi Sorting: 2.16 Fines (230): 21.62% (SM)
-25.4	10.2		ROCK, trace shell hash, trace silt, rock component is rock fragments up to 2.0", dark gray (2.5Y-4/1), (GW).			
-28.0	12.8		No Recovery.			

End of Boring

0
5
10
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25

REDFISH_PASS_VIBRACORES.GPJ 9/1/20

SAJ FORM 1836
JUN 04

DRILLING LOG	**DIVISION**	**INSTALLATION**	**SHEET** 1 **OF** 1 **SHEETS**

1. PROJECT
Redfish Pass Sand Search
Lee County, FL

APTIM

2. BORING DESIGNATION RPVC-20-07
LOCATION COORDINATES (ft) X = 586,392 Y = 805,456

3. DRILLING AGENCY Athena
CONTRACTOR FILE NO.

4. NAME OF DRILLER Neal Wicker

5. DIRECTION OF BORING
☒ VERTICAL
☐ INCLINED
DEG. FROM VERTICAL
BEARING

6. THICKNESS OF OVERBURDEN 0.0 Ft.

7. DEPTH DRILLED INTO ROCK 0.0 Ft.

8. TOTAL DEPTH OF BORING 15.5 Ft.

9. SIZE AND TYPE OF BIT 3.0 In.

10. COORDINATE SYSTEM/DATUM Florida State Plane West
HORIZONTAL NAD 1983
VERTICAL NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL Mechanical
☐ AUTO HAMMER
☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED 5
UNDISTURBED (UD)

13. TOTAL NUMBER CORE BOXES

14. ELEVATION GROUND WATER

15. DATE BORING
STARTED 07-27-20
COMPLETED 07-27-20

16. ELEVATION TOP OF BORING -15.1 Ft.

17. TOTAL RECOVERY FOR BORING 13.2 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR Beth Forrest, PhD

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-15.1	0.0					
-17.3	2.2		SAND, fine grained, quartz, little shell hash, trace shell fragments, trace silt, trace whole shell, shell fragments and whole shells up to 1.0", light gray (2.5Y-7/1), (SW).		1	Sample #1, Depth = 1.0' Mean (mm): 0.54, Phi Sorting: 1.84 Fines (230): 1.35% (SW) Sample #2, Depth = 2.6' Mean (mm): 0.19, Phi Sorting: 1.39 Fines (230): 3.07% (SW) Sample #3, Depth = 3.4' Mean (mm): 0.39, Phi Sorting: 1.86 Fines (230): 3.02% (SW) Sample #4, Depth = 4.2' Mean (mm): 0.15, Phi Sorting: 0.84 Fines (230): 3.74% (SP) Sample #5, Depth = 5.4' Mean (mm): 0.13, Phi Sorting: 1.10 Fines (230): 20.53% (SM)
-18.1	3.0		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, shell fragments up to 1.0", light gray (2.5Y-7/1), (SW).		2	
-18.9	3.8		SAND, fine grained, quartz, little shell hash, trace shell fragments, trace silt, trace whole shell, shell fragments up to 1.0", 1.5" whole shell @ 3.1', gray (5Y-6/1), (SW).		3	
-19.7	4.6		SAND, fine grained, quartz, trace shell hash, trace silt, light gray (2.5Y-7/1), (SP).		4	
-20.9	5.8		SAND, fine grained, quartz, little silt, trace clay, trace shell hash, (0.5"x2.0") shell fragment @ 4.6', 1.0" clay pocket @ 5.5', gray (2.5Y-6/1), (SM).		5	
-25.1	10.0		Shelly CLAY, trace silt, shell components are shell hash, shell fragments and whole shells up to 1.0", dark gray (2.5Y-4/1), (GC).			
-27.1	12.0		SAND, fine grained, quartz, little silt, silt distributed in laminae and pockets up to 1.0", mottled dark gray (2.5Y 4/1) and, light gray (2.5Y-7/1), (SC).			
-28.3	13.2		ROCK, some clay, trace shell hash, rock component is rock fragments up to 3.0", dark gray (2.5Y-4/1), (GW).			
-30.6	15.5		No Recovery.			
			End of Boring			

Boring Designation RPVC-20-08

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Redfish Pass Sand Search
Lee County, FL

APTIM

2. BORING DESIGNATION: RPVC-20-08
LOCATION COORDINATES (ft): X = 587,228 Y = 805,426

3. DRILLING AGENCY: Athena
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Neal Wicker

5. DIRECTION OF BORING
☒ VERTICAL
☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 15.0 Ft.

9. SIZE AND TYPE OF BIT: 3.0 In.

10. COORDINATE SYSTEM/DATUM: Florida State Plane West
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Mechanical
☐ AUTO HAMMER
☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED: 7
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES

14. ELEVATION GROUND WATER

15. DATE BORING
STARTED: 07-27-20
COMPLETED: 07-27-20

16. ELEVATION TOP OF BORING: -13.0 Ft.

17. TOTAL RECOVERY FOR BORING: 13.1 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR
Sabrina Porto, MSc

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE
-13.0	0.0				
-14.2	1.2		Shelly SAND, fine grained, quartz, trace shell fragments, trace silt, trace whole shell, shell component is shell hash, shell fragments up to (0.75"x1.5"), whole shells up to (1.0"x2.25"), gray (2.5Y-6/1), (SW).		1
-15.0	2.0		Shelly SAND, fine grained, quartz, trace shell fragments, trace silt, trace whole shell, shell component is shell hash, shell fragments up to (0.75"x1.5") @ 1.5', (0.5"x0.75") whole shell @ 1.6', (0.5"x1.0") whole shell @ 1.6', (0.75"x1.0") whole shell @ 1.9', 0.75" sand pocket @ 1.8', sand increases with depth, light gray (2.5Y-7/1), (SW).		2
-15.6	2.6		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, trace whole shell, (0.5"x0.75") shell fragment @ 2.4', (0.25"x0.5") whole shell @ 2.5', shell increases with depth, light gray (2.5Y-7/1), (SW).		3
-16.5	3.5		Shelly SAND, fine grained, quartz, trace shell fragments, trace silt, trace whole shell, shell fragments up to 1.25", (0.75"x1.0") whole shell @ 3.4', 1.0" sand pocket @ 3', light gray (2.5Y-7/1), (SW).		4
-17.9	4.9		SAND, fine grained, quartz, trace clay, trace shell fragments, trace shell hash, trace silt, (0.25"x1.25") clay laminae @ 3.6', (0.5"x0.75") shell fragment @ 4.1', light gray (2.5Y-7/1), (SW).		5
-19.0	6.0		SAND, fine grained, quartz, trace clay, trace shell fragments, trace shell hash, trace silt, trace whole shell, silt distributed in laminae, (0.5"x0.75") whole shell @ 5.0', (0.5"x0.75") whole shell @ 5.1', 0.5" shell fragment @ 5.3', 1.0" clay pocket @ 5.8', (0.5"x1.0") shell fragment @ 5.1', gray (5Y-6/1), (SP).		6
-25.6	12.6		SAND, fine grained, quartz, little shell hash, little silt, trace clay, trace shell fragments, trace whole shell, clay distributed in laminae, shell fragments up to (2.0"x3.0"), (1.75"x2.0") whole shell @ 6.2', (2.0"x2.5") shell fragment @ 6.9', 2 (2.5"x3.0") whole shells @ 8.5', 2.5" whole shell and shell fragment pocket @ 9.8', clay increases with depth, dark gray (2.5Y-4/1), (SM).		7
-26.1	13.1		Silty GRAVEL, little shell fragments, little whole shell, trace shell hash, gravel component is rock fragments, shell fragments up to (0.5"x1.0"), whole shells up to (0.5"x1.5"), rock fragments up to (2.0"x2.75") from 12.8' to 13.1', dark gray (2.5Y-4/1), (GW).		
-28.0	15.0		No Recovery.		
			End of Boring		

REMARKS

Sample #1, Depth = 0.6'
Mean (mm): 1.06, Phi Sorting: 1.64
Fines (230): 1.42% (SW)
Sample #2, Depth = 1.6'
Mean (mm): 0.70, Phi Sorting: 1.93
Fines (230): 1.37% (SW)
Sample #3, Depth = 2.5'
Mean (mm): 0.23, Phi Sorting: 1.39
Fines (230): 2.72% (SW)
Sample #4, Depth = 3.3'
Mean (mm): 1.36, Phi Sorting: 2.02
Fines (230): 1.14% (SW)
Sample #5, Depth = 4.3'
Mean (mm): 0.25, Phi Sorting: 1.09
Fines (230): 2.31% (SW)
Sample #6, Depth = 5.5'
Mean (mm): 0.13, Phi Sorting: 0.93
Fines (230): 8.58% (SM)
Sample #7, Depth = 8.0'
Mean (mm): 0.32, Phi Sorting: 2.57
Fines (230): 18.55% (SM)

Boring Designation RPVC-20-09

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 **OF** 1 **SHEETS**

1. PROJECT Redfish Pass Sand Search
Lee County, FL

2. BORING DESIGNATION RPVC-20-09

LOCATION COORDINATES (ft) X = 586,656 Y = 807,097

3. DRILLING AGENCY Athena

CONTRACTOR FILE NO.

4. NAME OF DRILLER Neal Wicker

5. DIRECTION OF BORING
☒ **VERTICAL**
☐ **INCLINED**

DEG. FROM VERTICAL

BEARING

6. THICKNESS OF OVERBURDEN 0.0 Ft.

7. DEPTH DRILLED INTO ROCK 0.0 Ft.

8. TOTAL DEPTH OF BORING 13.0 Ft.

9. SIZE AND TYPE OF BIT 3.0 In.

10. COORDINATE SYSTEM/DATUM Florida State Plane West | **HORIZONTAL** NAD 1983 | **VERTICAL** NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL Mechanical
☐ **AUTO HAMMER**
☐ **MANUAL HAMMER**

12. TOTAL SAMPLES | **DISTURBED** 5 | **UNDISTURBED (UD)** 2

13. TOTAL NUMBER CORE BOXES

14. ELEVATION GROUND WATER

15. DATE BORING | **STARTED** 07-28-20 | **COMPLETED** 07-28-20

16. ELEVATION TOP OF BORING -10.8 Ft.

17. TOTAL RECOVERY FOR BORING 10.7 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR Beth Forrest, PhD

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-10.8	0.0					
-11.6	0.8		SHELL, trace sand, fine grained, quartz, trace silt, shell components are shell hash, shell fragments up to 1.0" and whole shells up to 0.5", light brownish gray (2.5Y-6/2), (SW).		1	Sample #1, Depth = 0.5' Mean (mm): 2.66, Phi Sorting: 1.72 Fines (230): 1.97% (SW)
-15.0	4.2		SHELL, little sand, fine grained, quartz, trace silt, shell components are shell hash, shell fragments and whole shells up to 0.5", sand increases with depth, light brownish gray (2.5Y-6/2), (SW).		2	Sample #2, Depth = 3.0' Mean (mm): 1.36, Phi Sorting: 1.75 Fines (230): 1.76% (SW)
-15.7	4.9		Shelly SAND, fine grained, quartz, trace silt, shell component is shell hash, gray (5Y-6/1), (SW).		3	Sample #3, Depth = 4.6' Mean (mm): 0.62, Phi Sorting: 1.46 Fines (230): 1.76% (SW)
-16.6	5.8		SAND, fine grained, quartz, some shell hash, trace silt, light gray (2.5Y-7/1), (SW).		4	Sample #4, Depth = 5.5' Mean (mm): 0.37, Phi Sorting: 1.44 Fines (230): 2.09% (SW)
-18.8	8.0		SHELL, little sand, trace silt, shell components are shell hash, shell fragments and whole shells up to 0.5", sand increases with depth, light brownish gray (2.5Y-6/2), (SW).		2	
-20.1	9.3		SAND, fine grained, quartz, some shell hash, trace silt, light gray (2.5Y-7/1), (SW).		4	
-21.5	10.7		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, shell fragments up to 0.5", light gray (5Y-7/1), (SW-SM).		5	Sample #5, Depth = 10.1' Mean (mm): 0.19, Phi Sorting: 1.20 Fines (230): 7.63% (SW-SM)
-23.8	13.0		No Recovery.			
			End of Boring			

Boring Designation RPVC-20-10

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 **OF** 1 **SHEETS**

1. PROJECT
Redfish Pass Sand Search
Lee County, FL

APTIM

2. BORING DESIGNATION RPVC-20-10

LOCATION COORDINATES (ft) X = 585,913 Y = 807,149

3. DRILLING AGENCY Athena

CONTRACTOR FILE NO.

4. NAME OF DRILLER Neal Wicker

5. DIRECTION OF BORING
☒ **VERTICAL**
☐ **INCLINED**

DEG. FROM VERTICAL

BEARING

6. THICKNESS OF OVERBURDEN 0.0 Ft.

7. DEPTH DRILLED INTO ROCK 0.0 Ft.

8. TOTAL DEPTH OF BORING 6.7 Ft.

9. SIZE AND TYPE OF BIT 3.0 In.

10. COORDINATE SYSTEM/DATUM Florida State Plane West | **HORIZONTAL** NAD 1983 | **VERTICAL** NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL Mechanical
☐ **AUTO HAMMER**
☐ **MANUAL HAMMER**

12. TOTAL SAMPLES | **DISTURBED** 5 | **UNDISTURBED (UD)**

13. TOTAL NUMBER CORE BOXES

14. ELEVATION GROUND WATER

15. DATE BORING | **STARTED** 07-27-20 | **COMPLETED** 07-27-20

16. ELEVATION TOP OF BORING -7.9 Ft.

17. TOTAL RECOVERY FOR BORING 5.9 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR
Sabrina Porto, MSc

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-7.9	0.0					
-9.6	1.7		Shelly SAND, fine grained, quartz, trace silt, trace whole shell, shell components are shell hash and shell fragments up to 1.25", 0.75" whole shell @ 0.1', gray (2.5Y-6/1), (SW).		1	Sample #1, Depth = 1.0' Mean (mm): 0.91, Phi Sorting: 1.68 Fines (230): 3.08% (SW)
-10.5	2.6		Shelly SAND, fine grained, quartz, trace rock fragments, trace silt, shell components are shell hash and shell fragments up to (0.5"x0.75"), (0.5"x1.0") rock fragment @ 2.1', gray (2.5Y-6/1), (SW).		2	Sample #2, Depth = 2.1' Mean (mm): 1.83, Phi Sorting: 1.53 Fines (230): 0.86% (SW)
-13.2	5.3		Shelly SAND, fine grained, quartz, trace silt, shell components are shell hash and shell fragments up to 1.0", 4.0" pocket of shell fragments up to 0.75" @ 3.6', 4.0" sandy pocket @ 4.5', gray (2.5Y-6/1), (SW).		3 4	Sample #3, Depth = 3.5' Mean (mm): 1.10, Phi Sorting: 1.67 Fines (230): 1.43% (SW) Sample #4, Depth = 4.6' Mean (mm): 0.42, Phi Sorting: 1.32 Fines (230): 1.63% (SW)
-13.8	5.9		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, (0.5"x0.75") whole shell @ 5.3', (1.0"x1.25") shell fragment @ 5.8', gray (2.5Y-6/1), (SW).		5	Sample #5, Depth = 5.5' Mean (mm): 0.44, Phi Sorting: 1.43 Fines (230): 1.55% (SW)
-14.6	6.7		No Recovery.			

End of Boring

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SAJ FORM 1836
JUN 04

Boring Designation RPVC-20-11

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Redfish Pass Sand Search
Lee County, FL

APTIM

2. BORING DESIGNATION RPVC-20-11
LOCATION COORDINATES (ft) X = 586,946 Y = 806,237

3. DRILLING AGENCY Athena
CONTRACTOR FILE NO.

4. NAME OF DRILLER Neal Wicker

5. DIRECTION OF BORING
☒ VERTICAL
☐ INCLINED
DEG. FROM VERTICAL
BEARING

6. THICKNESS OF OVERBURDEN 0.0 Ft.

7. DEPTH DRILLED INTO ROCK 0.0 Ft.

8. TOTAL DEPTH OF BORING 16.1 Ft.

9. SIZE AND TYPE OF BIT 3.0 In.

10. COORDINATE SYSTEM/DATUM Florida State Plane West
HORIZONTAL NAD 1983
VERTICAL NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL Mechanical
☐ AUTO HAMMER
☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED 4
UNDISTURBED (UD)

13. TOTAL NUMBER CORE BOXES

14. ELEVATION GROUND WATER

15. DATE BORING
STARTED 07-28-20
COMPLETED 07-28-20

16. ELEVATION TOP OF BORING -9.3 Ft.

17. TOTAL RECOVERY FOR BORING 13.2 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR
Sarah Finkle

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-9.3	0.0					
-13.4	4.1		Shelly SAND, fine grained, quartz, trace silt, shell components are shell hash, shell fragments up to (0.75"x1.75") and whole shells up to (1.5"x2.0"), gray (5Y-6/1), (SW).		1	Sample #1, Depth = 2.6' Mean (mm): 1.43, Phi Sorting: 1.70 Fines (230): 1.28% (SW)
-14.6	5.3		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, trace whole shell, shell fragments up to (0.5"x0.75"), 1.5" pocket of shell hash @ 4.4', (0.75"x1.0") whole shells @ 4.3' and 5.3', light gray (5Y-7/1), (SW).		2	Sample #2, Depth = 4.7' Mean (mm): 0.28, Phi Sorting: 1.30 Fines (230): 1.96% (SW)
-15.3	6.0		Shelly SAND, fine grained, quartz, trace silt, shell components are shell hash, shell fragments up to (0.5"x0.75") and whole shells up to 0.75", 1.0" sand pocket @ 5.7', gray (5Y-6/1), (SW).		4	Sample #4, Depth = 5.6' Mean (mm): 0.61, Phi Sorting: 1.68 Fines (230): 1.40% (SW)
-16.9	7.6		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, trace whole shell, whole shells up to (0.75"x1.0"), 0.75" shell fragment @ 6.2', 2.0" pocket of shell hash and shell fragments up to (1.0"x1.25") @ 7.1', light gray (5Y-7/1), (SW).		3	Sample #3, Depth = 6.5' Mean (mm): 0.26, Phi Sorting: 1.45 Fines (230): 1.60% (SW)
-17.3	8.0		Silty SAND, fine grained, quartz, trace shell hash, trace whole shell, (0.5"x0.75") whole shell @ 7.6', gray (5Y-5/1), (SM).			
-18.1	8.8		Clayey SAND, fine grained, quartz, little shell hash, little silt, trace shell fragments, trace whole shell, shell fragments up to 1.0", whole shells up to (1.5"x1.75"), gray (5Y-5/1), (SC).			
-19.2	9.9		Silty SAND, fine grained, quartz, trace clay, trace shell fragments, trace shell hash, trace whole shell, whole shells up to 0.75", (0.75"x1.0") shell fragment @ 9.4', 1.0" sandy pockets with trace silt and shell hash @ 8.8' and 9.6', gray (5Y-5/1), (SW-SM).			
-22.5	13.2		Clayey SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, trace whole shell, (1.25"x1.5") whole shell @ 10.0', 1.0" shell fragment @ 11.6', (0.75"x1.25") whole shell @ 12.9', dark gray (5Y-4/1), (SC).			
-25.4	16.1		No Recovery.			
			End of Boring			

0 5 10 15 20 25

Boring Designation RPVC-20-12

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Redfish Pass Sand Search
Lee County, FL

APTIM

2. BORING DESIGNATION: RPVC-20-12
LOCATION COORDINATES (ft): X = 586,788 Y = 804,609

3. DRILLING AGENCY: Athena
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Neal Wicker

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 18.2 Ft.

9. SIZE AND TYPE OF BIT: 3.0 In.

10. COORDINATE SYSTEM/DATUM: Florida State Plane West
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Mechanical
☐ AUTO HAMMER
☐ MANUAL HAMMER

12. TOTAL SAMPLES: DISTURBED 9
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES:

14. ELEVATION GROUND WATER:

15. DATE BORING: STARTED 07-28-20 COMPLETED 07-28-20

16. ELEVATION TOP OF BORING: -10.9 Ft.

17. TOTAL RECOVERY FOR BORING: 16 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Beth Forrest, PhD

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE
-10.9	0.0				
-12.1	1.2		SAND, fine grained, quartz, trace shell hash, trace silt, light gray (2.5Y-7/1), (SP).		1
-15.9	5.0		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, shell fragments up to 1.0", 2.0" pocket of shell hash @ 2.4', 1.0" pockets of shell hash @ 2.8', 3.2', 3.8' and 4.1', light gray (5Y-7/1), (SW).		2
-16.3	5.4		SAND, fine grained, quartz, little shell hash, trace shell fragments, trace silt, trace whole shell, shell fragments and whole shells up to 1.0", gray (2.5Y-6/1), (SW).		3
-16.8	5.9		SAND, fine grained, quartz, trace shell hash, trace silt, light gray (5Y-7/1), (SW).		4
-18.3	7.4		SAND, fine grained, quartz, trace shell hash, trace silt, light gray (2.5Y-7/1), (SP).		5
-18.9	8.0		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, trace whole shell, silt distributed in laminae, shell fragments up to 1.5", whole shells up to 0.5", light gray (2.5Y-7/2), (SW).		6
-19.9	9.0		SAND, fine grained, quartz, trace shell hash, trace silt, light gray (2.5Y-7/1), (SP).		7
-20.7	9.8		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, trace whole shell, shell fragments and whole shells up to 0.5", light gray (2.5Y-7/1), (SP).		8
-22.8	11.9		SAND, fine grained, quartz, trace clay, trace shell fragments, trace shell hash, trace silt, trace whole shell, clay distributed in laminae and pockets up to 1.0", shell fragments up to 1.0", (1.0"x2.0") whole shell @ 11.8', clayey sand pocket from 11' to 11.3', mottled gray (2.5Y 6/1) and, light gray (2.5Y-7/1), (SP-SC).		9
-26.4	15.5		Shelly CLAY, trace sand, trace silt, shell components are shell hash, shell fragments up to 3.0" and whole shells up to 2.0", dark gray (2.5Y-4/1), (GC).		
-26.9	16.0		ROCK, little shell hash, trace silt, rock component is fragments of lithified clay, very dark gray (2.5Y-3/1), (GC).		
-29.1	18.2		No Recovery.		

End of Boring

REMARKS

Sample #1, Depth = 0.6'
Mean (mm): 0.22, Phi Sorting: 0.83
Fines (230): 1.68% (SP)

Sample #2, Depth = 3.4'
Mean (mm): 0.24, Phi Sorting: 0.88
Fines (230): 1.56% (SW)

Sample #3, Depth = 5.2'
Mean (mm): 0.50, Phi Sorting: 1.43
Fines (230): 1.44% (SW)
Sample #4, Depth = 5.6'
Mean (mm): 0.25, Phi Sorting: 1.00
Fines (230): 1.21% (SW)
Sample #5, Depth = 6.6'
Mean (mm): 0.20, Phi Sorting: 0.57
Fines (230): 1.66% (SP)
Sample #6, Depth = 7.7'
Mean (mm): 0.38, Phi Sorting: 1.43
Fines (230): 1.64% (SW)
Sample #7, Depth = 8.5'
Mean (mm): 0.14, Phi Sorting: 0.44
Fines (230): 3.48% (SP)
Sample #8, Depth = 9.5'
Mean (mm): 0.15, Phi Sorting: 0.64
Fines (230): 4.03% (SP)
Sample #9, Depth = 10.8'
Mean (mm): 0.14, Phi Sorting: 0.59
Fines (230): 6.90% (SP-SC)

Boring Designation RPVC-20-13

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 **OF** 1 **SHEETS**

1. PROJECT
Redfish Pass Sand Search
Lee County, FL

APTIM

2. BORING DESIGNATION RPVC-20-13

LOCATION COORDINATES (ft) X = 586,153 Y = 804,038

3. DRILLING AGENCY Athena

CONTRACTOR FILE NO.

4. NAME OF DRILLER Neal Wicker

5. DIRECTION OF BORING
☒ VERTICAL
☐ INCLINED

DEG. FROM VERTICAL

BEARING

6. THICKNESS OF OVERBURDEN 0.0 Ft.

7. DEPTH DRILLED INTO ROCK 0.0 Ft.

8. TOTAL DEPTH OF BORING 8.2 Ft.

9. SIZE AND TYPE OF BIT 3.0 In.

10. COORDINATE SYSTEM/DATUM Florida State Plane West

HORIZONTAL NAD 1983

VERTICAL NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL Mechanical

☐ AUTO HAMMER
☐ MANUAL HAMMER

12. TOTAL SAMPLES

DISTURBED 2

UNDISTURBED (UD)

13. TOTAL NUMBER CORE BOXES

14. ELEVATION GROUND WATER

15. DATE BORING

STARTED 07-28-20

COMPLETED 07-28-20

16. ELEVATION TOP OF BORING -20.0 Ft.

17. TOTAL RECOVERY FOR BORING 7.4 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR Sabrina Porto, MSc

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-20.0	0.0					
-21.6	1.6		SAND, fine grained, quartz, little silt, trace shell fragments, trace shell hash, trace whole shell, (0.75"x1.0") shell fragment @ 0.1', 1.6', (1.0"x2.0") shell fragment @ 0.3', 2 (0.5"x0.75") whole shells @ 0.8', gray (2.5Y-6/1), (SW-SM).		1	Sample #1, Depth = 1.0' Mean (mm): 0.17, Phi Sorting: 1.18 Fines (230): 10.18% (SW-SM)
-22.5	2.5		SAND, fine grained, quartz, little clay, trace shell fragments, trace shell hash, trace silt, trace whole shell, shell fragments up to 1.0", whole shells up to (1.5"x1.75"), 2.0" sand pocket at 2.4', gray (2.5Y-5/1), (SC).		2	Sample #2, Depth = 2.0' Mean (mm): 0.33, Phi Sorting: 2.15 Fines (230): 13.65% (SC)
-27.1	7.1		Shelly CLAY, little silt, trace sand, shell components are shell hash, shell fragments and whole shells up to (0.75"x1.0"), dark gray (2.5Y-4/1), (GC).			
-27.4	7.4		ROCK, little shell hash, trace clay, trace sand, trace silt, rock component is rock fragments up to 3.0", gray (2.5Y-5/1), (GW).			
-28.2	8.2		No Recovery.			
			End of Boring			

0
5
10
15
20
25

REDFISH_PASS_VIBRACORES.GPJ 9/1/20

Boring Designation RPVC-20-14

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 **OF** 1 **SHEETS**

1. PROJECT
Redfish Pass Sand Search
Lee County, FL

2. BORING DESIGNATION RPVC-20-14

LOCATION COORDINATES (ft) X = 586,410 Y = 803,293

3. DRILLING AGENCY Athena

CONTRACTOR FILE NO.

4. NAME OF DRILLER Neal Wicker

5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED

DEG. FROM VERTICAL

BEARING

6. THICKNESS OF OVERBURDEN 0.0 Ft.

7. DEPTH DRILLED INTO ROCK 0.0 Ft.

8. TOTAL DEPTH OF BORING 8.1 Ft.

9. SIZE AND TYPE OF BIT 3.0 In.

10. COORDINATE SYSTEM/DATUM Florida State Plane West

HORIZONTAL NAD 1983

VERTICAL NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL Mechanical

☐ AUTO HAMMER
☐ MANUAL HAMMER

12. TOTAL SAMPLES

DISTURBED 2

UNDISTURBED (UD)

13. TOTAL NUMBER CORE BOXES

14. ELEVATION GROUND WATER

15. DATE BORING

STARTED 07-28-20

COMPLETED 07-28-20

16. ELEVATION TOP OF BORING -20.0 Ft.

17. TOTAL RECOVERY FOR BORING 7.3 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR Sarah Finkle

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-20.0	0.0					
-21.5	1.5		SAND, fine grained, quartz, little shell hash, trace shell fragments, trace silt, trace whole shell, whole shells typically up to (0.5"x0.75"), shell fragments up to 0.75", 2.0" whole shell @ 0.1', gray (2.5Y-6/1), (SW-SM).		1	Sample #1, Depth = 0.8' Mean (mm): 0.31, Phi Sorting: 2.10 Fines (230): 8.47% (SW-SM)
-22.7	2.7		SAND, fine grained, quartz, trace shell hash, trace silt, trace whole shell, whole shells up to (0.5"x1.0"), (2.0"x2.5") shell hash pocket @ 2.5', gray (5Y-6/1), (SW-SM).		2	Sample #2, Depth = 2.2' Mean (mm): 0.16, Phi Sorting: 0.93 Fines (230): 9.34% (SW-SM)
-26.9	6.9		Clayey SAND, fine grained, quartz, little shell fragments, little shell hash, little whole shell, trace silt, whole shells and shell fragments typically up to 1.0", (1.5"x2.25") shell fragment @ 2.8', (1.75"x2.5") shell fragment @ 3.9', dark gray (5Y-4/1), (SC).			
-27.3	7.3		ROCK, some silt, rock component is rock fragments up to (1.5"x2.0"), mottled dark gray (N-4/1) and, dark gray (5Y-4/1), (GW).			
-28.1	8.1		No Recovery.			

End of Boring

Boring Designation RPVC-20-15

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 **OF** 1 **SHEETS**

1. PROJECT
Redfish Pass Sand Search
Lee County, FL

2. BORING DESIGNATION RPVC-20-15

LOCATION COORDINATES (ft) X = 587,092 Y = 803,710

3. DRILLING AGENCY Athena

CONTRACTOR FILE NO.

4. NAME OF DRILLER Neal Wicker

5. DIRECTION OF BORING
☒ **VERTICAL**
☐ **INCLINED**

DEG. FROM VERTICAL

BEARING

6. THICKNESS OF OVERBURDEN 0.0 Ft.

7. DEPTH DRILLED INTO ROCK 0.0 Ft.

8. TOTAL DEPTH OF BORING 12.4 Ft.

9. SIZE AND TYPE OF BIT 3.0 In.

10. COORDINATE SYSTEM/DATUM Florida State Plane West

HORIZONTAL NAD 1983

VERTICAL NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL Mechanical
☐ **AUTO HAMMER**
☐ **MANUAL HAMMER**

12. TOTAL SAMPLES

DISTURBED 4

UNDISTURBED (UD)

13. TOTAL NUMBER CORE BOXES

14. ELEVATION GROUND WATER

15. DATE BORING

STARTED 07-28-20

COMPLETED 07-28-20

16. ELEVATION TOP OF BORING -15.4 Ft.

17. TOTAL RECOVERY FOR BORING 11 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR Beth Forrest, PhD

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-15.4	0.0					
-16.6	1.2		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, trace whole shell, whole shells up to 0.25", 3 (0.5"x1.0") shell fragments @ 0.6', light brownish gray (2.5Y-6/2), (SW).		1	Sample #1, Depth = 0.7' Mean (mm): 0.17, Phi Sorting: 1.17 Fines (230): 2.83% (SW)
-19.2	3.8		SAND, fine grained, quartz, trace clay, trace shell fragments, trace shell hash, trace silt, trace whole shell, 2.0" pocket of shell hash and shell fragments up to 1.0" @ 1.3', (0.5"x1.0") whole shell @ 1.8', (0.5"x1.0") clay pocket @ 2.4', silt increases with depth, light gray (2.5Y-7/1), (SW).		2	Sample #2, Depth = 2.5' Mean (mm): 0.20, Phi Sorting: 1.06 Fines (230): 1.81% (SW)
-21.1	5.7		SAND, fine grained, quartz, trace clay, trace shell fragments, trace shell hash, trace silt, clay distributed in pockets up to 0.25", shell fragments up to 0.5", olive gray (5Y-5/2), (SM).		3	Sample #3, Depth = 4.6' Mean (mm): 0.15, Phi Sorting: 1.19 Fines (230): 10.99% (SM)
-21.8	6.4		SAND, fine grained, quartz, some shell hash, trace shell fragments, trace silt, trace whole shell, whole shells up to 1.0", 2.0" shell fragment @ 6.2', olive gray (5Y-5/2), (SW-SM).		4	Sample #4, Depth = 6.1' Mean (mm): 0.44, Phi Sorting: 2.66 Fines (230): 8.47% (SW-SM)
-26.4	11.0		Shelly CLAY, little sand, trace silt, shell components are shell hash, shell fragments and whole shells up to 1.0", dark gray (2.5Y-4/1), (SC).			
-27.8	12.4		No Recovery.			

End of Boring

Boring Designation RPVC-20-16

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 **OF** 1 **SHEETS**

1. PROJECT
Redfish Pass Sand Search
Lee County, FL

APTIM

2. BORING DESIGNATION RPVC-20-16

LOCATION COORDINATES (ft) X = 586,334 Y = 808,074

3. DRILLING AGENCY Athena

CONTRACTOR FILE NO.

4. NAME OF DRILLER Neal Wicker

5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED

DEG. FROM VERTICAL

BEARING

6. THICKNESS OF OVERBURDEN 0.0 Ft.

7. DEPTH DRILLED INTO ROCK 0.0 Ft.

8. TOTAL DEPTH OF BORING 14.0 Ft.

9. SIZE AND TYPE OF BIT 3.0 In.

10. COORDINATE SYSTEM/DATUM Florida State Plane West | **HORIZONTAL** NAD 1983 | **VERTICAL** NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL Mechanical ☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES | **DISTURBED** 4 | **UNDISTURBED (UD)**

13. TOTAL NUMBER CORE BOXES

14. ELEVATION GROUND WATER

15. DATE BORING | **STARTED** 07-28-20 | **COMPLETED** 07-28-20

16. ELEVATION TOP OF BORING -12.1 Ft.

17. TOTAL RECOVERY FOR BORING 11.3 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR Beth Forrest, PhD

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-12.1	0.0					
-14.5	2.4		SAND, fine grained, quartz, trace shell hash, trace silt, silt distributed in laminae and pockets up to 0.25", light gray (5Y-7/1), (SP).		1	Sample #1, Depth = 1.2' Mean (mm): 0.15, Phi Sorting: 0.43 Fines (230): 2.12% (SP)
-15.8	3.7		SAND, fine grained, quartz, trace shell hash, trace silt, 1.0" shell hash pocket @ 3.0', 2.0" shell hash pocket @ 3.5', light gray (5Y-7/1), (SW).		2	Sample #2, Depth = 3.3' Mean (mm): 0.21, Phi Sorting: 1.35 Fines (230): 2.24% (SW)
-17.5	5.4		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, trace whole shell, shell fragments up to 0.25", (0.5"x1.0") whole shell @ 4.7', 2.0" shell hash pocket at 5.0', (1.5"x2.0") whole shell @ 5.2', light gray (5Y-7/1), (SW).		3	Sample #3, Depth = 4.4' Mean (mm): 0.21, Phi Sorting: 0.96 Fines (230): 1.49% (SW)
-19.7	7.6		SAND, fine grained, quartz, little silt, trace clay, trace shell fragments, trace shell hash, trace whole shell, silt distributed in laminae and pockets up to 1.0", clay distributed in pockets up to 0.5", shell fragments and whole shells typically up to 1.0", (0.5"x2.0") whole shell @ 6.7', silt increases with depth, olive gray (5Y-5/2), (SM).		4	Sample #4, Depth = 6.5' Mean (mm): 0.15, Phi Sorting: 1.22 Fines (230): 12.70% (SM)
-20.6	8.5		Shelly SAND, fine grained, quartz, trace clay, trace silt, shell components are shell hash, shell fragments and whole shells up to 1.0", clay distributed in pockets up to 1.0", (1.0"x2.0") whole shells @ 8.3' and 7.8', gray (5Y-5/1), (SW).			
-21.7	9.6		SHELL, little sand, fine grained, quartz, trace silt, shell components are shell hash, shell fragments and whole shells up to 1.0", gray (5Y-6/1), (SW).			
-23.4	11.3		CLAY, some shell, trace sand, trace silt, shell components are shell hash, shell fragments and whole shells up to 1.5", (2.5"x3.0") whole shell @ 10.2', dark gray (5Y-4/1), (GC).			
-26.1	14.0		No Recovery.			
			End of Boring			

APPENDIX 3
2020 APTIM VIBRACORE PHOTOGRAPHS


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-01
0.0'- 2.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-01
2.0'- 4.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-01
4.0'- 6.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-01
6.0'- 8.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-01
8.0'-9.7'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-02
0.0'- 2.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-02
2.0'- 4.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-02
4.0'- 6.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-02
6.0'- 8.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-02
8.0'- 8.1'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-03
0.0'- 2.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-03
2.0'- 4.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-03
4.0'- 6.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-03
6.0'- 8.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-04
0.0'- 2.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-04
2.0'- 4.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-04
4.0'- 6.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-04
6.0'- 8.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-04
8.0'-10.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-04
10.0'-11.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-05
0.0'- 2.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-05
2.0'- 4.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-05
4.0'- 6.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-05
6.0'- 8.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-05
8.0'-10.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-05
10.0'-12.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-05
12.0'-12.5'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-06
0.0'- 2.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-06
2.0'- 4.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-06
4.0'- 6.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-06
6.0'- 8.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-06
8.0'-10.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-06
10.0'-10.2'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-07
0.0'- 2.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-07
2.0'- 4.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-07
4.0'- 6.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-07
6.0'- 8.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-07
8.0'-10.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-07
10.0'-12.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-07
12.0'-13.2'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-08
0.0'- 2.0'

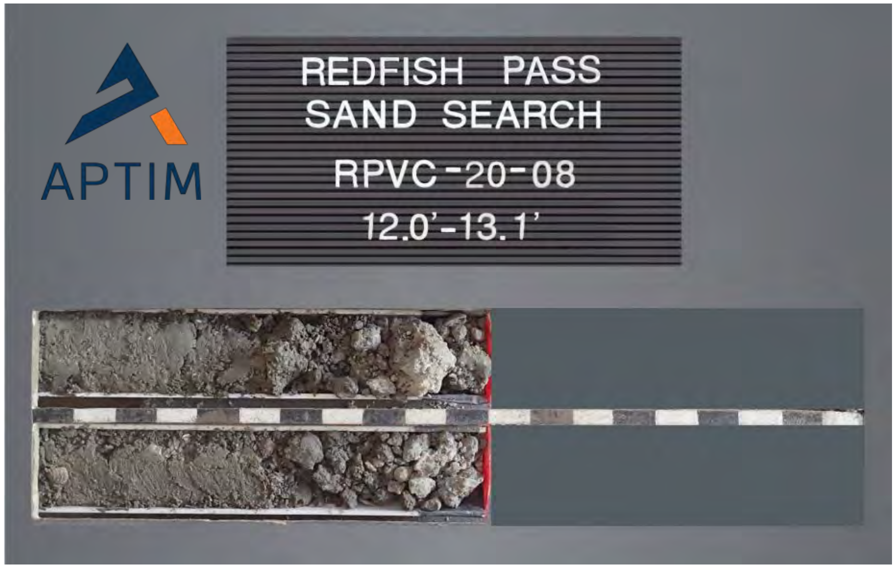

APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-08
2.0'- 4.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-08
4.0'- 6.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-08
6.0'- 8.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-08
8.0'-10.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-08
10.0'-12.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-08
12.0'-13.1'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-09
0.0'- 2.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-09
2.0'- 4.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-09
4.0'- 6.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-09
6.0'- 8.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-09
8.0'-10.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-09
10.0'-10.7'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-10
0.0'- 2.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-10
2.0'- 4.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-10
4.0'- 5.9'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-11
0.0'- 2.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-11
2.0'- 4.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-11
4.0'- 6.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-11
6.0'- 8.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-11
8.0'-10.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-11
10.0'-12.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-11
12.0'-13.2'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-12
0.0'- 2.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-12
2.0'- 4.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-12
4.0'- 6.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-12
6.0'- 8.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-12
8.0'-10.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-12
10.0'-12.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-12
12.0'-14.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-12
14.0'-16.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-13
0.0'- 2.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-13
2.0'- 4.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-13
4.0'- 6.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-13
6.0'- 7.4'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-14
0.0'- 2.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-14
2.0'- 4.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-14
4.0'- 6.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-14
6.0'- 7.3'

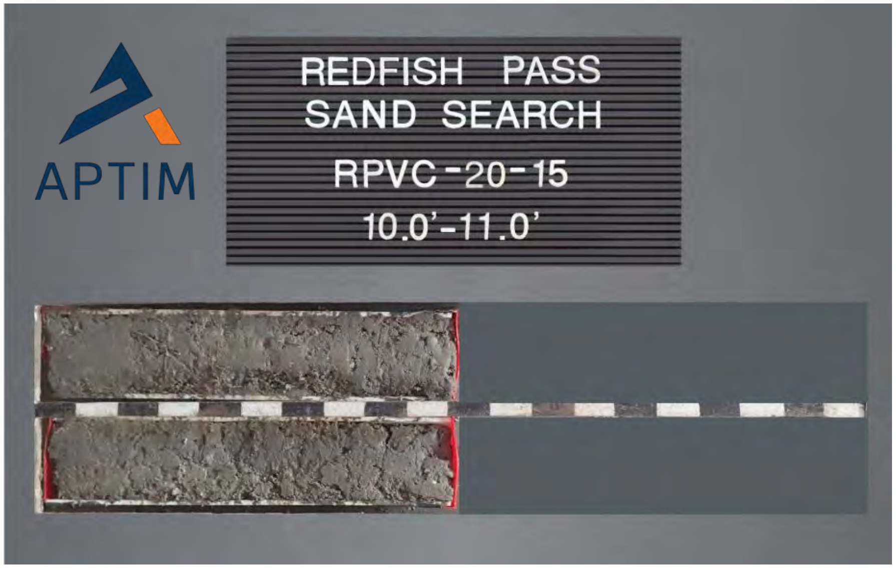

APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-15
0.0'- 2.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-15
2.0'- 4.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-15
4.0'- 6.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-15
6.0'- 8.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-15
8.0'-10.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-15
10.0'-11.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-16
0.0'- 2.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-16
2.0'- 4.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-16
4.0'- 6.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-16
6.0'- 8.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-16
8.0'-10.0'


APTIM
REDFISH PASS
SAND SEARCH
RPVC-20-16
10.0'-11.3'

APPENDIX 4
2020 APTIM INDIVIDUAL VIBRACORE GRANULARMETRIC REPORTS

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-01 #1

Analysis Date: 08-12-20

Analyzed By: SF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,775	807,850	Florida State Plane West	-16.6 NAVD 88

USCS:	Munsell:	Comments:
SP	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
98.80	96.95	0.10	0.02	#200 - 3.10 #230 - 2.01		3	2

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.01	0.01	0.01	0.01
10	-1.00	2.00	0.06	0.06	0.07	0.07
14	-0.50	1.41	0.06	0.06	0.13	0.13
18	0.00	1.00	0.10	0.10	0.23	0.23
25	0.50	0.71	0.14	0.14	0.37	0.37
35	1.00	0.50	0.23	0.23	0.60	0.60
45	1.50	0.35	0.38	0.38	0.98	0.98
60	2.00	0.25	1.10	1.11	2.08	2.09
80	2.50	0.18	10.32	10.45	12.40	12.54
120	3.00	0.13	56.56	57.25	68.96	69.79
170	3.50	0.09	24.26	24.55	93.22	94.34
200	3.75	0.07	2.53	2.56	95.75	96.90
230	4.00	0.06	1.08	1.09	96.83	97.99

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.56	3.29	3.11	2.83	2.61	2.53	2.14

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.82	0.14	0.43	-2	17.41

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-01 #2

Analysis Date: 08-12-20

Analyzed By: RH

APTIM

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,775	807,850	Florida State Plane West	-21.6 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
97.59	95.34	0.05	0.18	#200 - 2.75 #230 - 2.53		27	25

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.44	0.45	0.44	0.45
5/16"	-3.00	8.00	0.72	0.74	1.16	1.19
3.5	-2.50	5.66	0.83	0.85	1.99	2.04
4	-2.25	4.76	0.34	0.35	2.33	2.39
5	-2.00	4.00	0.22	0.23	2.55	2.62
7	-1.50	2.83	0.76	0.78	3.31	3.40
10	-1.00	2.00	1.09	1.12	4.40	4.52
14	-0.50	1.41	1.63	1.67	6.03	6.19
18	0.00	1.00	1.98	2.03	8.01	8.22
25	0.50	0.71	2.36	2.42	10.37	10.64
35	1.00	0.50	3.23	3.31	13.60	13.95
45	1.50	0.35	5.04	5.16	18.64	19.11
60	2.00	0.25	17.60	18.03	36.24	37.14
80	2.50	0.18	28.89	29.60	65.13	66.74
120	3.00	0.13	24.14	24.74	89.27	91.48
170	3.50	0.09	5.56	5.70	94.83	97.18
200	3.75	0.07	0.07	0.07	94.90	97.25
230	4.00	0.06	0.21	0.22	95.11	97.47

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.31	2.85	2.67	2.22	1.66	1.20	-0.86

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	1.88	0.27	1.25	-2.17	8.3

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-02 #1

Analysis Date: 08-13-20

Analyzed By: EB

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,049	807,556	Florida State Plane West	-18.5 NAVD 88

USCS:	Munsell:	Comments:
SP-SM	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
97.65	93.98	0.24	0.12	#200 - 8.42 #230 - 4.13		6	1

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.50	0.51	0.50	0.51
4	-2.25	4.76	0.00	0.00	0.50	0.51
5	-2.00	4.00	0.00	0.00	0.50	0.51
7	-1.50	2.83	0.04	0.04	0.54	0.55
10	-1.00	2.00	0.04	0.04	0.58	0.59
14	-0.50	1.41	0.05	0.05	0.63	0.64
18	0.00	1.00	0.11	0.11	0.74	0.75
25	0.50	0.71	0.24	0.25	0.98	1.00
35	1.00	0.50	0.37	0.38	1.35	1.38
45	1.50	0.35	0.50	0.51	1.85	1.89
60	2.00	0.25	1.22	1.25	3.07	3.14
80	2.50	0.18	7.12	7.29	10.19	10.43
120	3.00	0.13	45.19	46.28	55.38	56.71
170	3.50	0.09	33.79	34.60	89.17	91.31
200	3.75	0.07	0.26	0.27	89.43	91.58
230	4.00	0.06	4.19	4.29	93.62	95.87

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.95	3.39	3.26	2.93	2.66	2.56	2.13

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.87	0.14	0.64	-4.51	37.8

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-02 #2
Analysis Date: 08-13-20
Analyzed By: EB

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,049	807,556	Florida State Plane West	-20.5 NAVD 88

USCS:	Munsell:	Comments:
SM	Wet - 2.5Y-6/1 Dry - 2.5Y-7/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
100.07	87.65	0.62	0.25	#200 - 20.77 #230 - 13.28		14	10

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	1.28	1.28	1.28	1.28
3.5	-2.50	5.66	0.31	0.31	1.59	1.59
4	-2.25	4.76	0.55	0.55	2.14	2.14
5	-2.00	4.00	0.42	0.42	2.56	2.56
7	-1.50	2.83	0.96	0.96	3.52	3.52
10	-1.00	2.00	0.95	0.95	4.47	4.47
14	-0.50	1.41	1.02	1.02	5.49	5.49
18	0.00	1.00	0.76	0.76	6.25	6.25
25	0.50	0.71	0.94	0.94	7.19	7.19
35	1.00	0.50	0.82	0.82	8.01	8.01
45	1.50	0.35	0.69	0.69	8.70	8.70
60	2.00	0.25	0.88	0.88	9.58	9.58
80	2.50	0.18	2.29	2.29	11.87	11.87
120	3.00	0.13	27.06	27.04	38.93	38.91
170	3.50	0.09	40.23	40.20	79.16	79.11
200	3.75	0.07	0.12	0.12	79.28	79.23
230	4.00	0.06	7.50	7.49	86.78	86.72

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.91	3.45	3.14	2.74	2.58	-0.74

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.67	0.16	1.38	-2.78	10.44

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-03 #1

Analysis Date: 08-14-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,257	806,648	Florida State Plane West	-16.1 NAVD 88

USCS:	Munsell:	Comments:
SP	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
106.46	105.09	0.02	0.13	#200 - 1.56 #230 - 1.45		16	30

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.06	0.06	0.06	0.06
10	-1.00	2.00	0.12	0.11	0.18	0.17
14	-0.50	1.41	0.36	0.34	0.54	0.51
18	0.00	1.00	0.91	0.85	1.45	1.36
25	0.50	0.71	1.41	1.32	2.86	2.68
35	1.00	0.50	2.51	2.36	5.37	5.04
45	1.50	0.35	4.29	4.03	9.66	9.07
60	2.00	0.25	12.63	11.86	22.29	20.93
80	2.50	0.18	39.93	37.51	62.22	58.44
120	3.00	0.13	37.17	34.91	99.39	93.35
170	3.50	0.09	5.15	4.84	104.54	98.19
200	3.75	0.07	0.27	0.25	104.81	98.44
230	4.00	0.06	0.12	0.11	104.93	98.55

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.17	2.87	2.74	2.39	2.05	1.79	0.99

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.28	0.21	0.66	-1.73	7.86

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-03 #2

Analysis Date: 08-14-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,257	806,648	Florida State Plane West	-17.8 NAVD 88

USCS:	Munsell:	Comments:
SP	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
102.18	100.52	0.05	0.09	#200 - 2.01 #230 - 1.78		8	15

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.03	0.03	0.03	0.03
10	-1.00	2.00	0.08	0.08	0.11	0.11
14	-0.50	1.41	0.26	0.25	0.37	0.36
18	0.00	1.00	0.34	0.33	0.71	0.69
25	0.50	0.71	0.48	0.47	1.19	1.16
35	1.00	0.50	0.77	0.75	1.96	1.91
45	1.50	0.35	1.23	1.20	3.19	3.11
60	2.00	0.25	4.37	4.28	7.56	7.39
80	2.50	0.18	29.63	29.00	37.19	36.39
120	3.00	0.13	48.24	47.21	85.43	83.60
170	3.50	0.09	13.92	13.62	99.35	97.22
200	3.75	0.07	0.79	0.77	100.14	97.99
230	4.00	0.06	0.24	0.23	100.38	98.22

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.42	3.01	2.91	2.64	2.30	2.15	1.72

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.57	0.17	0.55	-2.13	12.79

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-03 #3

Analysis Date: 08-14-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,257	806,648	Florida State Plane West	-20.3 NAVD 88

USCS:	Munsell:	Comments:
SP	Wet - 2.5Y-6/1 Dry - 2.5Y-7/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
98.80	94.90	0.14	0.06	#200 - 4.94 #230 - 4.17		8	10

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.06	0.06	0.06	0.06
4	-2.25	4.76	0.00	0.00	0.06	0.06
5	-2.00	4.00	0.06	0.06	0.12	0.12
7	-1.50	2.83	0.28	0.28	0.40	0.40
10	-1.00	2.00	0.07	0.07	0.47	0.47
14	-0.50	1.41	0.18	0.18	0.65	0.65
18	0.00	1.00	0.23	0.23	0.88	0.88
25	0.50	0.71	0.20	0.20	1.08	1.08
35	1.00	0.50	0.25	0.25	1.33	1.33
45	1.50	0.35	0.36	0.36	1.69	1.69
60	2.00	0.25	1.32	1.34	3.01	3.03
80	2.50	0.18	19.05	19.28	22.06	22.31
120	3.00	0.13	51.97	52.60	74.03	74.91
170	3.50	0.09	18.51	18.73	92.54	93.64
200	3.75	0.07	1.40	1.42	93.94	95.06
230	4.00	0.06	0.76	0.77	94.70	95.83

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.74	3.24	3.00	2.76	2.53	2.34	2.05

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.7	0.15	0.56	-3.71	29.06

REDFISH_PASS_VIBRACORES.GPJ 9/1/20

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-04 #1

Analysis Date: 08-12-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,097	806,318	Florida State Plane West	-13.4 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
105.46	104.15	0.03	0.12	#200 - 1.48 #230 - 1.39		69	40

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	5.19	4.92	5.19	4.92
5/16"	-3.00	8.00	2.64	2.50	7.83	7.42
3.5	-2.50	5.66	4.82	4.57	12.65	11.99
4	-2.25	4.76	2.13	2.02	14.78	14.01
5	-2.00	4.00	2.79	2.65	17.57	16.66
7	-1.50	2.83	8.09	7.67	25.66	24.33
10	-1.00	2.00	8.37	7.94	34.03	32.27
14	-0.50	1.41	11.10	10.53	45.13	42.80
18	0.00	1.00	9.11	8.64	54.24	51.44
25	0.50	0.71	9.26	8.78	63.50	60.22
35	1.00	0.50	7.24	6.87	70.74	67.09
45	1.50	0.35	5.67	5.38	76.41	72.47
60	2.00	0.25	4.76	4.51	81.17	76.98
80	2.50	0.18	7.44	7.05	88.61	84.03
120	3.00	0.13	11.47	10.88	100.08	94.91
170	3.50	0.09	3.63	3.44	103.71	98.35
200	3.75	0.07	0.18	0.17	103.89	98.52
230	4.00	0.06	0.10	0.09	103.99	98.61

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.01	2.50	1.78	-0.08	-1.46	-2.06	-3.48

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	-0.03	1.02	1.96	-0.06	2.05

Granularmetric Report

Depths and elevations based on measured values

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-04 #2
Analysis Date: 08-12-20
Analyzed By: SF

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,097	806,318	Florida State Plane West	-14.4 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
97.81	95.97	0.03	0.02	#200 - 2.10 #230 - 1.93		22	25

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.09	0.09	0.09	0.09
4	-2.25	4.76	0.26	0.27	0.35	0.36
5	-2.00	4.00	0.42	0.43	0.77	0.79
7	-1.50	2.83	0.92	0.94	1.69	1.73
10	-1.00	2.00	1.38	1.41	3.07	3.14
14	-0.50	1.41	2.16	2.21	5.23	5.35
18	0.00	1.00	2.18	2.23	7.41	7.58
25	0.50	0.71	2.74	2.80	10.15	10.38
35	1.00	0.50	3.15	3.22	13.30	13.60
45	1.50	0.35	4.07	4.16	17.37	17.76
60	2.00	0.25	7.48	7.65	24.85	25.41
80	2.50	0.18	27.82	28.44	52.67	53.85
120	3.00	0.13	35.13	35.92	87.80	89.77
170	3.50	0.09	7.59	7.76	95.39	97.53
200	3.75	0.07	0.36	0.37	95.75	97.90
230	4.00	0.06	0.17	0.17	95.92	98.07

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.34	2.92	2.79	2.43	1.97	1.29	-0.58

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.08	0.24	1.12	-1.85	6.22

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-04 #3

Analysis Date: 08-13-20

Analyzed By: SF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,097	806,318	Florida State Plane West	-15.8 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 5Y-6/1 Dry - 5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
97.03	95.41	0.03	0.00	#200 - 1.75 #230 - 1.69		23	30

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.22	0.23	0.22	0.23
3.5	-2.50	5.66	0.00	0.00	0.22	0.23
4	-2.25	4.76	0.00	0.00	0.22	0.23
5	-2.00	4.00	0.18	0.19	0.40	0.42
7	-1.50	2.83	0.91	0.94	1.31	1.36
10	-1.00	2.00	0.79	0.81	2.10	2.17
14	-0.50	1.41	1.54	1.59	3.64	3.76
18	0.00	1.00	1.29	1.33	4.93	5.09
25	0.50	0.71	1.72	1.77	6.65	6.86
35	1.00	0.50	2.51	2.59	9.16	9.45
45	1.50	0.35	4.72	4.86	13.88	14.31
60	2.00	0.25	13.25	13.66	27.13	27.97
80	2.50	0.18	37.17	38.31	64.30	66.28
120	3.00	0.13	26.40	27.21	90.70	93.49
170	3.50	0.09	4.49	4.63	95.19	98.12
200	3.75	0.07	0.13	0.13	95.32	98.25
230	4.00	0.06	0.06	0.06	95.38	98.31

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.16	2.83	2.66	2.29	1.89	1.56	-0.03

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.07	0.24	0.95	-2.23	9.21

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-04 #4

Analysis Date: 08-13-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,097	806,318	Florida State Plane West	-17.0 NAVD 88

USCS:	Munsell:	Comments:
SW-SM	Wet - 5Y-6/1 Dry - 5Y-7/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
97.88	90.95	0.52	0.05	#200 - 9.13 #230 - 7.67		10	10

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.55	0.56	0.55	0.56
3.5	-2.50	5.66	0.23	0.23	0.78	0.79
4	-2.25	4.76	0.02	0.02	0.80	0.81
5	-2.00	4.00	0.10	0.10	0.90	0.91
7	-1.50	2.83	0.48	0.49	1.38	1.40
10	-1.00	2.00	0.70	0.72	2.08	2.12
14	-0.50	1.41	0.86	0.88	2.94	3.00
18	0.00	1.00	0.96	0.98	3.90	3.98
25	0.50	0.71	0.79	0.81	4.69	4.79
35	1.00	0.50	0.75	0.77	5.44	5.56
45	1.50	0.35	1.93	1.97	7.37	7.53
60	2.00	0.25	2.81	2.87	10.18	10.40
80	2.50	0.18	2.34	2.39	12.52	12.79
120	3.00	0.13	48.86	49.92	61.38	62.71
170	3.50	0.09	25.52	26.07	86.90	88.78
200	3.75	0.07	2.05	2.09	88.95	90.87
230	4.00	0.06	1.43	1.46	90.38	92.33

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.41	3.24	2.87	2.62	2.53	0.64

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.64	0.16	1.02	-3.25	15.22

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-04 #5

Analysis Date: 08-13-20

Analyzed By: RH

APTIM

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,097	806,318	Florida State Plane West	-18.4 NAVD 88

USCS:	Munsell:	Comments:
SM	Wet - 5Y-5/1 Dry - 5Y-7/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
97.44	88.06	0.54	0.04	#200 - 13.33 #230 - 10.23		32	25

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	4.30	4.41	4.30	4.41
5/16"	-3.00	8.00	1.31	1.34	5.61	5.75
3.5	-2.50	5.66	1.14	1.17	6.75	6.92
4	-2.25	4.76	1.67	1.71	8.42	8.63
5	-2.00	4.00	0.89	0.91	9.31	9.54
7	-1.50	2.83	2.38	2.44	11.69	11.98
10	-1.00	2.00	2.72	2.79	14.41	14.77
14	-0.50	1.41	2.76	2.83	17.17	17.60
18	0.00	1.00	2.55	2.62	19.72	20.22
25	0.50	0.71	2.52	2.59	22.24	22.81
35	1.00	0.50	2.85	2.92	25.09	25.73
45	1.50	0.35	2.03	2.08	27.12	27.81
60	2.00	0.25	1.52	1.56	28.64	29.37
80	2.50	0.18	3.32	3.41	31.96	32.78
120	3.00	0.13	13.53	13.89	45.49	46.67
170	3.50	0.09	34.48	35.39	79.97	82.06
200	3.75	0.07	4.49	4.61	84.46	86.67
230	4.00	0.06	3.02	3.10	87.48	89.77

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.61	3.40	3.05	0.87	-0.78	-3.28

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.75	0.30	2.24	-1.23	3.15

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-04 #6
Analysis Date: 08-13-20
Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,097	806,318	Florida State Plane West	-12.1 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-6/1 Dry - 5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
108.12	106.77	0.01	0.02	#200 - 1.39 #230 - 1.28		73	55

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	4.39	4.06	4.39	4.06
5/16"	-3.00	8.00	0.80	0.74	5.19	4.80
3.5	-2.50	5.66	1.63	1.51	6.82	6.31
4	-2.25	4.76	1.59	1.47	8.41	7.78
5	-2.00	4.00	1.91	1.77	10.32	9.55
7	-1.50	2.83	6.89	6.37	17.21	15.92
10	-1.00	2.00	11.83	10.94	29.04	26.86
14	-0.50	1.41	16.44	15.21	45.48	42.07
18	0.00	1.00	13.76	12.73	59.24	54.80
25	0.50	0.71	10.13	9.37	69.37	64.17
35	1.00	0.50	8.94	8.27	78.31	72.44
45	1.50	0.35	6.46	5.97	84.77	78.41
60	2.00	0.25	5.66	5.23	90.43	83.64
80	2.50	0.18	6.01	5.56	96.44	89.20
120	3.00	0.13	8.60	7.95	105.04	97.15
170	3.50	0.09	1.51	1.40	106.55	98.55
200	3.75	0.07	0.07	0.06	106.62	98.61
230	4.00	0.06	0.12	0.11	106.74	98.72

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.86	2.03	1.21	-0.19	-1.09	-1.50	-2.93

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	-0.04	1.03	1.67	-0.02	2.62

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-04 #7
Analysis Date: 08-13-20
Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,097	806,318	Florida State Plane West	-12.5 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-6/1 Dry - 2.5Y-8/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
138.29	135.77	0.03	0.02	#200 - 1.94 #230 - 1.85		47	40

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	6.40	4.63	6.40	4.63
5/16"	-3.00	8.00	1.70	1.23	8.10	5.86
3.5	-2.50	5.66	4.41	3.19	12.51	9.05
4	-2.25	4.76	2.07	1.50	14.58	10.55
5	-2.00	4.00	2.68	1.94	17.26	12.49
7	-1.50	2.83	6.59	4.77	23.85	17.26
10	-1.00	2.00	6.44	4.66	30.29	21.92
14	-0.50	1.41	6.13	4.43	36.42	26.35
18	0.00	1.00	5.46	3.95	41.88	30.30
25	0.50	0.71	4.61	3.33	46.49	33.63
35	1.00	0.50	5.41	3.91	51.90	37.54
45	1.50	0.35	6.23	4.51	58.13	42.05
60	2.00	0.25	11.32	8.19	69.45	50.24
80	2.50	0.18	43.00	31.09	112.45	81.33
120	3.00	0.13	19.52	14.12	131.97	95.45
170	3.50	0.09	3.41	2.47	135.38	97.92
200	3.75	0.07	0.20	0.14	135.58	98.06
230	4.00	0.06	0.13	0.09	135.71	98.15

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.98	2.59	2.40	1.99	-0.65	-1.63	-3.35

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	0.87	0.55	2.01	-0.91	2.52

Granularmetric Report

Depths and elevations based on measured values

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-04 #8

Analysis Date: 08-13-20

Analyzed By: RH

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,097	806,318	Florida State Plane West	-15.1 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 5Y-6/1 Dry - 5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
107.42	106.16	0.03	0.11	#200 - 1.39 #230 - 1.31		71	50

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	2.52	2.35	2.52	2.35
7/16"	-3.50	11.31	1.53	1.42	4.05	3.77
5/16"	-3.00	8.00	3.76	3.50	7.81	7.27
3.5	-2.50	5.66	4.26	3.97	12.07	11.24
4	-2.25	4.76	1.48	1.38	13.55	12.62
5	-2.00	4.00	2.54	2.36	16.09	14.98
7	-1.50	2.83	6.73	6.27	22.82	21.25
10	-1.00	2.00	10.05	9.36	32.87	30.61
14	-0.50	1.41	11.69	10.88	44.56	41.49
18	0.00	1.00	9.70	9.03	54.26	50.52
25	0.50	0.71	7.93	7.38	62.19	57.90
35	1.00	0.50	8.04	7.48	70.23	65.38
45	1.50	0.35	8.53	7.94	78.76	73.32
60	2.00	0.25	9.19	8.56	87.95	81.88
80	2.50	0.18	9.38	8.73	97.33	90.61
120	3.00	0.13	6.92	6.44	104.25	97.05
170	3.50	0.09	1.60	1.49	105.85	98.54
200	3.75	0.07	0.07	0.07	105.92	98.61
230	4.00	0.06	0.09	0.08	106.01	98.69

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.84	2.12	1.60	-0.03	-1.30	-1.92	-3.32

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	-0.04	1.03	1.86	-0.23	2.24

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-05 #1

Analysis Date: 08-13-20

Analyzed By: EB

APTIM

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,458	805,750	Florida State Plane West	-17.0 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 5Y-7/1 Dry - 5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
103.73	102.35	0.05	0.07	#200 - 1.51 #230 - 1.45		24	30

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.09	0.09	0.09	0.09
5	-2.00	4.00	0.05	0.05	0.14	0.14
7	-1.50	2.83	0.12	0.12	0.26	0.26
10	-1.00	2.00	0.51	0.49	0.77	0.75
14	-0.50	1.41	1.26	1.21	2.03	1.96
18	0.00	1.00	2.25	2.17	4.28	4.13
25	0.50	0.71	3.33	3.21	7.61	7.34
35	1.00	0.50	4.59	4.42	12.20	11.76
45	1.50	0.35	7.08	6.83	19.28	18.59
60	2.00	0.25	16.56	15.96	35.84	34.55
80	2.50	0.18	37.19	35.85	73.03	70.40
120	3.00	0.13	24.99	24.09	98.02	94.49
170	3.50	0.09	4.00	3.86	102.02	98.35
200	3.75	0.07	0.15	0.14	102.17	98.49
230	4.00	0.06	0.06	0.06	102.23	98.55

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.07	2.78	2.60	2.22	1.70	1.31	0.14

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.01	0.25	0.86	-1.51	5.75

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-05 #2

Analysis Date: 08-13-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,458	805,750	Florida State Plane West	-21.1 NAVD 88

USCS:	Munsell:	Comments:
SC	Wet - 5Y-5/1 Dry - 5Y-7/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
94.35	79.80	0.23	0.10	#200 - 16.94 #230 - 15.76		21	20

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.37	0.39	0.37	0.39
3.5	-2.50	5.66	0.19	0.20	0.56	0.59
4	-2.25	4.76	0.14	0.15	0.70	0.74
5	-2.00	4.00	0.15	0.16	0.85	0.90
7	-1.50	2.83	0.71	0.75	1.56	1.65
10	-1.00	2.00	0.82	0.87	2.38	2.52
14	-0.50	1.41	1.36	1.44	3.74	3.96
18	0.00	1.00	1.85	1.96	5.59	5.92
25	0.50	0.71	3.03	3.21	8.62	9.13
35	1.00	0.50	3.62	3.84	12.24	12.97
45	1.50	0.35	3.80	4.03	16.04	17.00
60	2.00	0.25	3.63	3.85	19.67	20.85
80	2.50	0.18	7.38	7.82	27.05	28.67
120	3.00	0.13	28.19	29.88	55.24	58.55
170	3.50	0.09	21.10	22.36	76.34	80.91
200	3.75	0.07	2.03	2.15	78.37	83.06
230	4.00	0.06	1.11	1.18	79.48	84.24

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.95	3.37	2.86	2.27	1.38	-0.23

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.3	0.20	1.26	-1.77	6.07

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-06 #1

Analysis Date: 08-12-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft): 585,845	Northing (ft): 804,924	Coordinate System: Florida State Plane West	Elevation (ft): -16.0 NAVD 88

USCS: SP	Munsell: Wet - 2.5Y-6/1 Dry - 2.5Y-8/1 Washed - 2.5Y-8/1	Comments:

Dry Weight (g): 102.48	Wash Weight (g): 100.85	Pan Retained (g): 0.06	Sieve Loss (%): 0.08	Fines (%): #200 - 3.11 #230 - 1.72	Organics (%):	Carbonates (%): 13	Shell Hash (%): 2

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.06	0.06	0.06	0.06
10	-1.00	2.00	0.06	0.06	0.12	0.12
14	-0.50	1.41	0.26	0.25	0.38	0.37
18	0.00	1.00	0.49	0.48	0.87	0.85
25	0.50	0.71	0.94	0.92	1.81	1.77
35	1.00	0.50	1.69	1.65	3.50	3.42
45	1.50	0.35	2.29	2.23	5.79	5.65
60	2.00	0.25	4.24	4.14	10.03	9.79
80	2.50	0.18	13.58	13.25	23.61	23.04
120	3.00	0.13	55.03	53.70	78.64	76.74
170	3.50	0.09	20.62	20.12	99.26	96.86
200	3.75	0.07	0.03	0.03	99.29	96.89
230	4.00	0.06	1.42	1.39	100.71	98.28

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.45	3.18	2.98	2.75	2.52	2.23	1.35

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.64	0.16	0.64	-2.19	10.48

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-06 #2
Analysis Date: 08-12-20
Analyzed By: RH

APTIM

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,845	804,924	Florida State Plane West	-17.7 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-6/1 Dry - 2.5Y-8/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
101.25	99.20	0.04	0.00	#200 - 2.36 #230 - 2.06		21	10

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.34	0.34	0.34	0.34
3.5	-2.50	5.66	0.00	0.00	0.34	0.34
4	-2.25	4.76	0.04	0.04	0.38	0.38
5	-2.00	4.00	0.12	0.12	0.50	0.50
7	-1.50	2.83	0.47	0.46	0.97	0.96
10	-1.00	2.00	0.66	0.65	1.63	1.61
14	-0.50	1.41	1.89	1.87	3.52	3.48
18	0.00	1.00	2.75	2.72	6.27	6.20
25	0.50	0.71	3.09	3.05	9.36	9.25
35	1.00	0.50	3.21	3.17	12.57	12.42
45	1.50	0.35	2.91	2.87	15.48	15.29
60	2.00	0.25	4.17	4.12	19.65	19.41
80	2.50	0.18	25.97	25.65	45.62	45.06
120	3.00	0.13	40.95	40.44	86.57	85.50
170	3.50	0.09	11.57	11.43	98.14	96.93
200	3.75	0.07	0.72	0.71	98.86	97.64
230	4.00	0.06	0.30	0.30	99.16	97.94

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.42	2.98	2.87	2.56	2.11	1.59	-0.22

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.23	0.21	1.06	-2.02	7.47

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-06 #3

Analysis Date: 08-12-20

Analyzed By: RH

APTIM

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,845	804,924	Florida State Plane West	-19.8 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
100.82	98.83	0.02	0.00	#200 - 2.46 #230 - 1.97		17	5

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.24	0.24	0.24	0.24
3.5	-2.50	5.66	0.00	0.00	0.24	0.24
4	-2.25	4.76	0.00	0.00	0.24	0.24
5	-2.00	4.00	0.15	0.15	0.39	0.39
7	-1.50	2.83	0.22	0.22	0.61	0.61
10	-1.00	2.00	0.34	0.34	0.95	0.95
14	-0.50	1.41	1.12	1.11	2.07	2.06
18	0.00	1.00	1.47	1.46	3.54	3.52
25	0.50	0.71	1.73	1.72	5.27	5.24
35	1.00	0.50	2.43	2.41	7.70	7.65
45	1.50	0.35	2.75	2.73	10.45	10.38
60	2.00	0.25	4.72	4.68	15.17	15.06
80	2.50	0.18	18.65	18.50	33.82	33.56
120	3.00	0.13	53.17	52.74	86.99	86.30
170	3.50	0.09	10.95	10.86	97.94	97.16
200	3.75	0.07	0.38	0.38	98.32	97.54
230	4.00	0.06	0.49	0.49	98.81	98.03

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.40	2.98	2.89	2.66	2.27	2.03	0.43

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.41	0.19	0.88	-2.58	11.46

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-06 #4
Analysis Date: 08-13-20
Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,845	804,924	Florida State Plane West	-21.9 NAVD 88

USCS:	Munsell:	Comments:
SP-SM	Wet - 2.5Y-5/1 Dry - 2.5Y-7/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
101.27	96.90	0.12	0.00	#200 - 5.07 #230 - 4.42		8	10

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.30	0.30	0.30	0.30
3.5	-2.50	5.66	0.16	0.16	0.46	0.46
4	-2.25	4.76	0.20	0.20	0.66	0.66
5	-2.00	4.00	0.10	0.10	0.76	0.76
7	-1.50	2.83	0.23	0.23	0.99	0.99
10	-1.00	2.00	0.22	0.22	1.21	1.21
14	-0.50	1.41	0.39	0.39	1.60	1.60
18	0.00	1.00	0.46	0.45	2.06	2.05
25	0.50	0.71	0.70	0.69	2.76	2.74
35	1.00	0.50	0.81	0.80	3.57	3.54
45	1.50	0.35	0.91	0.90	4.48	4.44
60	2.00	0.25	1.27	1.25	5.75	5.69
80	2.50	0.18	5.98	5.91	11.73	11.60
120	3.00	0.13	55.52	54.82	67.25	66.42
170	3.50	0.09	26.98	26.64	94.23	93.06
200	3.75	0.07	1.89	1.87	96.12	94.93
230	4.00	0.06	0.66	0.65	96.78	95.58

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.78	3.33	3.16	2.85	2.62	2.54	1.72

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.73	0.15	0.8	-4.2	25.6

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-06 #5

Analysis Date: 08-13-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,845	804,924	Florida State Plane West	-24.3 NAVD 88

USCS:	Munsell:	Comments:
SM	Wet - 2.5Y-4/1 Dry - 2.5Y-6/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
96.48	76.05	0.42	0.01	#200 - 23.57 #230 - 21.62		38	40

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	1.34	1.39	1.34	1.39
3.5	-2.50	5.66	2.54	2.63	3.88	4.02
4	-2.25	4.76	1.61	1.67	5.49	5.69
5	-2.00	4.00	1.58	1.64	7.07	7.33
7	-1.50	2.83	4.68	4.85	11.75	12.18
10	-1.00	2.00	4.26	4.42	16.01	16.60
14	-0.50	1.41	4.23	4.38	20.24	20.98
18	0.00	1.00	3.50	3.63	23.74	24.61
25	0.50	0.71	2.23	2.31	25.97	26.92
35	1.00	0.50	1.66	1.72	27.63	28.64
45	1.50	0.35	0.94	0.97	28.57	29.61
60	2.00	0.25	1.13	1.17	29.70	30.78
80	2.50	0.18	3.95	4.09	33.65	34.87
120	3.00	0.13	17.18	17.81	50.83	52.68
170	3.50	0.09	20.20	20.94	71.03	73.62
200	3.75	0.07	2.71	2.81	73.74	76.43
230	4.00	0.06	1.88	1.95	75.62	78.38

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
		3.62	2.92	0.08	-1.07	-2.35

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	1.43	0.37	2.16	-0.73	1.96

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-07 #1

Analysis Date: 08-12-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,392	805,456	Florida State Plane West	-16.1 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
107.90	106.67	0.01	0.19	#200 - 1.48 #230 - 1.35		53	40

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	2.58	2.39	2.58	2.39
5/16"	-3.00	8.00	2.22	2.06	4.80	4.45
3.5	-2.50	5.66	0.72	0.67	5.52	5.12
4	-2.25	4.76	1.00	0.93	6.52	6.05
5	-2.00	4.00	1.44	1.33	7.96	7.38
7	-1.50	2.83	4.29	3.98	12.25	11.36
10	-1.00	2.00	5.97	5.53	18.22	16.89
14	-0.50	1.41	8.31	7.70	26.53	24.59
18	0.00	1.00	7.65	7.09	34.18	31.68
25	0.50	0.71	7.22	6.69	41.40	38.37
35	1.00	0.50	7.20	6.67	48.60	45.04
45	1.50	0.35	7.32	6.78	55.92	51.82
60	2.00	0.25	9.90	9.18	65.82	61.00
80	2.50	0.18	14.55	13.48	80.37	74.48
120	3.00	0.13	19.77	18.32	100.14	92.80
170	3.50	0.09	5.93	5.50	106.07	98.30
200	3.75	0.07	0.24	0.22	106.31	98.52
230	4.00	0.06	0.14	0.13	106.45	98.65

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.20	2.76	2.51	1.37	-0.47	-1.08	-2.59

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.88	0.54	1.84	-0.68	2.56

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-07 #2
Analysis Date: 08-12-20
Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,392	805,456	Florida State Plane West	-17.7 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
100.24	97.35	0.11	0.10	#200 - 3.35 #230 - 3.07		14	5

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	1.10	1.10	1.10	1.10
5/16"	-3.00	8.00	0.86	0.86	1.96	1.96
3.5	-2.50	5.66	1.05	1.05	3.01	3.01
4	-2.25	4.76	0.31	0.31	3.32	3.32
5	-2.00	4.00	0.62	0.62	3.94	3.94
7	-1.50	2.83	0.89	0.89	4.83	4.83
10	-1.00	2.00	0.96	0.96	5.79	5.79
14	-0.50	1.41	0.78	0.78	6.57	6.57
18	0.00	1.00	0.54	0.54	7.11	7.11
25	0.50	0.71	0.52	0.52	7.63	7.63
35	1.00	0.50	0.56	0.56	8.19	8.19
45	1.50	0.35	0.71	0.71	8.90	8.90
60	2.00	0.25	2.11	2.10	11.01	11.00
80	2.50	0.18	10.43	10.41	21.44	21.41
120	3.00	0.13	50.87	50.75	72.31	72.16
170	3.50	0.09	23.40	23.34	95.71	95.50
200	3.75	0.07	1.15	1.15	96.86	96.65
230	4.00	0.06	0.28	0.28	97.14	96.93

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.49	3.25	3.06	2.78	2.54	2.24	-1.41

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.41	0.19	1.39	-3.02	11.64

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-07 #3

Analysis Date: 08-12-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,392	805,456	Florida State Plane West	-18.5 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 5Y-6/1 Dry - 5Y-7/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
102.60	99.63	0.07	0.06	#200 - 3.80 #230 - 3.02		39	30

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	1.35	1.32	1.35	1.32
5/16"	-3.00	8.00	2.66	2.59	4.01	3.91
3.5	-2.50	5.66	1.31	1.28	5.32	5.19
4	-2.25	4.76	1.18	1.15	6.50	6.34
5	-2.00	4.00	0.78	0.76	7.28	7.10
7	-1.50	2.83	2.21	2.15	9.49	9.25
10	-1.00	2.00	3.70	3.61	13.19	12.86
14	-0.50	1.41	5.49	5.35	18.68	18.21
18	0.00	1.00	5.64	5.50	24.32	23.71
25	0.50	0.71	5.13	5.00	29.45	28.71
35	1.00	0.50	5.55	5.41	35.00	34.12
45	1.50	0.35	4.94	4.81	39.94	38.93
60	2.00	0.25	5.62	5.48	45.56	44.41
80	2.50	0.18	12.15	11.84	57.71	56.25
120	3.00	0.13	30.73	29.95	88.44	86.20
170	3.50	0.09	9.96	9.71	98.40	95.91
200	3.75	0.07	0.30	0.29	98.70	96.20
230	4.00	0.06	0.80	0.78	99.50	96.98

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.45	2.96	2.81	2.24	0.13	-0.71	-2.57

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	1.35	0.39	1.86	-1.01	3.02

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-07 #4

Analysis Date: 08-12-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,392	805,456	Florida State Plane West	-19.3 NAVD 88

USCS:	Munsell:	Comments:
SP	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
97.50	94.24	0.27	0.09	#200 - 4.45 #230 - 3.74		9	2

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.29	0.30	0.29	0.30
3.5	-2.50	5.66	0.00	0.00	0.29	0.30
4	-2.25	4.76	0.19	0.19	0.48	0.49
5	-2.00	4.00	0.17	0.17	0.65	0.66
7	-1.50	2.83	0.47	0.48	1.12	1.14
10	-1.00	2.00	0.39	0.40	1.51	1.54
14	-0.50	1.41	0.63	0.65	2.14	2.19
18	0.00	1.00	0.50	0.51	2.64	2.70
25	0.50	0.71	0.53	0.54	3.17	3.24
35	1.00	0.50	0.46	0.47	3.63	3.71
45	1.50	0.35	0.45	0.46	4.08	4.17
60	2.00	0.25	0.93	0.95	5.01	5.12
80	2.50	0.18	6.43	6.59	11.44	11.71
120	3.00	0.13	50.40	51.69	61.84	63.40
170	3.50	0.09	30.12	30.89	91.96	94.29
200	3.75	0.07	1.23	1.26	93.19	95.55
230	4.00	0.06	0.69	0.71	93.88	96.26

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.64	3.33	3.19	2.87	2.63	2.54	1.94

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.74	0.15	0.84	-4.09	23.11

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-07 #5

Analysis Date: 08-12-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft): 586,392	Northing (ft): 805,456	Coordinate System: Florida State Plane West	Elevation (ft): -20.5 NAVD 88

USCS: SM	Munsell: Wet - 2.5Y-6/1 Dry - 2.5Y-7/1 Washed - 5Y-8/1	Comments:

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.32	81.50	2.45	0.10	#200 - 24.78 #230 - 20.53		13	5

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.94	0.95	0.94	0.95
3.5	-2.50	5.66	0.25	0.25	1.19	1.20
4	-2.25	4.76	0.27	0.27	1.46	1.47
5	-2.00	4.00	0.04	0.04	1.50	1.51
7	-1.50	2.83	0.28	0.28	1.78	1.79
10	-1.00	2.00	0.41	0.41	2.19	2.20
14	-0.50	1.41	0.47	0.47	2.66	2.67
18	0.00	1.00	0.40	0.40	3.06	3.07
25	0.50	0.71	0.44	0.44	3.50	3.51
35	1.00	0.50	0.37	0.37	3.87	3.88
45	1.50	0.35	0.26	0.26	4.13	4.14
60	2.00	0.25	0.30	0.30	4.43	4.44
80	2.50	0.18	0.90	0.91	5.33	5.35
120	3.00	0.13	18.79	18.92	24.12	24.27
170	3.50	0.09	44.34	44.64	68.46	68.91
200	3.75	0.07	6.27	6.31	74.73	75.22
230	4.00	0.06	4.22	4.25	78.95	79.47

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
		3.74	3.29	3.01	2.78	2.31

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.94	0.13	1.1	-4.03	20.38

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-08 #1

Analysis Date: 08-14-20

Analyzed By: HV

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
587,228	805,426	Florida State Plane West	-13.6 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-6/1 Dry - 2.5Y-7/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
110.53	108.98	0.01	0.00	#200 - 1.48 #230 - 1.42		74	60

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	2.39	2.16	2.39	2.16
5/16"	-3.00	8.00	3.31	2.99	5.70	5.15
3.5	-2.50	5.66	2.90	2.62	8.60	7.77
4	-2.25	4.76	1.52	1.38	10.12	9.15
5	-2.00	4.00	2.22	2.01	12.34	11.16
7	-1.50	2.83	7.20	6.51	19.54	17.67
10	-1.00	2.00	10.91	9.87	30.45	27.54
14	-0.50	1.41	15.63	14.14	46.08	41.68
18	0.00	1.00	12.74	11.53	58.82	53.21
25	0.50	0.71	12.75	11.54	71.57	64.75
35	1.00	0.50	9.08	8.21	80.65	72.96
45	1.50	0.35	7.05	6.38	87.70	79.34
60	2.00	0.25	7.20	6.51	94.90	85.85
80	2.50	0.18	6.47	5.85	101.37	91.70
120	3.00	0.13	5.59	5.06	106.96	96.76
170	3.50	0.09	1.80	1.63	108.76	98.39
200	3.75	0.07	0.14	0.13	108.90	98.52
230	4.00	0.06	0.07	0.06	108.97	98.58

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.83	1.86	1.16	-0.14	-1.13	-1.63	-3.03

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	-0.08	1.06	1.64	-0.03	2.54

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-08 #2
Analysis Date: 08-14-20
Analyzed By: HV

APTIM

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
587,228	805,426	Florida State Plane West	-14.6 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
108.43	106.96	0.02	0.01	#200 - 1.47 #230 - 1.37		58	50

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	2.28	2.10	2.28	2.10
5/16"	-3.00	8.00	1.38	1.27	3.66	3.37
3.5	-2.50	5.66	4.11	3.79	7.77	7.16
4	-2.25	4.76	2.17	2.00	9.94	9.16
5	-2.00	4.00	1.76	1.62	11.70	10.78
7	-1.50	2.83	7.50	6.92	19.20	17.70
10	-1.00	2.00	8.24	7.60	27.44	25.30
14	-0.50	1.41	9.88	9.11	37.32	34.41
18	0.00	1.00	7.86	7.25	45.18	41.66
25	0.50	0.71	6.64	6.12	51.82	47.78
35	1.00	0.50	5.19	4.79	57.01	52.57
45	1.50	0.35	5.58	5.15	62.59	57.72
60	2.00	0.25	8.64	7.97	71.23	65.69
80	2.50	0.18	15.11	13.94	86.34	79.63
120	3.00	0.13	16.27	15.01	102.61	94.64
170	3.50	0.09	4.03	3.72	106.64	98.36
200	3.75	0.07	0.18	0.17	106.82	98.53
230	4.00	0.06	0.11	0.10	106.93	98.63

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.05	2.65	2.33	0.73	-1.02	-1.62	-2.78

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	0.51	0.70	1.93	-0.34	1.94

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-08 #3
Analysis Date: 08-14-20
Analyzed By: HV

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
587,228	805,426	Florida State Plane West	-15.5 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.26	96.62	0.03	0.03	#200 - 2.89 #230 - 2.72		20	30

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.90	0.91	0.90	0.91
3.5	-2.50	5.66	1.06	1.07	1.96	1.98
4	-2.25	4.76	0.46	0.46	2.42	2.44
5	-2.00	4.00	0.48	0.48	2.90	2.92
7	-1.50	2.83	1.02	1.03	3.92	3.95
10	-1.00	2.00	1.69	1.70	5.61	5.65
14	-0.50	1.41	2.23	2.25	7.84	7.90
18	0.00	1.00	2.09	2.11	9.93	10.01
25	0.50	0.71	2.58	2.60	12.51	12.61
35	1.00	0.50	2.48	2.50	14.99	15.11
45	1.50	0.35	2.69	2.71	17.68	17.82
60	2.00	0.25	4.93	4.97	22.61	22.79
80	2.50	0.18	17.24	17.37	39.85	40.16
120	3.00	0.13	40.66	40.96	80.51	81.12
170	3.50	0.09	15.32	15.43	95.83	96.55
200	3.75	0.07	0.56	0.56	96.39	97.11
230	4.00	0.06	0.17	0.17	96.56	97.28

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.45	3.09	2.93	2.62	2.06	1.16	-1.19

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.11	0.23	1.39	-2.02	6.58

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-08 #4
Analysis Date: 08-18-20
Analyzed By: SF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
587,228	805,426	Florida State Plane West	-16.3 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
101.82	100.68	0.02	0.00	#200 - 1.20 #230 - 1.14		73	60

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	5.32	5.22	5.32	5.22
5/16"	-3.00	8.00	4.67	4.59	9.99	9.81
3.5	-2.50	5.66	7.58	7.44	17.57	17.25
4	-2.25	4.76	2.82	2.77	20.39	20.02
5	-2.00	4.00	3.66	3.59	24.05	23.61
7	-1.50	2.83	10.07	9.89	34.12	33.50
10	-1.00	2.00	9.94	9.76	44.06	43.26
14	-0.50	1.41	11.46	11.26	55.52	54.52
18	0.00	1.00	8.69	8.53	64.21	63.05
25	0.50	0.71	6.15	6.04	70.36	69.09
35	1.00	0.50	4.58	4.50	74.94	73.59
45	1.50	0.35	3.00	2.95	77.94	76.54
60	2.00	0.25	3.42	3.36	81.36	79.90
80	2.50	0.18	4.96	4.87	86.32	84.77
120	3.00	0.13	10.25	10.07	96.57	94.84
170	3.50	0.09	3.92	3.85	100.49	98.69
200	3.75	0.07	0.11	0.11	100.60	98.80
230	4.00	0.06	0.06	0.06	100.66	98.86

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.02	2.42	1.24	-0.70	-1.93	-2.58	-3.53

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	-0.44	1.36	2.02	0.28	2.04

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-08 #5

Analysis Date: 08-18-20

Analyzed By: SF

APTIM

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft): 587,228

Northing (ft): 805,426

Coordinate System: Florida State Plane West

Elevation (ft): -17.3 NAVD 88

USCS: SW

Munsell: Wet - 2.5Y-7/1
Dry - 5Y-8/1
Washed - 5Y-8/1

Comments:

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
80.37	78.61	0.07	0.00	#200 - 2.50 #230 - 2.31		27	35

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.22	0.27	0.22	0.27
4	-2.25	4.76	0.20	0.25	0.42	0.52
5	-2.00	4.00	0.34	0.42	0.76	0.94
7	-1.50	2.83	0.55	0.68	1.31	1.62
10	-1.00	2.00	0.96	1.19	2.27	2.81
14	-0.50	1.41	1.64	2.04	3.91	4.85
18	0.00	1.00	1.90	2.36	5.81	7.21
25	0.50	0.71	2.35	2.92	8.16	10.13
35	1.00	0.50	3.11	3.87	11.27	14.00
45	1.50	0.35	4.09	5.09	15.36	19.09
60	2.00	0.25	9.80	12.19	25.16	31.28
80	2.50	0.18	23.84	29.66	49.00	60.94
120	3.00	0.13	24.58	30.58	73.58	91.52
170	3.50	0.09	4.60	5.72	78.18	97.24
200	3.75	0.07	0.21	0.26	78.39	97.50
230	4.00	0.06	0.15	0.19	78.54	97.69

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.30	2.88	2.73	2.32	1.74	1.20	-0.47

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2	0.25	1.09	-1.78	6.31

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-08 #6
Analysis Date: 08-18-20
Analyzed By: DH

APTIM

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
587,228	805,426	Florida State Plane West	-18.5 NAVD 88

USCS:	Munsell:	Comments:
SM	Wet - 5Y-6/1 Dry - 5Y-7/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
107.21	99.09	0.87	0.20	#200 - 13.41 #230 - 8.58		9	10

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.21	0.20	0.21	0.20
5	-2.00	4.00	0.32	0.30	0.53	0.50
7	-1.50	2.83	0.40	0.37	0.93	0.87
10	-1.00	2.00	0.72	0.67	1.65	1.54
14	-0.50	1.41	0.91	0.85	2.56	2.39
18	0.00	1.00	0.81	0.76	3.37	3.15
25	0.50	0.71	0.68	0.63	4.05	3.78
35	1.00	0.50	0.72	0.67	4.77	4.45
45	1.50	0.35	0.62	0.58	5.39	5.03
60	2.00	0.25	0.95	0.89	6.34	5.92
80	2.50	0.18	2.76	2.57	9.10	8.49
120	3.00	0.13	16.33	15.23	25.43	23.72
170	3.50	0.09	56.55	52.75	81.98	76.47
200	3.75	0.07	10.85	10.12	92.83	86.59
230	4.00	0.06	5.18	4.83	98.01	91.42

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.69	3.49	3.25	3.01	2.75	1.47

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	3	0.13	0.93	-3.46	16.17

REDFISH_PASS_VIBRACORES.GPJ 9/1/20

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-08 #7

Analysis Date: 08-14-20

Analyzed By: HV

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
587,228	805,426	Florida State Plane West	-21.0 NAVD 88

USCS:	Munsell:	Comments:
SM	Wet - 2.5Y-4/1 Dry - 5Y-6/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
83.68	68.78	0.57	0.07	#200 - 23.94 #230 - 18.55		28	25

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	4.60	5.50	4.60	5.50
7/16"	-3.50	11.31	1.55	1.85	6.15	7.35
5/16"	-3.00	8.00	0.77	0.92	6.92	8.27
3.5	-2.50	5.66	2.26	2.70	9.18	10.97
4	-2.25	4.76	0.66	0.79	9.84	11.76
5	-2.00	4.00	0.31	0.37	10.15	12.13
7	-1.50	2.83	1.35	1.61	11.50	13.74
10	-1.00	2.00	1.89	2.26	13.39	16.00
14	-0.50	1.41	1.94	2.32	15.33	18.32
18	0.00	1.00	1.38	1.65	16.71	19.97
25	0.50	0.71	1.23	1.47	17.94	21.44
35	1.00	0.50	0.92	1.10	18.86	22.54
45	1.50	0.35	0.96	1.15	19.82	23.69
60	2.00	0.25	1.21	1.45	21.03	25.14
80	2.50	0.18	2.98	3.56	24.01	28.70
120	3.00	0.13	9.33	11.15	33.34	39.85
170	3.50	0.09	23.41	27.98	56.75	67.83
200	3.75	0.07	6.89	8.23	63.64	76.06
230	4.00	0.06	4.51	5.39	68.15	81.45

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
		3.72	3.18	1.95	-1.00	-4.02

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.66	0.32	2.57	-1.23	2.98

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-09 #1

Analysis Date: 08-14-20

Analyzed By: RH

APTIM

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,656	807,097	Florida State Plane West	-11.3 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-6/2 Dry - 2.5Y-8/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
113.55	111.38	0.03	0.04	#200 - 2.10 #230 - 1.97		89	70

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
1"	-4.64	24.93	0.00	0.00	0.00	0.00
3/4"	-4.25	19.03	5.64	4.97	5.64	4.97
5/8"	-4.00	16.00	0.00	0.00	5.64	4.97
7/16"	-3.50	11.31	7.16	6.31	12.80	11.28
5/16"	-3.00	8.00	7.58	6.68	20.38	17.96
3.5	-2.50	5.66	10.34	9.11	30.72	27.07
4	-2.25	4.76	4.17	3.67	34.89	30.74
5	-2.00	4.00	6.38	5.62	41.27	36.36
7	-1.50	2.83	14.50	12.77	55.77	49.13
10	-1.00	2.00	13.55	11.93	69.32	61.06
14	-0.50	1.41	13.18	11.61	82.50	72.67
18	0.00	1.00	7.84	6.90	90.34	79.57
25	0.50	0.71	6.95	6.12	97.29	85.69
35	1.00	0.50	4.42	3.89	101.71	89.58
45	1.50	0.35	2.44	2.15	104.15	91.73
60	2.00	0.25	1.83	1.61	105.98	93.34
80	2.50	0.18	1.57	1.38	107.55	94.72
120	3.00	0.13	2.40	2.11	109.95	96.83
170	3.50	0.09	1.20	1.06	111.15	97.89
200	3.75	0.07	0.01	0.01	111.16	97.90
230	4.00	0.06	0.15	0.13	111.31	98.03

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.57	0.36	-0.33	-1.46	-2.61	-3.15	-4.25

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	-1.41	2.66	1.72	0.46	3.06

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-09 #2
Analysis Date: 08-14-20
Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,656	807,097	Florida State Plane West	-13.8 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-6/2 Dry - 2.5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
109.24	107.39	0.03	0.03	#200 - 1.81 #230 - 1.76		80	50

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	3.08	2.82	3.08	2.82
7/16"	-3.50	11.31	0.85	0.78	3.93	3.60
5/16"	-3.00	8.00	3.86	3.53	7.79	7.13
3.5	-2.50	5.66	5.68	5.20	13.47	12.33
4	-2.25	4.76	2.59	2.37	16.06	14.70
5	-2.00	4.00	3.89	3.56	19.95	18.26
7	-1.50	2.83	9.47	8.67	29.42	26.93
10	-1.00	2.00	11.76	10.77	41.18	37.70
14	-0.50	1.41	14.26	13.05	55.44	50.75
18	0.00	1.00	11.36	10.40	66.80	61.15
25	0.50	0.71	9.25	8.47	76.05	69.62
35	1.00	0.50	7.79	7.13	83.84	76.75
45	1.50	0.35	5.59	5.12	89.43	81.87
60	2.00	0.25	6.03	5.52	95.46	87.39
80	2.50	0.18	5.74	5.25	101.20	92.64
120	3.00	0.13	4.69	4.29	105.89	96.93
170	3.50	0.09	1.27	1.16	107.16	98.09
200	3.75	0.07	0.11	0.10	107.27	98.19
230	4.00	0.06	0.06	0.05	107.33	98.24

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.78	1.69	0.88	-0.53	-1.61	-2.16	-3.30

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	-0.44	1.36	1.75	0.07	2.44

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-09 #3

Analysis Date: 08-14-20

Analyzed By: RH

APTIM

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,656	807,097	Florida State Plane West	-15.4 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 5Y-6/1 Dry - 5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
109.83	107.97	0.03	0.03	#200 - 1.82 #230 - 1.76		62	45

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	1.66	1.51	1.66	1.51
3.5	-2.50	5.66	1.41	1.28	3.07	2.79
4	-2.25	4.76	0.78	0.71	3.85	3.50
5	-2.00	4.00	1.00	0.91	4.85	4.41
7	-1.50	2.83	3.42	3.11	8.27	7.52
10	-1.00	2.00	5.44	4.95	13.71	12.47
14	-0.50	1.41	9.52	8.67	23.23	21.14
18	0.00	1.00	11.42	10.40	34.65	31.54
25	0.50	0.71	10.72	9.76	45.37	41.30
35	1.00	0.50	12.15	11.06	57.52	52.36
45	1.50	0.35	13.05	11.88	70.57	64.24
60	2.00	0.25	14.34	13.06	84.91	77.30
80	2.50	0.18	13.76	12.53	98.67	89.83
120	3.00	0.13	7.16	6.52	105.83	96.35
170	3.50	0.09	1.92	1.75	107.75	98.10
200	3.75	0.07	0.09	0.08	107.84	98.18
230	4.00	0.06	0.07	0.06	107.91	98.24

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.90	2.27	1.91	0.89	-0.31	-0.80	-1.91

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.69	0.62	1.46	-0.49	2.69

Granularmetric Report
Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-09 #4
Analysis Date: 08-14-20
Analyzed By: SF

APTIM
APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,656	807,097	Florida State Plane West	-16.3 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
105.06	102.91	0.03	0.00	#200 - 2.19 #230 - 2.09		40	35

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.73	0.69	0.73	0.69
5/16"	-3.00	8.00	0.57	0.54	1.30	1.23
3.5	-2.50	5.66	1.39	1.32	2.69	2.55
4	-2.25	4.76	0.60	0.57	3.29	3.12
5	-2.00	4.00	0.59	0.56	3.88	3.68
7	-1.50	2.83	1.67	1.59	5.55	5.27
10	-1.00	2.00	2.69	2.56	8.24	7.83
14	-0.50	1.41	3.93	3.74	12.17	11.57
18	0.00	1.00	4.29	4.08	16.46	15.65
25	0.50	0.71	4.69	4.46	21.15	20.11
35	1.00	0.50	6.17	5.87	27.32	25.98
45	1.50	0.35	7.94	7.56	35.26	33.54
60	2.00	0.25	21.43	20.40	56.69	53.94
80	2.50	0.18	23.70	22.56	80.39	76.50
120	3.00	0.13	18.20	17.32	98.59	93.82
170	3.50	0.09	4.01	3.82	102.60	97.64
200	3.75	0.07	0.18	0.17	102.78	97.81
230	4.00	0.06	0.10	0.10	102.88	97.91

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.15	2.72	2.47	1.90	0.92	0.04	-1.58

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	1.45	0.37	1.44	-1.39	4.6

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-09 #5

Analysis Date: 08-14-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,656	807,097	Florida State Plane West	-20.9 NAVD 88

USCS:	Munsell:	Comments:
SW-SM	Wet - 5Y-7/1 Dry - 2.5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
106.71	98.98	0.39	0.03	#200 - 9.41 #230 - 7.63		13	20

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.71	0.67	0.71	0.67
5/16"	-3.00	8.00	0.20	0.19	0.91	0.86
3.5	-2.50	5.66	1.01	0.95	1.92	1.81
4	-2.25	4.76	0.31	0.29	2.23	2.10
5	-2.00	4.00	0.16	0.15	2.39	2.25
7	-1.50	2.83	0.59	0.55	2.98	2.80
10	-1.00	2.00	0.74	0.69	3.72	3.49
14	-0.50	1.41	0.91	0.85	4.63	4.34
18	0.00	1.00	0.93	0.87	5.56	5.21
25	0.50	0.71	0.87	0.82	6.43	6.03
35	1.00	0.50	1.00	0.94	7.43	6.97
45	1.50	0.35	1.31	1.23	8.74	8.20
60	2.00	0.25	2.67	2.50	11.41	10.70
80	2.50	0.18	21.64	20.28	33.05	30.98
120	3.00	0.13	43.22	40.50	76.27	71.48
170	3.50	0.09	18.04	16.91	94.31	88.39
200	3.75	0.07	2.35	2.20	96.66	90.59
230	4.00	0.06	1.90	1.78	98.56	92.37

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.37	3.10	2.73	2.35	2.13	-0.12

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.43	0.19	1.2	-3.03	13.26

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-10 #1

Analysis Date: 08-14-20

Analyzed By: HV

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,913	807,149	Florida State Plane West	-8.9 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-6/1 Dry - 2.5Y-8/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
110.15	106.86	0.09	0.02	#200 - 3.20 #230 - 3.08		68	50

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	3.53	3.20	3.53	3.20
3.5	-2.50	5.66	3.74	3.40	7.27	6.60
4	-2.25	4.76	3.18	2.89	10.45	9.49
5	-2.00	4.00	3.33	3.02	13.78	12.51
7	-1.50	2.83	5.92	5.37	19.70	17.88
10	-1.00	2.00	8.29	7.53	27.99	25.41
14	-0.50	1.41	10.67	9.69	38.66	35.10
18	0.00	1.00	10.43	9.47	49.09	44.57
25	0.50	0.71	11.76	10.68	60.85	55.25
35	1.00	0.50	10.79	9.80	71.64	65.05
45	1.50	0.35	9.19	8.34	80.83	73.39
60	2.00	0.25	7.88	7.15	88.71	80.54
80	2.50	0.18	8.53	7.74	97.24	88.28
120	3.00	0.13	7.47	6.78	104.71	95.06
170	3.50	0.09	1.77	1.61	106.48	96.67
200	3.75	0.07	0.14	0.13	106.62	96.80
230	4.00	0.06	0.13	0.12	106.75	96.92

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.00	2.22	1.61	0.25	-1.03	-1.68	-2.74

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.14	0.91	1.68	-0.12	2.17

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-10 #2

Analysis Date: 08-14-20

Analyzed By: HV

APTIM

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,913	807,149	Florida State Plane West	-10.0 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-6/1 Dry - 2.5Y-8/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
111.06	110.10	0.00	0.01	#200 - 0.88 #230 - 0.86		83	65

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	3.52	3.17	3.52	3.17
5/16"	-3.00	8.00	4.64	4.18	8.16	7.35
3.5	-2.50	5.66	8.82	7.94	16.98	15.29
4	-2.25	4.76	4.90	4.41	21.88	19.70
5	-2.00	4.00	6.63	5.97	28.51	25.67
7	-1.50	2.83	11.06	9.96	39.57	35.63
10	-1.00	2.00	13.79	12.42	53.36	48.05
14	-0.50	1.41	14.00	12.61	67.36	60.66
18	0.00	1.00	10.73	9.66	78.09	70.32
25	0.50	0.71	11.29	10.17	89.38	80.49
35	1.00	0.50	8.48	7.64	97.86	88.13
45	1.50	0.35	5.23	4.71	103.09	92.84
60	2.00	0.25	2.78	2.50	105.87	95.34
80	2.50	0.18	1.63	1.47	107.50	96.81
120	3.00	0.13	1.59	1.43	109.09	98.24
170	3.50	0.09	0.92	0.83	110.01	99.07
200	3.75	0.07	0.06	0.05	110.07	99.12
230	4.00	0.06	0.02	0.02	110.09	99.14

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
1.93	0.73	0.23	-0.92	-2.03	-2.46	-3.28

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	-0.87	1.83	1.53	0.28	2.67

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-10 #3
Analysis Date: 08-17-20
Analyzed By: SF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,913	807,149	Florida State Plane West	-11.4 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-6/1 Dry - 2.5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
98.96	97.54	0.01	0.00	#200 - 1.47 #230 - 1.43		74	55

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	4.95	5.00	4.95	5.00
5/16"	-3.00	8.00	3.39	3.43	8.34	8.43
3.5	-2.50	5.66	2.84	2.87	11.18	11.30
4	-2.25	4.76	1.55	1.57	12.73	12.87
5	-2.00	4.00	2.38	2.41	15.11	15.28
7	-1.50	2.83	4.81	4.86	19.92	20.14
10	-1.00	2.00	6.71	6.78	26.63	26.92
14	-0.50	1.41	9.39	9.49	36.02	36.41
18	0.00	1.00	9.66	9.76	45.68	46.17
25	0.50	0.71	12.30	12.43	57.98	58.60
35	1.00	0.50	13.13	13.27	71.11	71.87
45	1.50	0.35	12.12	12.25	83.23	84.12
60	2.00	0.25	7.49	7.57	90.72	91.69
80	2.50	0.18	2.97	3.00	93.69	94.69
120	3.00	0.13	2.87	2.90	96.56	97.59
170	3.50	0.09	0.88	0.89	97.44	98.48
200	3.75	0.07	0.05	0.05	97.49	98.53
230	4.00	0.06	0.04	0.04	97.53	98.57

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.55	1.50	1.13	0.15	-1.14	-1.93	-3.50

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	-0.14	1.10	1.67	-0.46	2.61

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-10 #4
Analysis Date: 08-12-20
Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,913	807,149	Florida State Plane West	-12.5 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-6/1 Dry - 2.5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.23	97.63	0.00	0.01	#200 - 1.72 #230 - 1.63		45	30

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.59	0.59	0.59	0.59
4	-2.25	4.76	0.23	0.23	0.82	0.82
5	-2.00	4.00	0.59	0.59	1.41	1.41
7	-1.50	2.83	1.77	1.78	3.18	3.19
10	-1.00	2.00	2.62	2.64	5.80	5.83
14	-0.50	1.41	6.04	6.09	11.84	11.92
18	0.00	1.00	7.45	7.51	19.29	19.43
25	0.50	0.71	8.04	8.10	27.33	27.53
35	1.00	0.50	9.67	9.75	37.00	37.28
45	1.50	0.35	10.15	10.23	47.15	47.51
60	2.00	0.25	14.53	14.64	61.68	62.15
80	2.50	0.18	17.21	17.34	78.89	79.49
120	3.00	0.13	16.31	16.44	95.20	95.93
170	3.50	0.09	2.32	2.34	97.52	98.27
200	3.75	0.07	0.01	0.01	97.53	98.28
230	4.00	0.06	0.09	0.09	97.62	98.37

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.97	2.64	2.37	1.59	0.34	-0.23	-1.16

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	1.26	0.42	1.32	-0.68	2.7

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-10 #5
Analysis Date: 08-12-20
Analyzed By: SF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,913	807,149	Florida State Plane West	-13.4 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-6/1 Dry - 2.5Y-8/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
101.99	100.45	0.02	0.00	#200 - 1.59 #230 - 1.55		43	35

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	1.32	1.29	1.32	1.29
4	-2.25	4.76	1.30	1.27	2.62	2.56
5	-2.00	4.00	0.83	0.81	3.45	3.37
7	-1.50	2.83	2.06	2.02	5.51	5.39
10	-1.00	2.00	3.49	3.42	9.00	8.81
14	-0.50	1.41	6.09	5.97	15.09	14.78
18	0.00	1.00	6.50	6.37	21.59	21.15
25	0.50	0.71	8.17	8.01	29.76	29.16
35	1.00	0.50	9.16	8.98	38.92	38.14
45	1.50	0.35	10.04	9.84	48.96	47.98
60	2.00	0.25	13.45	13.19	62.41	61.17
80	2.50	0.18	21.34	20.92	83.75	82.09
120	3.00	0.13	13.82	13.55	97.57	95.64
170	3.50	0.09	2.73	2.68	100.30	98.32
200	3.75	0.07	0.09	0.09	100.39	98.41
230	4.00	0.06	0.04	0.04	100.43	98.45

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.98	2.57	2.33	1.58	0.24	-0.40	-1.60

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	1.17	0.44	1.43	-0.78	2.83

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-11 #1

Analysis Date: 08-17-20

Analyzed By: SF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft): 586,946

Northing (ft): 806,237

Coordinate System: Florida State Plane West

Elevation (ft): -11.9 NAVD 88

USCS: SW

Munsell: Wet - 5Y-6/1
Dry - 5Y-8/1
Washed - 5Y-8/1

Comments:

Dry Weight (g): 106.71

Wash Weight (g): 105.37

Pan Retained (g): 0.01

Sieve Loss (%): 0.01

Fines (%): #200 - 1.31
#230 - 1.28

Organics (%):

Carbonates (%): 80

Shell Hash (%): 55

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	4.73	4.43	4.73	4.43
5/16"	-3.00	8.00	5.86	5.49	10.59	9.92
3.5	-2.50	5.66	4.03	3.78	14.62	13.70
4	-2.25	4.76	2.66	2.49	17.28	16.19
5	-2.00	4.00	3.97	3.72	21.25	19.91
7	-1.50	2.83	8.61	8.07	29.86	27.98
10	-1.00	2.00	11.15	10.45	41.01	38.43
14	-0.50	1.41	13.40	12.56	54.41	50.99
18	0.00	1.00	10.27	9.62	64.68	60.61
25	0.50	0.71	9.81	9.19	74.49	69.80
35	1.00	0.50	9.32	8.73	83.81	78.53
45	1.50	0.35	7.65	7.17	91.46	85.70
60	2.00	0.25	6.11	5.73	97.57	91.43
80	2.50	0.18	4.25	3.98	101.82	95.41
120	3.00	0.13	2.55	2.39	104.37	97.80
170	3.50	0.09	0.88	0.82	105.25	98.62
200	3.75	0.07	0.07	0.07	105.32	98.69
230	4.00	0.06	0.03	0.03	105.35	98.72

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.45	1.38	0.80	-0.54	-1.68	-2.27	-3.45

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	-0.52	1.43	1.7	-0.01	2.33

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-11 #2

Analysis Date: 08-17-20

Analyzed By: SF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,946	806,237	Florida State Plane West	-14.0 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 5Y-7/1 Dry - 5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.78	97.93	0.05	0.04	#200 - 2.10 #230 - 1.96		29	35

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.38	0.38	0.38	0.38
5/16"	-3.00	8.00	0.56	0.56	0.94	0.94
3.5	-2.50	5.66	0.23	0.23	1.17	1.17
4	-2.25	4.76	0.18	0.18	1.35	1.35
5	-2.00	4.00	0.60	0.60	1.95	1.95
7	-1.50	2.83	1.24	1.24	3.19	3.19
10	-1.00	2.00	2.06	2.06	5.25	5.25
14	-0.50	1.41	2.34	2.35	7.59	7.60
18	0.00	1.00	2.16	2.16	9.75	9.76
25	0.50	0.71	3.01	3.02	12.76	12.78
35	1.00	0.50	3.92	3.93	16.68	16.71
45	1.50	0.35	6.57	6.58	23.25	23.29
60	2.00	0.25	14.57	14.60	37.82	37.89
80	2.50	0.18	25.63	25.69	63.45	63.58
120	3.00	0.13	24.54	24.59	87.99	88.17
170	3.50	0.09	9.28	9.30	97.27	97.47
200	3.75	0.07	0.43	0.43	97.70	97.90
230	4.00	0.06	0.14	0.14	97.84	98.04

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.37	2.92	2.73	2.24	1.56	0.91	-1.06

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.86	0.28	1.3	-1.74	6.21

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-11 #3
Analysis Date: 08-17-20
Analyzed By: SF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,946	806,237	Florida State Plane West	-15.8 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 5Y-7/1 Dry - 5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
101.85	100.28	0.03	0.03	#200 - 1.77 #230 - 1.60		22	25

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	1.14	1.12	1.14	1.12
5/16"	-3.00	8.00	0.29	0.28	1.43	1.40
3.5	-2.50	5.66	1.51	1.48	2.94	2.88
4	-2.25	4.76	0.38	0.37	3.32	3.25
5	-2.00	4.00	0.80	0.79	4.12	4.04
7	-1.50	2.83	1.47	1.44	5.59	5.48
10	-1.00	2.00	1.58	1.55	7.17	7.03
14	-0.50	1.41	1.99	1.95	9.16	8.98
18	0.00	1.00	1.78	1.75	10.94	10.73
25	0.50	0.71	1.89	1.86	12.83	12.59
35	1.00	0.50	2.30	2.26	15.13	14.85
45	1.50	0.35	2.84	2.79	17.97	17.64
60	2.00	0.25	6.80	6.68	24.77	24.32
80	2.50	0.18	30.16	29.61	54.93	53.93
120	3.00	0.13	35.09	34.45	90.02	88.38
170	3.50	0.09	9.57	9.40	99.59	97.78
200	3.75	0.07	0.46	0.45	100.05	98.23
230	4.00	0.06	0.17	0.17	100.22	98.40

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.35	2.94	2.81	2.43	2.01	1.21	-1.67

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.97	0.26	1.45	-2.14	7.16

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-11 #4

Analysis Date: 08-14-20

Analyzed By: SF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,946	806,237	Florida State Plane West	-14.9 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 5Y-6/1 Dry - 5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
104.87	103.50	0.05	0.05	#200 - 1.49 #230 - 1.40		60	50

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	1.90	1.81	1.90	1.81
3.5	-2.50	5.66	2.34	2.23	4.24	4.04
4	-2.25	4.76	1.10	1.05	5.34	5.09
5	-2.00	4.00	1.31	1.25	6.65	6.34
7	-1.50	2.83	4.13	3.94	10.78	10.28
10	-1.00	2.00	7.35	7.01	18.13	17.29
14	-0.50	1.41	10.09	9.62	28.22	26.91
18	0.00	1.00	9.19	8.76	37.41	35.67
25	0.50	0.71	8.50	8.11	45.91	43.78
35	1.00	0.50	7.85	7.49	53.76	51.27
45	1.50	0.35	6.49	6.19	60.25	57.46
60	2.00	0.25	10.53	10.04	70.78	67.50
80	2.50	0.18	16.27	15.51	87.05	83.01
120	3.00	0.13	13.49	12.86	100.54	95.87
170	3.50	0.09	2.63	2.51	103.17	98.38
200	3.75	0.07	0.14	0.13	103.31	98.51
230	4.00	0.06	0.09	0.09	103.40	98.60

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.97	2.54	2.24	0.92	-0.60	-1.09	-2.27

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.71	0.61	1.68	-0.41	2.16

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-12 #1
Analysis Date: 08-17-20
Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft): 586,788	Northing (ft): 804,609	Coordinate System: Florida State Plane West	Elevation (ft): -11.5 NAVD 88

USCS: SP	Munsell: Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 5Y-8/1	Comments:

Dry Weight (g): 99.68	Wash Weight (g): 98.11	Pan Retained (g): 0.01	Sieve Loss (%): 0.09	Fines (%): #200 - 1.80 #230 - 1.68	Organics (%):	Carbonates (%): 18	Shell Hash (%): 35

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.04	0.04	0.04	0.04
5	-2.00	4.00	0.09	0.09	0.13	0.13
7	-1.50	2.83	0.14	0.14	0.27	0.27
10	-1.00	2.00	0.44	0.44	0.71	0.71
14	-0.50	1.41	1.00	1.00	1.71	1.71
18	0.00	1.00	1.29	1.29	3.00	3.00
25	0.50	0.71	2.01	2.02	5.01	5.02
35	1.00	0.50	3.17	3.18	8.18	8.20
45	1.50	0.35	6.53	6.55	14.71	14.75
60	2.00	0.25	17.66	17.72	32.37	32.47
80	2.50	0.18	24.85	24.93	57.22	57.40
120	3.00	0.13	33.90	34.01	91.12	91.41
170	3.50	0.09	6.74	6.76	97.86	98.17
200	3.75	0.07	0.03	0.03	97.89	98.20
230	4.00	0.06	0.12	0.12	98.01	98.32

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.27	2.89	2.76	2.35	1.79	1.54	0.50

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.16	0.22	0.83	-1.61	6.6

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-12 #2
Analysis Date: 08-17-20
Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,788	804,609	Florida State Plane West	-14.3 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 5Y-7/1 Dry - 5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.71	98.22	0.03	0.04	#200 - 1.58 #230 - 1.56		21	35

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.07	0.07	0.07	0.07
7	-1.50	2.83	0.35	0.35	0.42	0.42
10	-1.00	2.00	0.81	0.81	1.23	1.23
14	-0.50	1.41	1.27	1.27	2.50	2.50
18	0.00	1.00	1.90	1.91	4.40	4.41
25	0.50	0.71	2.25	2.26	6.65	6.67
35	1.00	0.50	3.69	3.70	10.34	10.37
45	1.50	0.35	6.79	6.81	17.13	17.18
60	2.00	0.25	18.97	19.03	36.10	36.21
80	2.50	0.18	30.56	30.65	66.66	66.86
120	3.00	0.13	27.33	27.41	93.99	94.27
170	3.50	0.09	4.03	4.04	98.02	98.31
200	3.75	0.07	0.11	0.11	98.13	98.42
230	4.00	0.06	0.02	0.02	98.15	98.44

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.09	2.81	2.65	2.22	1.71	1.41	0.13

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.03	0.24	0.88	-1.64	6.32

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-12 #3

Analysis Date: 08-17-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,788	804,609	Florida State Plane West	-16.1 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-6/1 Dry - 2.5Y-7/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
105.13	103.61	0.00	0.00	#200 - 1.47 #230 - 1.44		53	50

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.98	0.93	0.98	0.93
3.5	-2.50	5.66	1.43	1.36	2.41	2.29
4	-2.25	4.76	0.43	0.41	2.84	2.70
5	-2.00	4.00	0.78	0.74	3.62	3.44
7	-1.50	2.83	1.66	1.58	5.28	5.02
10	-1.00	2.00	3.65	3.47	8.93	8.49
14	-0.50	1.41	7.15	6.80	16.08	15.29
18	0.00	1.00	9.42	8.96	25.50	24.25
25	0.50	0.71	10.52	10.01	36.02	34.26
35	1.00	0.50	11.27	10.72	47.29	44.98
45	1.50	0.35	11.73	11.16	59.02	56.14
60	2.00	0.25	13.39	12.74	72.41	68.88
80	2.50	0.18	14.62	13.91	87.03	82.79
120	3.00	0.13	13.39	12.74	100.42	95.53
170	3.50	0.09	3.04	2.89	103.46	98.42
200	3.75	0.07	0.12	0.11	103.58	98.53
230	4.00	0.06	0.03	0.03	103.61	98.56

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.98	2.55	2.22	1.22	0.04	-0.46	-1.51

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.01	0.50	1.43	-0.62	2.9

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-12 #4

Analysis Date: 08-17-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,788	804,609	Florida State Plane West	-16.5 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 5Y-7/1 Dry - 5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
104.92	103.68	0.01	0.02	#200 - 1.33 #230 - 1.21		20	30

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.23	0.22	0.23	0.22
4	-2.25	4.76	0.11	0.10	0.34	0.32
5	-2.00	4.00	0.25	0.24	0.59	0.56
7	-1.50	2.83	0.47	0.45	1.06	1.01
10	-1.00	2.00	1.05	1.00	2.11	2.01
14	-0.50	1.41	1.59	1.52	3.70	3.53
18	0.00	1.00	2.48	2.36	6.18	5.89
25	0.50	0.71	2.71	2.58	8.89	8.47
35	1.00	0.50	4.10	3.91	12.99	12.38
45	1.50	0.35	8.47	8.07	21.46	20.45
60	2.00	0.25	21.31	20.31	42.77	40.76
80	2.50	0.18	24.31	23.17	67.08	63.93
120	3.00	0.13	30.15	28.74	97.23	92.67
170	3.50	0.09	5.99	5.71	103.22	98.38
200	3.75	0.07	0.30	0.29	103.52	98.67
230	4.00	0.06	0.13	0.12	103.65	98.79

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.20	2.85	2.69	2.20	1.61	1.22	-0.19

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.98	0.25	1	-1.6	6.22

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-12 #5

Analysis Date: 08-17-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,788	804,609	Florida State Plane West	-17.5 NAVD 88

USCS:	Munsell:	Comments:
SP	Wet - 2.5Y-7/1 Dry - 5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
104.46	102.83	0.03	0.07	#200 - 1.79 #230 - 1.66		10	25

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.02	0.02	0.02	0.02
10	-1.00	2.00	0.05	0.05	0.07	0.07
14	-0.50	1.41	0.16	0.15	0.23	0.22
18	0.00	1.00	0.24	0.23	0.47	0.45
25	0.50	0.71	0.53	0.51	1.00	0.96
35	1.00	0.50	1.24	1.19	2.24	2.15
45	1.50	0.35	3.69	3.53	5.93	5.68
60	2.00	0.25	15.74	15.07	21.67	20.75
80	2.50	0.18	37.04	35.46	58.71	56.21
120	3.00	0.13	35.79	34.26	94.50	90.47
170	3.50	0.09	7.65	7.32	102.15	97.79
200	3.75	0.07	0.44	0.42	102.59	98.21
230	4.00	0.06	0.14	0.13	102.73	98.34

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.31	2.91	2.77	2.41	2.06	1.84	1.40

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.35	0.20	0.57	-1.17	6.91

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-12 #6

Analysis Date: 08-17-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,788	804,609	Florida State Plane West	-18.6 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-7/2 Dry - 2.5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
106.15	104.57	0.06	0.11	#200 - 1.73 #230 - 1.64		37	35

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	1.94	1.83	1.94	1.83
7/16"	-3.50	11.31	0.00	0.00	1.94	1.83
5/16"	-3.00	8.00	0.89	0.84	2.83	2.67
3.5	-2.50	5.66	0.55	0.52	3.38	3.19
4	-2.25	4.76	0.24	0.23	3.62	3.42
5	-2.00	4.00	0.49	0.46	4.11	3.88
7	-1.50	2.83	0.93	0.88	5.04	4.76
10	-1.00	2.00	1.44	1.36	6.48	6.12
14	-0.50	1.41	2.80	2.64	9.28	8.76
18	0.00	1.00	4.72	4.45	14.00	13.21
25	0.50	0.71	5.92	5.58	19.92	18.79
35	1.00	0.50	8.77	8.26	28.69	27.05
45	1.50	0.35	10.45	9.84	39.14	36.89
60	2.00	0.25	22.48	21.18	61.62	58.07
80	2.50	0.18	23.85	22.47	85.47	80.54
120	3.00	0.13	15.84	14.92	101.31	95.46
170	3.50	0.09	2.78	2.62	104.09	98.08
200	3.75	0.07	0.20	0.19	104.29	98.27
230	4.00	0.06	0.10	0.09	104.39	98.36

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.98	2.62	2.38	1.81	0.88	0.25	-1.41

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	1.41	0.38	1.43	-1.75	6.61

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-12 #7

Analysis Date: 08-17-20

Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,788	804,609	Florida State Plane West	-19.4 NAVD 88

USCS:	Munsell:	Comments:
SP	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
96.62	93.44	0.16	0.00	#200 - 4.00 #230 - 3.48		6	5

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.10	0.10	0.10	0.10
10	-1.00	2.00	0.05	0.05	0.15	0.15
14	-0.50	1.41	0.08	0.08	0.23	0.23
18	0.00	1.00	0.10	0.10	0.33	0.33
25	0.50	0.71	0.10	0.10	0.43	0.43
35	1.00	0.50	0.13	0.13	0.56	0.56
45	1.50	0.35	0.25	0.26	0.81	0.82
60	2.00	0.25	0.98	1.01	1.79	1.83
80	2.50	0.18	11.19	11.58	12.98	13.41
120	3.00	0.13	52.35	54.18	65.33	67.59
170	3.50	0.09	26.19	27.11	91.52	94.70
200	3.75	0.07	1.26	1.30	92.78	96.00
230	4.00	0.06	0.50	0.52	93.28	96.52

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.56	3.30	3.14	2.84	2.61	2.52	2.14

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.82	0.14	0.44	-2.92	26.53

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-12 #8
Analysis Date: 08-17-20
Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,788	804,609	Florida State Plane West	-20.4 NAVD 88

USCS:	Munsell:	Comments:
SP	Wet - 2.5Y-7/1 Dry - 2.5Y-8/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
93.29	89.68	0.15	0.01	#200 - 4.79 #230 - 4.03		6	8

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.32	0.34	0.32	0.34
3.5	-2.50	5.66	0.00	0.00	0.32	0.34
4	-2.25	4.76	0.26	0.28	0.58	0.62
5	-2.00	4.00	0.08	0.09	0.66	0.71
7	-1.50	2.83	0.13	0.14	0.79	0.85
10	-1.00	2.00	0.11	0.12	0.90	0.97
14	-0.50	1.41	0.11	0.12	1.01	1.09
18	0.00	1.00	0.10	0.11	1.11	1.20
25	0.50	0.71	0.13	0.14	1.24	1.34
35	1.00	0.50	0.21	0.23	1.45	1.57
45	1.50	0.35	0.24	0.26	1.69	1.83
60	2.00	0.25	0.84	0.90	2.53	2.73
80	2.50	0.18	11.40	12.22	13.93	14.95
120	3.00	0.13	62.06	66.52	75.99	81.47
170	3.50	0.09	11.86	12.71	87.85	94.18
200	3.75	0.07	0.96	1.03	88.81	95.21
230	4.00	0.06	0.71	0.76	89.52	95.97

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.70	3.10	2.95	2.76	2.58	2.51	2.09

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.69	0.15	0.64	-5.73	47.3

REDFISH_PASS_VIBRACORES.GPJ 9/1/20

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-12 #9
Analysis Date: 08-17-20
Analyzed By: RH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,788	804,609	Florida State Plane West	-21.7 NAVD 88

USCS:	Munsell:	Comments:
SP-SC	Wet - 2.5Y-6/1 Dry - 2.5Y-7/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
101.02	94.37	0.25	0.08	#200 - 8.55 #230 - 6.90		5	10

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.18	0.18	0.18	0.18
4	-2.25	4.76	0.00	0.00	0.18	0.18
5	-2.00	4.00	0.07	0.07	0.25	0.25
7	-1.50	2.83	0.20	0.20	0.45	0.45
10	-1.00	2.00	0.15	0.15	0.60	0.60
14	-0.50	1.41	0.19	0.19	0.79	0.79
18	0.00	1.00	0.15	0.15	0.94	0.94
25	0.50	0.71	0.22	0.22	1.16	1.16
35	1.00	0.50	0.20	0.20	1.36	1.36
45	1.50	0.35	0.22	0.22	1.58	1.58
60	2.00	0.25	0.57	0.56	2.15	2.14
80	2.50	0.18	7.17	7.10	9.32	9.24
120	3.00	0.13	48.52	48.03	57.84	57.27
170	3.50	0.09	33.18	32.84	91.02	90.11
200	3.75	0.07	1.35	1.34	92.37	91.45
230	4.00	0.06	1.67	1.65	94.04	93.10

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.41	3.27	2.92	2.66	2.57	2.20

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.86	0.14	0.59	-4.62	37.29

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-13 #1

Analysis Date: 08-17-20

Analyzed By: SF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,153	804,038	Florida State Plane West	-21.0 NAVD 88

USCS:	Munsell:	Comments:
SW-SM	Wet - 2.5Y-6/1 Dry - 2.5Y-7/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
97.00	87.28	0.15	0.01	#200 - 11.39 #230 - 10.18		14	25

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.17	0.18	0.17	0.18
4	-2.25	4.76	0.32	0.33	0.49	0.51
5	-2.00	4.00	0.61	0.63	1.10	1.14
7	-1.50	2.83	0.59	0.61	1.69	1.75
10	-1.00	2.00	1.20	1.24	2.89	2.99
14	-0.50	1.41	1.60	1.65	4.49	4.64
18	0.00	1.00	1.32	1.36	5.81	6.00
25	0.50	0.71	1.67	1.72	7.48	7.72
35	1.00	0.50	1.64	1.69	9.12	9.41
45	1.50	0.35	1.24	1.28	10.36	10.69
60	2.00	0.25	1.04	1.07	11.40	11.76
80	2.50	0.18	3.01	3.10	14.41	14.86
120	3.00	0.13	37.29	38.44	51.70	53.30
170	3.50	0.09	31.34	32.31	83.04	85.61
200	3.75	0.07	2.91	3.00	85.95	88.61
230	4.00	0.06	1.17	1.21	87.12	89.82

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.48	3.34	2.96	2.63	2.51	-0.37

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.58	0.17	1.18	-2.46	8.65

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-13 #2

Analysis Date: 08-17-20

Analyzed By: SF

APTIM

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,153	804,038	Florida State Plane West	-22.0 NAVD 88

USCS:	Munsell:	Comments:
SC	Wet - 2.5Y-5/1 Dry - 2.5Y-6/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
97.66	84.85	0.45	0.07	#200 - 15.49 #230 - 13.65		34	45

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	2.56	2.62	2.56	2.62
5/16"	-3.00	8.00	2.11	2.16	4.67	4.78
3.5	-2.50	5.66	1.49	1.53	6.16	6.31
4	-2.25	4.76	0.75	0.77	6.91	7.08
5	-2.00	4.00	1.39	1.42	8.30	8.50
7	-1.50	2.83	2.45	2.51	10.75	11.01
10	-1.00	2.00	2.68	2.74	13.43	13.75
14	-0.50	1.41	3.48	3.56	16.91	17.31
18	0.00	1.00	2.90	2.97	19.81	20.28
25	0.50	0.71	3.14	3.22	22.95	23.50
35	1.00	0.50	3.72	3.81	26.67	27.31
45	1.50	0.35	2.31	2.37	28.98	29.68
60	2.00	0.25	1.61	1.65	30.59	31.33
80	2.50	0.18	3.76	3.85	34.35	35.18
120	3.00	0.13	18.94	19.39	53.29	54.57
170	3.50	0.09	26.12	26.75	79.41	81.32
200	3.75	0.07	3.12	3.19	82.53	84.51
230	4.00	0.06	1.80	1.84	84.33	86.35

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.71	3.38	2.88	0.70	-0.68	-2.93

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.62	0.33	2.15	-1.12	2.95

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-14 #1

Analysis Date: 08-18-20

Analyzed By: SF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,410	803,293	Florida State Plane West	-20.8 NAVD 88

USCS:	Munsell:	Comments:
SW-SM	Wet - 2.5Y-6/1 Dry - 2.5Y-7/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
100.96	92.64	0.23	0.02	#200 - 9.79 #230 - 8.47		30	40

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	3.25	3.22	3.25	3.22
5/16"	-3.00	8.00	2.51	2.49	5.76	5.71
3.5	-2.50	5.66	1.52	1.51	7.28	7.22
4	-2.25	4.76	1.02	1.01	8.30	8.23
5	-2.00	4.00	1.41	1.40	9.71	9.63
7	-1.50	2.83	1.91	1.89	11.62	11.52
10	-1.00	2.00	2.37	2.35	13.99	13.87
14	-0.50	1.41	2.78	2.75	16.77	16.62
18	0.00	1.00	2.47	2.45	19.24	19.07
25	0.50	0.71	2.54	2.52	21.78	21.59
35	1.00	0.50	2.85	2.82	24.63	24.41
45	1.50	0.35	2.85	2.82	27.48	27.23
60	2.00	0.25	2.56	2.54	30.04	29.77
80	2.50	0.18	5.09	5.04	35.13	34.81
120	3.00	0.13	31.75	31.45	66.88	66.26
170	3.50	0.09	21.96	21.75	88.84	88.01
200	3.75	0.07	2.22	2.20	91.06	90.21
230	4.00	0.06	1.33	1.32	92.39	91.53

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.41	3.20	2.74	1.10	-0.61	-3.14

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.68	0.31	2.1	-1.34	3.5

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-14 #2

Analysis Date: 08-18-20

Analyzed By: SF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,410	803,293	Florida State Plane West	-22.2 NAVD 88

USCS:	Munsell:	Comments:
SW-SM	Wet - 5Y-6/1 Dry - 5Y-7/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
100.90	91.87	0.38	0.02	#200 - 11.29 #230 - 9.34		11	30

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.11	0.11	0.11	0.11
4	-2.25	4.76	0.08	0.08	0.19	0.19
5	-2.00	4.00	0.09	0.09	0.28	0.28
7	-1.50	2.83	0.28	0.28	0.56	0.56
10	-1.00	2.00	0.50	0.50	1.06	1.06
14	-0.50	1.41	0.95	0.94	2.01	2.00
18	0.00	1.00	1.04	1.03	3.05	3.03
25	0.50	0.71	1.39	1.38	4.44	4.41
35	1.00	0.50	2.04	2.02	6.48	6.43
45	1.50	0.35	1.91	1.89	8.39	8.32
60	2.00	0.25	2.15	2.13	10.54	10.45
80	2.50	0.18	6.61	6.55	17.15	17.00
120	3.00	0.13	39.34	38.99	56.49	55.99
170	3.50	0.09	29.68	29.42	86.17	85.41
200	3.75	0.07	3.33	3.30	89.50	88.71
230	4.00	0.06	1.97	1.95	91.47	90.66

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.48	3.32	2.92	2.60	2.42	0.65

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.67	0.16	0.93	-2.53	10.56

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-15 #1

Analysis Date: 08-18-20

Analyzed By: SF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
587,092	803,710	Florida State Plane West	-16.1 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-6/2 Dry - 2.5Y-7/1 Washed - 2.5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
100.52	97.72	0.07	0.00	#200 - 3.44 #230 - 2.83		14	30

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.88	0.88	0.88	0.88
5/16"	-3.00	8.00	0.00	0.00	0.88	0.88
3.5	-2.50	5.66	0.36	0.36	1.24	1.24
4	-2.25	4.76	0.20	0.20	1.44	1.44
5	-2.00	4.00	0.21	0.21	1.65	1.65
7	-1.50	2.83	0.43	0.43	2.08	2.08
10	-1.00	2.00	0.64	0.64	2.72	2.72
14	-0.50	1.41	0.94	0.94	3.66	3.66
18	0.00	1.00	1.19	1.18	4.85	4.84
25	0.50	0.71	1.84	1.83	6.69	6.67
35	1.00	0.50	2.09	2.08	8.78	8.75
45	1.50	0.35	2.24	2.23	11.02	10.98
60	2.00	0.25	2.77	2.76	13.79	13.74
80	2.50	0.18	5.81	5.78	19.60	19.52
120	3.00	0.13	45.44	45.20	65.04	64.72
170	3.50	0.09	29.92	29.77	94.96	94.49
200	3.75	0.07	2.08	2.07	97.04	96.56
230	4.00	0.06	0.61	0.61	97.65	97.17

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.56	3.32	3.17	2.84	2.56	2.20	0.04

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.53	0.17	1.17	-2.98	13.15

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-15 #2
Analysis Date: 08-18-20
Analyzed By: DH

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
587,092	803,710	Florida State Plane West	-17.9 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 2.5Y-7/1 Dry - 5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
107.62	105.79	0.02	0.09	#200 - 2.08 #230 - 1.81		15	30

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	1.38	1.28	1.38	1.28
5/16"	-3.00	8.00	0.00	0.00	1.38	1.28
3.5	-2.50	5.66	0.37	0.34	1.75	1.62
4	-2.25	4.76	0.00	0.00	1.75	1.62
5	-2.00	4.00	0.24	0.22	1.99	1.84
7	-1.50	2.83	0.16	0.15	2.15	1.99
10	-1.00	2.00	0.22	0.20	2.37	2.19
14	-0.50	1.41	0.49	0.46	2.86	2.65
18	0.00	1.00	0.81	0.75	3.67	3.40
25	0.50	0.71	1.13	1.05	4.80	4.45
35	1.00	0.50	1.99	1.85	6.79	6.30
45	1.50	0.35	3.16	2.94	9.95	9.24
60	2.00	0.25	7.26	6.75	17.21	15.99
80	2.50	0.18	25.95	24.11	43.16	40.10
120	3.00	0.13	48.50	45.07	91.66	85.17
170	3.50	0.09	13.00	12.08	104.66	97.25
200	3.75	0.07	0.72	0.67	105.38	97.92
230	4.00	0.06	0.29	0.27	105.67	98.19

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.41	2.99	2.89	2.61	2.19	2.00	0.65

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.35	0.20	1.06	-3.54	18.66

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-15 #3
Analysis Date: 08-18-20
Analyzed By: DH

APTIM
APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
587,092	803,710	Florida State Plane West	-20.0 NAVD 88

USCS:	Munsell:	Comments:
SM	Wet - 5Y-5/2 Dry - 2.5Y-7/1 Washed - 5Y-8/2	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
96.03	86.19	0.64	0.06	#200 - 16.23 #230 - 10.99		11	20

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.79	0.82	0.79	0.82
5/16"	-3.00	8.00	0.04	0.04	0.83	0.86
3.5	-2.50	5.66	0.88	0.92	1.71	1.78
4	-2.25	4.76	0.10	0.10	1.81	1.88
5	-2.00	4.00	0.37	0.39	2.18	2.27
7	-1.50	2.83	0.33	0.34	2.51	2.61
10	-1.00	2.00	0.40	0.42	2.91	3.03
14	-0.50	1.41	0.41	0.43	3.32	3.46
18	0.00	1.00	0.55	0.57	3.87	4.03
25	0.50	0.71	0.51	0.53	4.38	4.56
35	1.00	0.50	0.60	0.62	4.98	5.18
45	1.50	0.35	0.57	0.59	5.55	5.77
60	2.00	0.25	0.97	1.01	6.52	6.78
80	2.50	0.18	7.29	7.59	13.81	14.37
120	3.00	0.13	28.83	30.02	42.64	44.39
170	3.50	0.09	37.60	39.15	80.24	83.54
200	3.75	0.07	0.22	0.23	80.46	83.77
230	4.00	0.06	5.03	5.24	85.49	89.01

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.76	3.39	3.07	2.68	2.53	0.85

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.73	0.15	1.19	-3.54	16.72

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-15 #4

Analysis Date: 08-18-20

Analyzed By: SF

APTIM

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft): 587,092

Northing (ft): 803,710

Coordinate System: Florida State Plane West

Elevation (ft): -21.5 NAVD 88

USCS: SW-SM

Munsell: Wet - 5Y-5/2
Dry - 5Y-7/1
Washed - 5Y-8/1

Munsell:
Wet - 5Y-5/2
Dry - 5Y-7/1
Washed - 5Y-8/1

Comments:

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
105.29	96.85	0.44	0.03	#200 - 10.10 #230 - 8.47		38	40

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
1"	-4.64	24.93	0.00	0.00	0.00	0.00
3/4"	-4.25	19.03	8.73	8.29	8.73	8.29
5/8"	-4.00	16.00	0.00	0.00	8.73	8.29
7/16"	-3.50	11.31	2.20	2.09	10.93	10.38
5/16"	-3.00	8.00	2.60	2.47	13.53	12.85
3.5	-2.50	5.66	1.46	1.39	14.99	14.24
4	-2.25	4.76	0.56	0.53	15.55	14.77
5	-2.00	4.00	0.99	0.94	16.54	15.71
7	-1.50	2.83	2.01	1.91	18.55	17.62
10	-1.00	2.00	2.36	2.24	20.91	19.86
14	-0.50	1.41	3.56	3.38	24.47	23.24
18	0.00	1.00	2.94	2.79	27.41	26.03
25	0.50	0.71	3.52	3.34	30.93	29.37
35	1.00	0.50	3.27	3.11	34.20	32.48
45	1.50	0.35	1.78	1.69	35.98	34.17
60	2.00	0.25	1.50	1.42	37.48	35.59
80	2.50	0.18	4.72	4.48	42.20	40.07
120	3.00	0.13	21.75	20.66	63.95	60.73
170	3.50	0.09	27.54	26.16	91.49	86.89
200	3.75	0.07	3.17	3.01	94.66	89.90
230	4.00	0.06	1.72	1.63	96.38	91.53

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.44	3.27	2.74	-0.18	-1.92	-4.25

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.18	0.44	2.66	-1.04	2.62

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-16 #1

Analysis Date: 08-18-20

Analyzed By: SF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,334	808,074	Florida State Plane West	-13.3 NAVD 88

USCS:	Munsell:	Comments:
SP	Wet - 5Y-7/1 Dry - 5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
101.44	99.32	0.04	0.00	#200 - 2.28 #230 - 2.12		7	15

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.05	0.05	0.05	0.05
10	-1.00	2.00	0.05	0.05	0.10	0.10
14	-0.50	1.41	0.09	0.09	0.19	0.19
18	0.00	1.00	0.11	0.11	0.30	0.30
25	0.50	0.71	0.17	0.17	0.47	0.47
35	1.00	0.50	0.32	0.32	0.79	0.79
45	1.50	0.35	0.53	0.52	1.32	1.31
60	2.00	0.25	2.24	2.21	3.56	3.52
80	2.50	0.18	13.32	13.13	16.88	16.65
120	3.00	0.13	62.83	61.94	79.71	78.59
170	3.50	0.09	18.77	18.50	98.48	97.09
200	3.75	0.07	0.64	0.63	99.12	97.72
230	4.00	0.06	0.16	0.16	99.28	97.88

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.44	3.15	2.97	2.77	2.57	2.48	2.06

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.73	0.15	0.43	-2.73	21.64

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-16 #2
Analysis Date: 08-18-20
Analyzed By: DH

APTIM

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2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,334	808,074	Florida State Plane West	-15.4 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 5Y-7/1 Dry - 5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.32	97.30	0.05	0.14	#200 - 2.46 #230 - 2.24		19	30

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.81	0.82	0.81	0.82
3.5	-2.50	5.66	0.72	0.72	1.53	1.54
4	-2.25	4.76	0.35	0.35	1.88	1.89
5	-2.00	4.00	0.36	0.36	2.24	2.25
7	-1.50	2.83	1.07	1.08	3.31	3.33
10	-1.00	2.00	1.71	1.72	5.02	5.05
14	-0.50	1.41	2.45	2.47	7.47	7.52
18	0.00	1.00	1.92	1.93	9.39	9.45
25	0.50	0.71	1.99	2.00	11.38	11.45
35	1.00	0.50	1.68	1.69	13.06	13.14
45	1.50	0.35	1.62	1.63	14.68	14.77
60	2.00	0.25	2.40	2.42	17.08	17.19
80	2.50	0.18	9.78	9.85	26.86	27.04
120	3.00	0.13	49.72	50.06	76.58	77.10
170	3.50	0.09	19.59	19.72	96.17	96.82
200	3.75	0.07	0.72	0.72	96.89	97.54
230	4.00	0.06	0.22	0.22	97.11	97.76

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.45	3.17	2.98	2.73	2.40	1.75	-1.01

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.28	0.21	1.35	-2.25	7.51

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-16 #3
Analysis Date: 08-18-20
Analyzed By: DH

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Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,334	808,074	Florida State Plane West	-16.5 NAVD 88

USCS:	Munsell:	Comments:
SW	Wet - 5Y-7/1 Dry - 5Y-8/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
105.21	103.78	0.04	0.10	#200 - 1.56 #230 - 1.49		17	35

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.47	0.45	0.47	0.45
4	-2.25	4.76	0.13	0.12	0.60	0.57
5	-2.00	4.00	0.27	0.26	0.87	0.83
7	-1.50	2.83	0.83	0.79	1.70	1.62
10	-1.00	2.00	0.82	0.78	2.52	2.40
14	-0.50	1.41	1.16	1.10	3.68	3.50
18	0.00	1.00	1.22	1.16	4.90	4.66
25	0.50	0.71	1.50	1.43	6.40	6.09
35	1.00	0.50	1.88	1.79	8.28	7.88
45	1.50	0.35	2.89	2.75	11.17	10.63
60	2.00	0.25	7.59	7.21	18.76	17.84
80	2.50	0.18	31.84	30.26	50.60	48.10
120	3.00	0.13	44.18	41.99	94.78	90.09
170	3.50	0.09	8.54	8.12	103.32	98.21
200	3.75	0.07	0.24	0.23	103.56	98.44
230	4.00	0.06	0.07	0.07	103.63	98.51

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.30	2.93	2.82	2.52	2.12	1.87	0.12

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.27	0.21	0.96	-2.64	11.12

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-16 #4
Analysis Date: 08-18-20
Analyzed By: DH

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Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,334	808,074	Florida State Plane West	-18.6 NAVD 88

USCS:	Munsell:	Comments:
SM	Wet - 5Y-5/2 Dry - 5Y-7/1 Washed - 5Y-8/1	

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
96.02	84.40	0.52	0.07	#200 - 19.49 #230 - 12.70		13	25

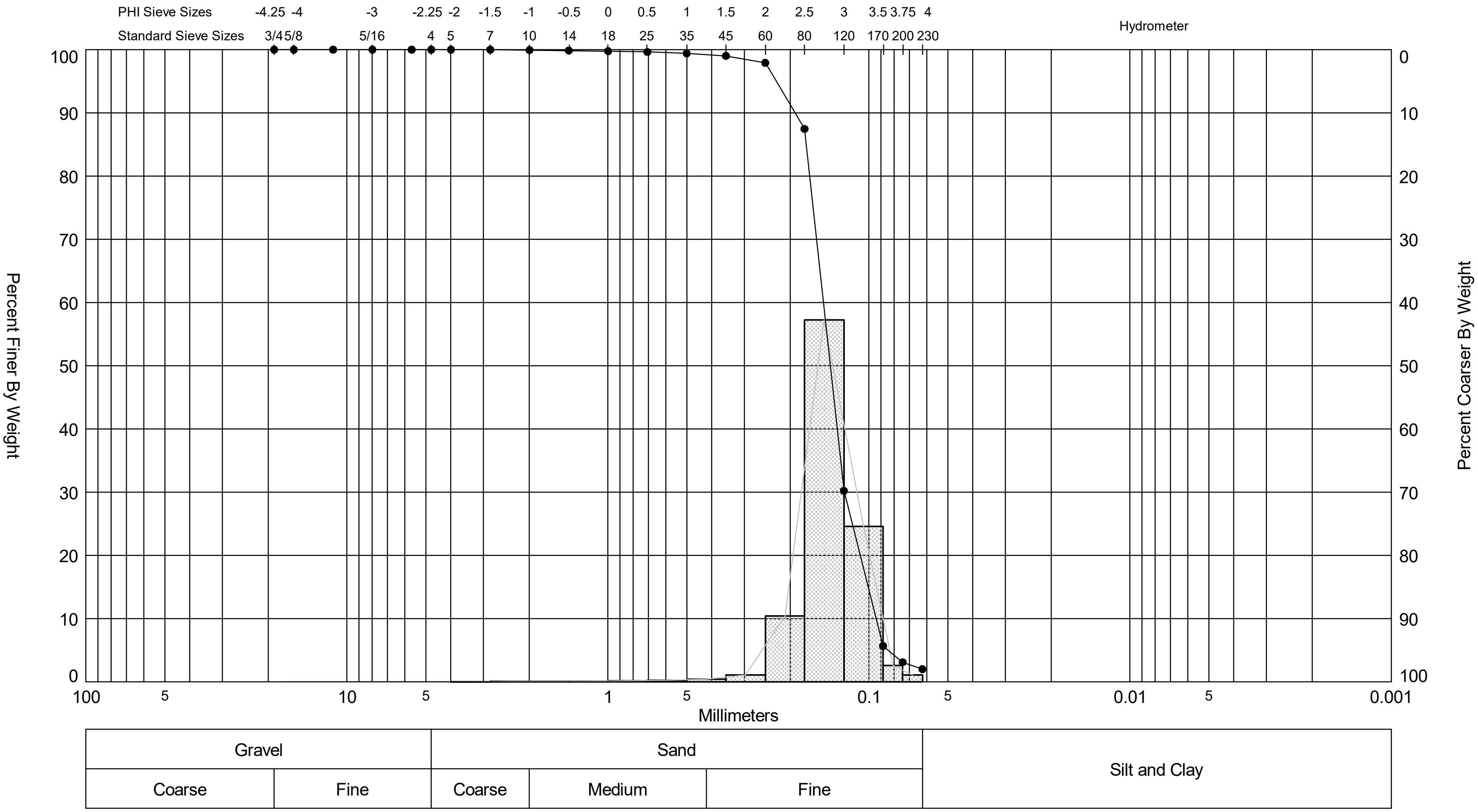
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.96	1.00	0.96	1.00
5/16"	-3.00	8.00	0.00	0.00	0.96	1.00
3.5	-2.50	5.66	0.25	0.26	1.21	1.26
4	-2.25	4.76	0.23	0.24	1.44	1.50
5	-2.00	4.00	0.15	0.16	1.59	1.66
7	-1.50	2.83	0.49	0.51	2.08	2.17
10	-1.00	2.00	0.67	0.70	2.75	2.87
14	-0.50	1.41	0.77	0.80	3.52	3.67
18	0.00	1.00	0.76	0.79	4.28	4.46
25	0.50	0.71	0.91	0.95	5.19	5.41
35	1.00	0.50	0.88	0.92	6.07	6.33
45	1.50	0.35	0.95	0.99	7.02	7.32
60	2.00	0.25	1.37	1.43	8.39	8.75
80	2.50	0.18	4.05	4.22	12.44	12.97
120	3.00	0.13	29.37	30.59	41.81	43.56
170	3.50	0.09	35.27	36.73	77.08	80.29
200	3.75	0.07	0.21	0.22	77.29	80.51
230	4.00	0.06	6.52	6.79	83.81	87.30

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.88	3.43	3.09	2.70	2.55	0.28

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.71	0.15	1.22	-3.21	14.53

APPENDIX 5

2020 APTIM INDIVIDUAL VIBRACORE GRAIN SIZE DISTRIBUTION CURVES/HISTOGRAMS



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-01 #1	—●—	-16.6	SP	#200 - 3.10 #230 - 2.01		3	2.83	2.82	-2	17.41	0.43

Comments:

Depths and elevations based on measured values

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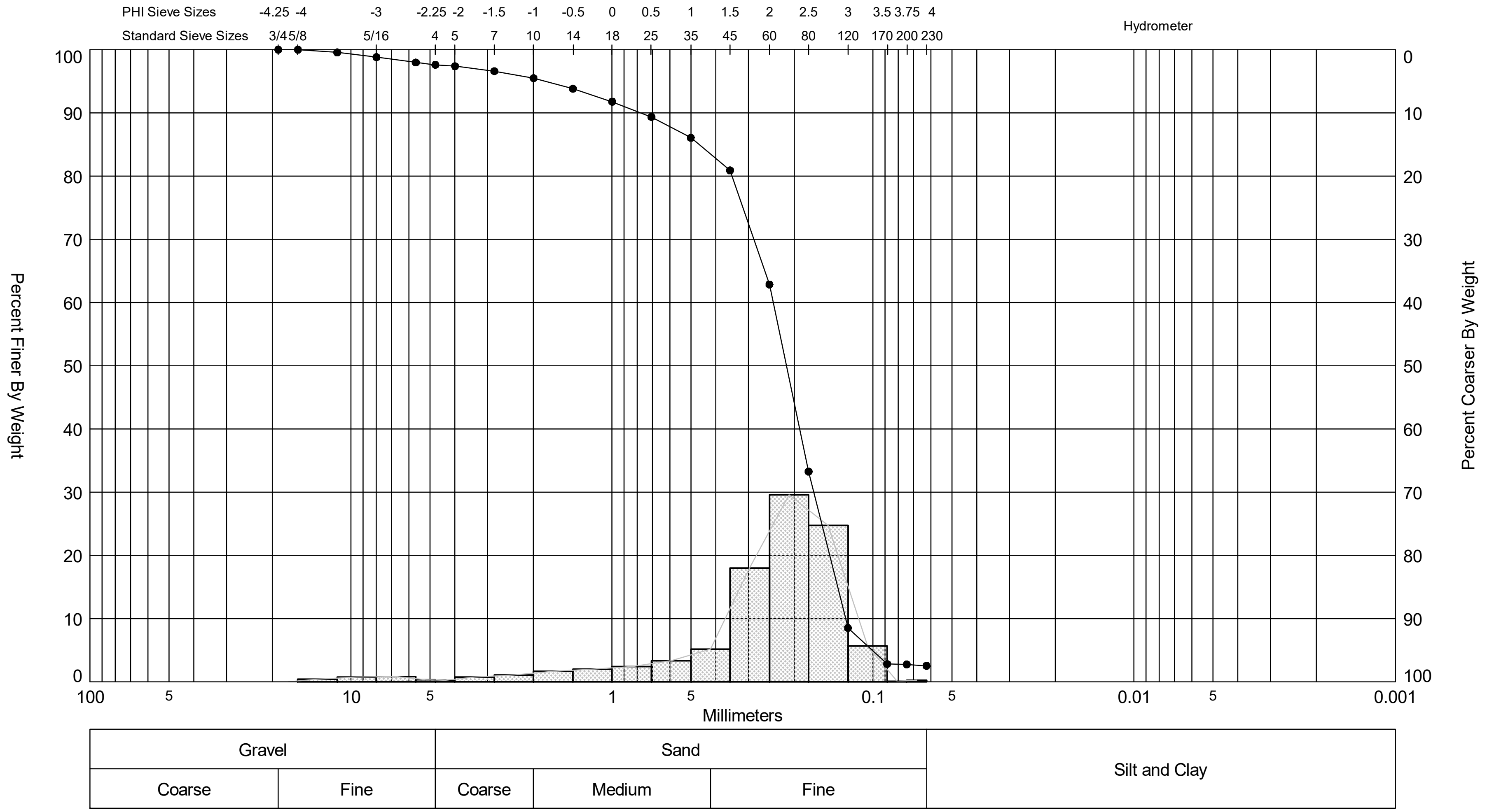
Boca Raton, FL 33431
ph (561) 391-8102

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-12-20
Analyzed By:	SF
Easting (X, ft):	585,775
Northing (Y, ft):	807,850
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-01 #2	—●—	-21.6	SW	#200 - 2.75 #230 - 2.53		27	2.22	1.88	-2.17	8.3	1.25

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-12-20
Analyzed By:	RH
Easting (X, ft):	585,775
Northing (Y, ft):	807,850
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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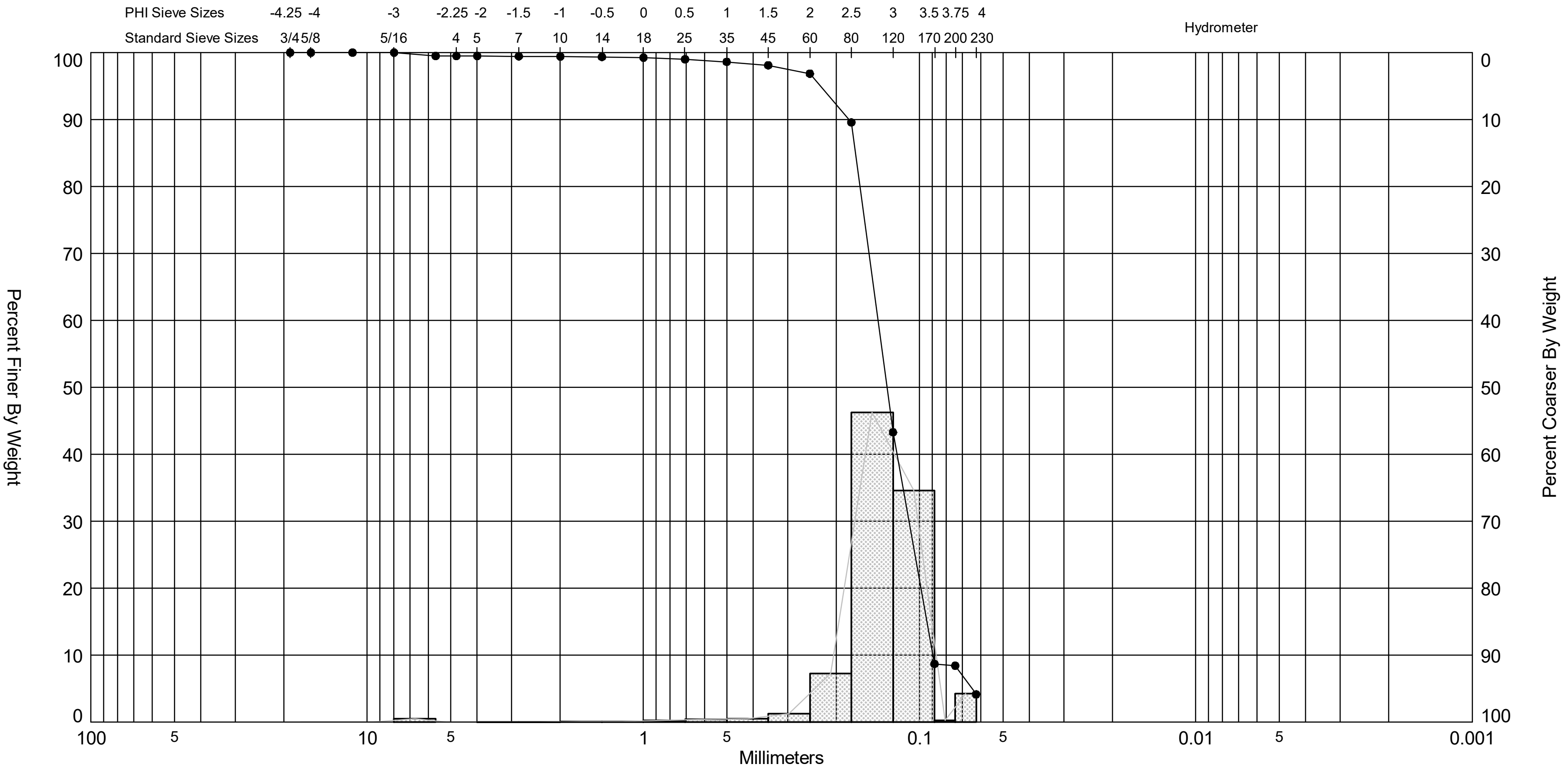

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-02 #1	—●—	-18.5	SP-SM	#200 - 8.42 #230 - 4.13		6	2.93	2.87	-4.51	37.8	0.64

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-13-20
Analyzed By:	EB
Easting (X, ft):	585,049
Northing (Y, ft):	807,556
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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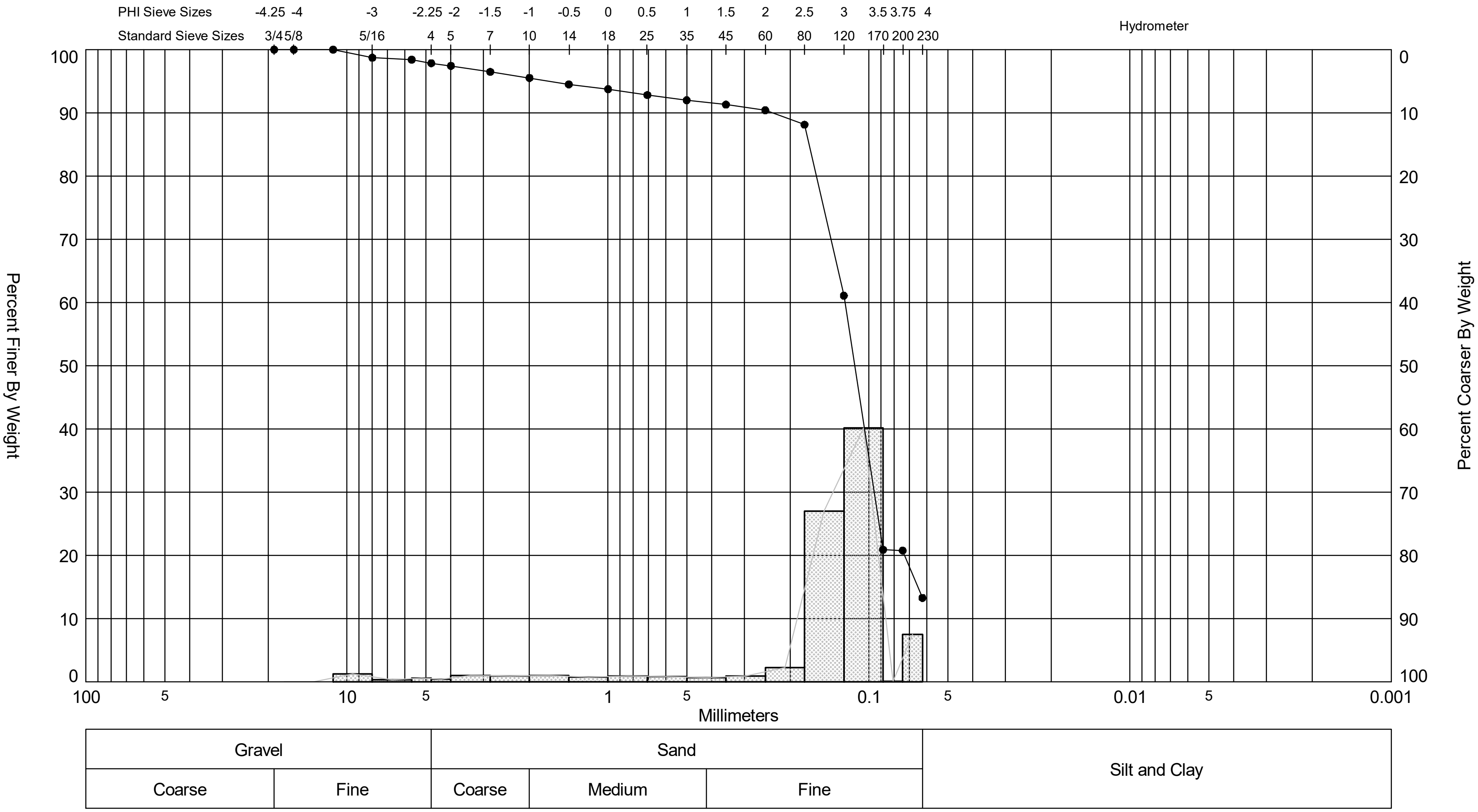
REDFISH_PASS_VIBRACORES.GPJ 9/1/20



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-02 #2	—●—	-20.5	SM	#200 - 20.77 #230 - 13.28		14	3.14	2.67	-2.78	10.44	1.38

Comments:

Depths and elevations based on measured values

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Boca Raton, FL 33431
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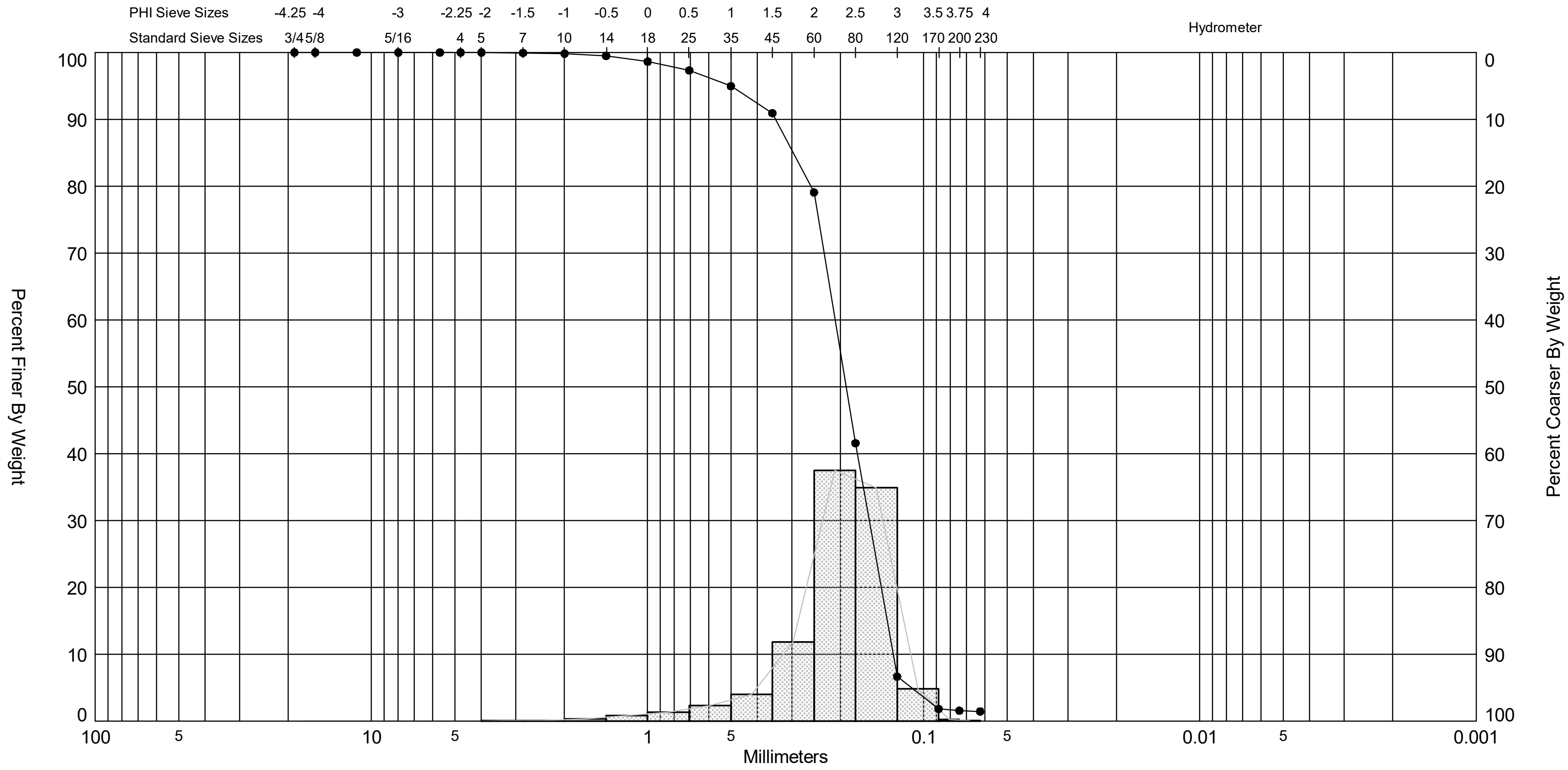
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-13-20
Analyzed By:	EB
Easting (X, ft):	585,049
Northing (Y, ft):	807,556
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-03 #1	—●—	-16.1	SP	#200 - 1.56 #230 - 1.45		16	2.39	2.28	-1.73	7.86	0.66

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-14-20
Analyzed By:	RH
Easting (X, ft):	585,257
Northing (Y, ft):	806,648
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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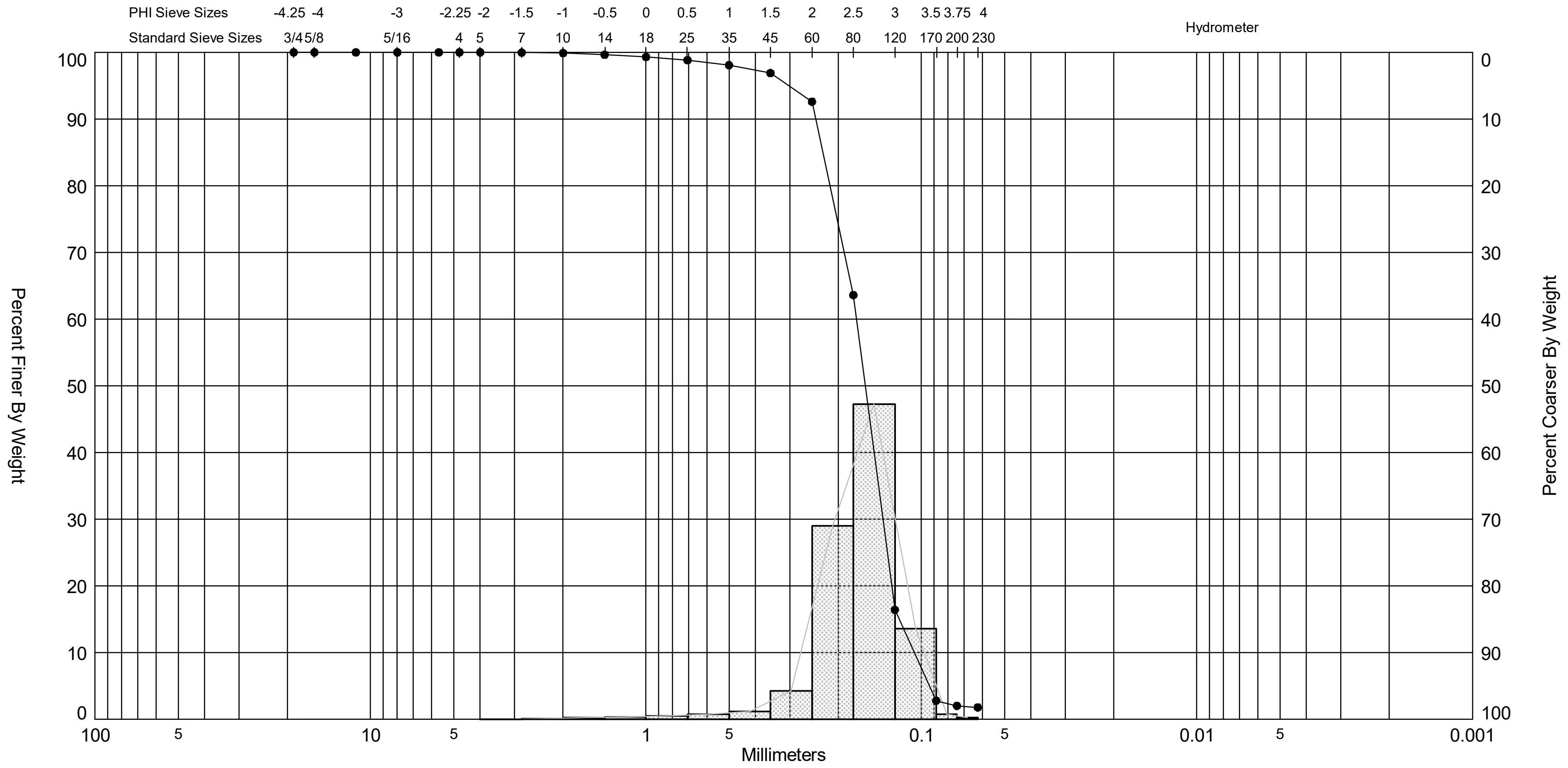

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-03 #2	—●—	-17.8	SP	#200 - 2.01 #230 - 1.78		8	2.64	2.57	-2.13	12.79	0.55

Comments:

Depths and elevations based on measured values

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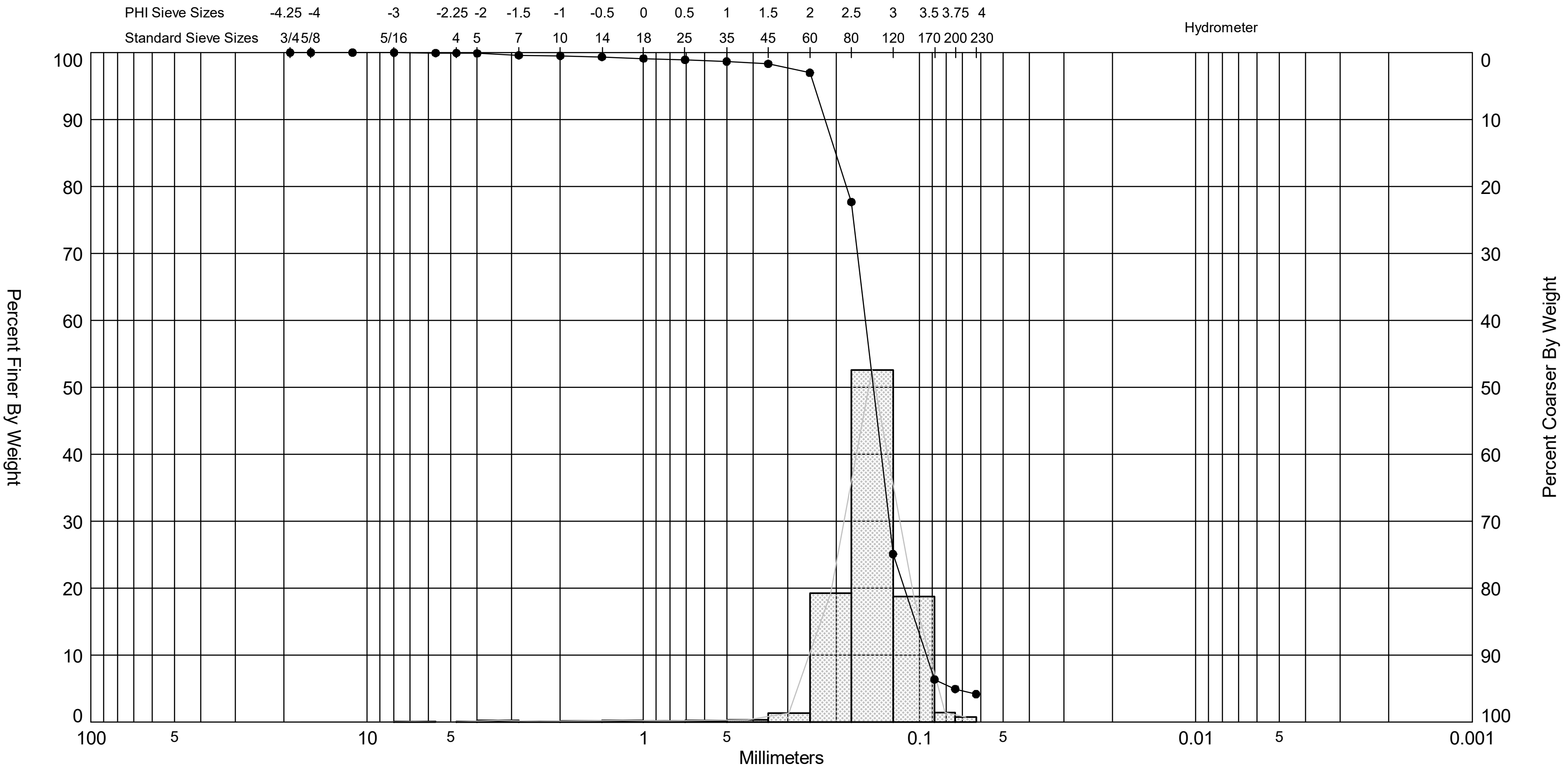
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-14-20
Analyzed By:	RH
Easting (X, ft):	585,257
Northing (Y, ft):	806,648
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-03 #3	─●─	-20.3	SP	#200 - 4.94 #230 - 4.17		8	2.76	2.7	-3.71	29.06	0.56

Comments:

Depths and elevations based on measured values

APTIM
2481 NW Boca Raton Blvd.
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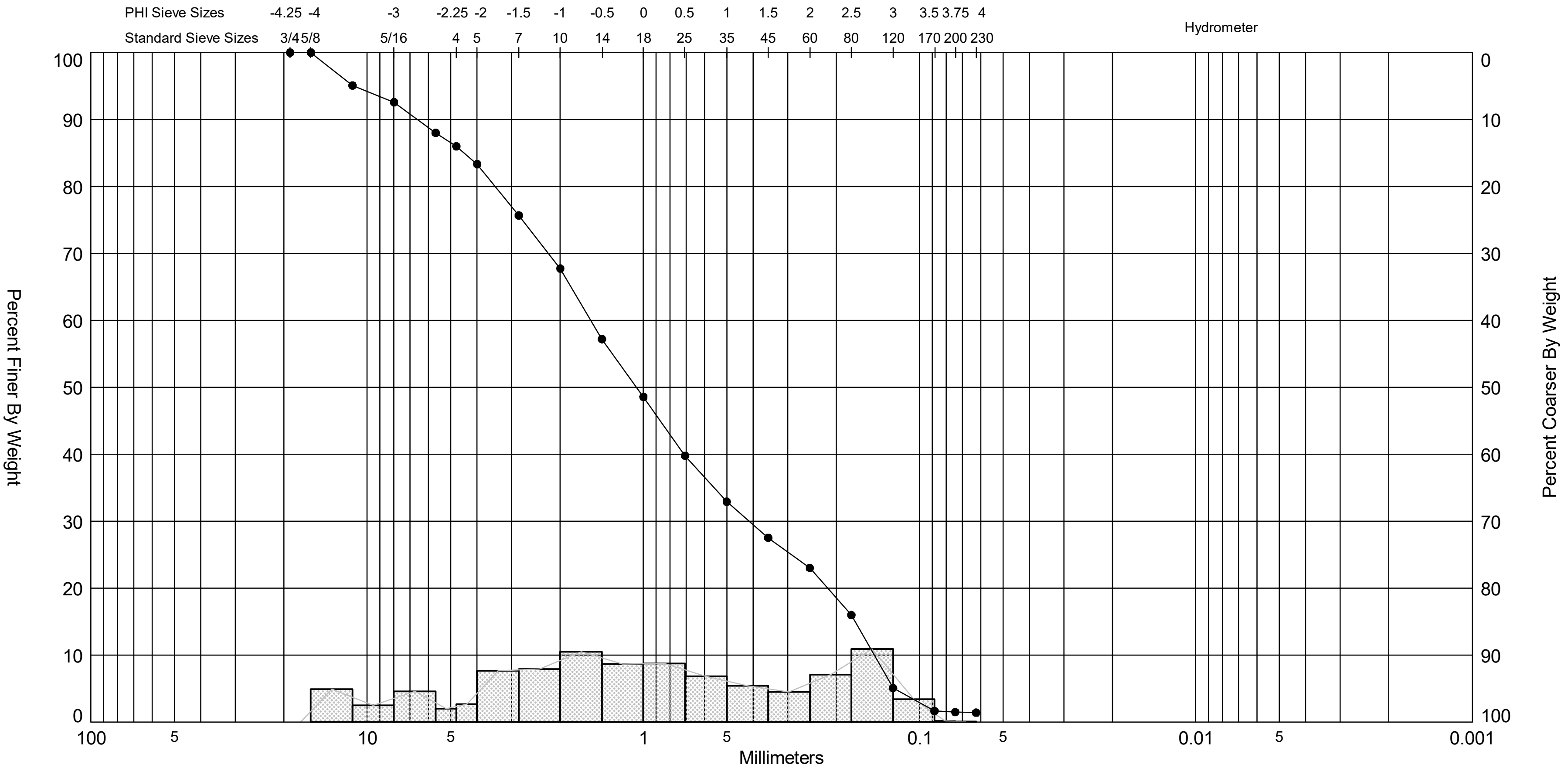
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-14-20
Analyzed By:	RH
Easting (X, ft):	585,257
Northing (Y, ft):	806,648
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-04 #1	—●—	-13.4	SW	#200 - 1.48 #230 - 1.39		69		-0.03	-0.06	2.05	1.96

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-12-20
Analyzed By:	RH
Easting (X, ft):	586,097
Northing (Y, ft):	806,318
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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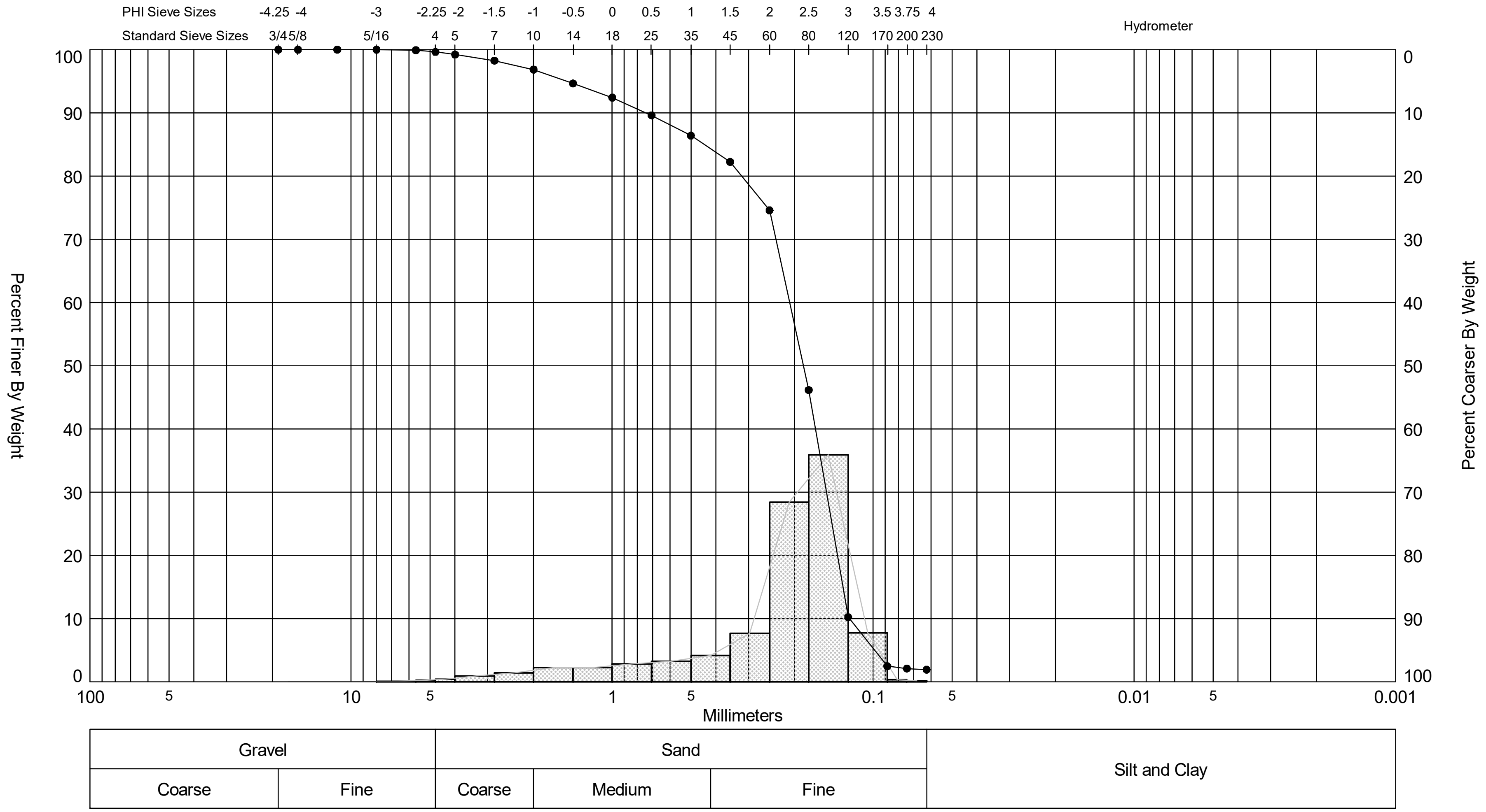

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-04 #2	—●—	-14.4	SW	#200 - 2.10 #230 - 1.93		22	2.43	2.08	-1.85	6.22	1.12

Comments:

Depths and elevations based on measured values

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Boca Raton, FL 33431
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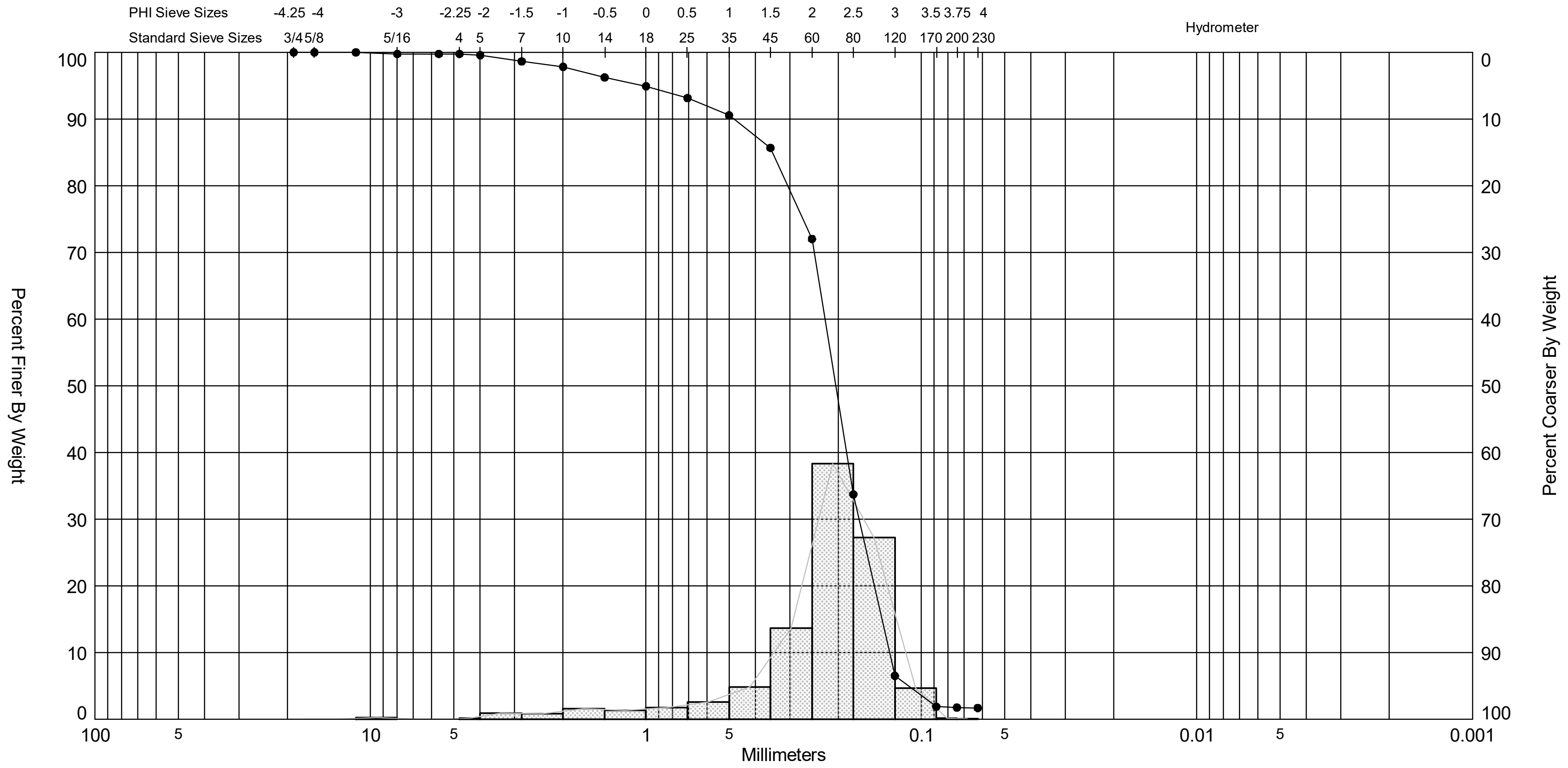
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-12-20
Analyzed By:	SF
Easting (X, ft):	586,097
Northing (Y, ft):	806,318
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-04 #3	—●—	-15.8	SW	#200 - 1.75 #230 - 1.69		23	2.29	2.07	-2.23	9.21	0.95

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-13-20
Analyzed By:	SF
Easting (X, ft):	586,097
Northing (Y, ft):	806,318
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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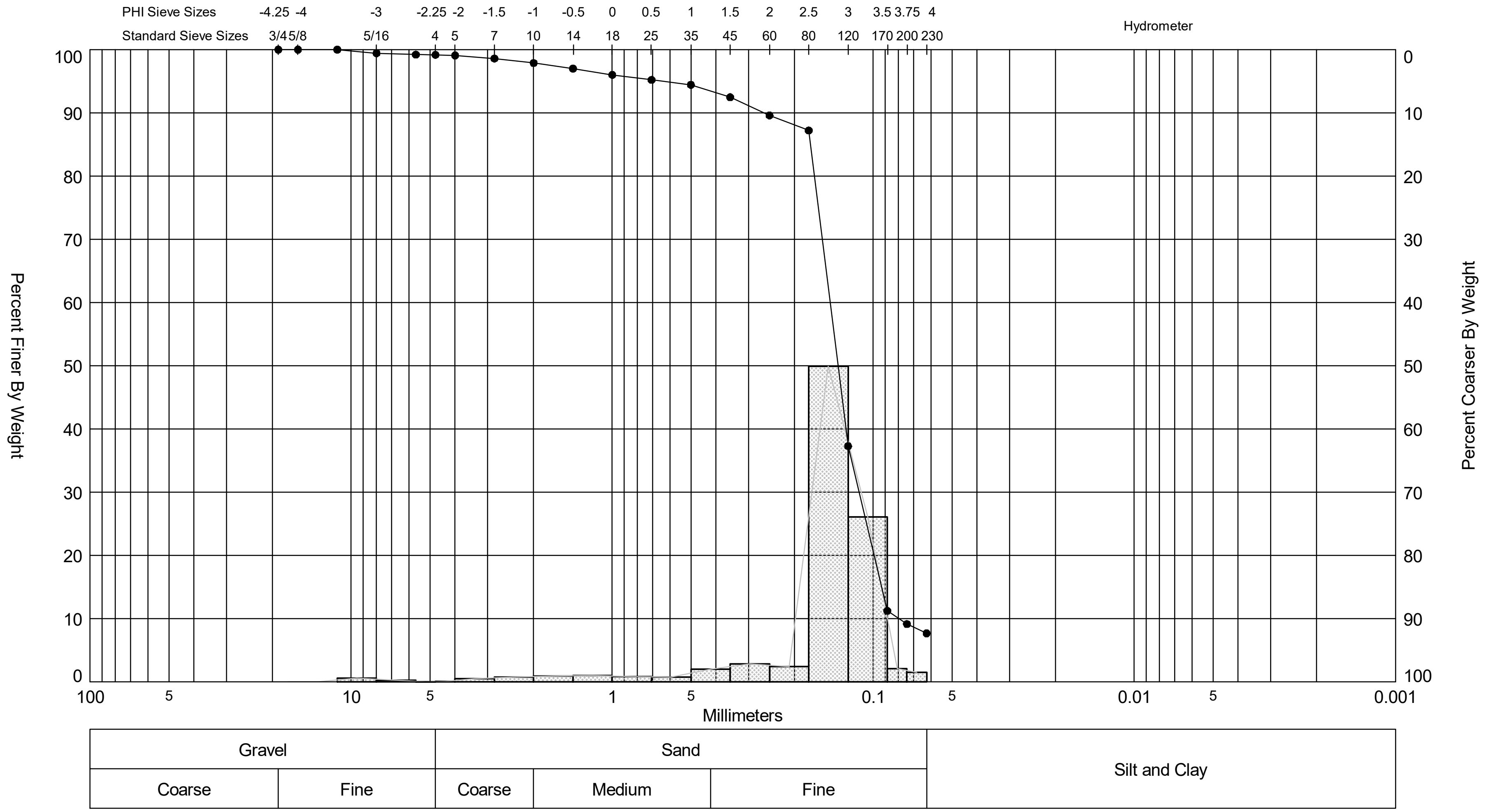

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-04 #4	—●—	-17.0	SW-SM	#200 - 9.13 #230 - 7.67		10	2.87	2.64	-3.25	15.22	1.02

Comments:

Depths and elevations based on measured values

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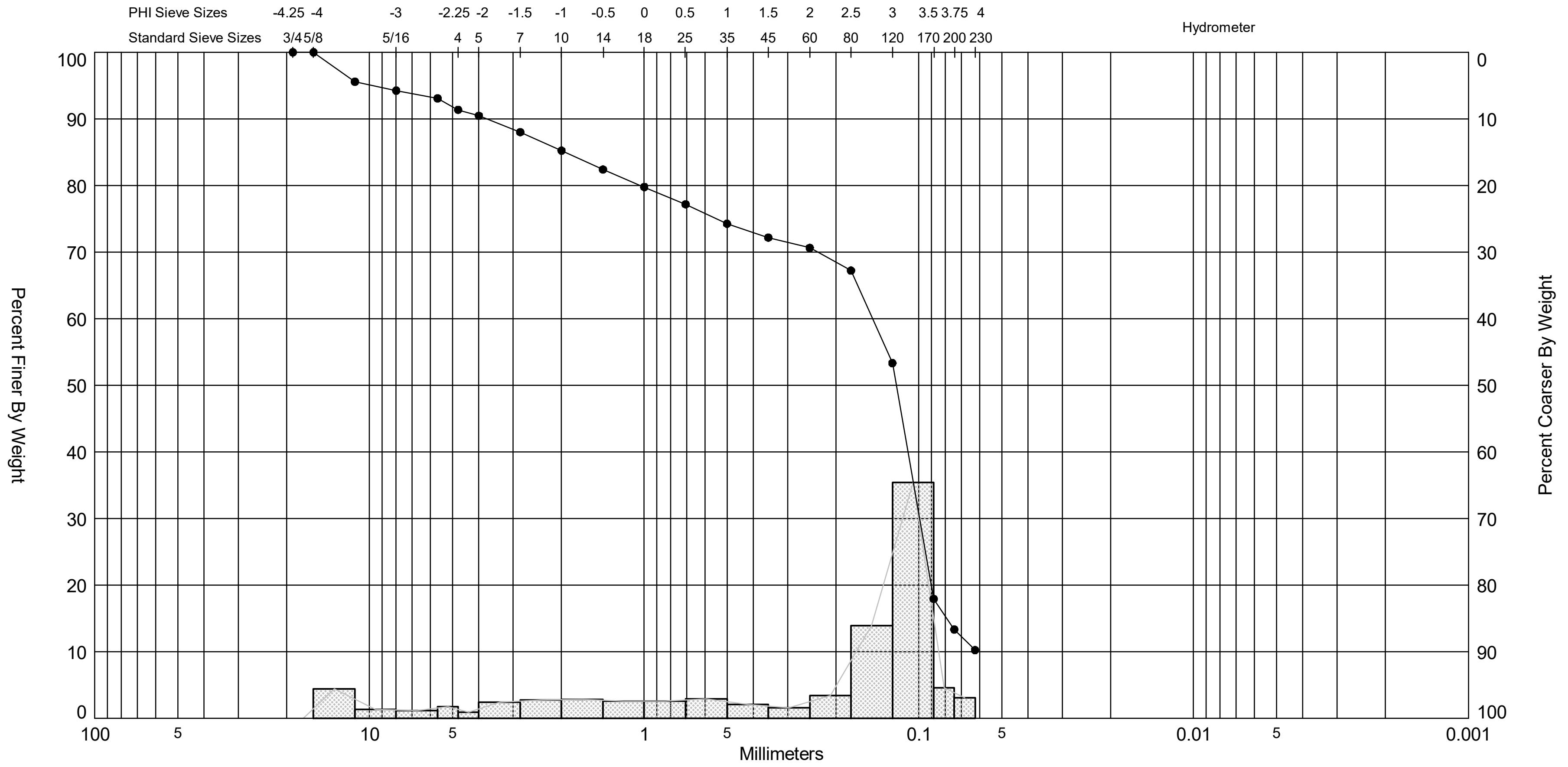
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-13-20
Analyzed By:	RH
Easting (X, ft):	586,097
Northing (Y, ft):	806,318
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-04 #5	—●—	-18.4	SM	#200 - 13.33 #230 - 10.23		32	3.05	1.75	-1.23	3.15	2.24

Comments:

Depths and elevations based on measured values

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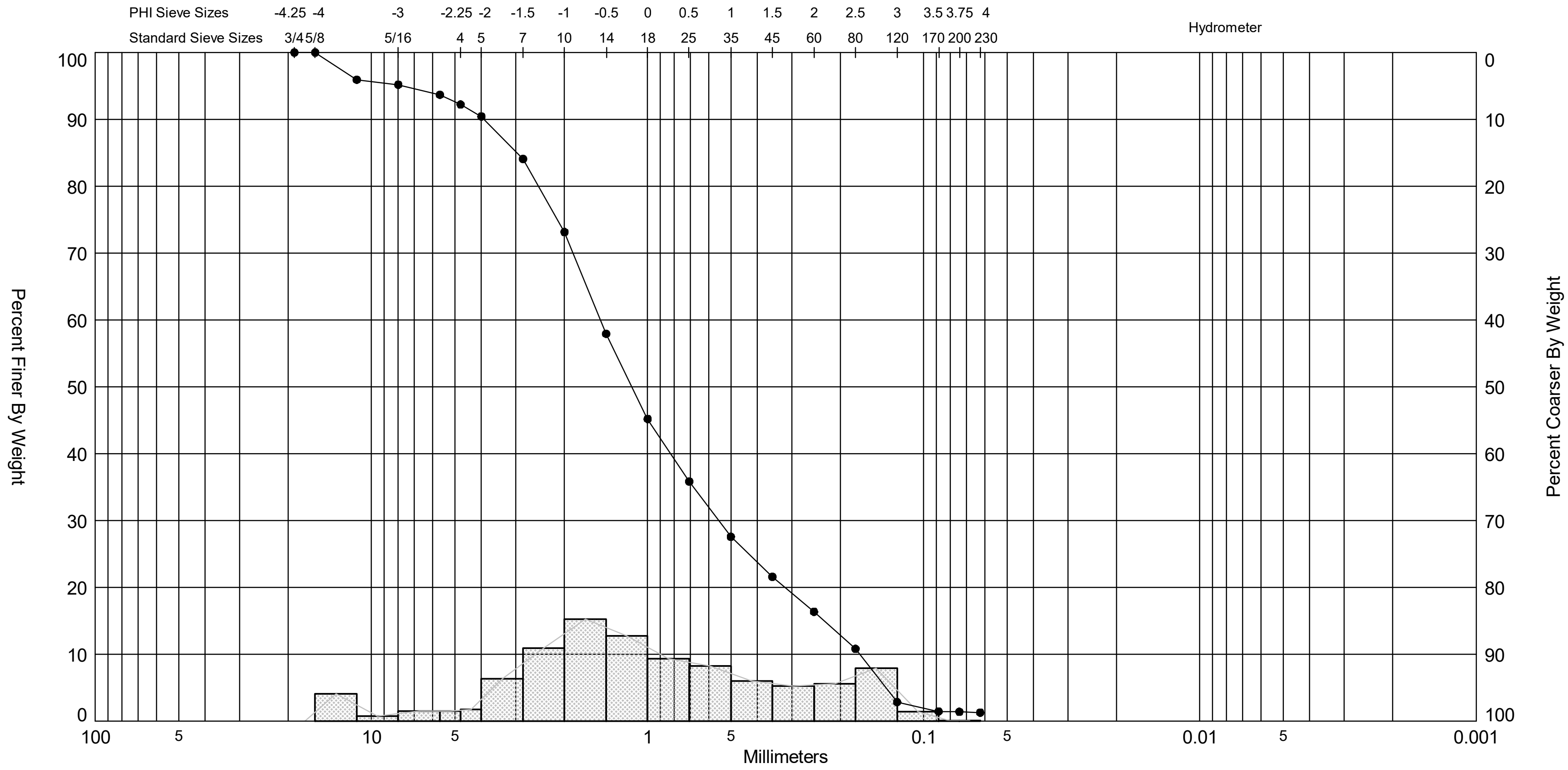
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-13-20
Analyzed By:	RH
Easting (X, ft):	586,097
Northing (Y, ft):	806,318
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

REDFISH_PASS_VIBRACORES.GPJ 9/1/20



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-04 #6	—●—	-12.1	SW	#200 - 1.39 #230 - 1.28		73		-0.04	-0.02	2.62	1.67

Comments:

Depths and elevations based on measured values

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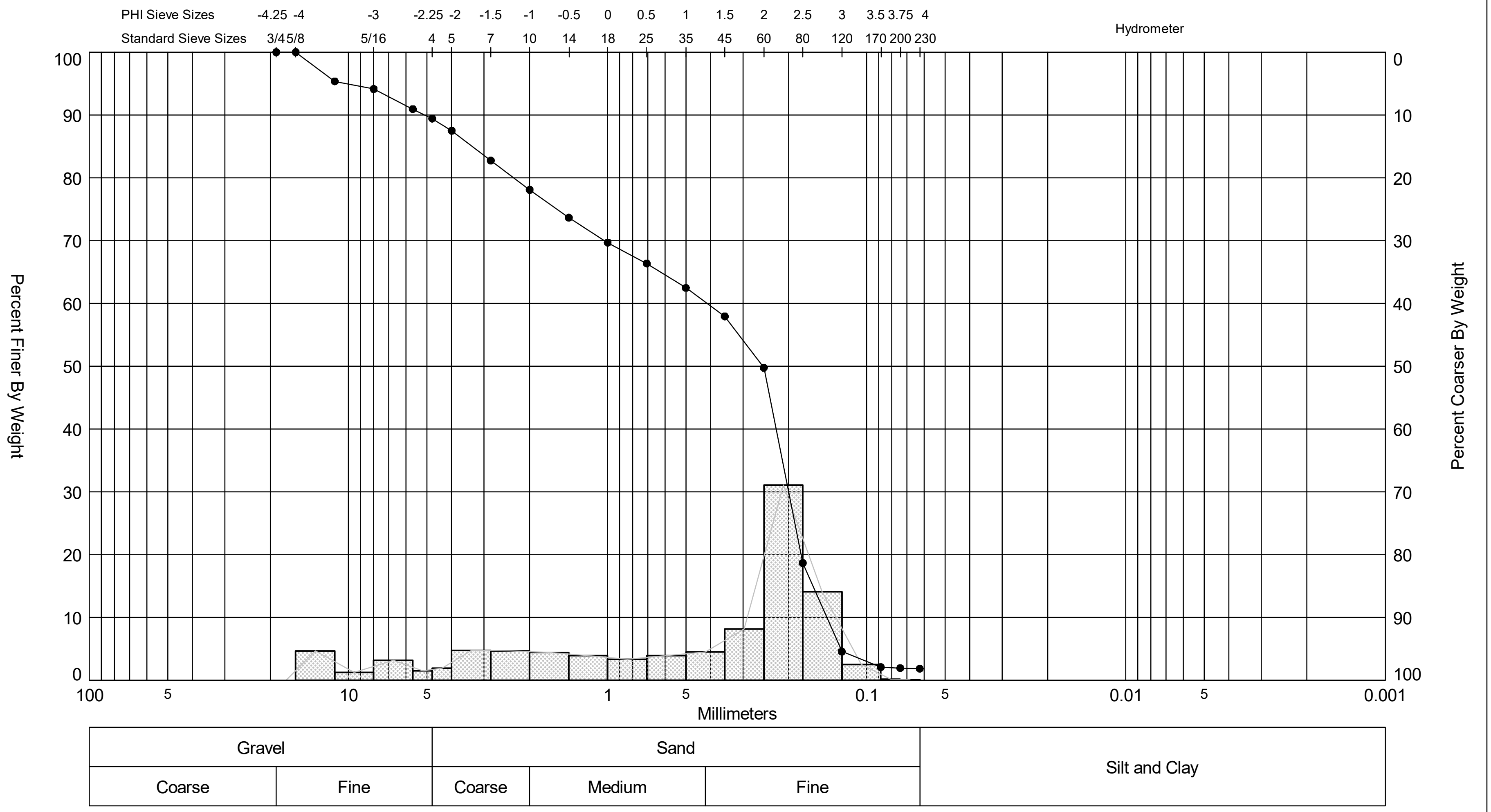
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-13-20
Analyzed By:	RH
Easting (X, ft):	586,097
Northing (Y, ft):	806,318
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

REDFISH_PASS_VIBRACORES.GPJ 9/1/20



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-04 #7	—●—	-12.5	SW	#200 - 1.94 #230 - 1.85		47	1.99	0.87	-0.91	2.52	2.01

Comments:

Depths and elevations based on measured values

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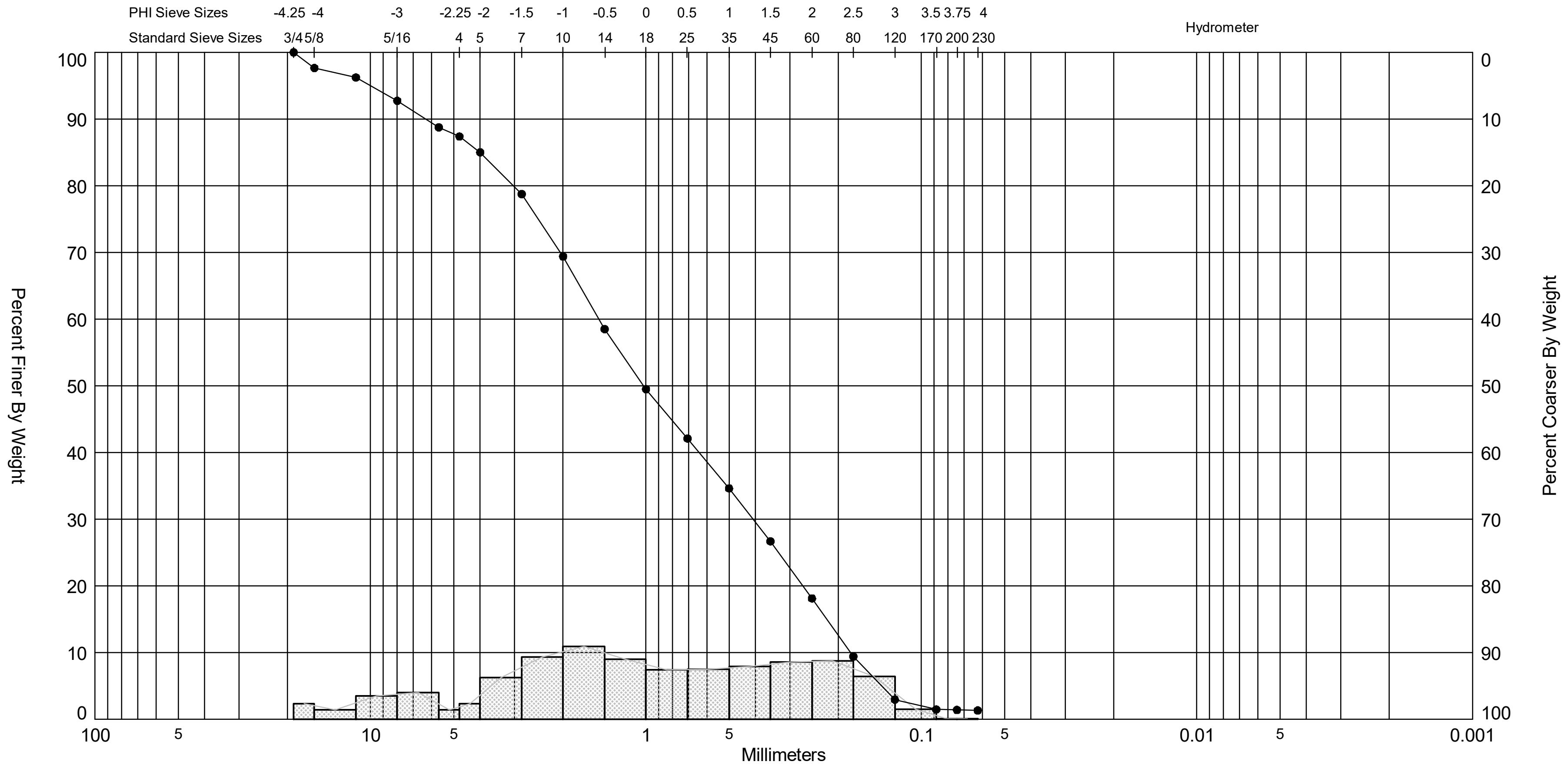
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-13-20
Analyzed By:	RH
Easting (X, ft):	586,097
Northing (Y, ft):	806,318
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-04 #8	—●—	-15.1	SW	#200 - 1.39 #230 - 1.31		71		-0.04	-0.23	2.24	1.86

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-13-20
Analyzed By:	RH
Easting (X, ft):	586,097
Northing (Y, ft):	806,318
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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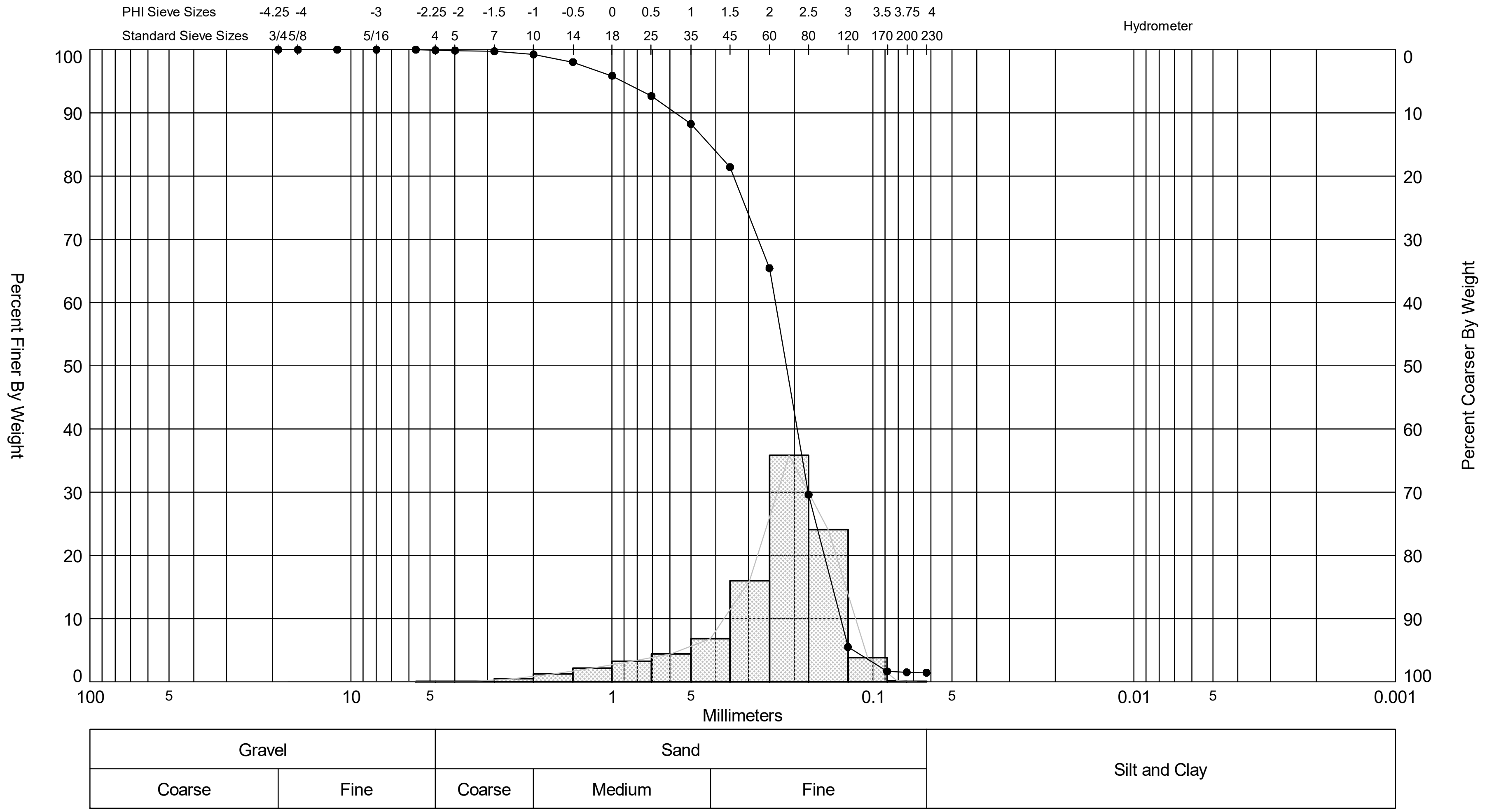

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-05 #1	─●─	-17.0	SW	#200 - 1.51 #230 - 1.45		24	2.22	2.01	-1.51	5.75	0.86

Comments:

Depths and elevations based on measured values

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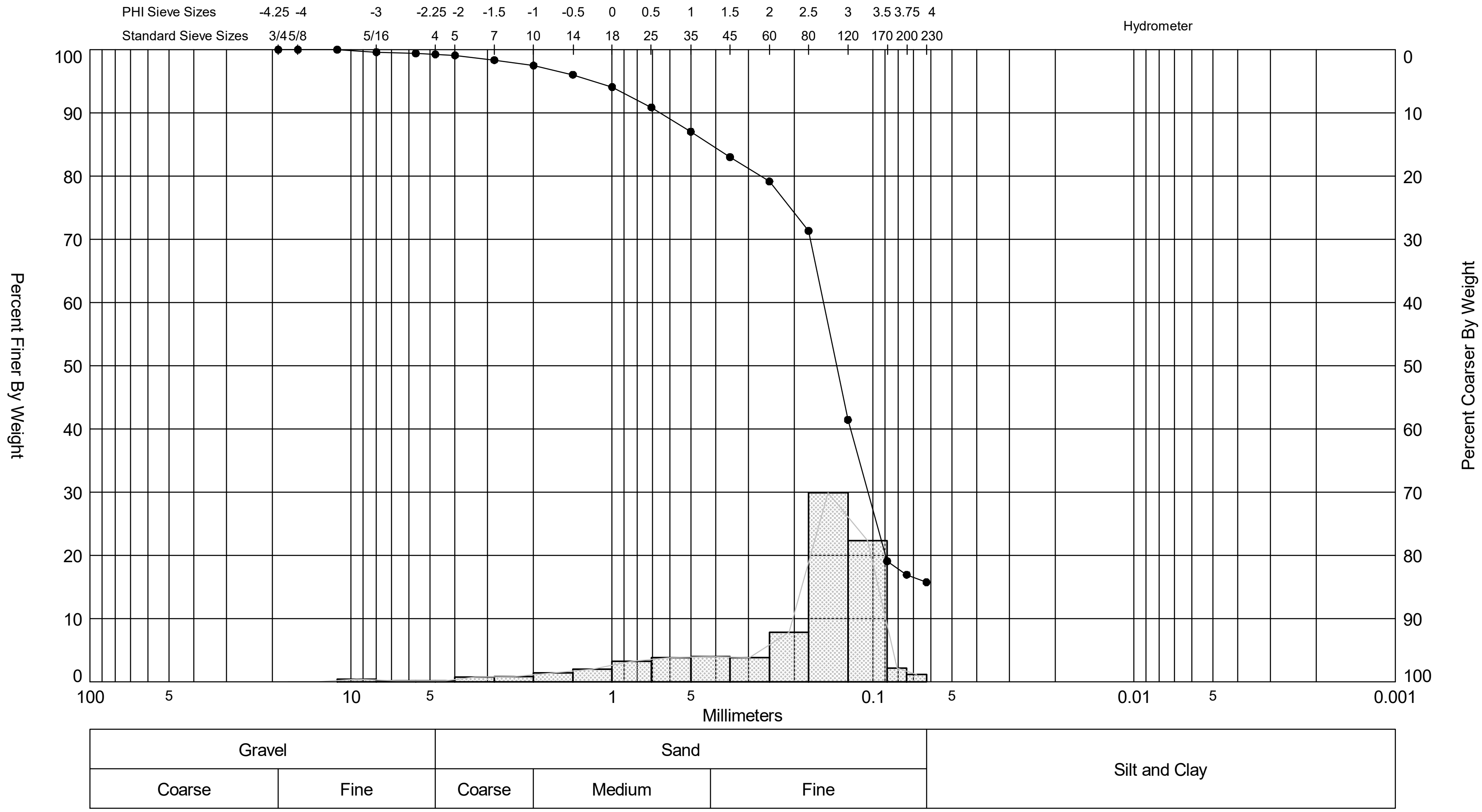
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-13-20
Analyzed By:	EB
Easting (X, ft):	585,458
Northing (Y, ft):	805,750
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-05 #2	—●—	-21.1	SC	#200 - 16.94 #230 - 15.76		21	2.86	2.3	-1.77	6.07	1.26

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-13-20
Analyzed By:	RH
Easting (X, ft):	585,458
Northing (Y, ft):	805,750
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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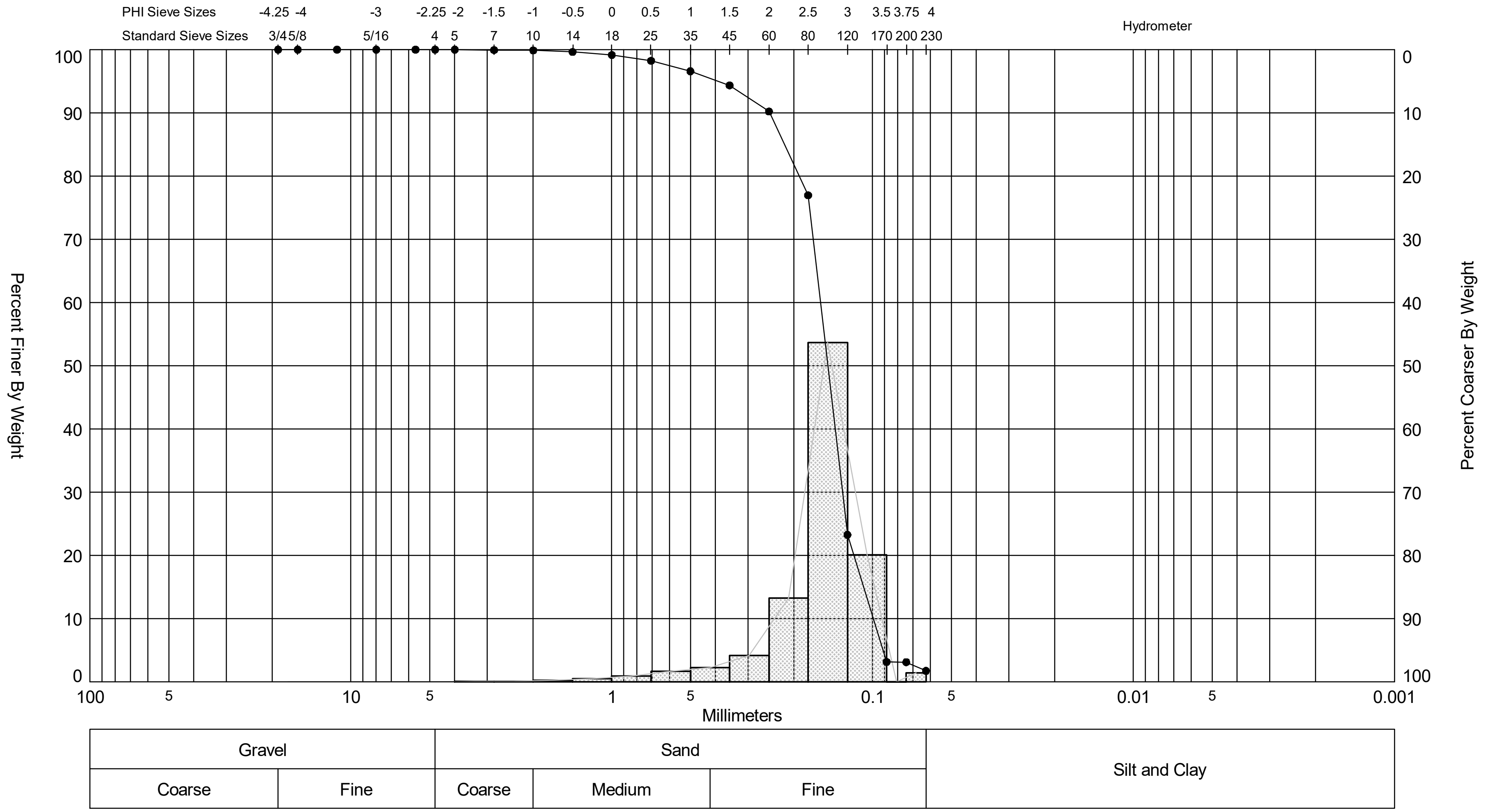

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-06 #1	—●—	-16.0	SP	#200 - 3.11 #230 - 1.72		13	2.75	2.64	-2.19	10.48	0.64

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-12-20
Analyzed By:	RH
Easting (X, ft):	585,845
Northing (Y, ft):	804,924
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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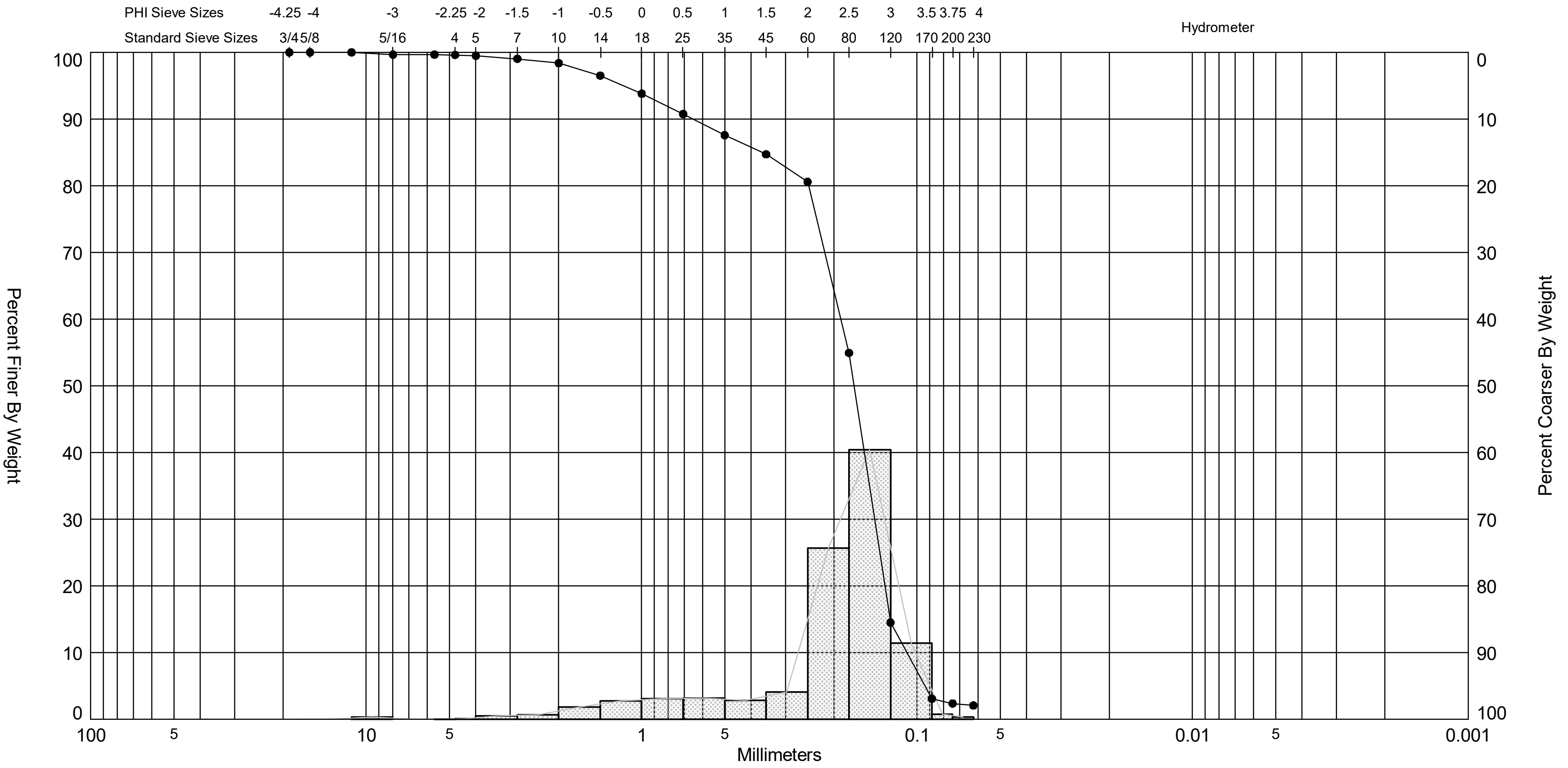

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-06 #2	—●—	-17.7	SW	#200 - 2.36 #230 - 2.06		21	2.56	2.23	-2.02	7.47	1.06

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-12-20
Analyzed By:	RH
Easting (X, ft):	585,845
Northing (Y, ft):	804,924
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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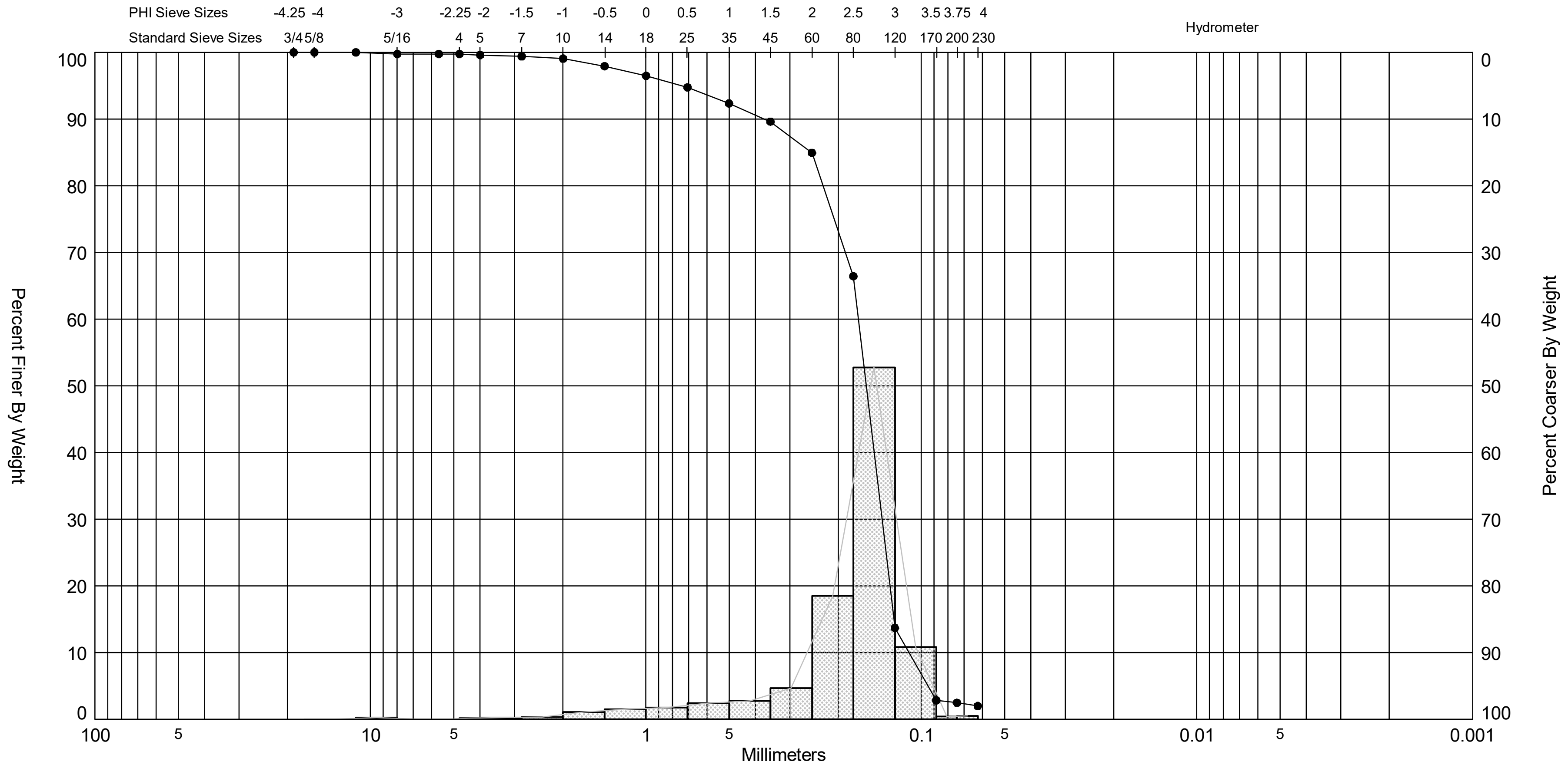

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-06 #3	—●—	-19.8	SW	#200 - 2.46 #230 - 1.97		17	2.66	2.41	-2.58	11.46	0.88

Comments:

Depths and elevations based on measured values

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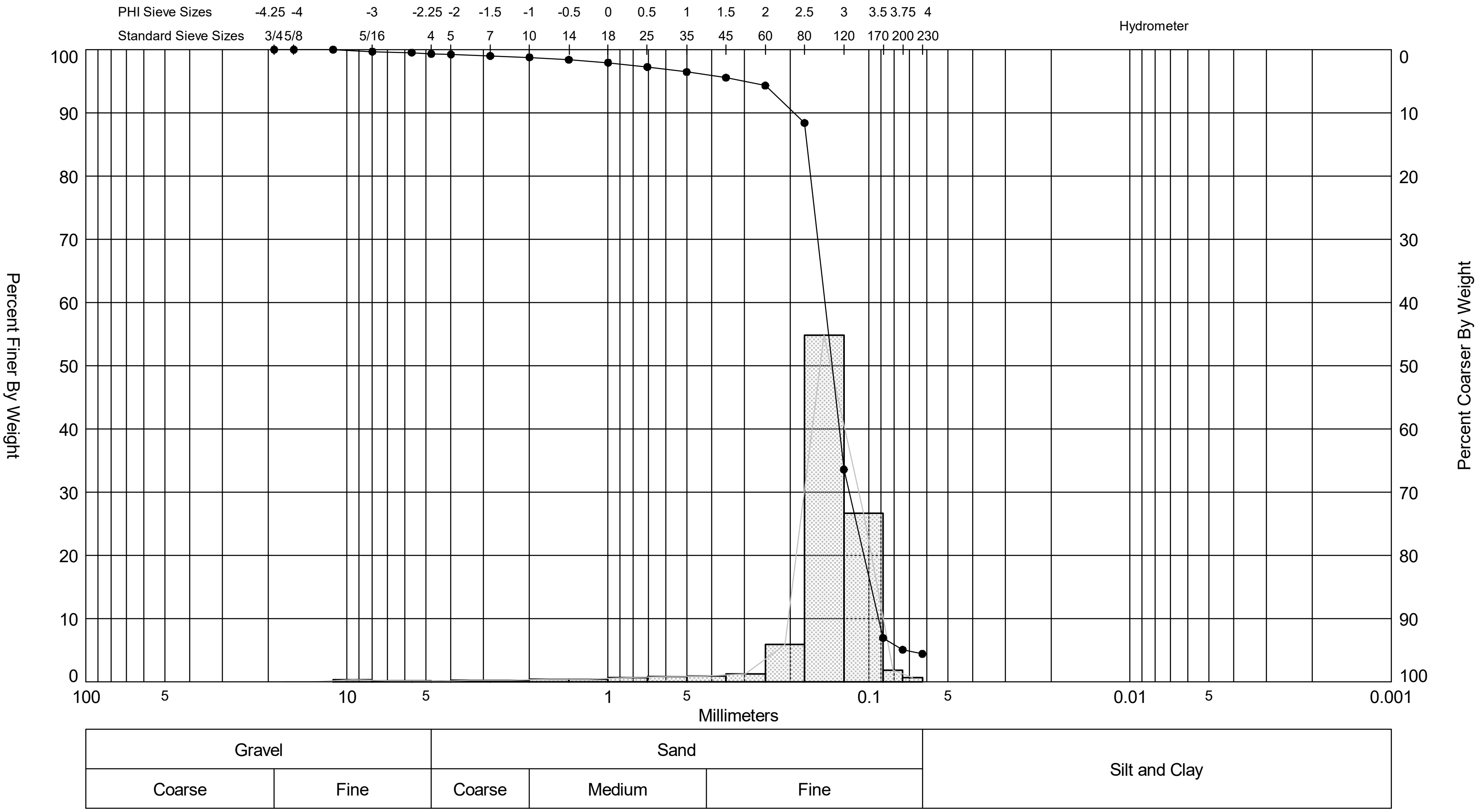
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-12-20
Analyzed By:	RH
Easting (X, ft):	585,845
Northing (Y, ft):	804,924
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-06 #4	—●—	-21.9	SP-SM	#200 - 5.07 #230 - 4.42		8	2.85	2.73	-4.2	25.6	0.8

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-13-20
Analyzed By:	RH
Easting (X, ft):	585,845
Northing (Y, ft):	804,924
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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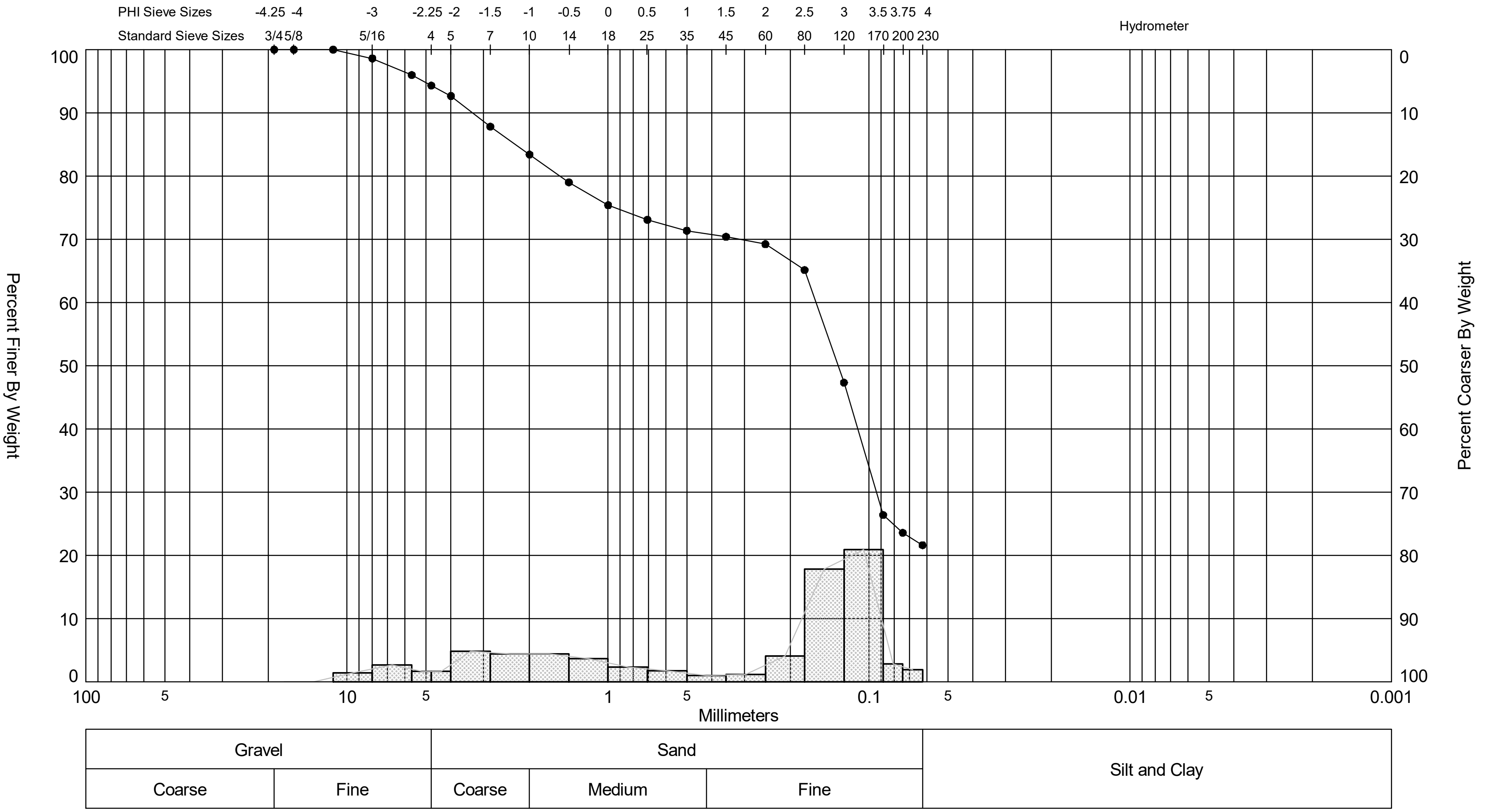

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-06 #5	—●—	-24.3	SM	#200 - 23.57 #230 - 21.62		38	2.92	1.43	-0.73	1.96	2.16

Comments:

Depths and elevations based on measured values

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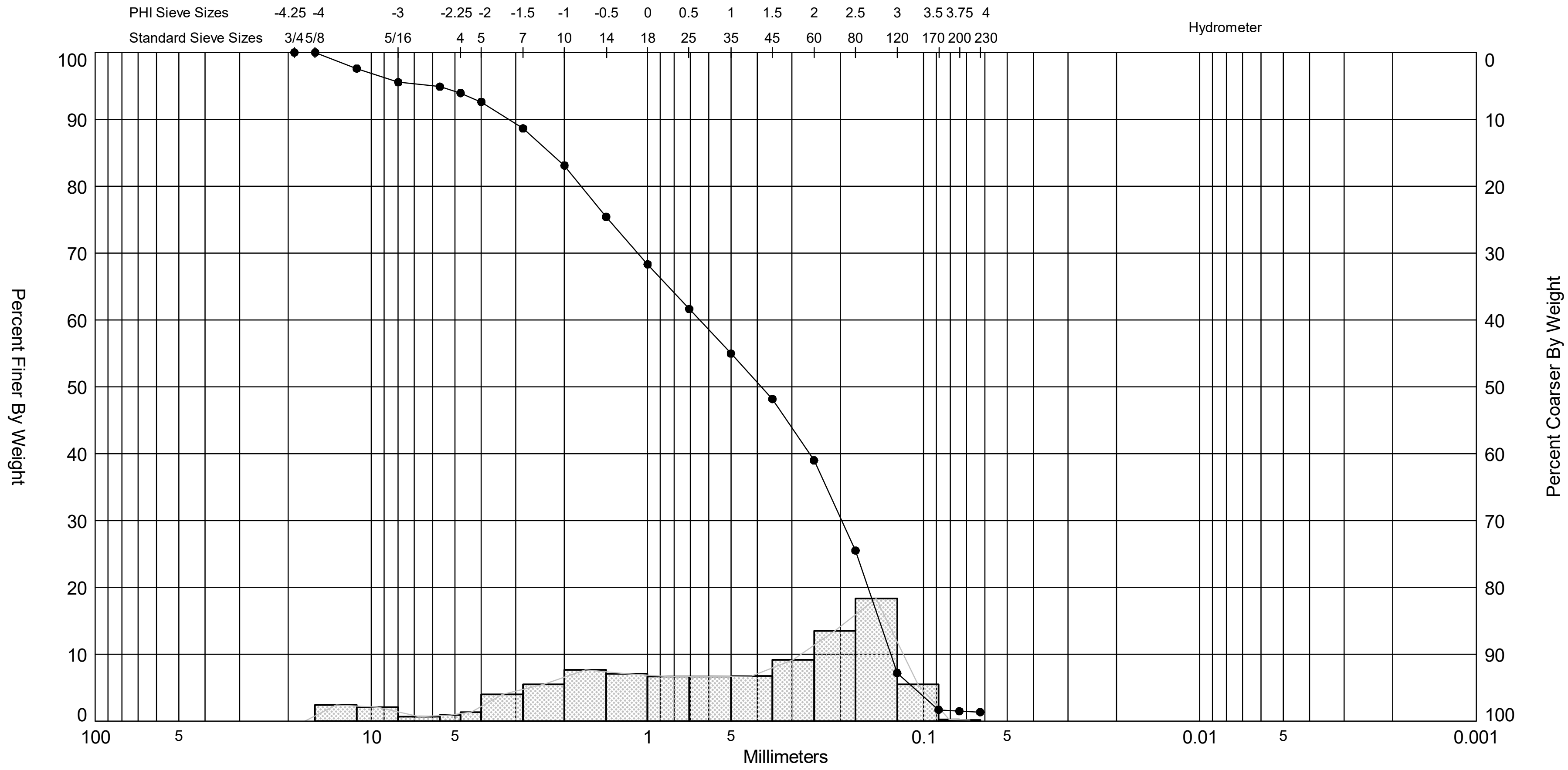
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-13-20
Analyzed By:	RH
Easting (X, ft):	585,845
Northing (Y, ft):	804,924
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-07 #1	—●—	-16.1	SW	#200 - 1.48 #230 - 1.35		53	1.37	0.88	-0.68	2.56	1.84

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-12-20
Analyzed By:	RH
Easting (X, ft):	586,392
Northing (Y, ft):	805,456
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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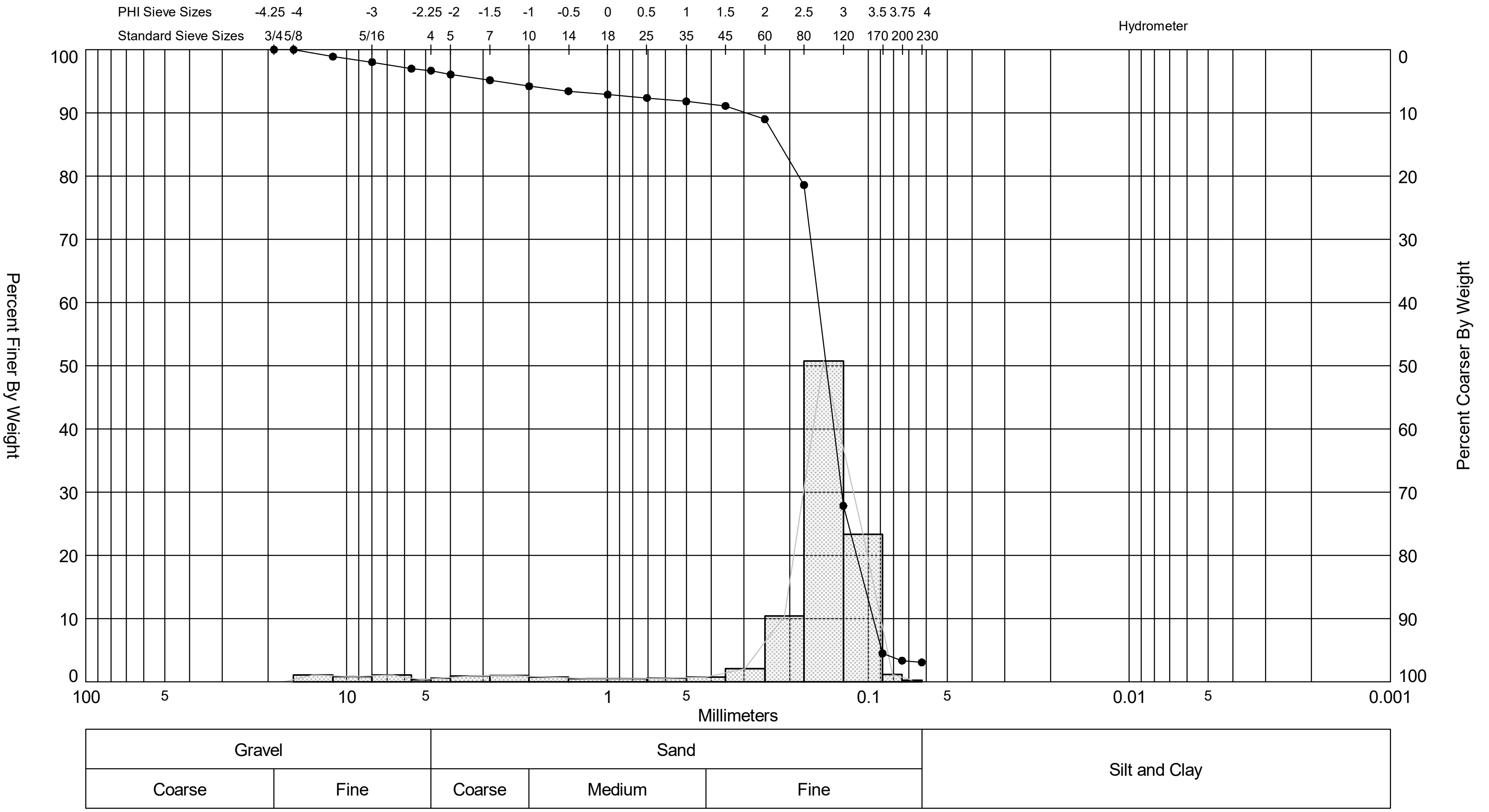

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-07 #2	—●—	-17.7	SW	#200 - 3.35 #230 - 3.07		14	2.78	2.41	-3.02	11.64	1.39

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-12-20
Analyzed By:	RH
Easting (X, ft):	586,392
Northing (Y, ft):	805,456
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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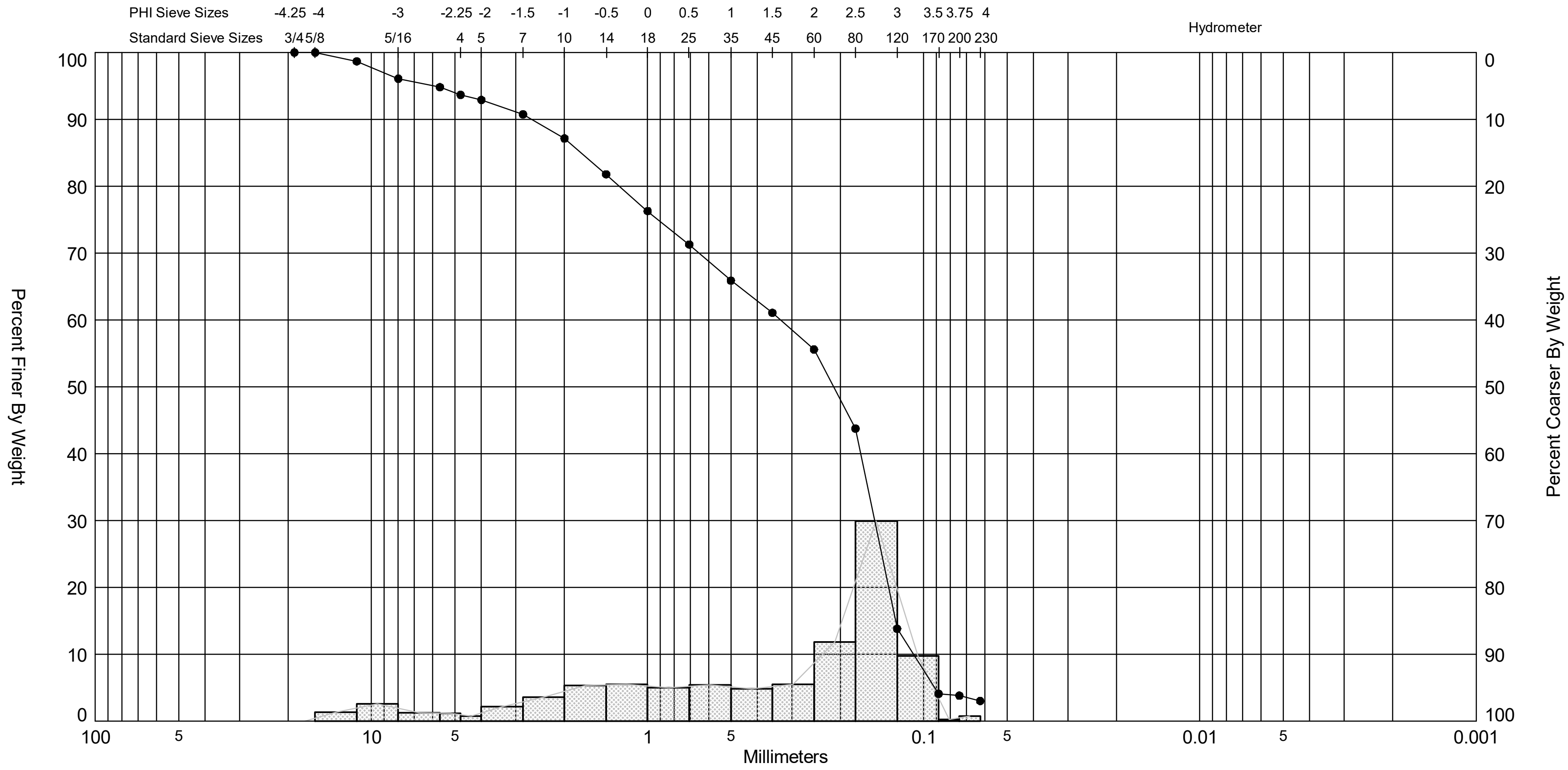

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-07 #3	—●—	-18.5	SW	#200 - 3.80 #230 - 3.02		39	2.24	1.35	-1.01	3.02	1.86

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-12-20
Analyzed By:	RH
Easting (X, ft):	586,392
Northing (Y, ft):	805,456
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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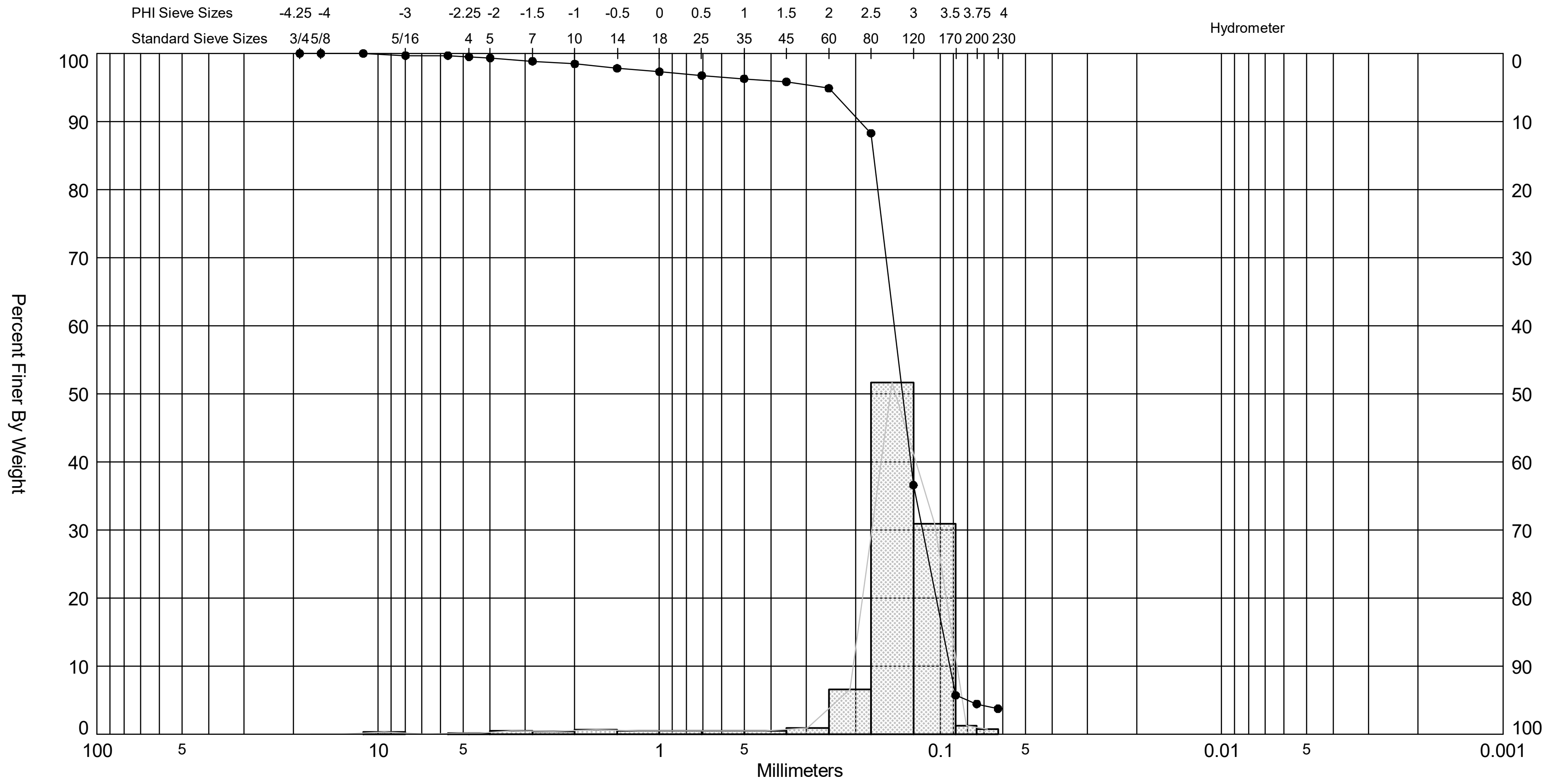

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-07 #4	—●—	-19.3	SP	#200 - 4.45 #230 - 3.74		9	2.87	2.74	-4.09	23.11	0.84

Comments:

Depths and elevations based on measured values

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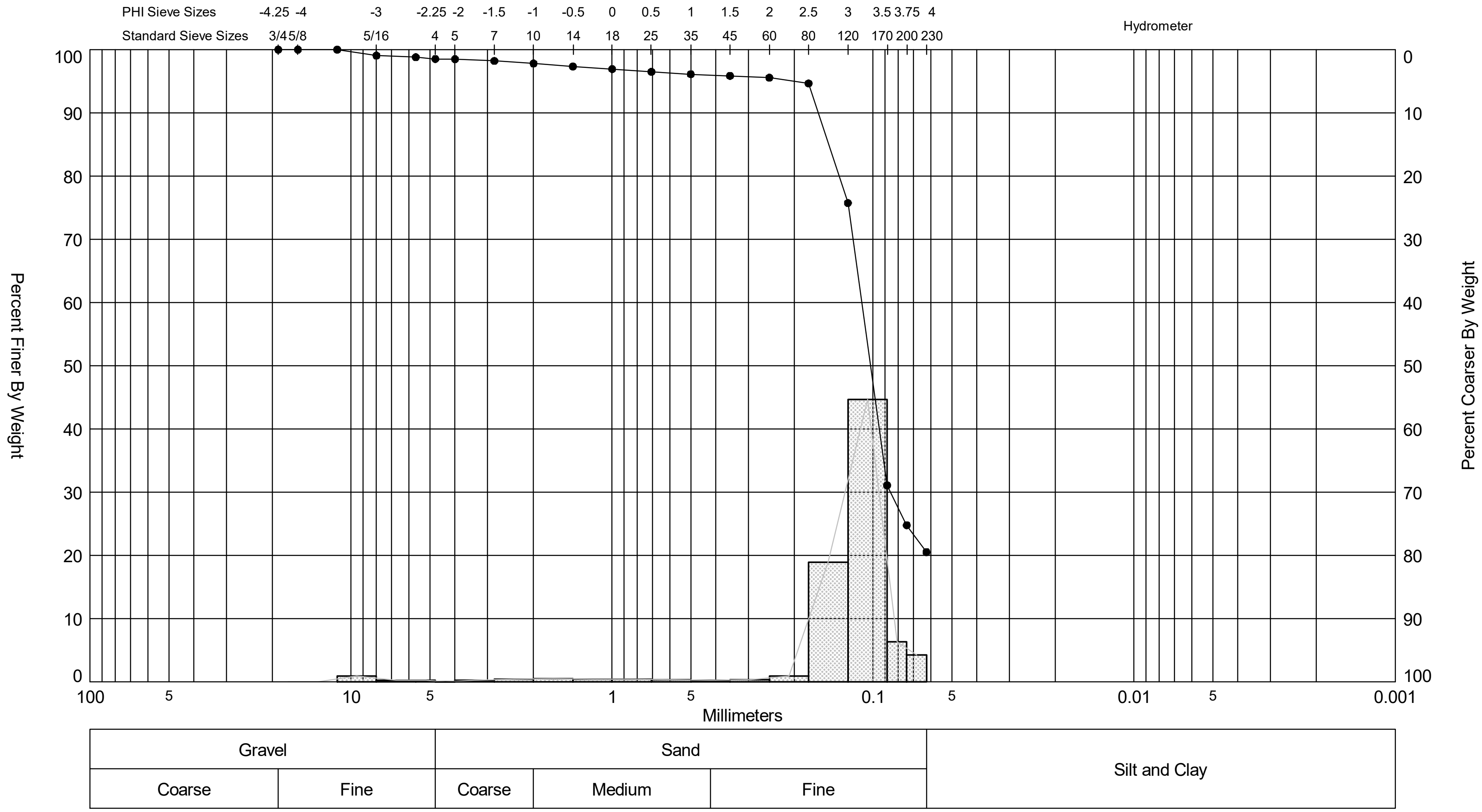
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-12-20
Analyzed By:	RH
Easting (X, ft):	586,392
Northing (Y, ft):	805,456
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-07 #5	—●—	-20.5	SM	#200 - 24.78 #230 - 20.53		13	3.29	2.94	-4.03	20.38	1.1

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-12-20
Analyzed By:	RH
Easting (X, ft):	586,392
Northing (Y, ft):	805,456
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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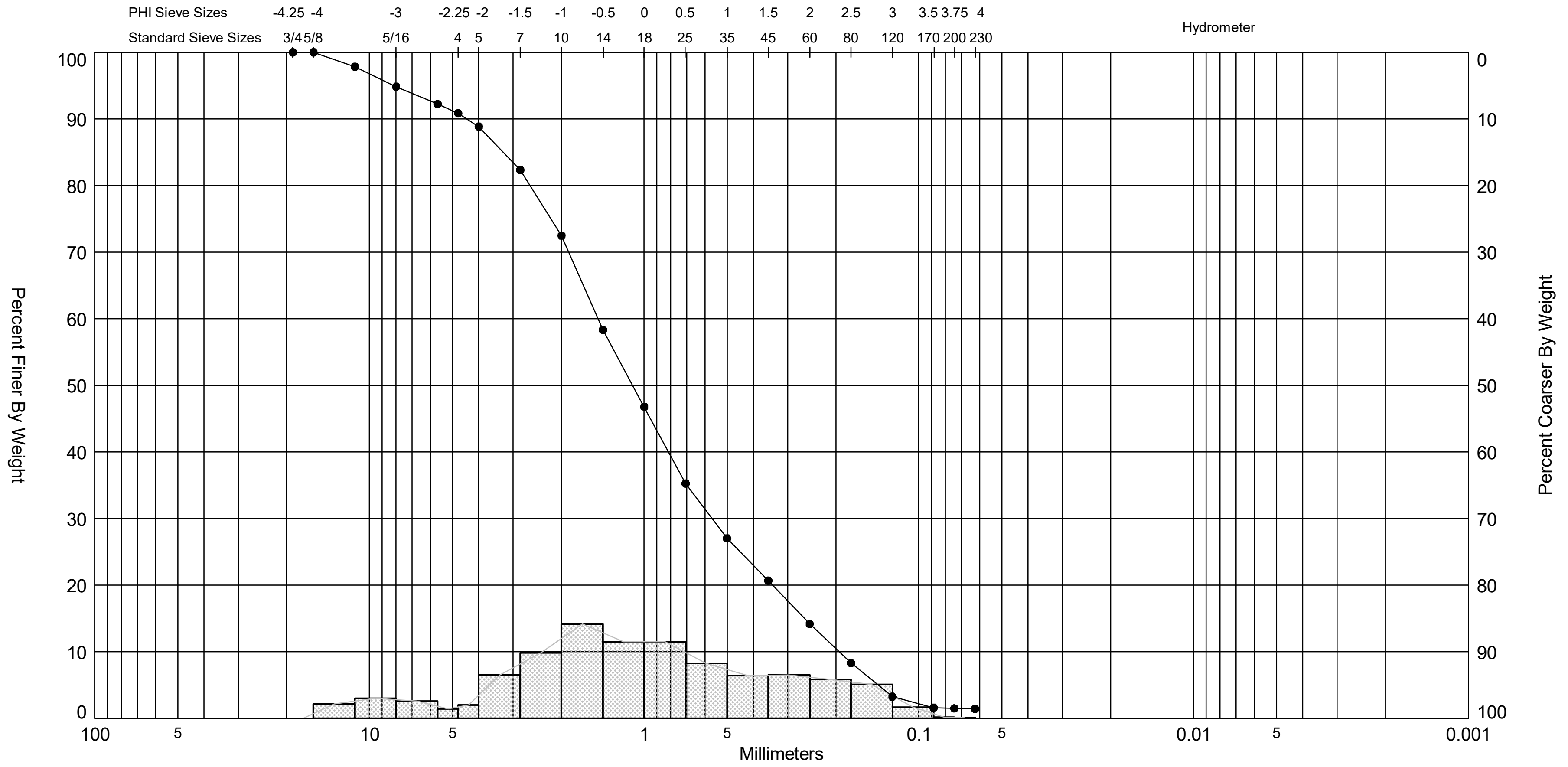

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-08 #1	—●—	-13.6	SW	#200 - 1.48 #230 - 1.42		74		-0.08	-0.03	2.54	1.64

Comments:

Depths and elevations based on measured values

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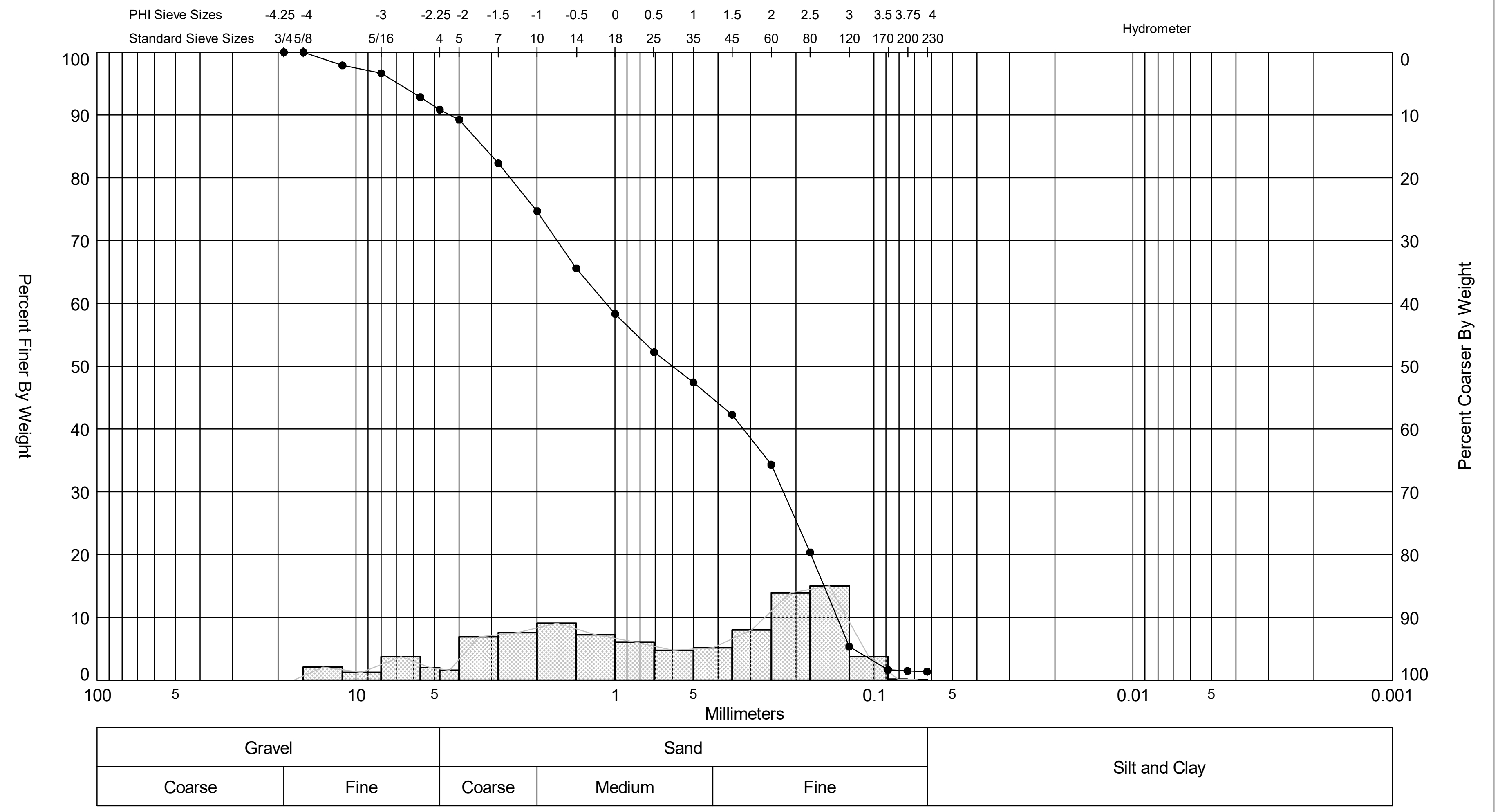
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-14-20
Analyzed By:	HV
Easting (X, ft):	587,228
Northing (Y, ft):	805,426
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-08 #2	—●—	-14.6	SW	#200 - 1.47 #230 - 1.37		58	0.73	0.51	-0.34	1.94	1.93

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-14-20
Analyzed By:	HV
Easting (X, ft):	587,228
Northing (Y, ft):	805,426
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

Comments:

Depths and elevations based on measured values

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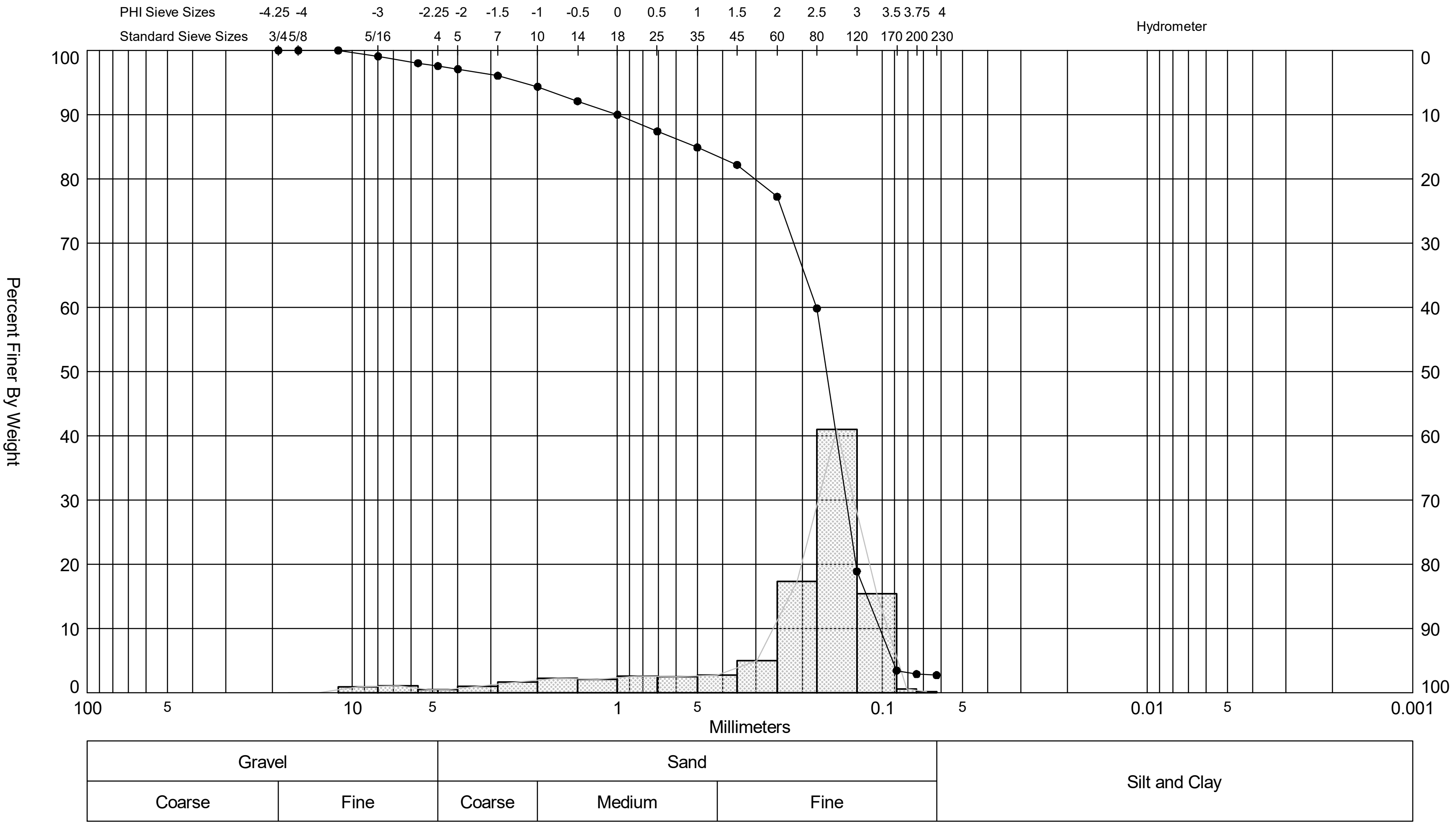

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-08 #3	—●—	-15.5	SW	#200 - 2.89 #230 - 2.72		20	2.62	2.11	-2.02	6.58	1.39

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-14-20
Analyzed By:	HV
Easting (X, ft):	587,228
Northing (Y, ft):	805,426
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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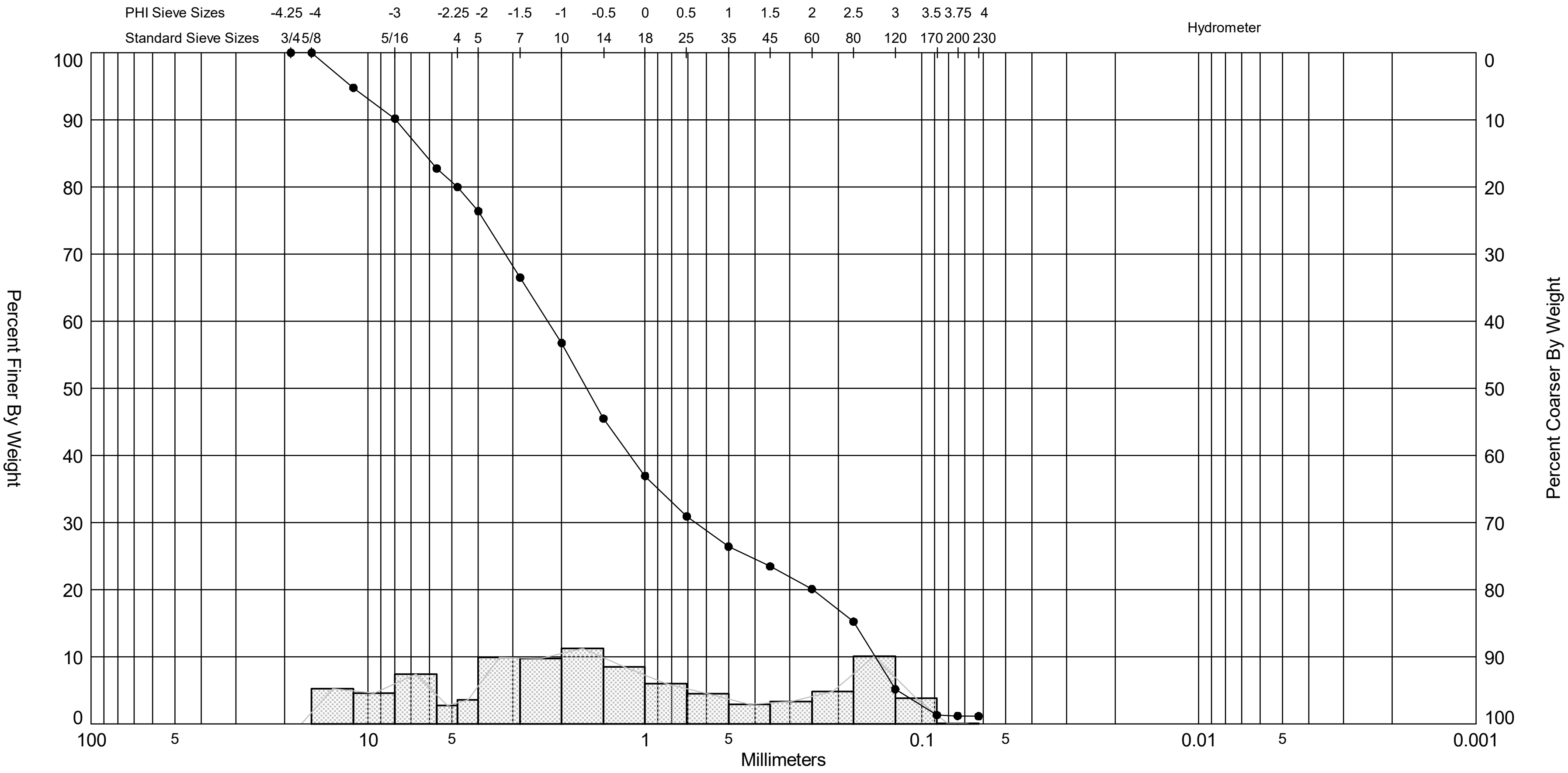

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-08 #4	—●—	-16.3	SW	#200 - 1.20 #230 - 1.14		73		-0.44	0.28	2.04	2.02

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-18-20
Analyzed By:	SF
Easting (X, ft):	587,228
Northing (Y, ft):	805,426
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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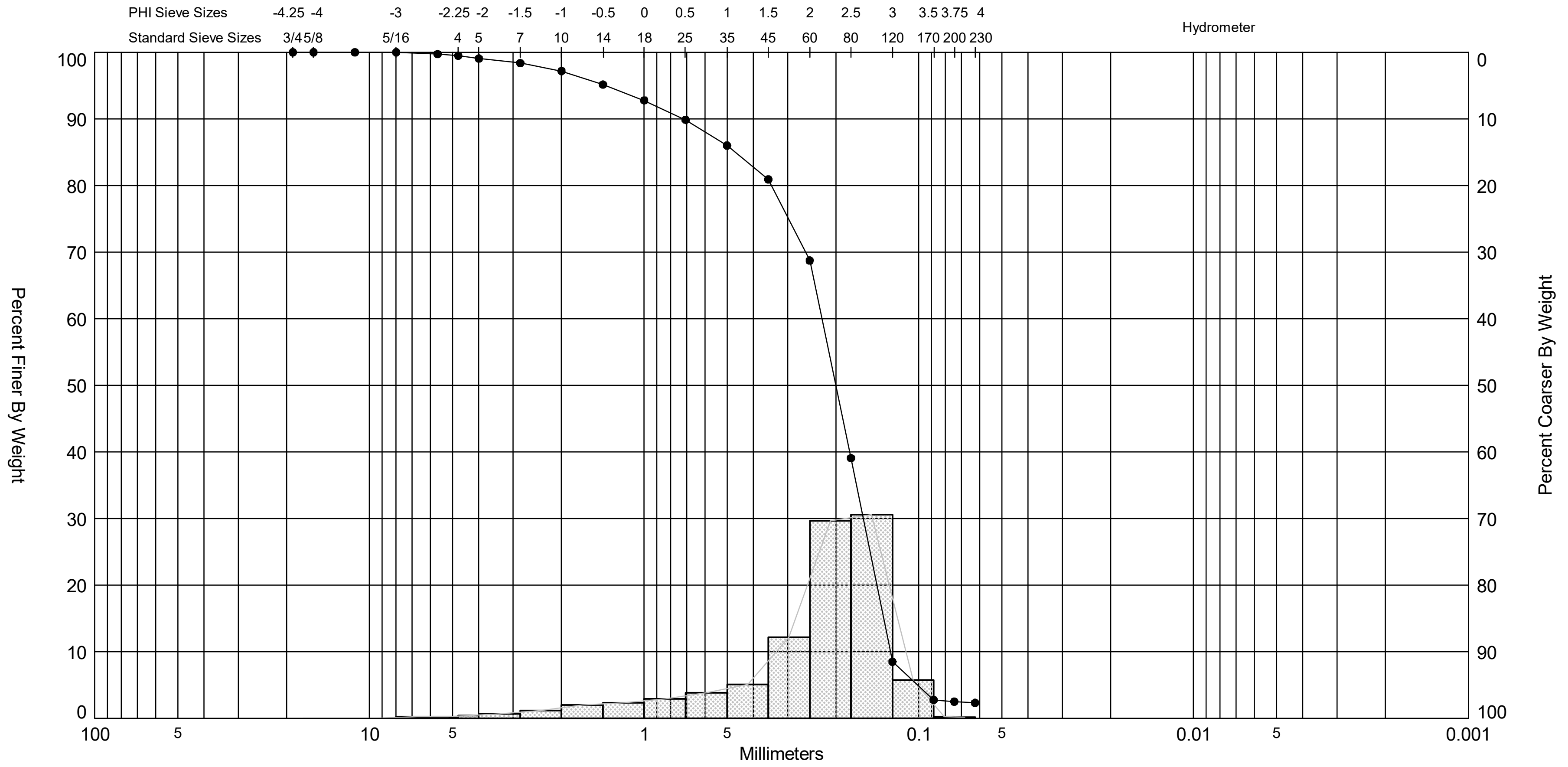

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-08 #5	—●—	-17.3	SW	#200 - 2.50 #230 - 2.31		27	2.32	2	-1.78	6.31	1.09

Comments:

Depths and elevations based on measured values

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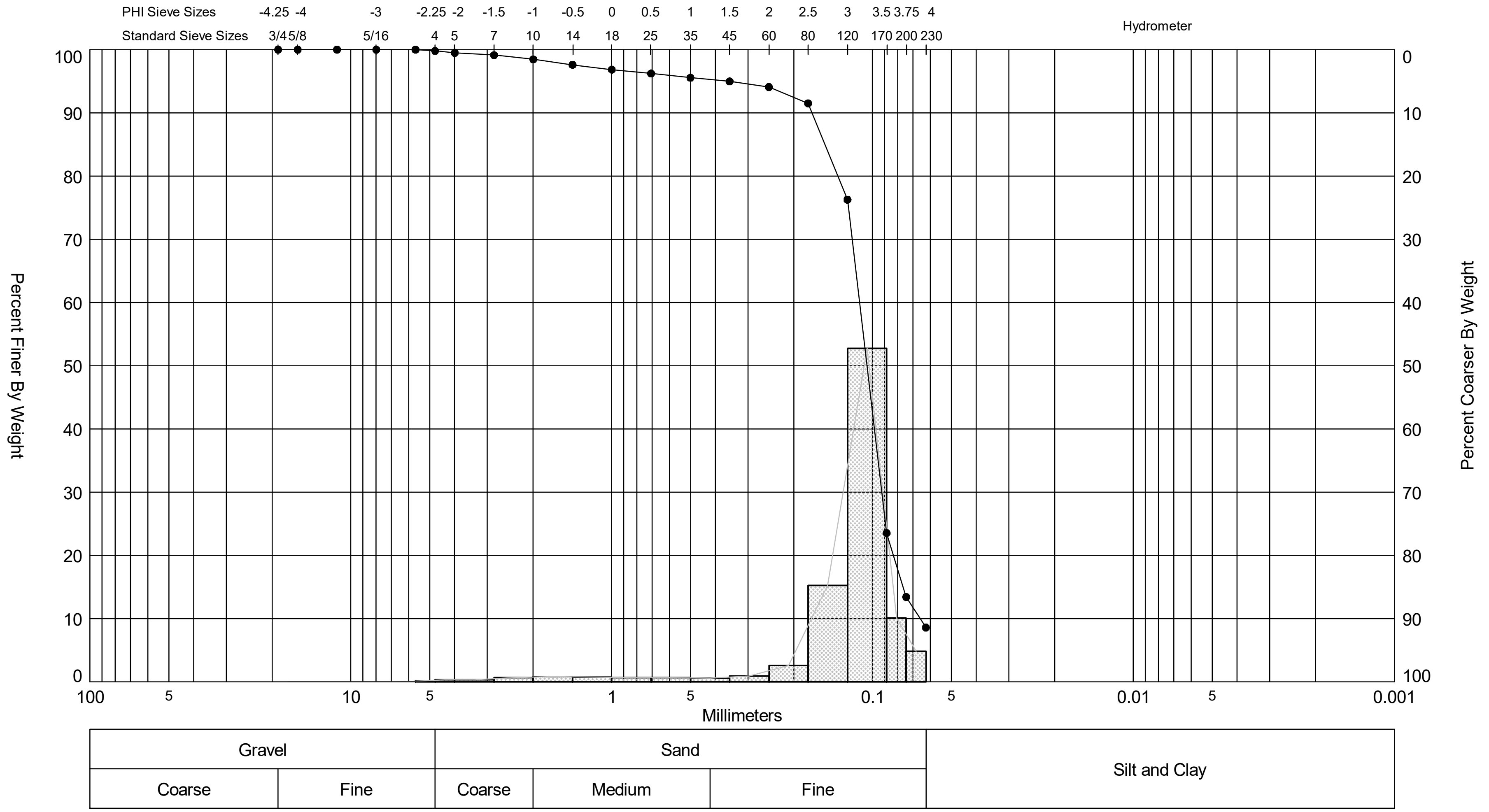
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-18-20
Analyzed By:	SF
Easting (X, ft):	587,228
Northing (Y, ft):	805,426
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-08 #6	—●—	-18.5	SM	#200 - 13.41 #230 - 8.58		9	3.25	3	-3.46	16.17	0.93

Comments:

Depths and elevations based on measured values

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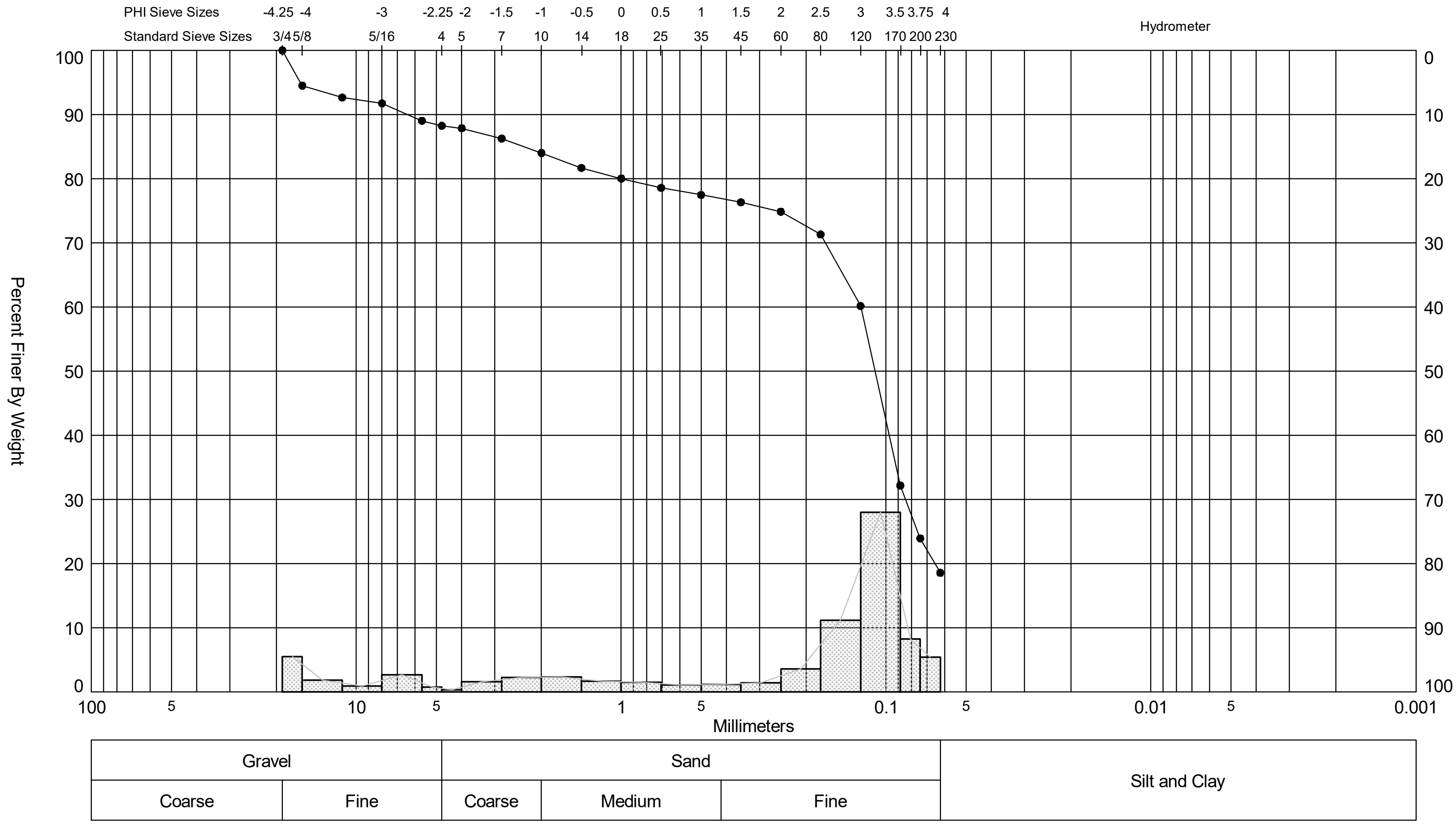
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-18-20
Analyzed By:	DH
Easting (X, ft):	587,228
Northing (Y, ft):	805,426
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-08 #7	—●—	-21.0	SM	#200 - 23.94 #230 - 18.55		28	3.18	1.66	-1.23	2.98	2.57

Comments:

Depths and elevations based on measured values

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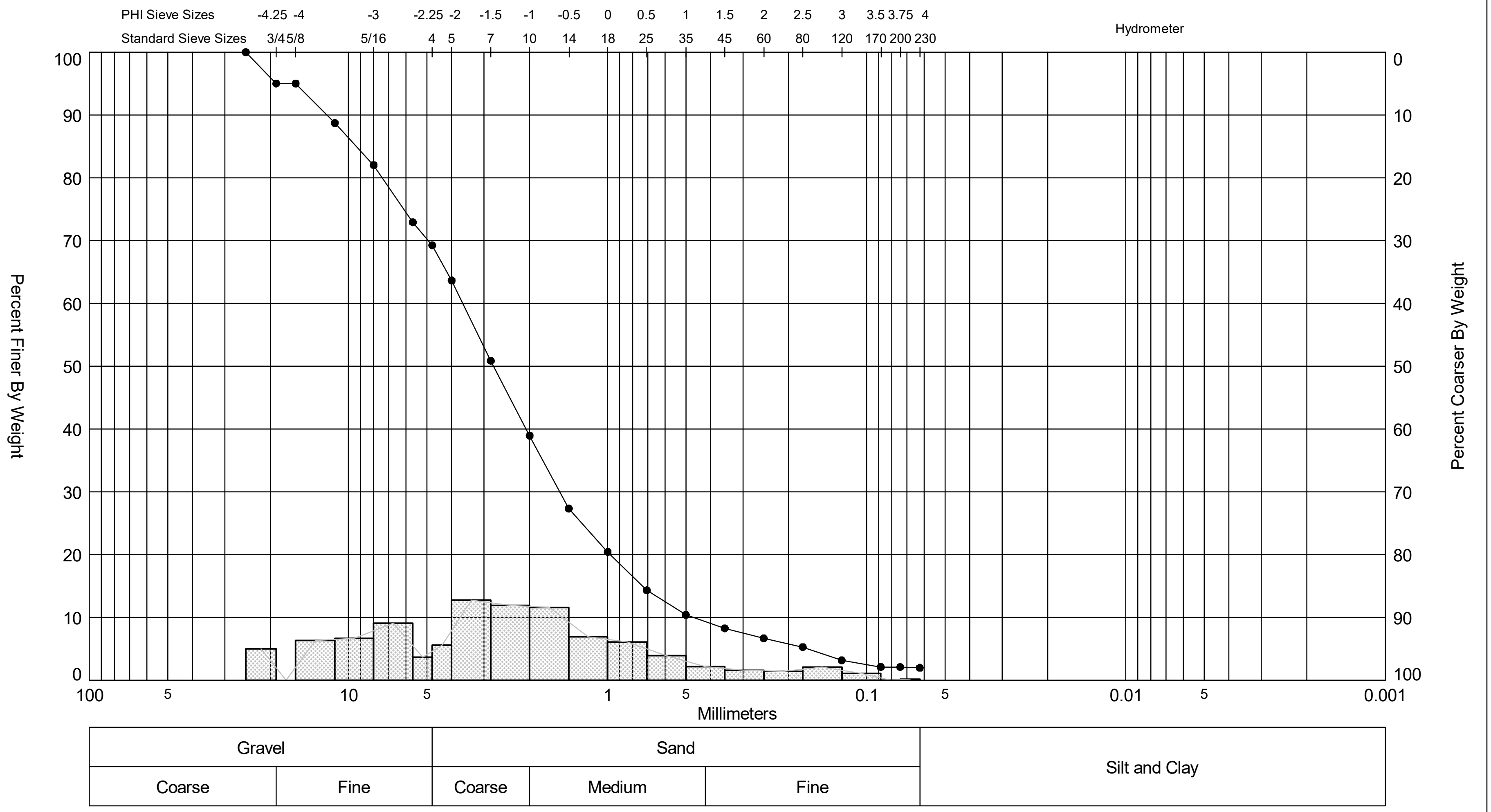
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-14-20
Analyzed By:	HV
Easting (X, ft):	587,228
Northing (Y, ft):	805,426
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-09 #1	—●—	-11.3	SW	#200 - 2.10 #230 - 1.97		89		-1.41	0.46	3.06	1.72

Comments:

Depths and elevations based on measured values

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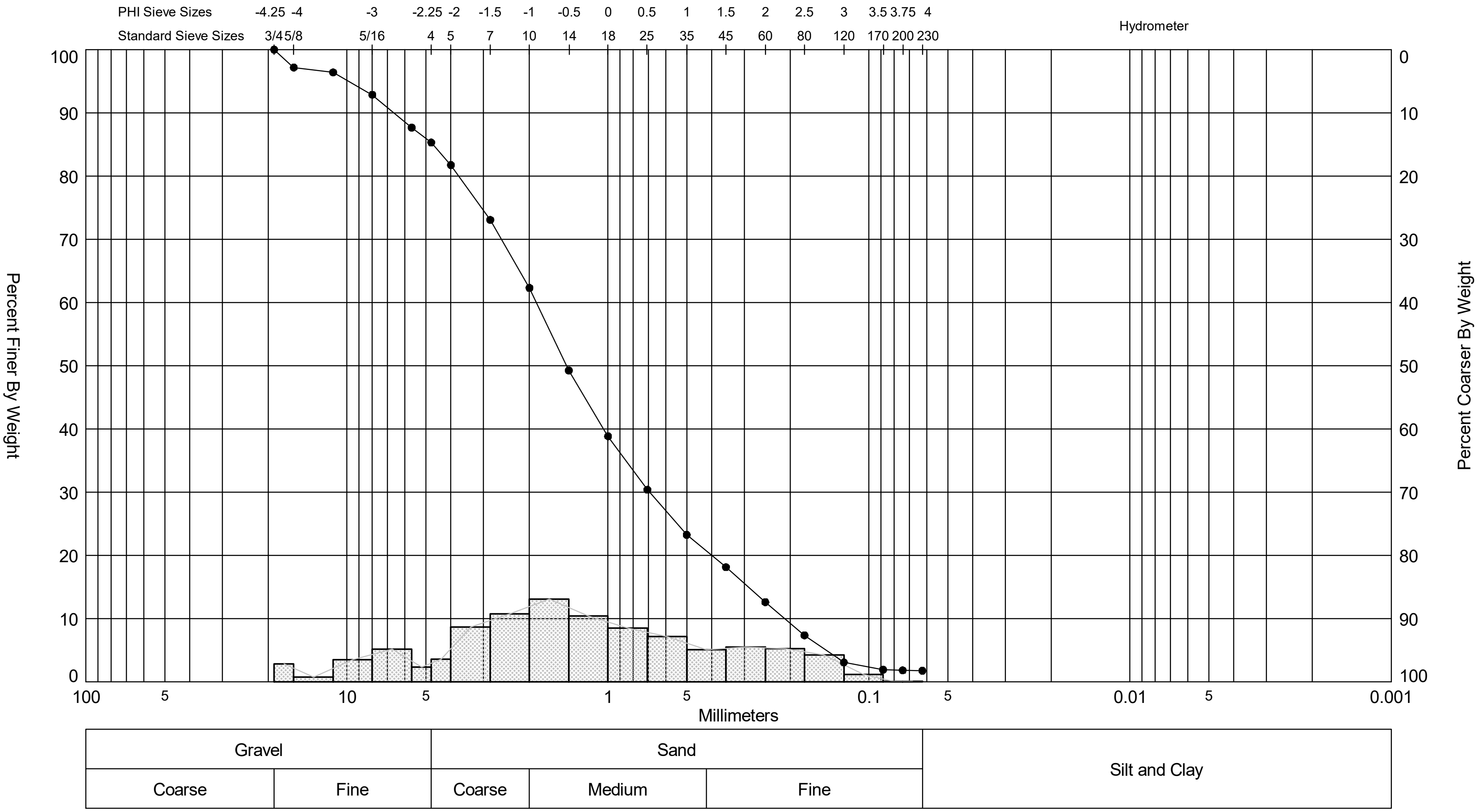
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-14-20
Analyzed By:	RH
Easting (X, ft):	586,656
Northing (Y, ft):	807,097
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-09 #2	—●—	-13.8	SW	#200 - 1.81 #230 - 1.76		80		-0.44	0.07	2.44	1.75

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-14-20
Analyzed By:	RH
Easting (X, ft):	586,656
Northing (Y, ft):	807,097
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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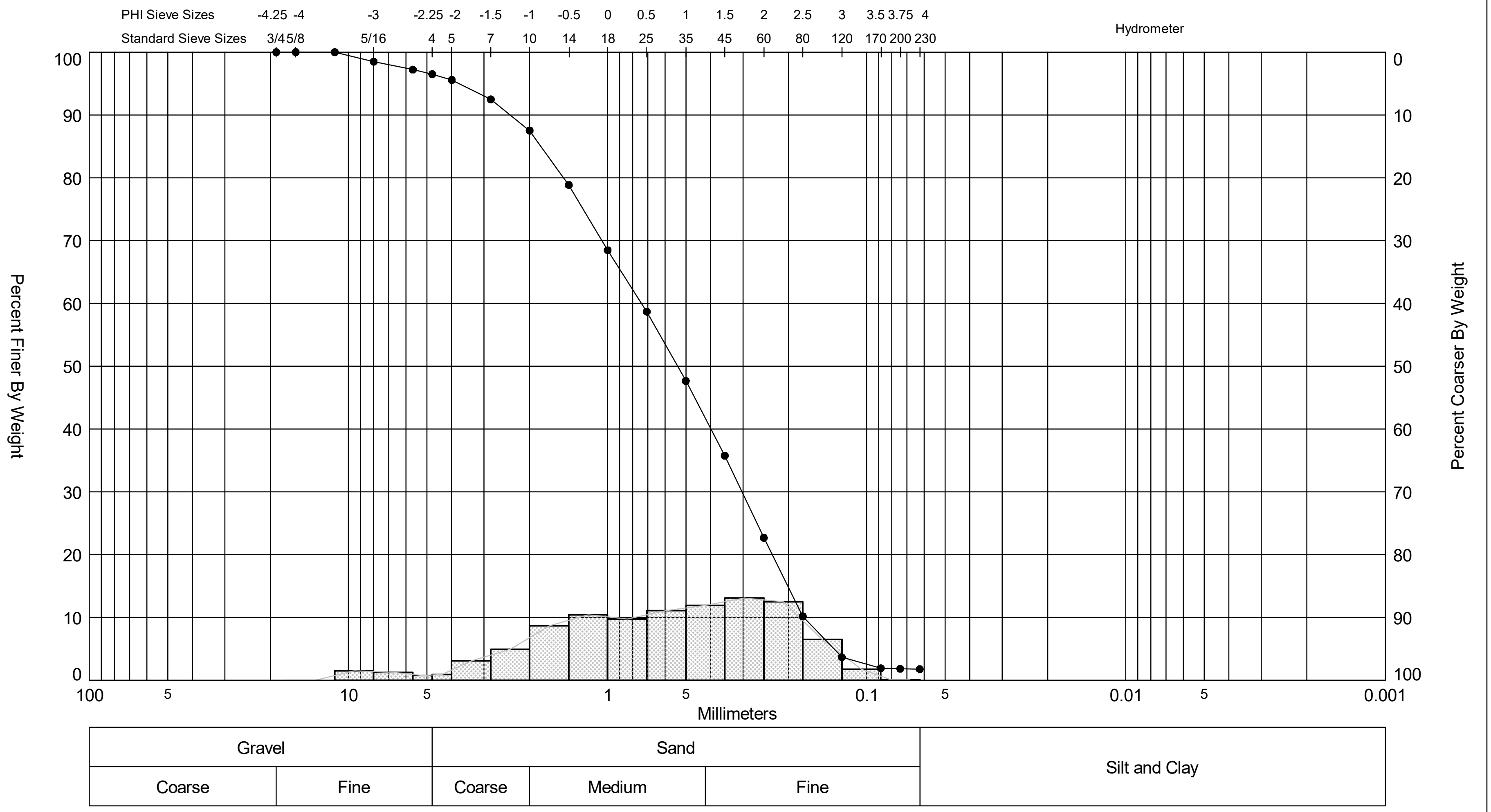

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-09 #3	—●—	-15.4	SW	#200 - 1.82 #230 - 1.76		62	0.89	0.69	-0.49	2.69	1.46

Comments:

Depths and elevations based on measured values

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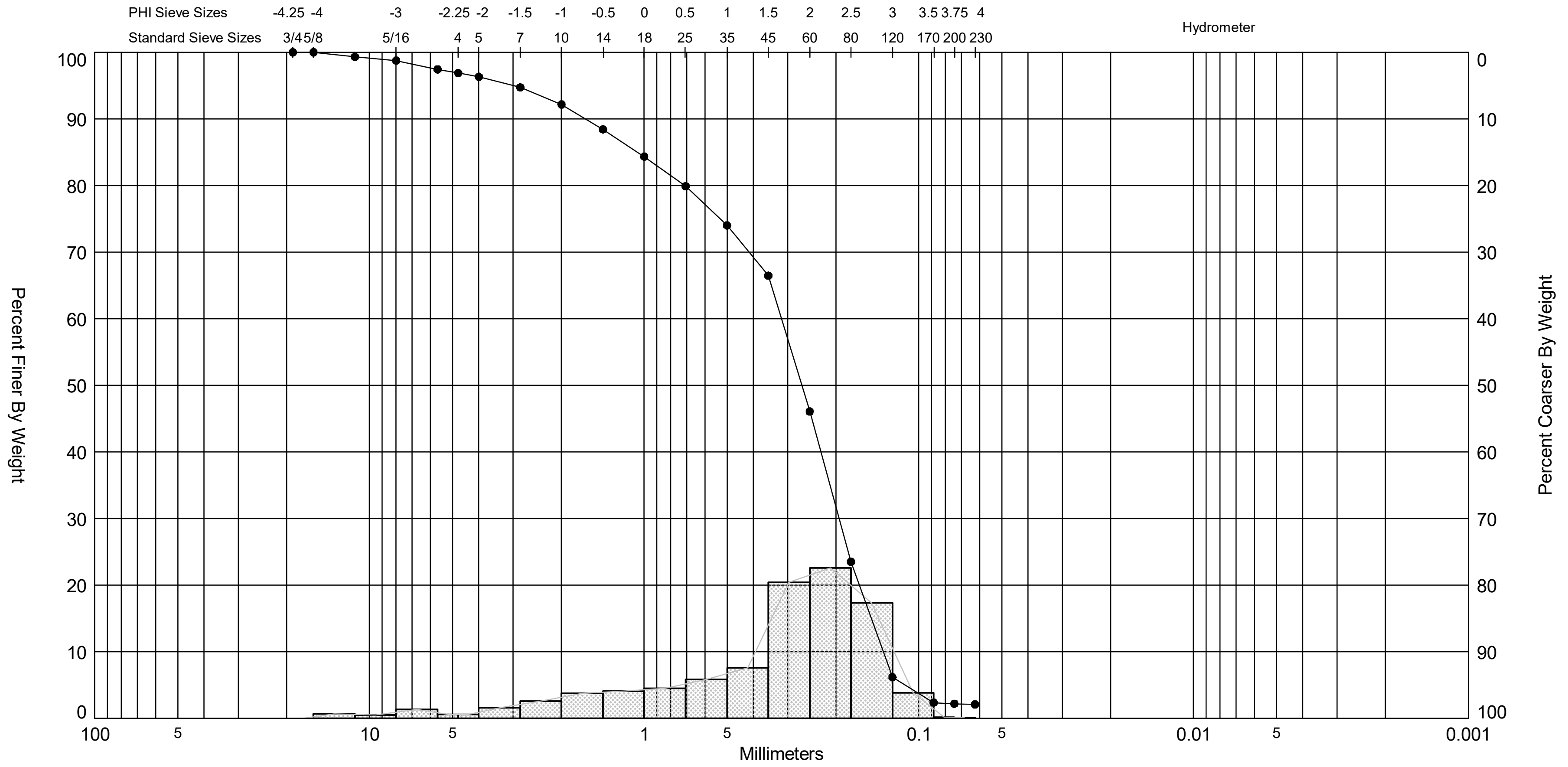
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-14-20
Analyzed By:	RH
Easting (X, ft):	586,656
Northing (Y, ft):	807,097
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-09 #4	—●—	-16.3	SW	#200 - 2.19 #230 - 2.09		40	1.9	1.45	-1.39	4.6	1.44

Comments:

Depths and elevations based on measured values

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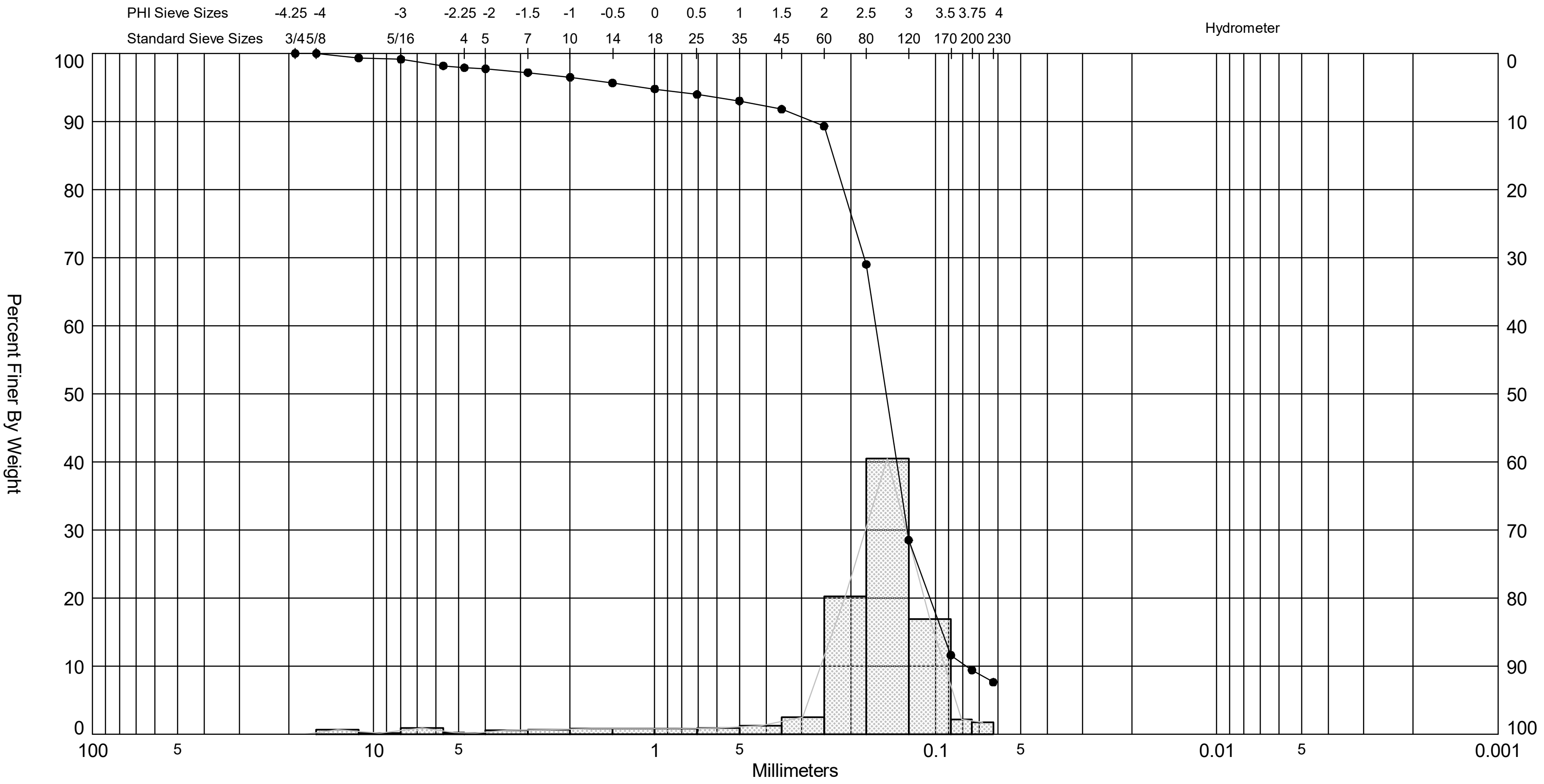
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-14-20
Analyzed By:	SF
Easting (X, ft):	586,656
Northing (Y, ft):	807,097
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-09 #5	—●—	-20.9	SW-SM	#200 - 9.41 #230 - 7.63		13	2.73	2.43	-3.03	13.26	1.2

Comments:

Depths and elevations based on measured values

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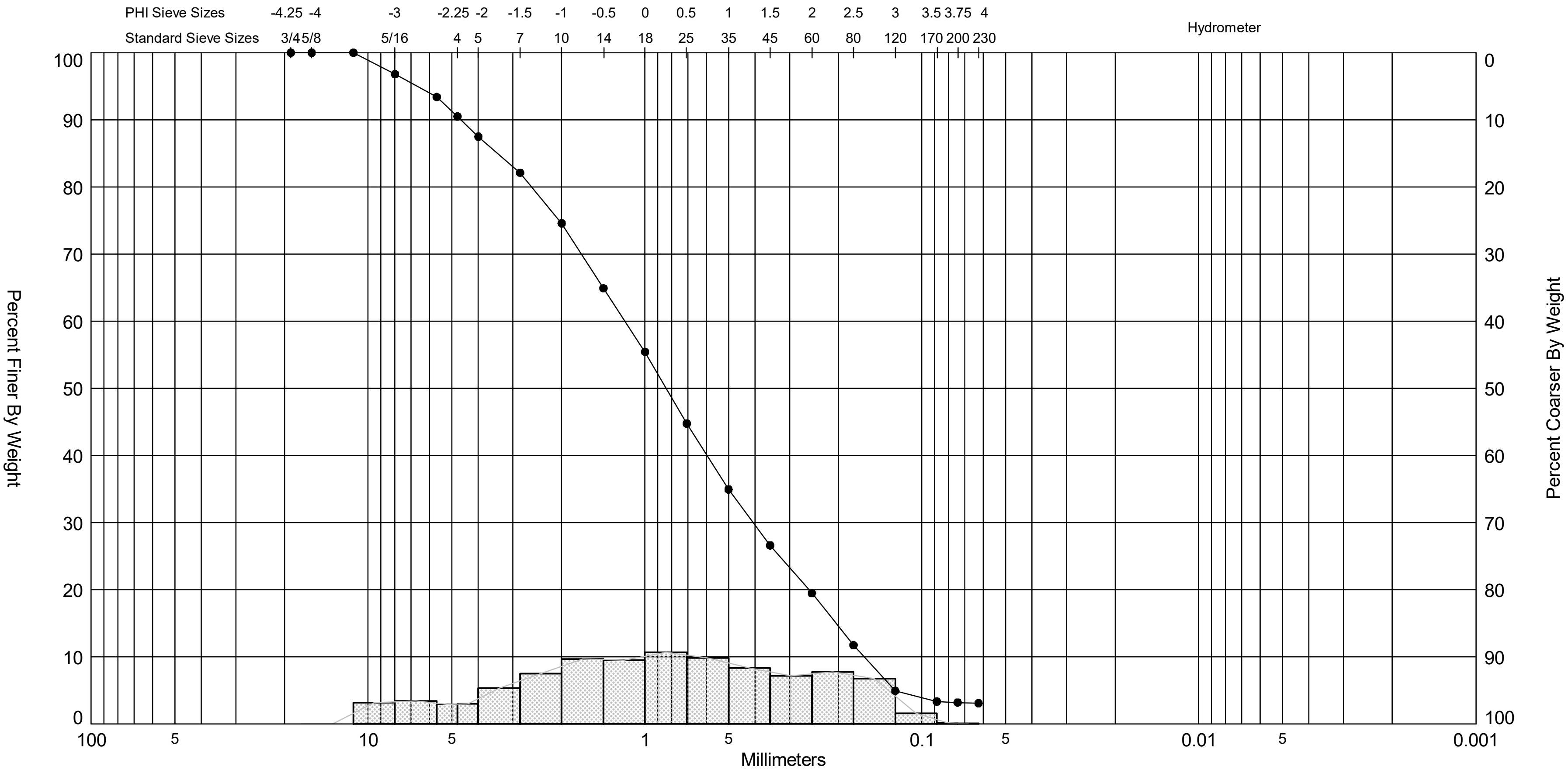
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-14-20
Analyzed By:	RH
Easting (X, ft):	586,656
Northing (Y, ft):	807,097
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-10 #1	—●—	-8.9	SW	#200 - 3.20 #230 - 3.08		68	0.25	0.14	-0.12	2.17	1.68

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-14-20
Analyzed By:	HV
Easting (X, ft):	585,913
Northing (Y, ft):	807,149
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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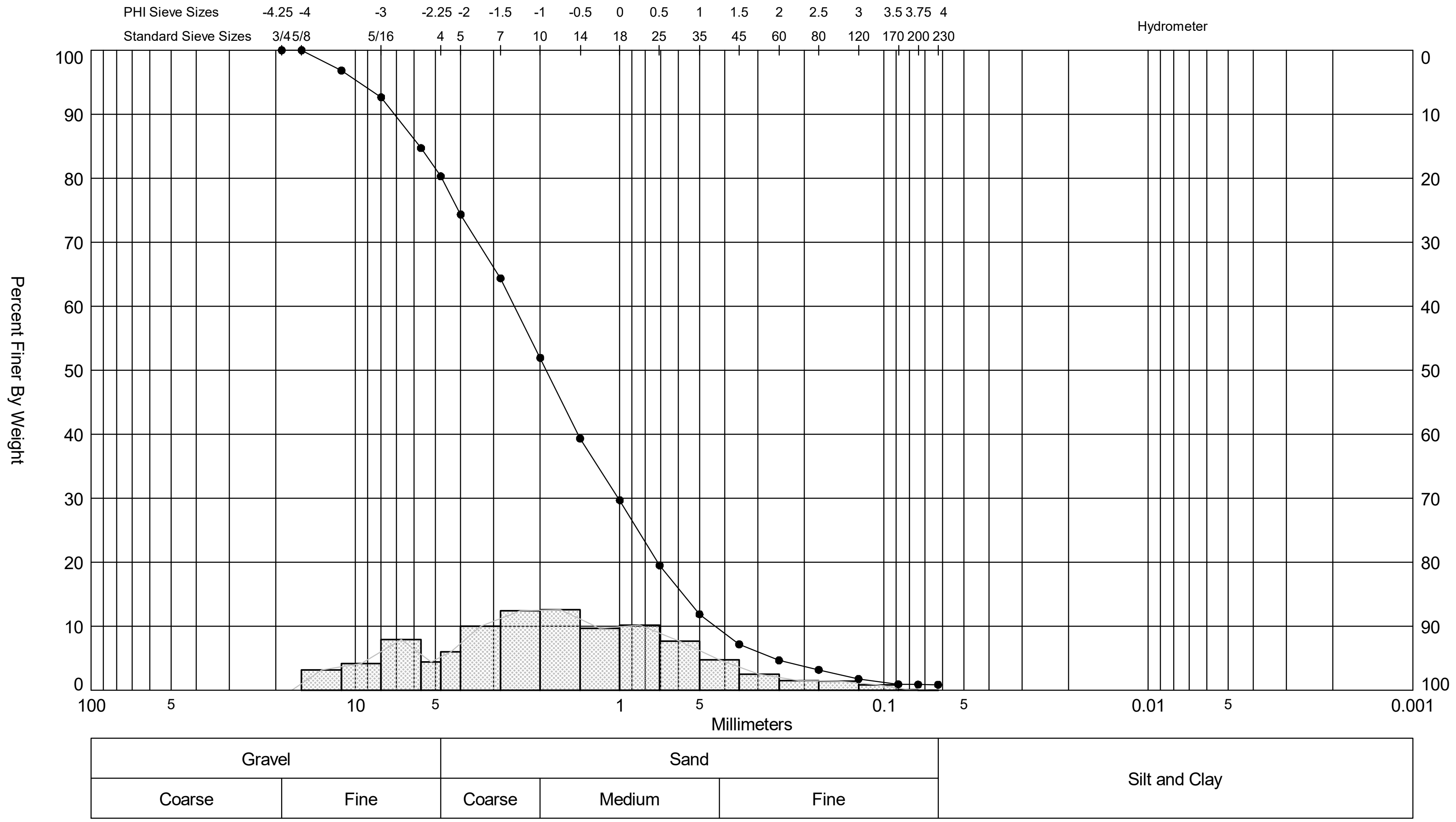
REDFISH_PASS_VIBRACORES.GPJ 9/1/20



REDFISH_PASS_VIBRACORES.GPJ 9/1/20

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-10 #2	●	-10.0	SW	#200 - 0.88 #230 - 0.86		83		-0.87	0.28	2.67	1.53

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-14-20
Analyzed By:	HV
Easting (X, ft):	585,913
Northing (Y, ft):	807,149
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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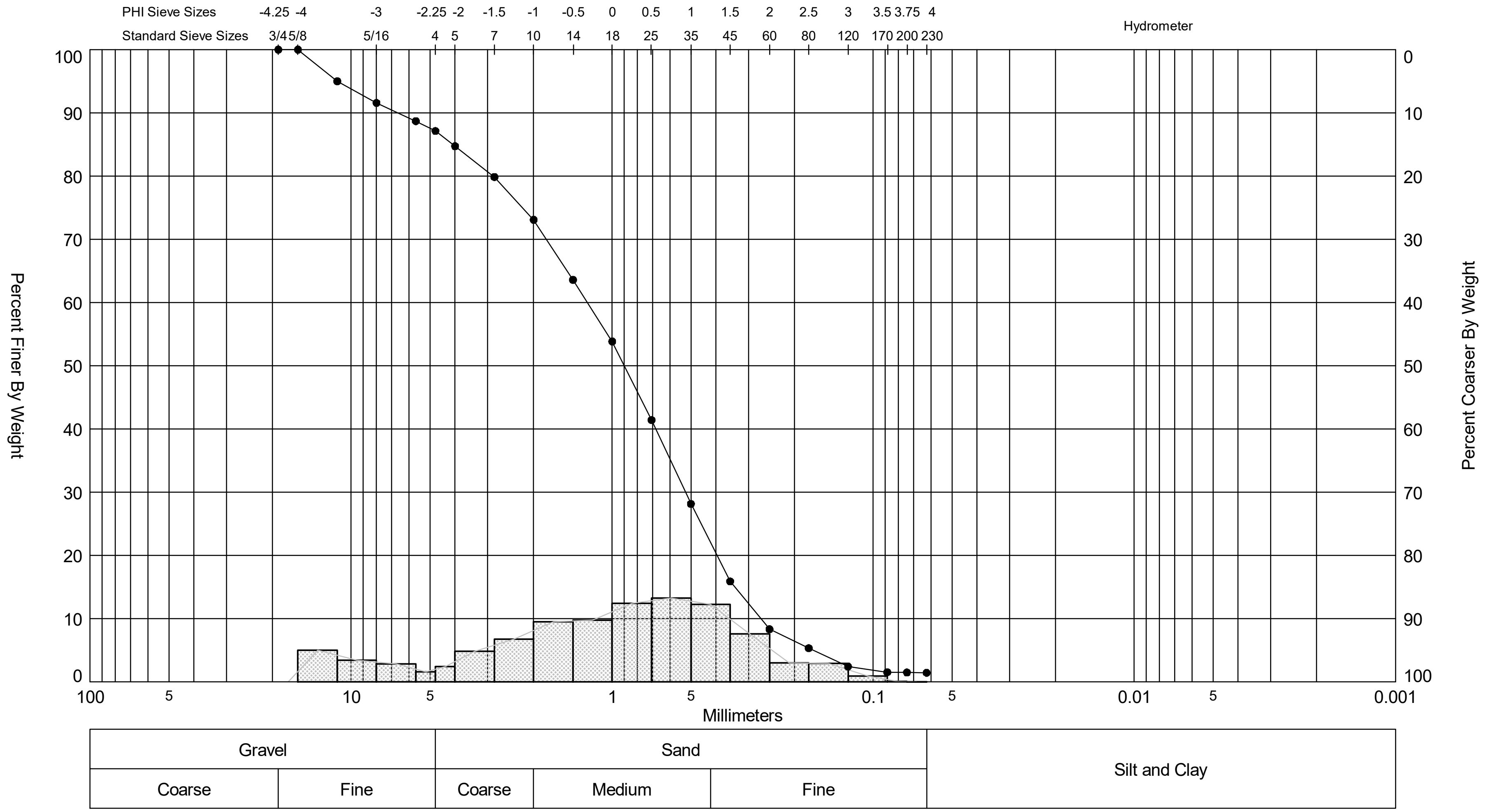

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-10 #3	—●—	-11.4	SW	#200 - 1.47 #230 - 1.43		74	0.15	-0.14	-0.46	2.61	1.67

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-17-20
Analyzed By:	SF
Easting (X, ft):	585,913
Northing (Y, ft):	807,149
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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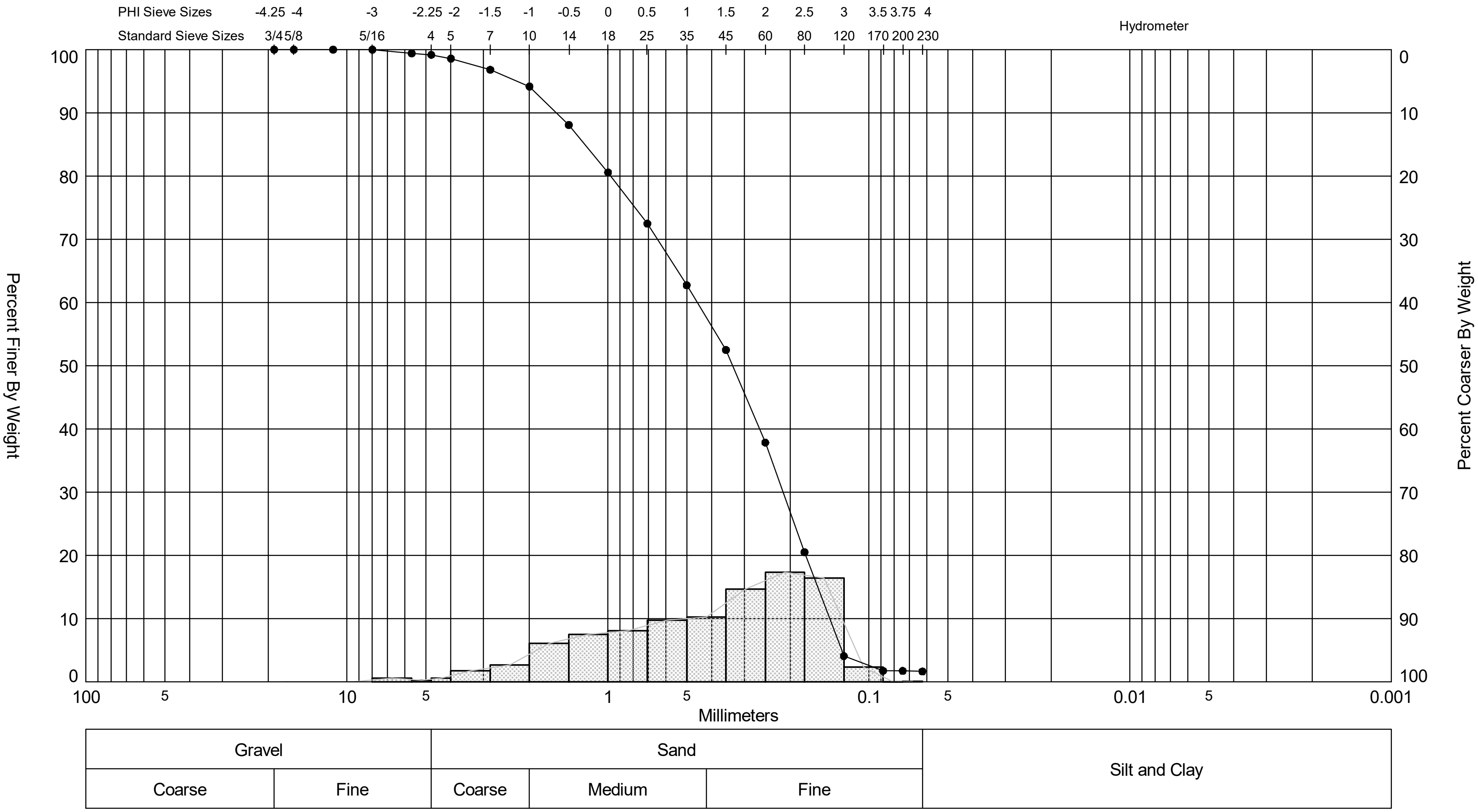

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-10 #4	—●—	-12.5	SW	#200 - 1.72 #230 - 1.63		45	1.59	1.26	-0.68	2.7	1.32

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-12-20
Analyzed By:	RH
Easting (X, ft):	585,913
Northing (Y, ft):	807,149
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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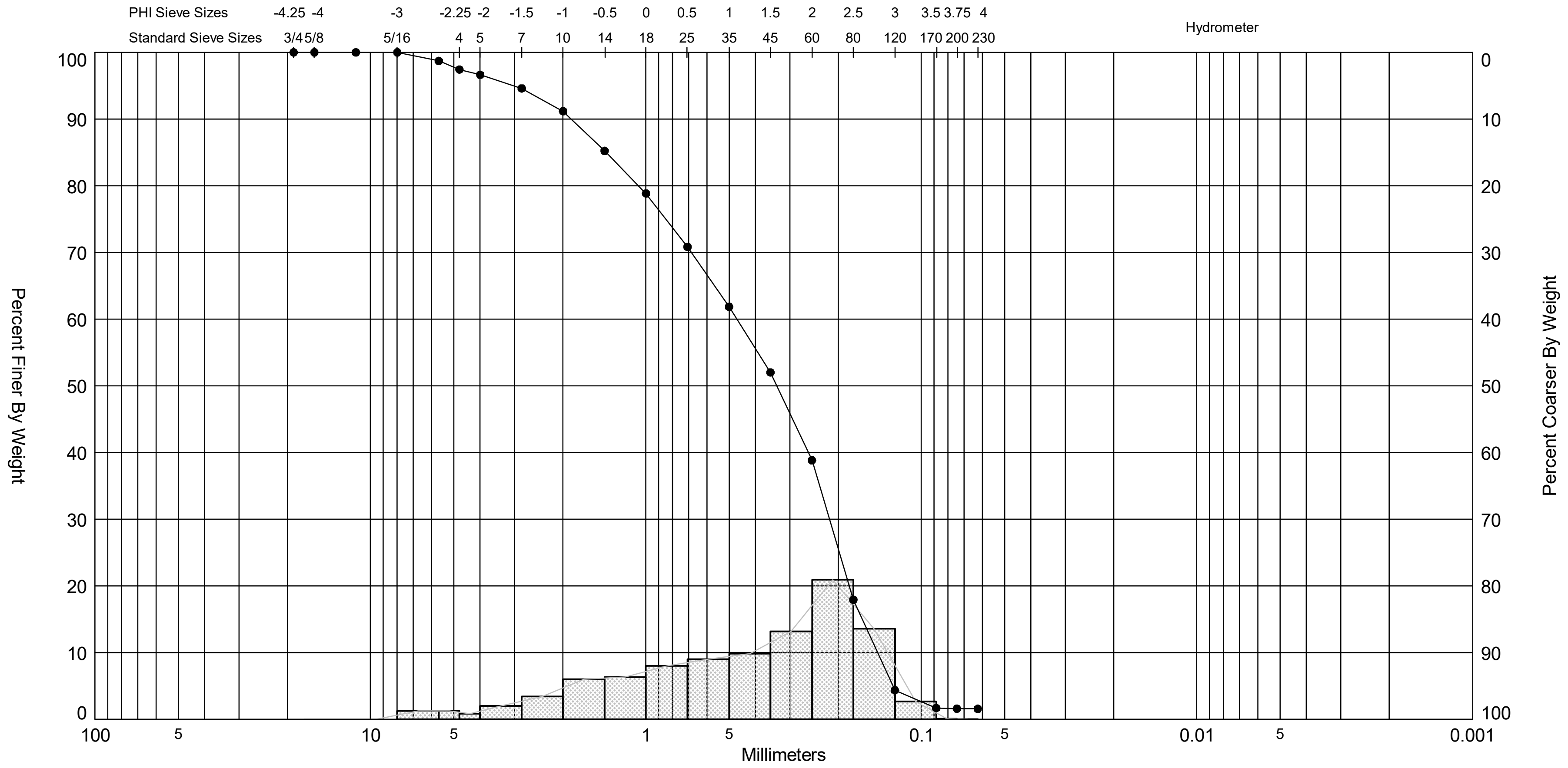

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-10 #5	—●—	-13.4	SW	#200 - 1.59 #230 - 1.55		43	1.58	1.17	-0.78	2.83	1.43

Comments:

Depths and elevations based on measured values

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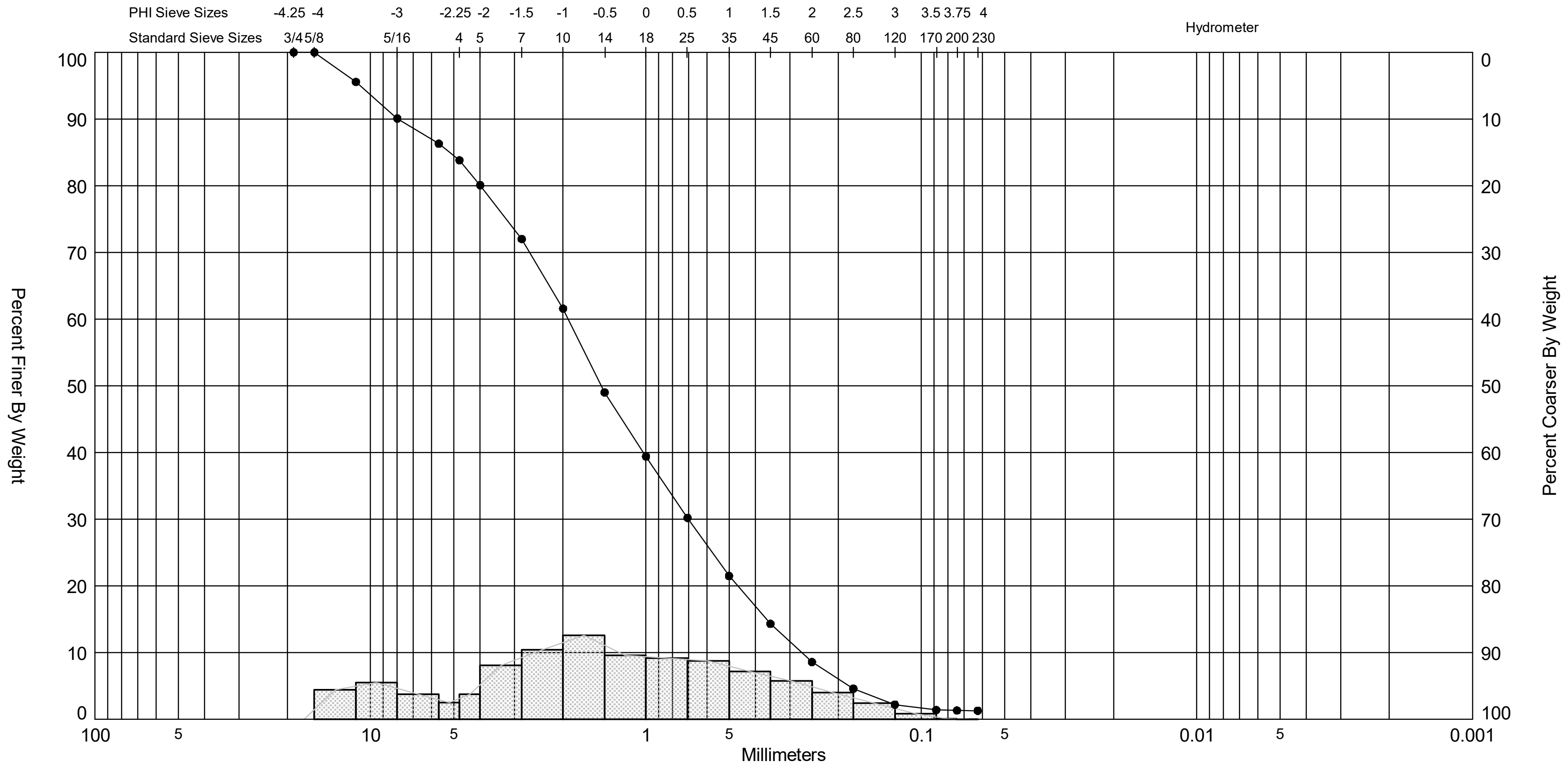
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-12-20
Analyzed By:	SF
Easting (X, ft):	585,913
Northing (Y, ft):	807,149
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-11 #1	—●—	-11.9	SW	#200 - 1.31 #230 - 1.28		80		-0.52	-0.01	2.33	1.7

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-17-20
Analyzed By:	SF
Easting (X, ft):	586,946
Northing (Y, ft):	806,237
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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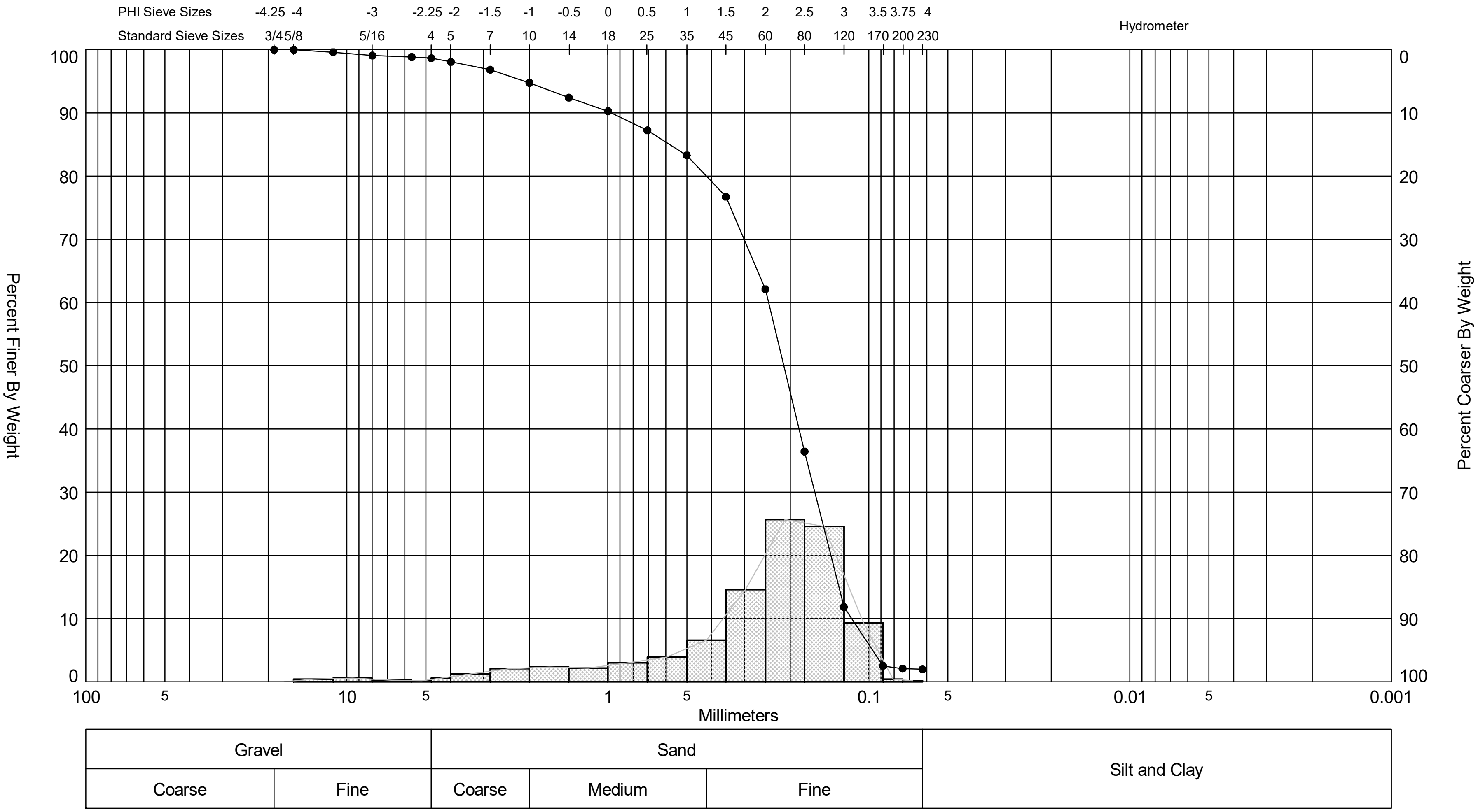

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-11 #2	—●—	-14.0	SW	#200 - 2.10 #230 - 1.96		29	2.24	1.86	-1.74	6.21	1.3

Comments:

Depths and elevations based on measured values

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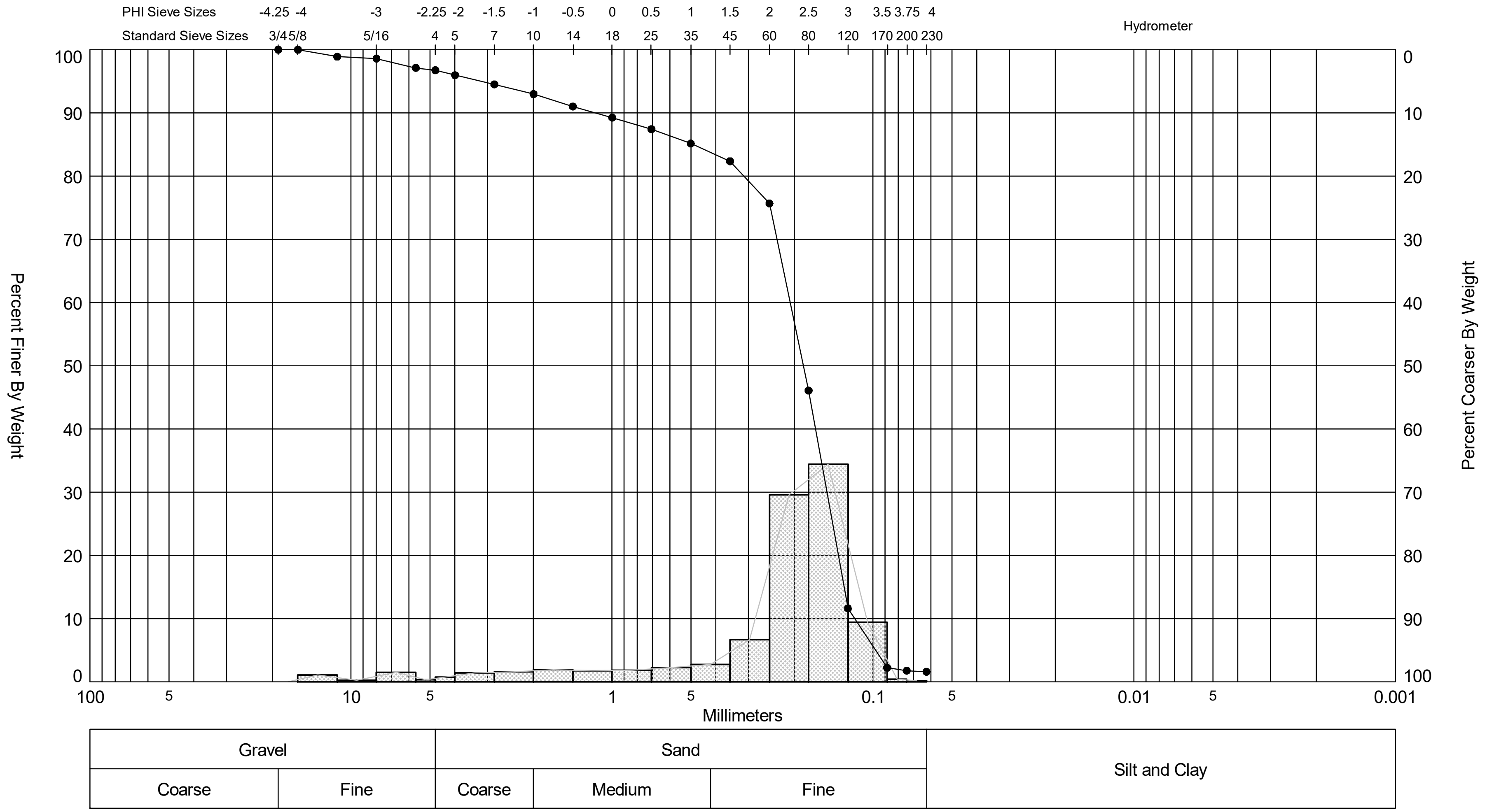
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-17-20
Analyzed By:	SF
Easting (X, ft):	586,946
Northing (Y, ft):	806,237
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-11 #3	—●—	-15.8	SW	#200 - 1.77 #230 - 1.60		22	2.43	1.97	-2.14	7.16	1.45

Comments:

Depths and elevations based on measured values

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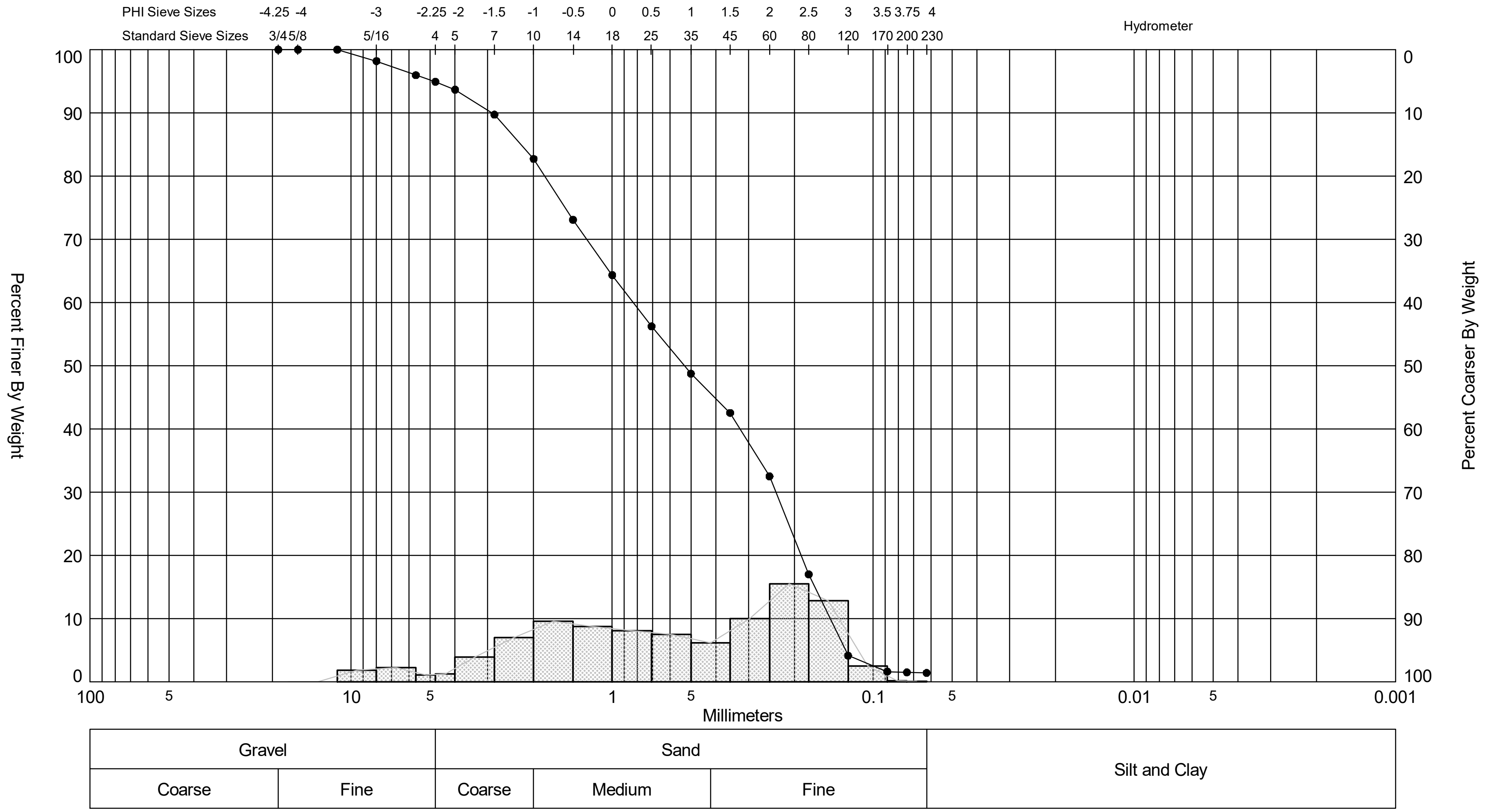
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-17-20
Analyzed By:	SF
Easting (X, ft):	586,946
Northing (Y, ft):	806,237
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-11 #4	—●—	-14.9	SW	#200 - 1.49 #230 - 1.40		60	0.92	0.71	-0.41	2.16	1.68

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-14-20
Analyzed By:	SF
Easting (X, ft):	586,946
Northing (Y, ft):	806,237
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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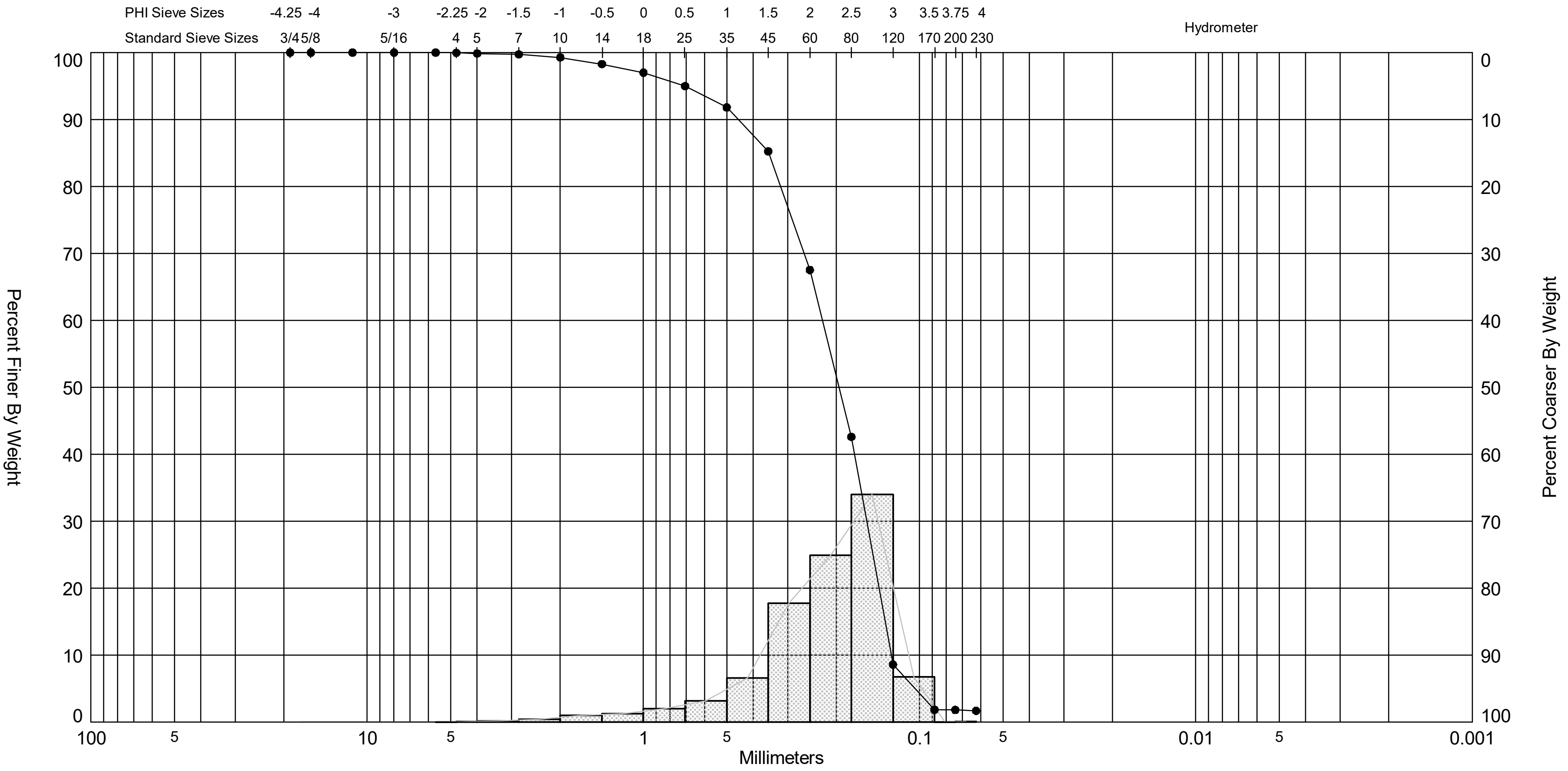

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-12 #1	—●—	-11.5	SP	#200 - 1.80 #230 - 1.68		18	2.35	2.16	-1.61	6.6	0.83

Comments:

Depths and elevations based on measured values

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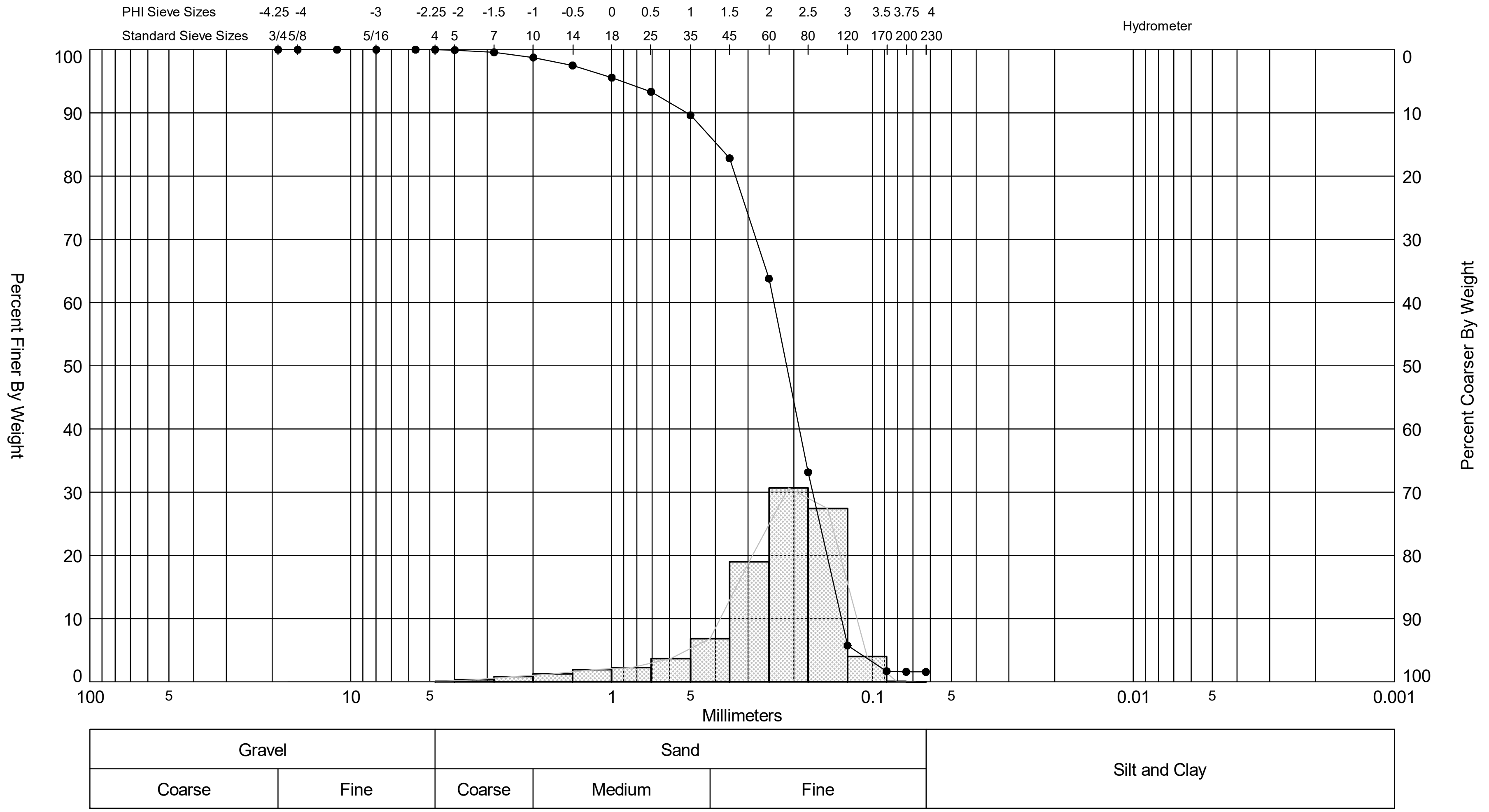
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-17-20
Analyzed By:	RH
Easting (X, ft):	586,788
Northing (Y, ft):	804,609
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-12 #2	─●─	-14.3	SW	#200 - 1.58 #230 - 1.56		21	2.22	2.03	-1.64	6.32	0.88

Comments:

Depths and elevations based on measured values

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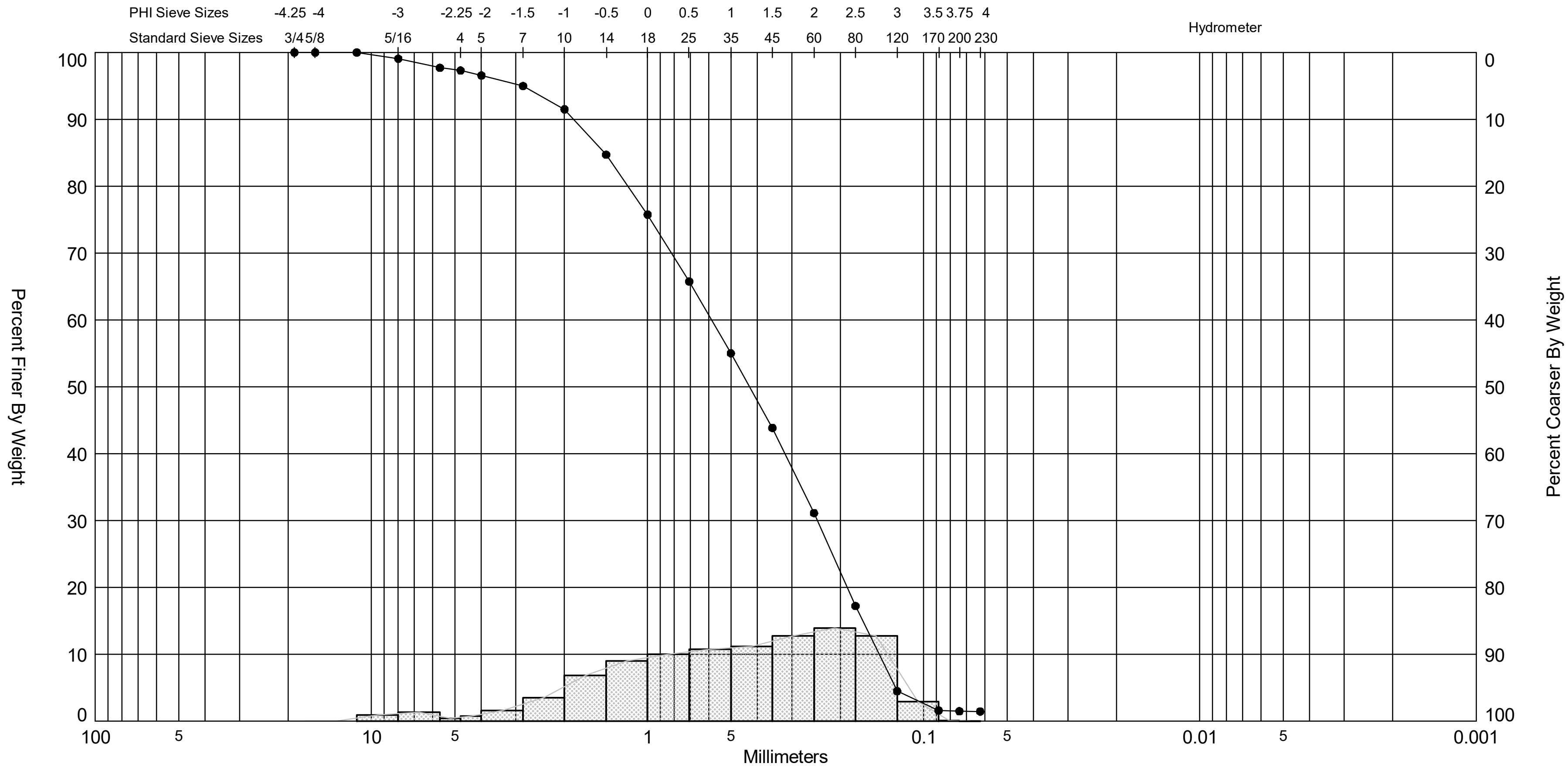
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-17-20
Analyzed By:	RH
Easting (X, ft):	586,788
Northing (Y, ft):	804,609
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-12 #3	—●—	-16.1	SW	#200 - 1.47 #230 - 1.44		53	1.22	1.01	-0.62	2.9	1.43

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-17-20
Analyzed By:	RH
Easting (X, ft):	586,788
Northing (Y, ft):	804,609
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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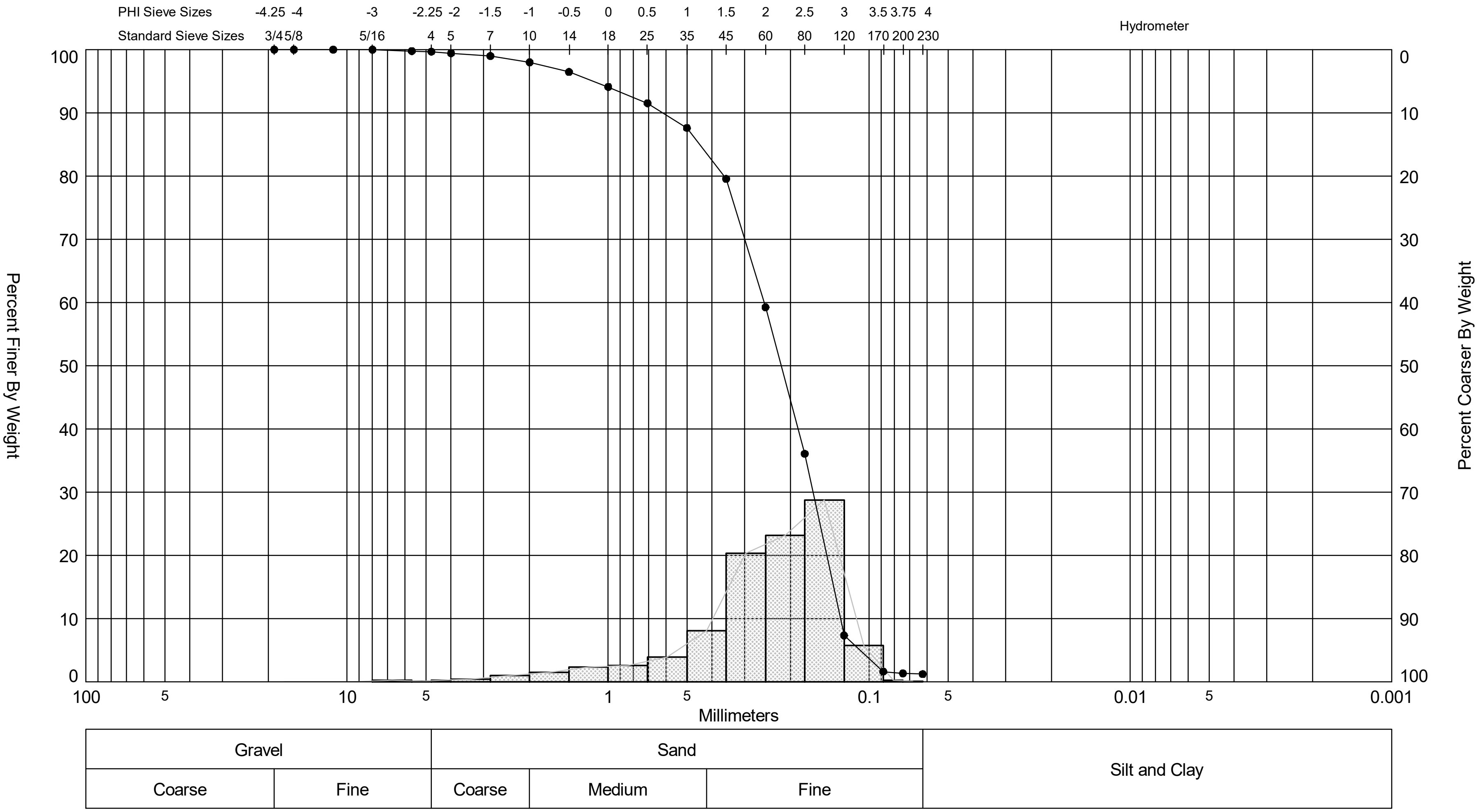

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-12 #4	—●—	-16.5	SW	#200 - 1.33 #230 - 1.21		20	2.2	1.98	-1.6	6.22	1

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-17-20
Analyzed By:	RH
Easting (X, ft):	586,788
Northing (Y, ft):	804,609
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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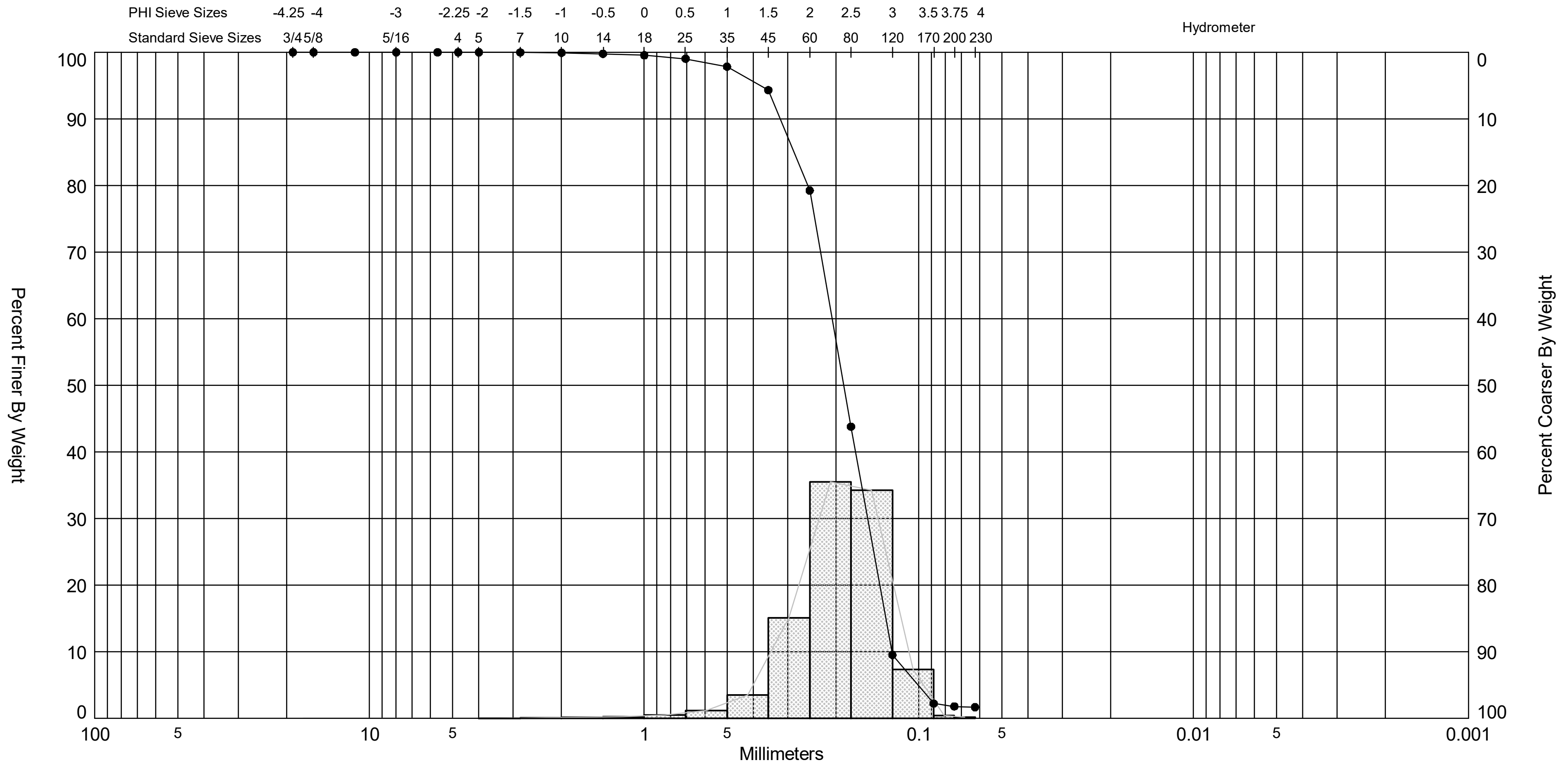

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-12 #5	—●—	-17.5	SP	#200 - 1.79 #230 - 1.66		10	2.41	2.35	-1.17	6.91	0.57

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-17-20
Analyzed By:	RH
Easting (X, ft):	586,788
Northing (Y, ft):	804,609
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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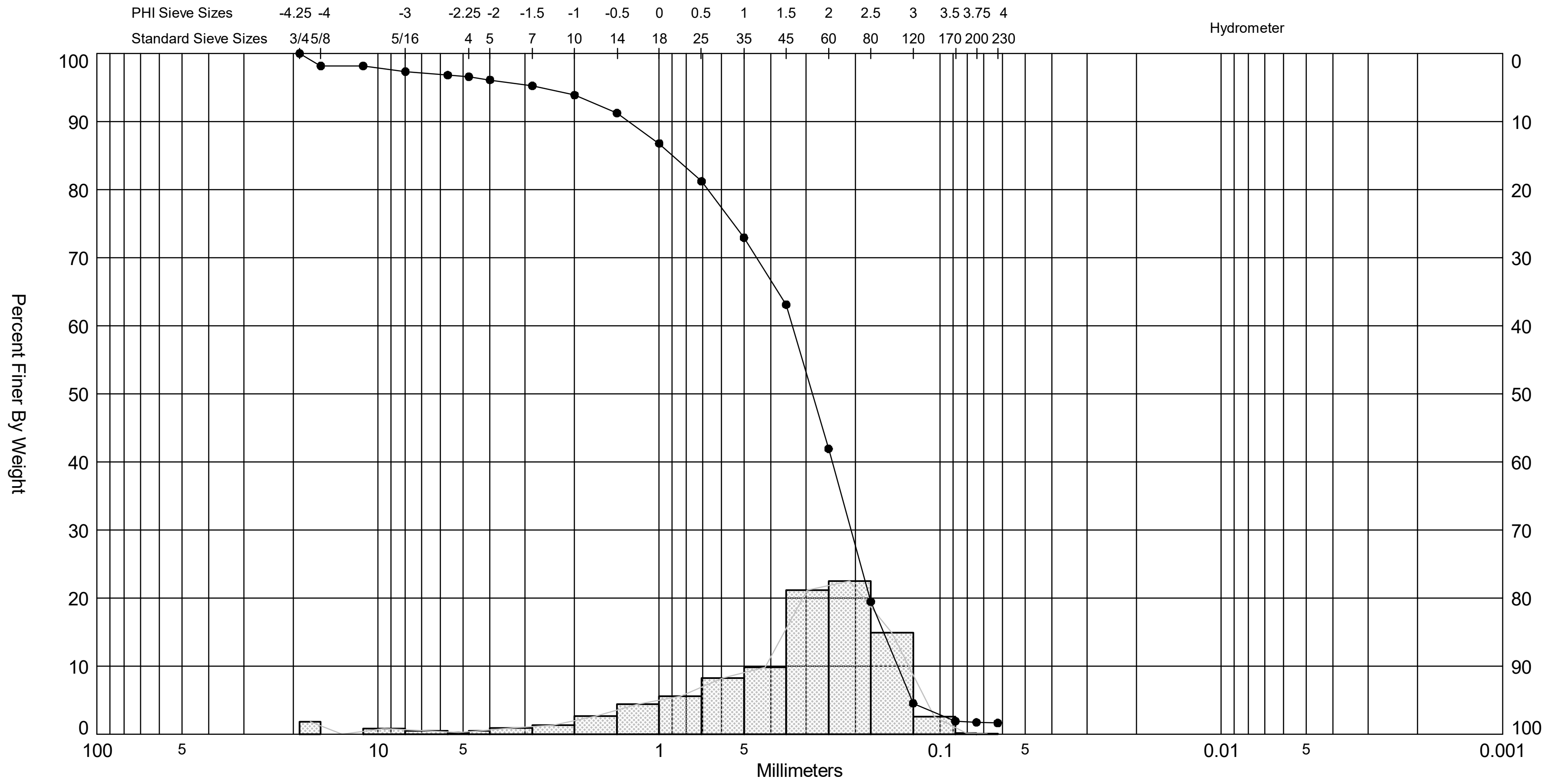

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-12 #6	—●—	-18.6	SW	#200 - 1.73 #230 - 1.64		37	1.81	1.41	-1.75	6.61	1.43

Comments:

Depths and elevations based on measured values

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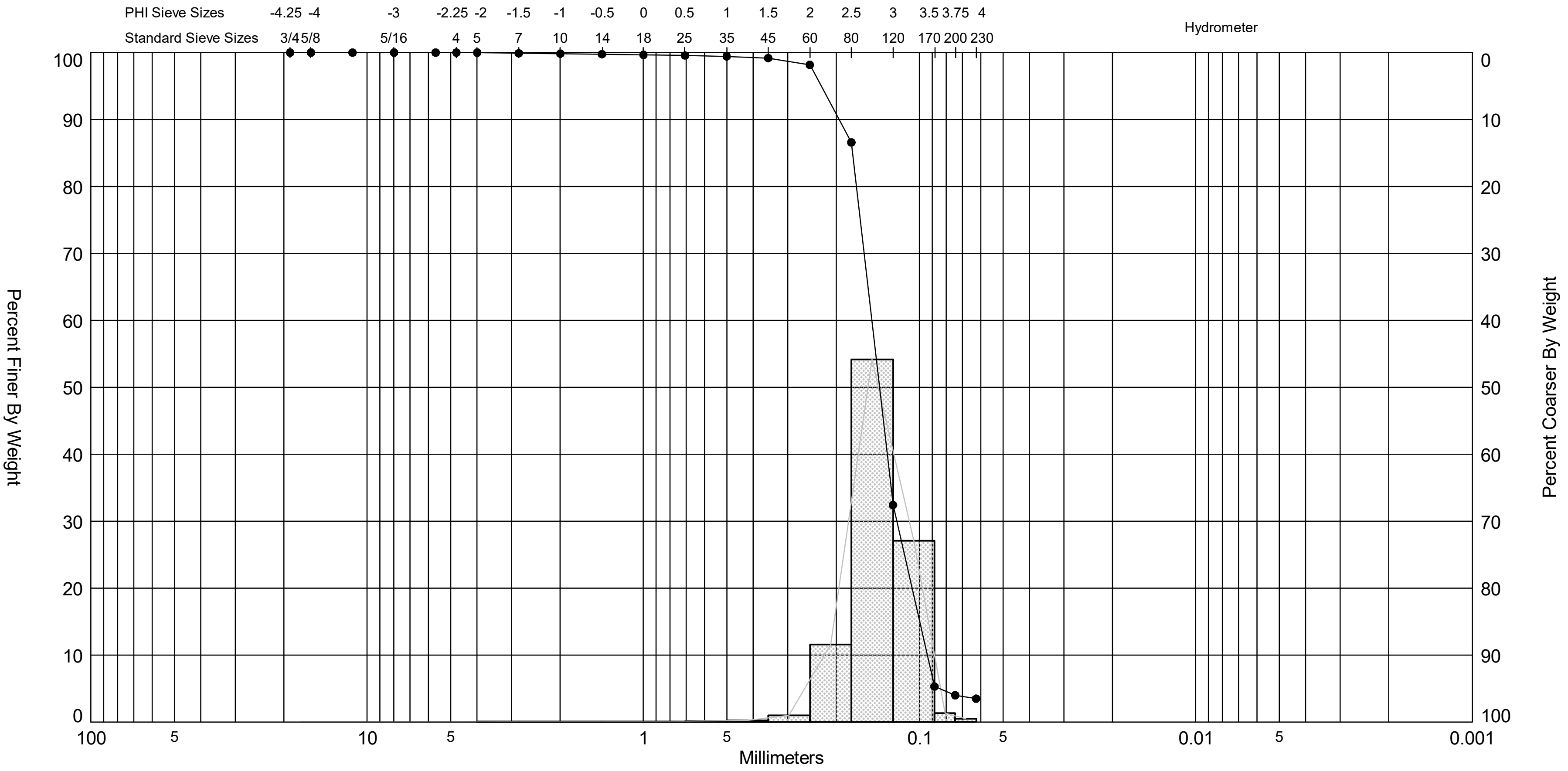
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-17-20
Analyzed By:	RH
Easting (X, ft):	586,788
Northing (Y, ft):	804,609
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

REDFISH_PASS_VIBRACORES.GPJ 9/1/20



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-12 #7	—●—	-19.4	SP	#200 - 4.00 #230 - 3.48		6	2.84	2.82	-2.92	26.53	0.44

Comments:

Depths and elevations based on measured values

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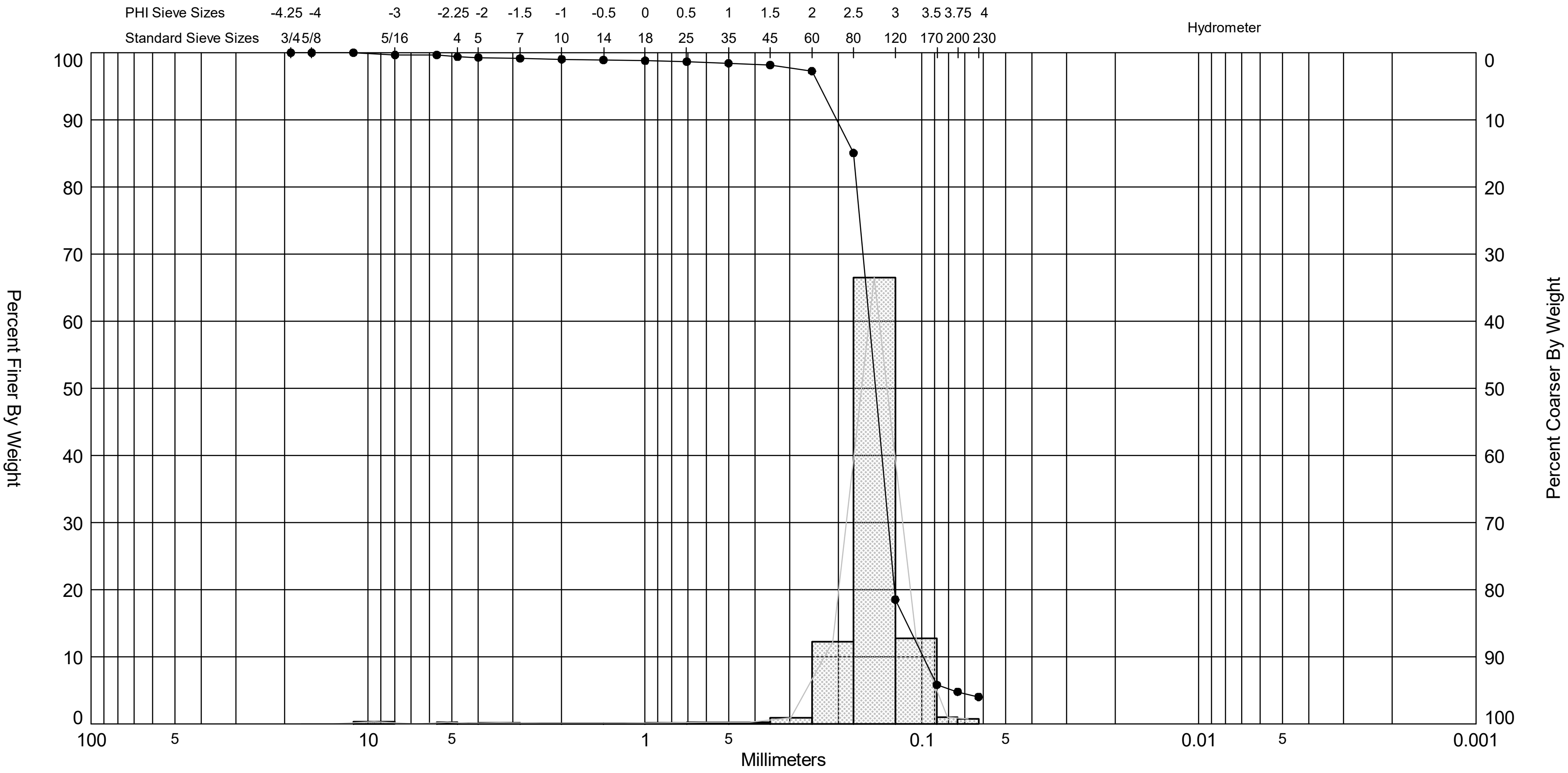
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-17-20
Analyzed By:	RH
Easting (X, ft):	586,788
Northing (Y, ft):	804,609
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-12 #8	—●—	-20.4	SP	#200 - 4.79 #230 - 4.03		6	2.76	2.69	-5.73	47.3	0.64

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-17-20
Analyzed By:	RH
Easting (X, ft):	586,788
Northing (Y, ft):	804,609
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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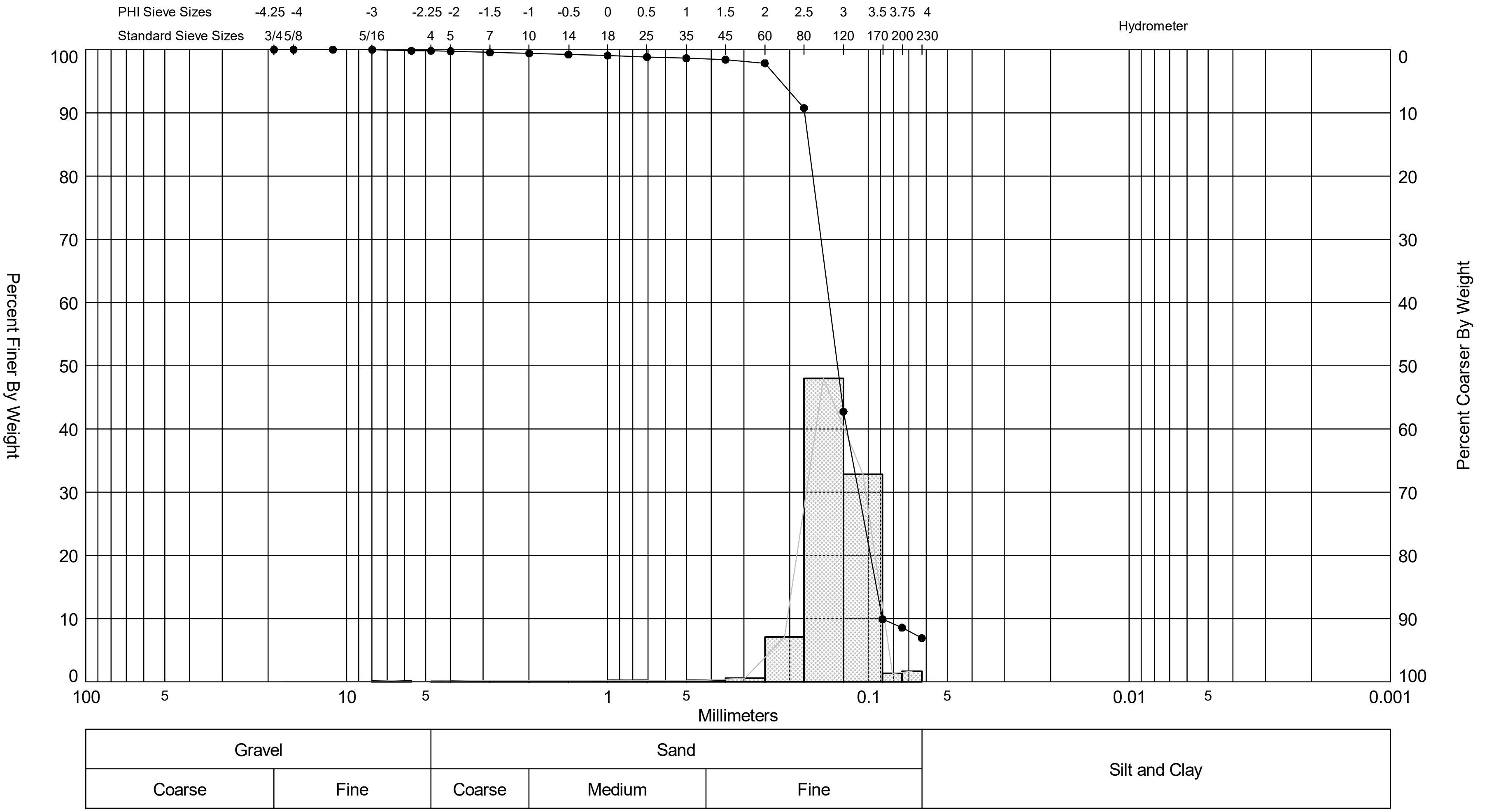

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-12 #9	─●─	-21.7	SP-SC	#200 - 8.55 #230 - 6.90		5	2.92	2.86	-4.62	37.29	0.59

Comments:

Depths and elevations based on measured values

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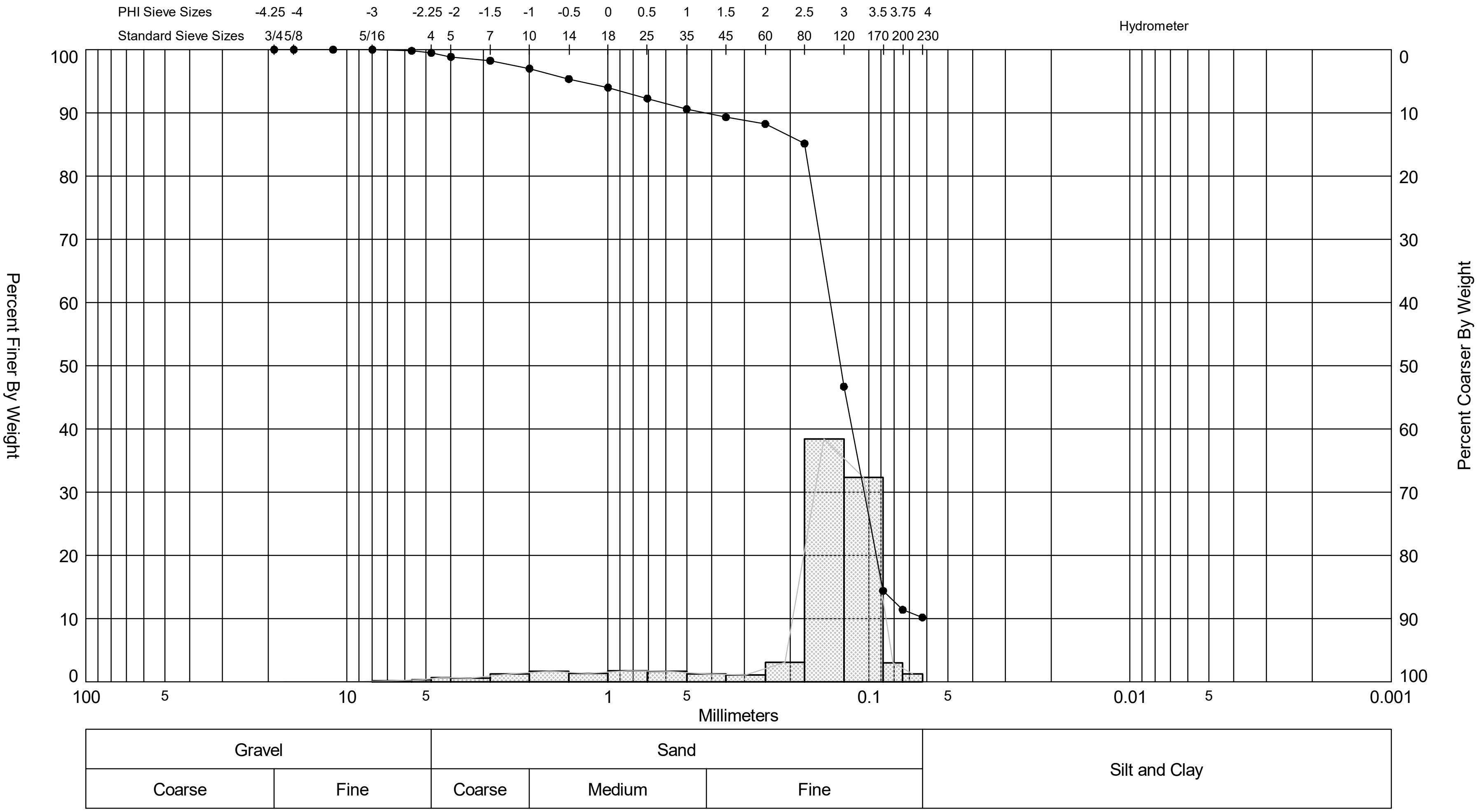
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-17-20
Analyzed By:	RH
Easting (X, ft):	586,788
Northing (Y, ft):	804,609
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-13 #1	—●—	-21.0	SW-SM	#200 - 11.39 #230 - 10.18		14	2.96	2.58	-2.46	8.65	1.18

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-17-20
Analyzed By:	SF
Easting (X, ft):	586,153
Northing (Y, ft):	804,038
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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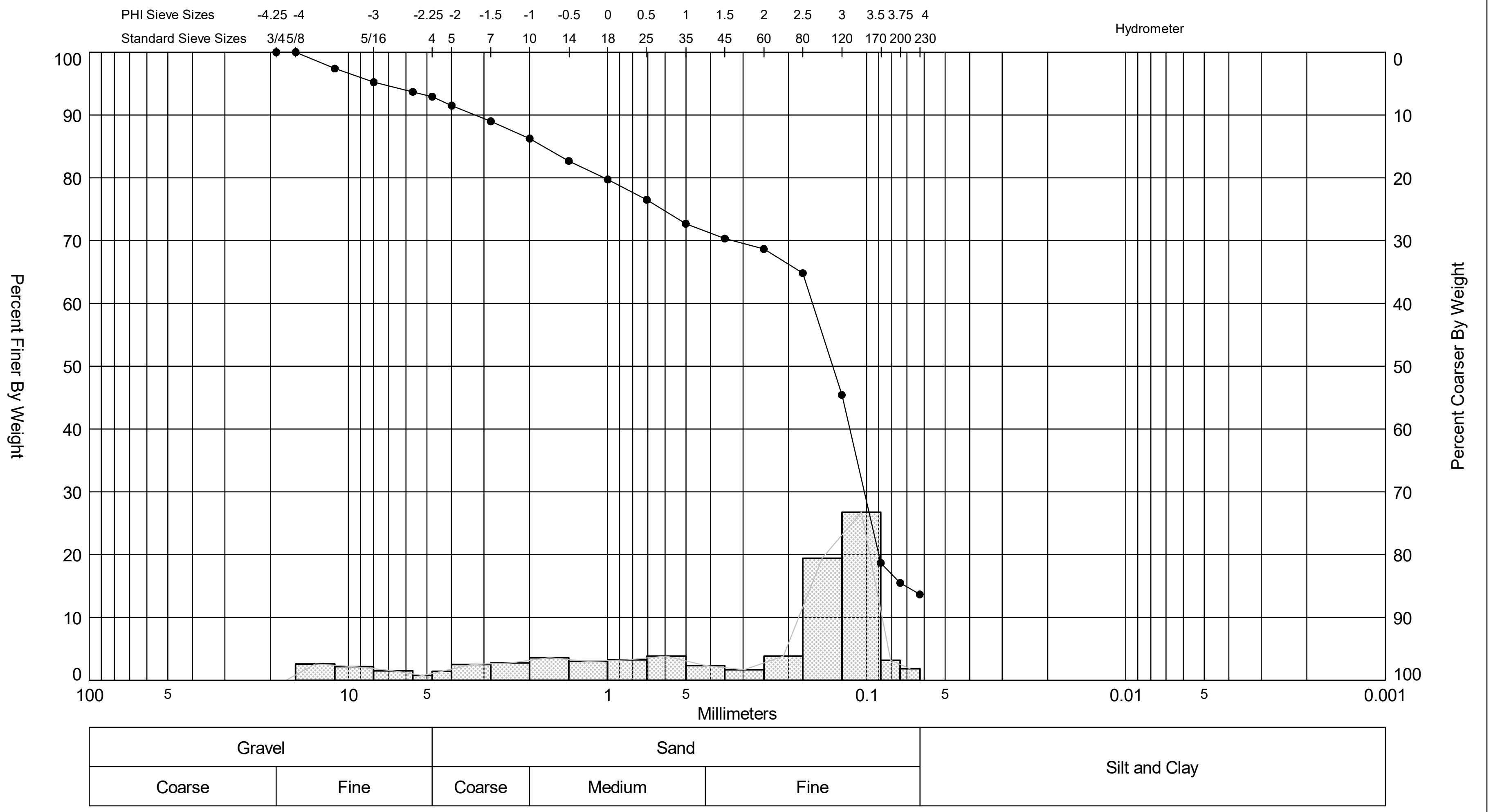

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-13 #2	—●—	-22.0	SC	#200 - 15.49 #230 - 13.65		34	2.88	1.62	-1.12	2.95	2.15

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-17-20
Analyzed By:	SF
Easting (X, ft):	586,153
Northing (Y, ft):	804,038
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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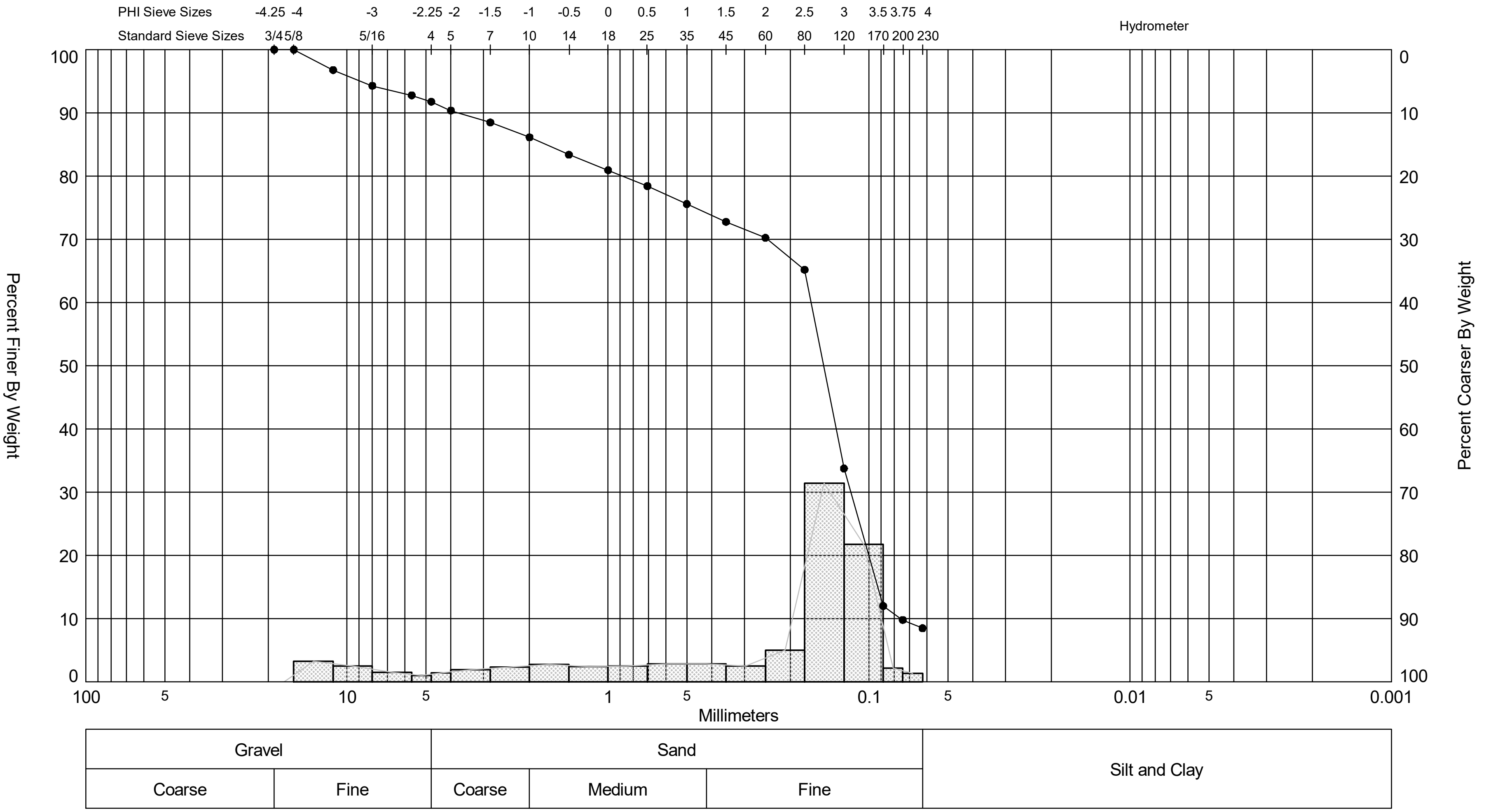
REDFISH_PASS_VIBRACORES.GPJ 9/1/20



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-14 #1	—●—	-20.8	SW-SM	#200 - 9.79 #230 - 8.47		30	2.74	1.68	-1.34	3.5	2.1

Comments:

Depths and elevations based on measured values

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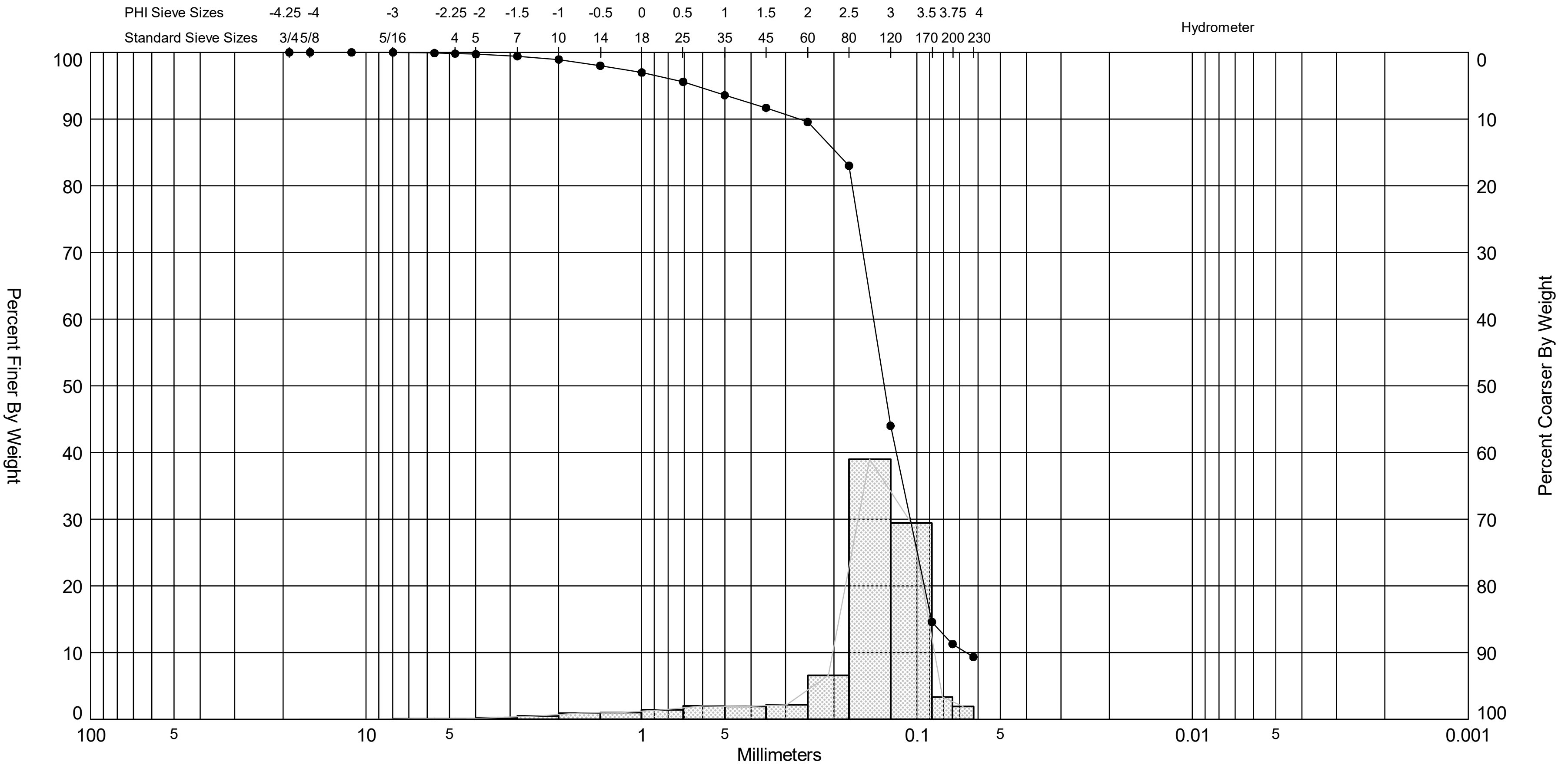
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-18-20
Analyzed By:	SF
Easting (X, ft):	586,410
Northing (Y, ft):	803,293
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-14 #2	—●—	-22.2	SW-SM	#200 - 11.29 #230 - 9.34		11	2.92	2.67	-2.53	10.56	0.93

Comments:

Depths and elevations based on measured values

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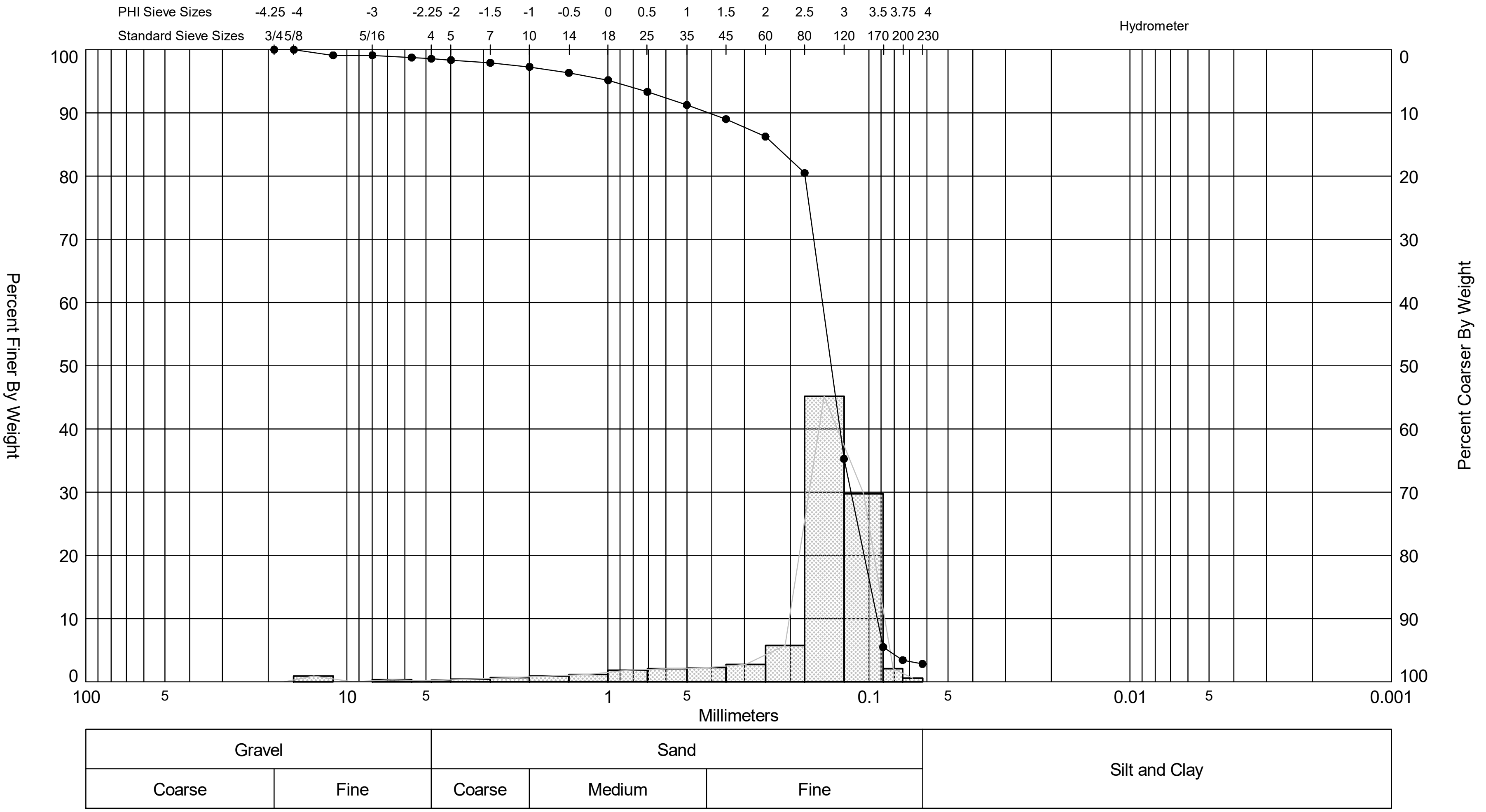
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-18-20
Analyzed By:	SF
Easting (X, ft):	586,410
Northing (Y, ft):	803,293
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-15 #1	—●—	-16.1	SW	#200 - 3.44 #230 - 2.83		14	2.84	2.53	-2.98	13.15	1.17

Comments:

Depths and elevations based on measured values

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Boca Raton, FL 33431
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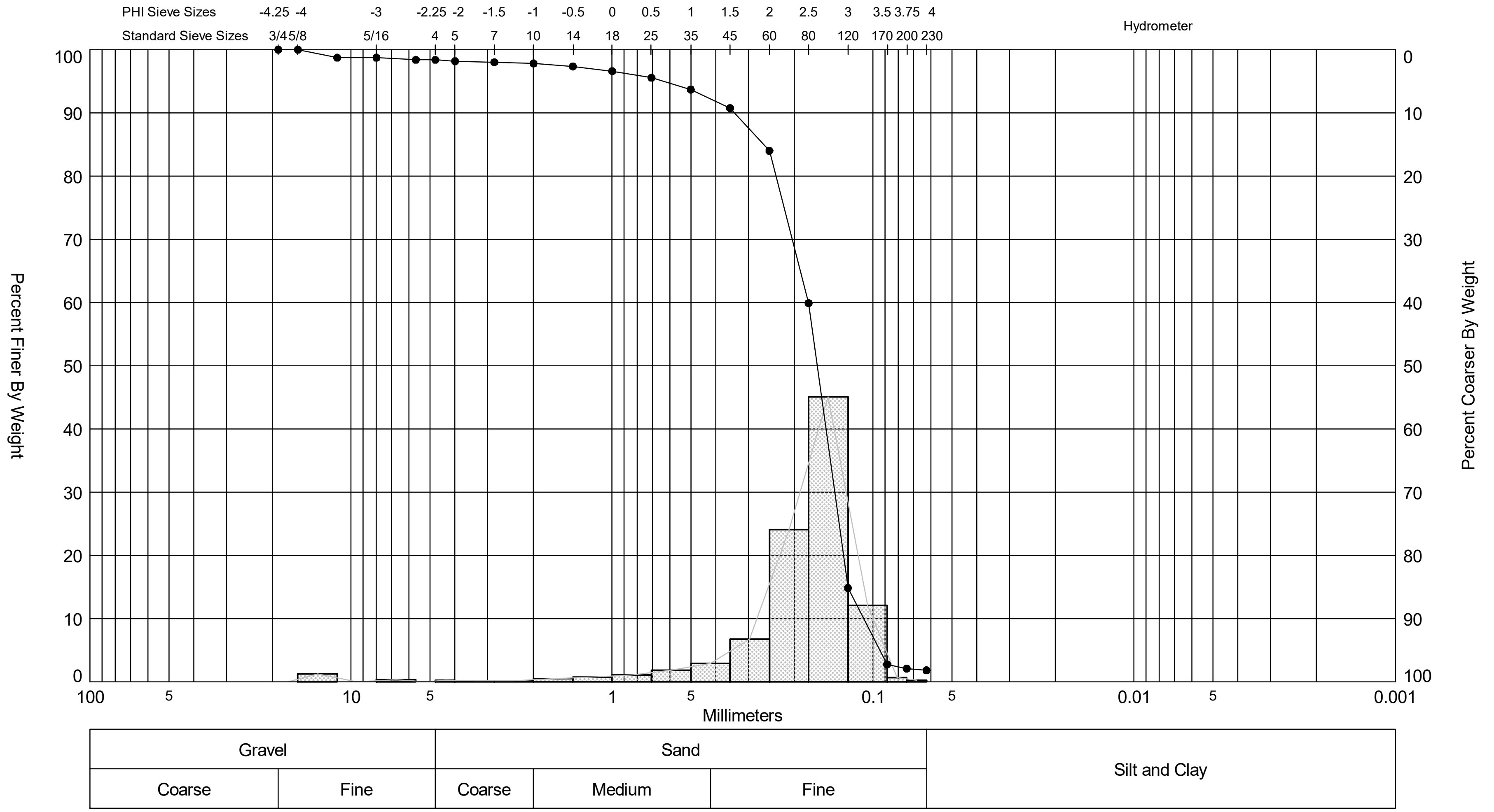
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-18-20
Analyzed By:	SF
Easting (X, ft):	587,092
Northing (Y, ft):	803,710
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



REDFISH_PASS_VIBRACORES.GPJ 9/1/20

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-15 #2	—●—	-17.9	SW	#200 - 2.08 #230 - 1.81		15	2.61	2.35	-3.54	18.66	1.06

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-18-20
Analyzed By:	DH
Easting (X, ft):	587,092
Northing (Y, ft):	803,710
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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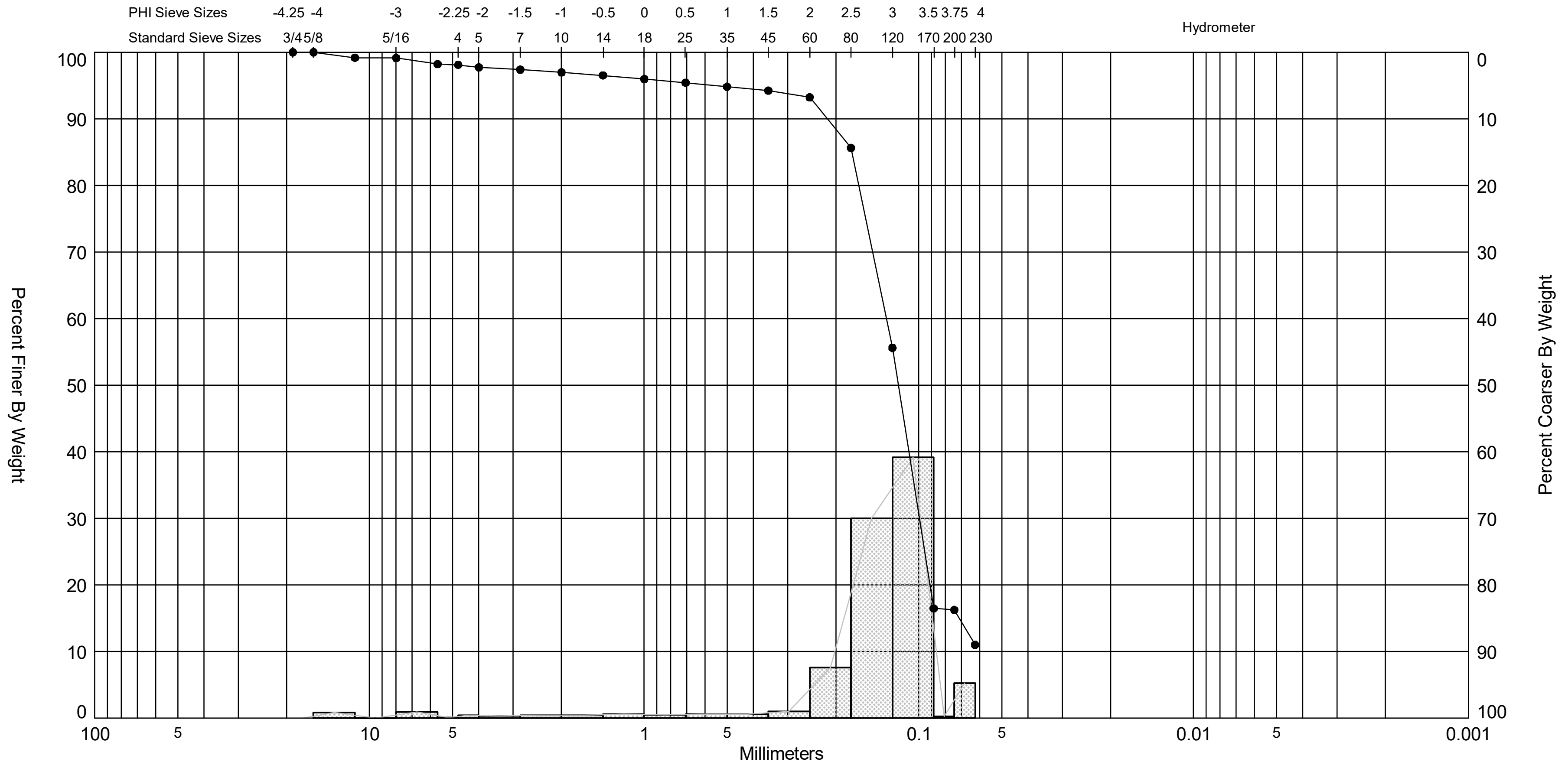

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-15 #3	—●—	-20.0	SM	#200 - 16.23 #230 - 10.99		11	3.07	2.73	-3.54	16.72	1.19

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-18-20
Analyzed By:	DH
Easting (X, ft):	587,092
Northing (Y, ft):	803,710
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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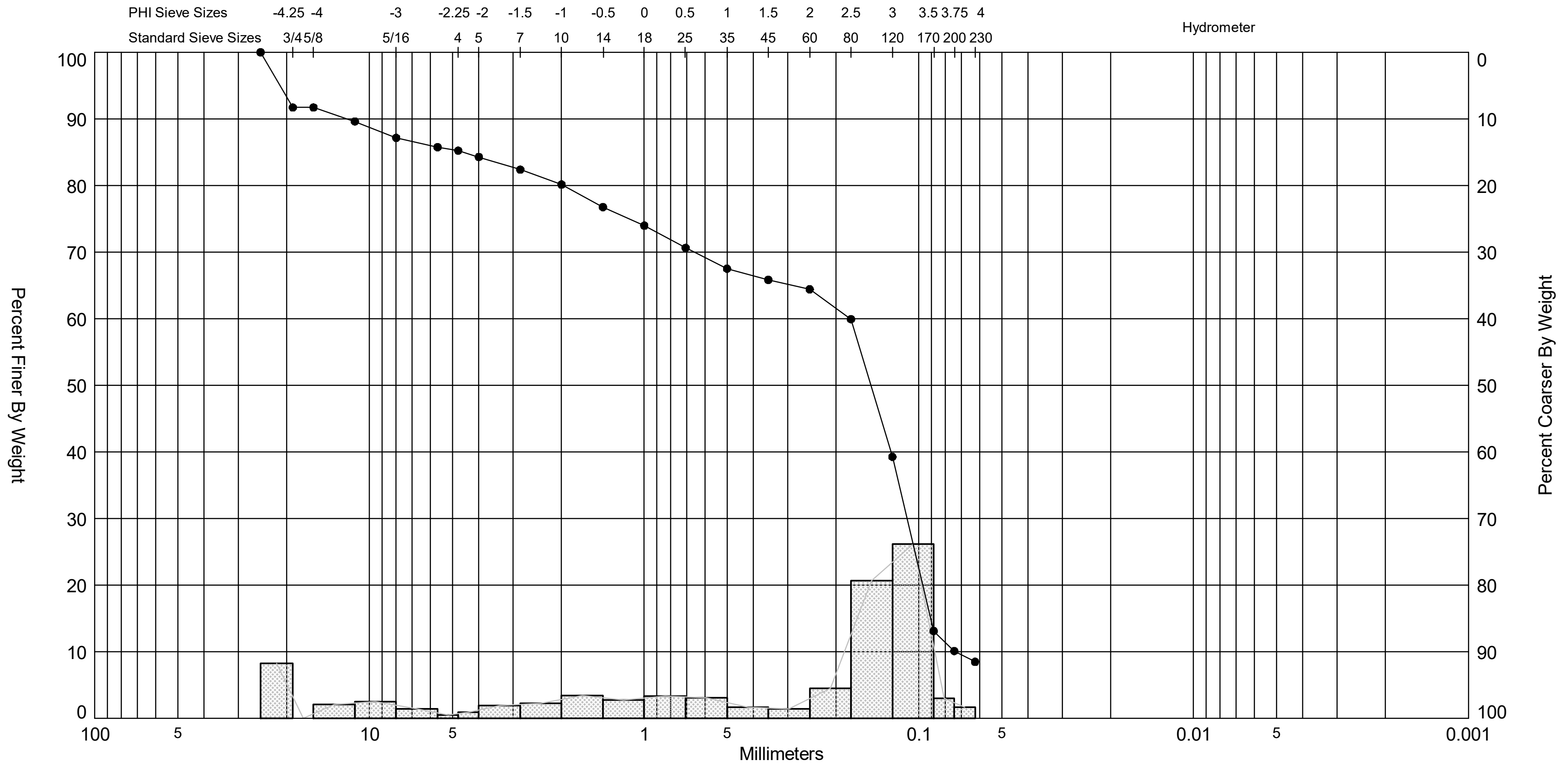

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-15 #4	—●—	-21.5	SW-SM	#200 - 10.10 #230 - 8.47		38	2.74	1.18	-1.04	2.62	2.66

Comments:

Depths and elevations based on measured values

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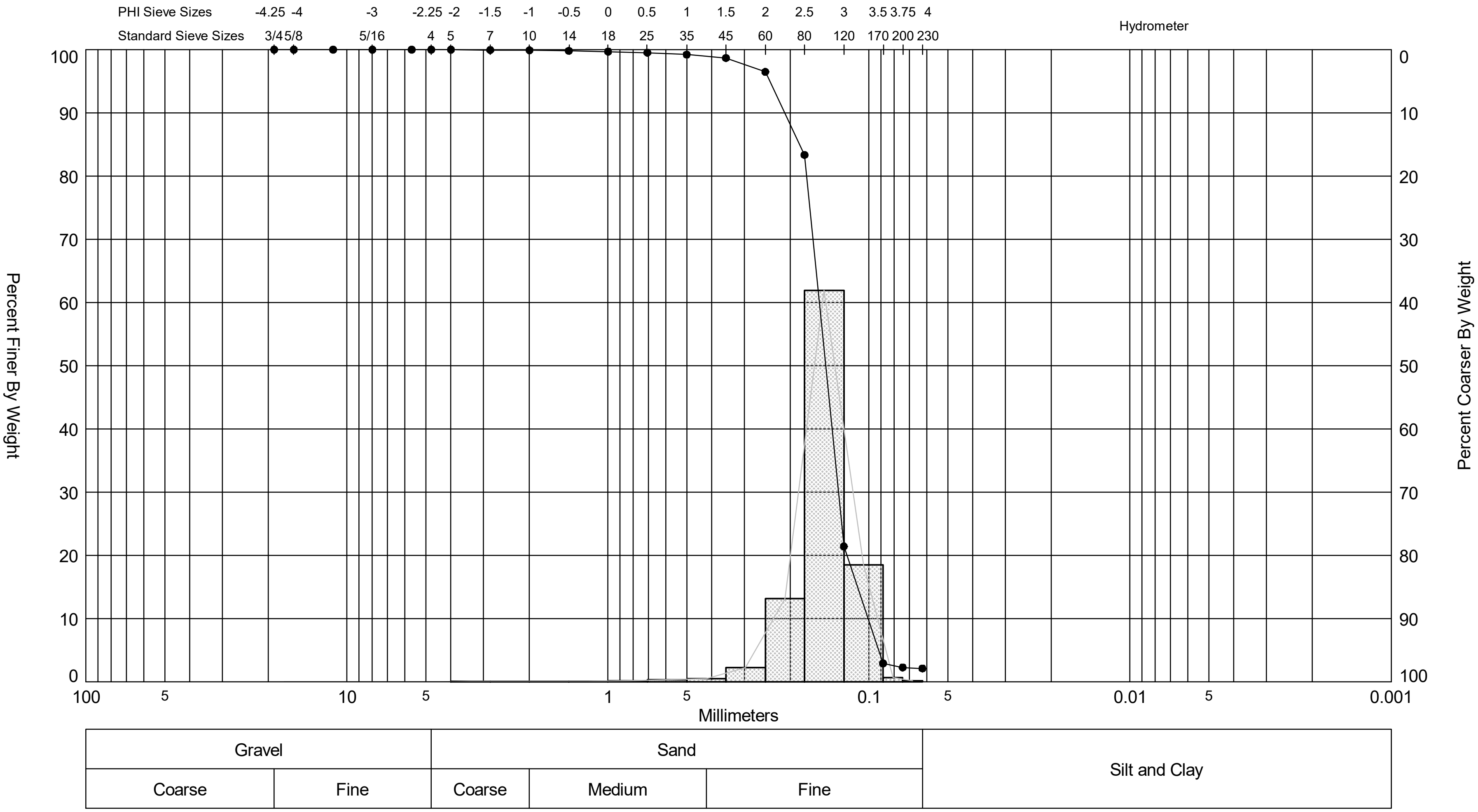
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-18-20
Analyzed By:	SF
Easting (X, ft):	587,092
Northing (Y, ft):	803,710
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-16 #1	—●—	-13.3	SP	#200 - 2.28 #230 - 2.12		7	2.77	2.73	-2.73	21.64	0.43

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-18-20
Analyzed By:	SF
Easting (X, ft):	586,334
Northing (Y, ft):	808,074
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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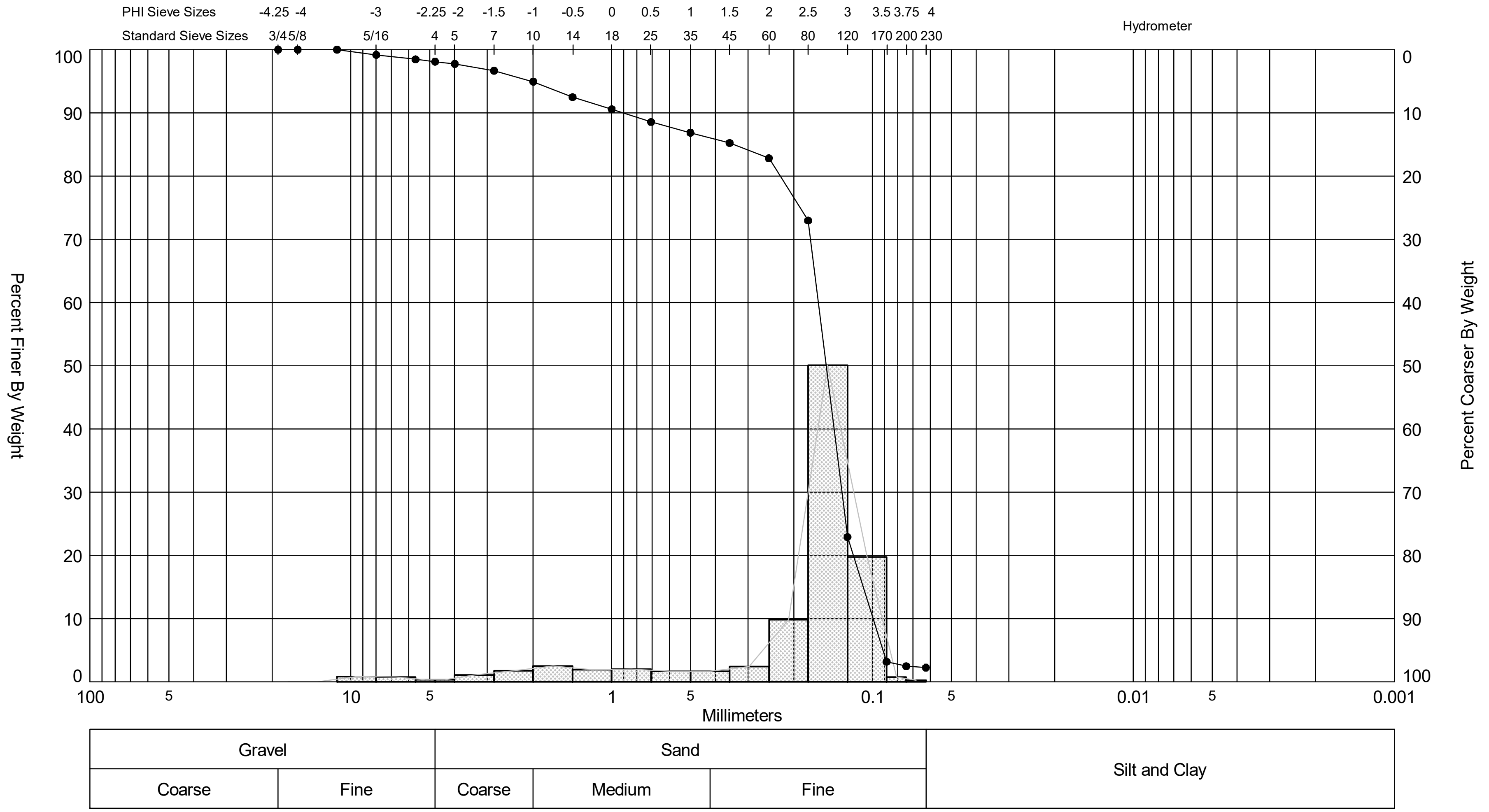

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-16 #2	—●—	-15.4	SW	#200 - 2.46 #230 - 2.24		19	2.73	2.28	-2.25	7.51	1.35

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-18-20
Analyzed By:	DH
Easting (X, ft):	586,334
Northing (Y, ft):	808,074
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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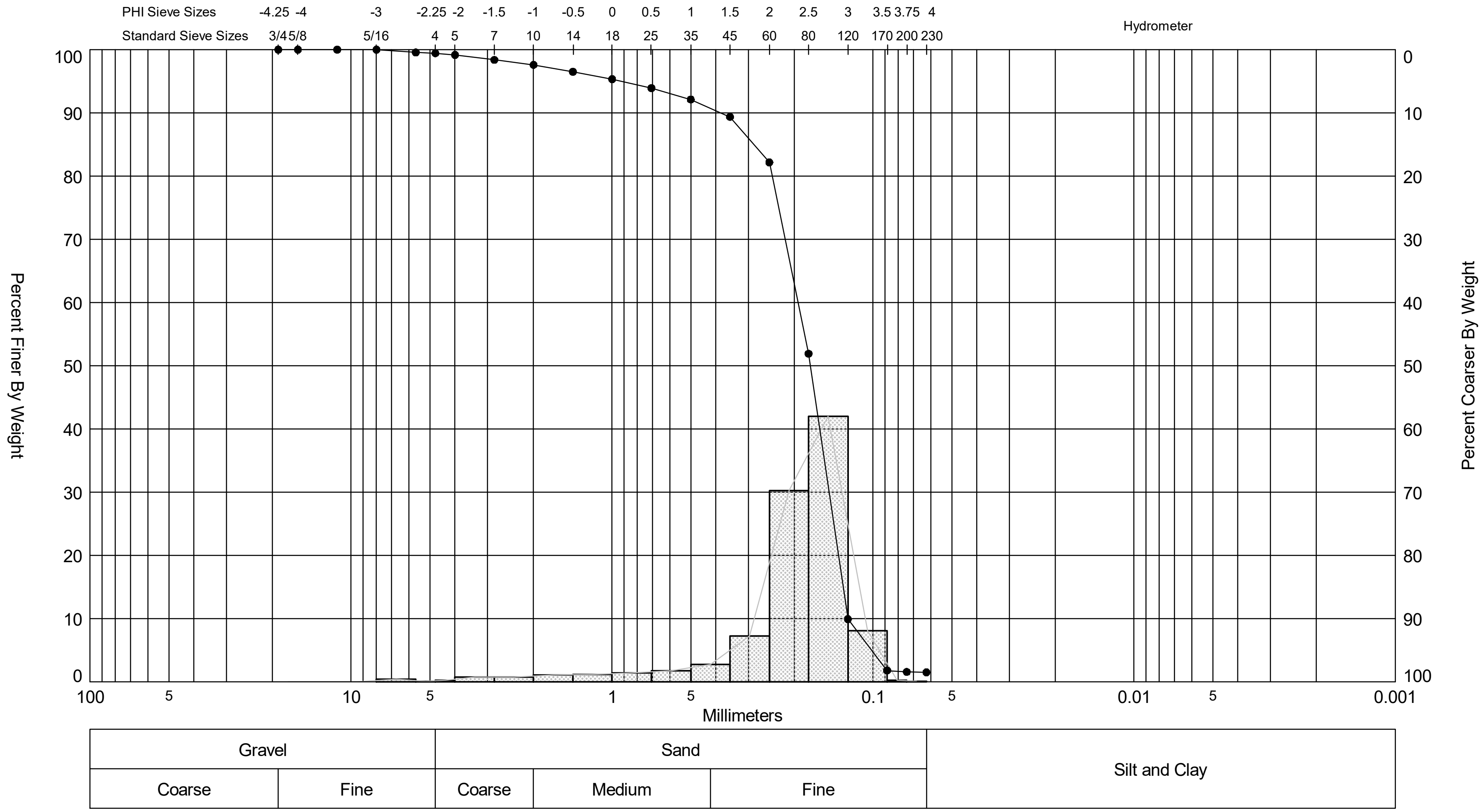

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-16 #3	─●─	-16.5	SW	#200 - 1.56 #230 - 1.49		17	2.52	2.27	-2.64	11.12	0.96

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-18-20
Analyzed By:	DH
Easting (X, ft):	586,334
Northing (Y, ft):	808,074
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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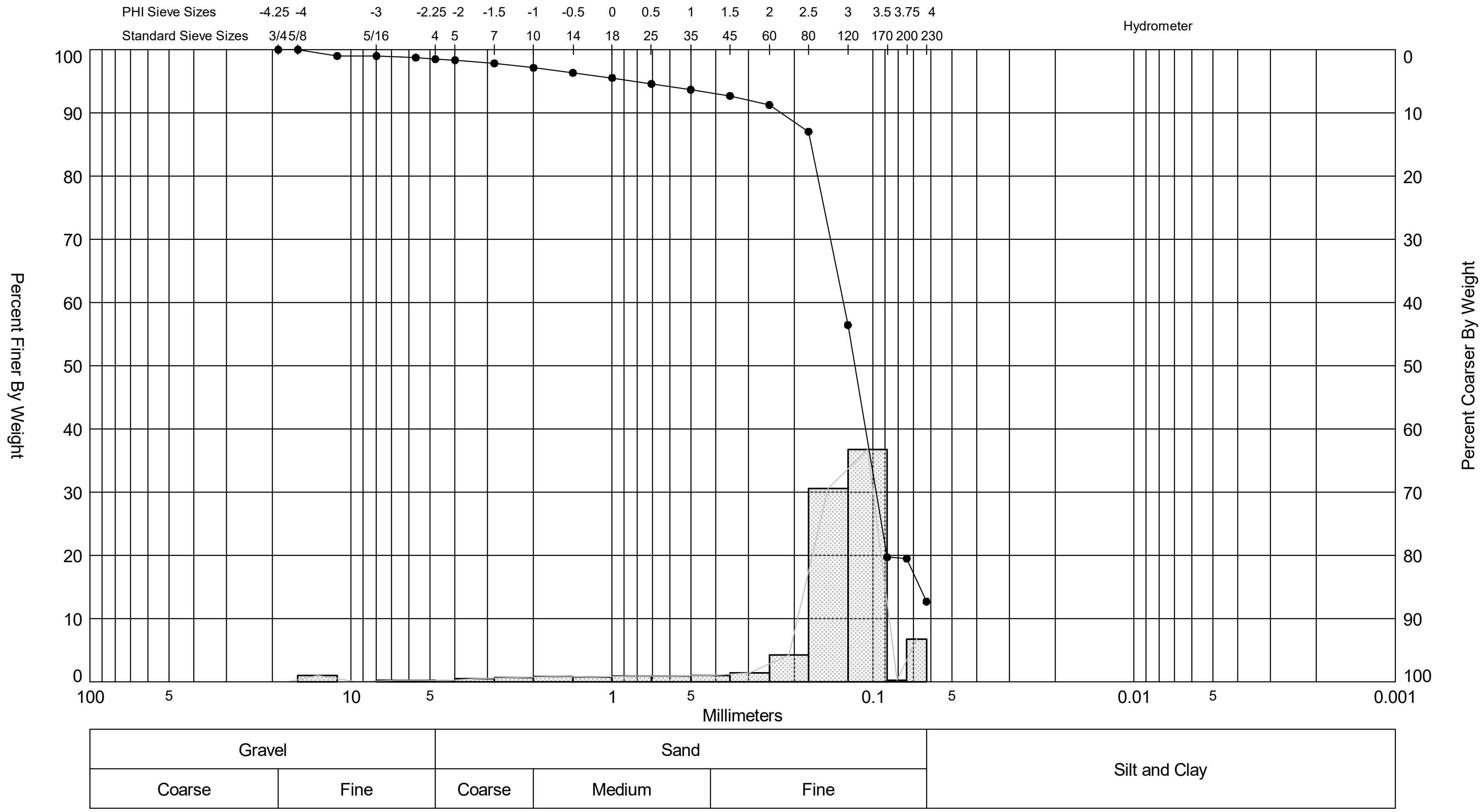

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-16 #4	—●—	-18.6	SM	#200 - 19.49 #230 - 12.70		13	3.09	2.71	-3.21	14.53	1.22

Comments:

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	08-18-20
Analyzed By:	DH
Easting (X, ft):	586,334
Northing (Y, ft):	808,074
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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APPENDIX 6
2020 CARBONATE TESTING RESULTS

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Redfish Pass Sand Search

Carbonate Report (Vibracore Samples)

Sample ID	Dish Weight	Dish + Dry	Dish + End	Dry Weight	Post Reaction Weight	% Terrigenous	% Carbonate
RPVC-20-01 #1	145.73	242.58	239.26	96.85	93.53	97%	3%
RPVC-20-01 #2	153.88	248.99	223.03	95.11	69.15	73%	27%
RPVC-20-02 #1	156.48	250.25	244.49	93.77	88.01	94%	6%
RPVC-20-02 #2	166.99	254.35	242.55	87.36	75.56	86%	14%
RPVC-20-03 #1	147.06	251.97	235.50	104.91	88.44	84%	16%
RPVC-20-03 #2	154.37	254.71	246.33	100.34	91.96	92%	8%
RPVC-20-03 #3	157.42	252.21	244.90	94.79	87.48	92%	8%
RPVC-20-04 #1	153.83	257.77	186.46	103.94	32.63	31%	69%
RPVC-20-04 #2	154.17	250.08	228.84	95.91	74.67	78%	22%
RPVC-20-04 #3	157.88	253.26	231.38	95.38	73.50	77%	23%
RPVC-20-04 #4	152.05	242.86	233.92	90.81	81.87	90%	10%
RPVC-20-04 #5	153.43	241.31	213.60	87.88	60.17	68%	32%
RPVC-20-04 #6	155.43	262.07	184.52	106.64	29.09	27%	73%
RPVC-20-04 #7	144.61	280.26	215.95	135.65	71.34	53%	47%
RPVC-20-04 #8	161.34	267.35	192.59	106.01	31.25	29%	71%
RPVC-20-05 #1	157.06	259.23	234.39	102.17	77.33	76%	24%
RPVC-20-05 #2	154.36	234.01	217.58	79.65	63.22	79%	21%
RPVC-20-06 #1	152.87	253.57	240.82	100.70	87.95	87%	13%
RPVC-20-06 #2	152.47	251.57	230.32	99.10	77.85	79%	21%
RPVC-20-06 #3	168.25	266.90	250.17	98.65	81.92	83%	17%
RPVC-20-06 #4	176.27	273.08	265.48	96.81	89.21	92%	8%
RPVC-20-06 #5	166.19	242.15	212.92	75.96	46.73	62%	38%
RPVC-20-07 #1	162.63	269.06	212.55	106.43	49.92	47%	53%
RPVC-20-07 #2	157.24	254.47	240.74	97.23	83.50	86%	14%
RPVC-20-07 #3	157.25	256.75	218.35	99.50	61.10	61%	39%
RPVC-20-07 #4	154.04	248.11	239.57	94.07	85.53	91%	9%
RPVC-20-07 #5	154.46	235.78	225.41	81.32	70.95	87%	13%
RPVC-20-08 #1	165.49	274.46	193.61	108.97	28.12	26%	74%
RPVC-20-08 #2	156.02	262.93	201.08	106.91	45.06	42%	58%
RPVC-20-08 #3	155.25	251.83	232.41	96.58	77.16	80%	20%
RPVC-20-08 #4	148.29	248.98	175.12	100.69	26.83	27%	73%
RPVC-20-08 #5	154.14	232.77	211.74	78.63	57.60	73%	27%
RPVC-20-08 #6	148.79	247.55	238.43	98.76	89.64	91%	9%
RPVC-20-08 #7	151.54	220.20	200.81	68.66	49.27	72%	28%
RPVC-20-09 #1	163.82	275.13	175.62	111.31	11.80	11%	89%
RPVC-20-09 #2	154.92	262.21	176.44	107.29	21.52	20%	80%
RPVC-20-09 #3	156.62	264.53	197.10	107.91	40.48	38%	62%
RPVC-20-09 #4	152.33	255.25	214.57	102.92	62.24	60%	40%
RPVC-20-09 #5	153.64	252.53	239.47	98.89	85.83	87%	13%
RPVC-20-10 #1	146.54	253.35	180.28	106.81	33.74	32%	68%
RPVC-20-10 #2	167.16	277.20	185.34	110.04	18.18	17%	83%
RPVC-20-10 #3	165.33	262.85	190.79	97.52	25.46	26%	74%
RPVC-20-10 #4	160.75	258.37	214.42	97.62	53.67	55%	45%
RPVC-20-10 #5	158.02	258.45	214.94	100.43	56.92	57%	43%
RPVC-20-11 #1	158.67	264.01	179.34	105.34	20.67	20%	80%
RPVC-20-11 #2	169.82	267.68	239.66	97.86	69.84	71%	29%

Redfish Pass Sand Search

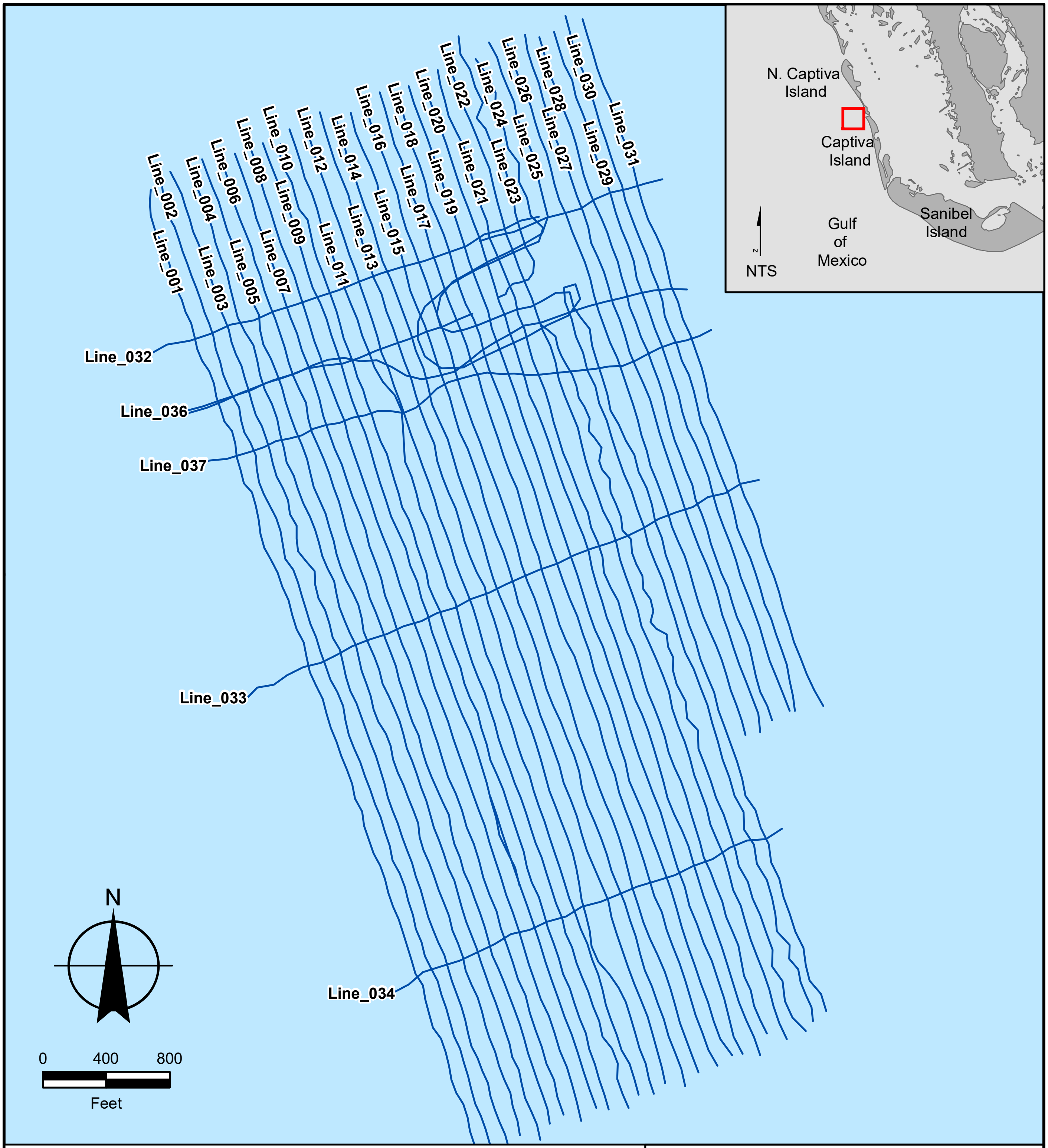
Carbonate Report (Vibracore Samples)

Sample ID	Dish Weight	Dish + Dry	Dish + End	Dry Weight	Post Reaction Weight	% Terrigenous	% Carbonate
RPVC-20-11 #3	153.10	253.32	231.27	100.22	78.17	78%	22%
RPVC-20-11 #4	156.99	269.40	202.50	112.41	45.51	40%	60%
RPVC-20-12 #1	154.04	252.04	234.87	98.00	80.83	82%	18%
RPVC-20-12 #2	151.37	249.42	228.39	98.05	77.02	79%	21%
RPVC-20-12 #3	166.79	270.33	215.37	103.54	48.58	47%	53%
RPVC-20-12 #4	154.29	257.89	236.70	103.60	82.41	80%	20%
RPVC-20-12 #5	154.34	257.09	247.32	102.75	92.98	90%	10%
RPVC-20-12 #6	156.21	260.64	221.71	104.43	65.50	63%	37%
RPVC-20-12 #7	149.75	243.05	237.84	93.30	88.09	94%	6%
RPVC-20-12 #8	158.56	248.03	242.63	89.47	84.07	94%	6%
RPVC-20-12 #9	157.81	252.08	247.00	94.27	89.19	95%	5%
RPVC-20-13 # 1	174.58	261.81	249.48	87.23	74.90	86%	14%
RPVC-20-13 # 2	155.41	240.15	211.20	84.74	55.79	66%	34%
RPVC-20-14 #1	147.85	240.35	212.34	92.50	64.49	70%	30%
RPVC-20-14 #2	174.97	266.74	256.30	91.77	81.33	89%	11%
RPVC-20-15 #1	165.92	263.61	249.98	97.69	84.06	86%	14%
RPVC-20-15 #2	154.97	260.61	244.86	105.64	89.89	85%	15%
RPVC-20-15 #3	154.77	240.86	231.71	86.09	76.94	89%	11%
RPVC-20-15 #4	155.00	251.78	215.35	96.78	60.35	62%	38%
RPVC-20-16 #1	165.36	264.67	258.00	99.31	92.64	93%	7%
RPVC-20-16 #2	172.42	269.51	250.92	97.09	78.50	81%	19%
RPVC-20-16 #3	158.11	261.75	244.46	103.64	86.35	83%	17%
RPVC-20-16 #4	153.13	237.21	226.62	84.08	73.49	87%	13%

APPENDIX 7
2020 APTIM SEISMIC DATA (DIGITAL COPY ONLY)

iDocs Document No.; Issue Statement; Ver. 0; 24Sep2020

G:\Enterprise\Lee\1745001138_RedfishPass\mxd\Appendix_Trackline_Map.mxd; Analyst: Beth.Forrest; Date: 9/24/2020 2:43:26 PM



Legend

— APTIM As-Run Tracklines (2020)

CAPTIVA EROSION PREVENTION DISTRICT
11513 ANDY ROSSE LANE, UNIT 4
CAPTIVA, FL 33924

REDFISH PASS SAND SEARCH

FIGURE NUMBER
A7.1

Trackline Map

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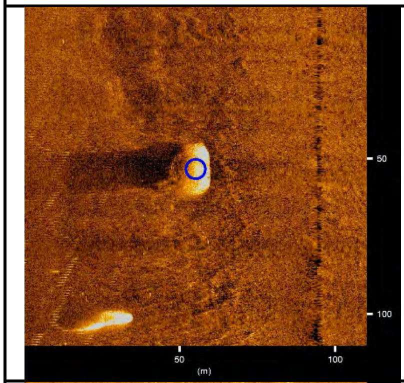
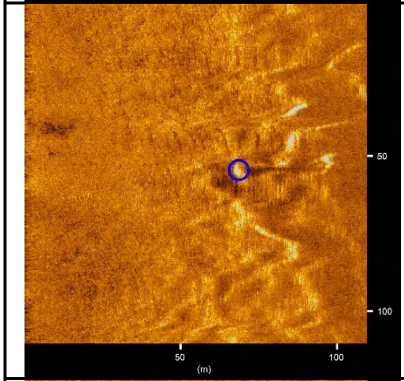
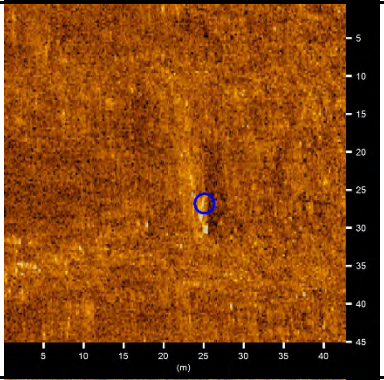
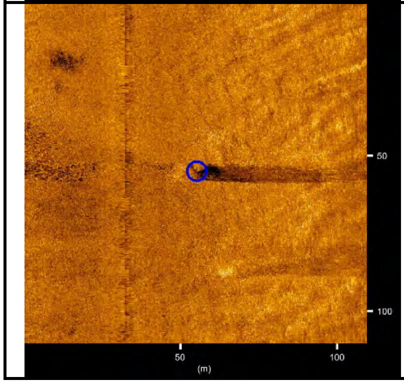
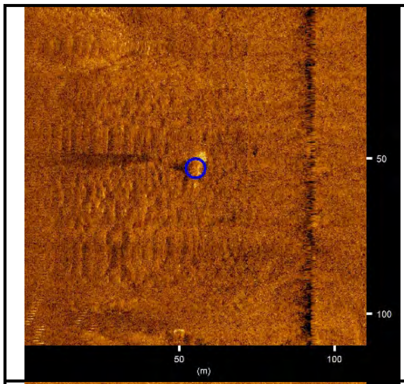
APPENDIX 8
2020 APTIM SIDESCAN SONAR CONTACT SHEETS

Redfish Pass Sand Search 2020 - Sidescan Target Report

Generated on 3/10/2020 3:01:56 PM

Target Image	Target Info	User Entered Info
	**Contact0000** • Sonar Time at Target: 1/14/2020 9:32:58 AM • Click Position 26.5514504362 -82.2186002550 (LocalLL) (X) 584705.79 (Y) 806186.89 (Projected Coordinates) • Map Projection: FL83-WF • Ping Number: 25399 • Range to target: 39.12 (ft) • Heading: 168.000 Degrees • Line Name: RFP_2020_Line_001	**Dimensions and attributes** • Target Width: 45.04 (ft) • Target Length: 51.82 (ft) • Classification1: School of Fish • Description: Bait Ball
	**Contact0001** • Sonar Time at Target: 1/14/2020 9:49:14 AM • Click Position 26.5438231047 -82.2142985142 (LocalLL) (X) 586107.41 (Y) 803412.09 (Projected Coordinates) • Map Projection: FL83-WF • Ping Number: 31680 • Range to target: 68.51 (ft) • Heading: 1.390 Degrees • Line Name: RFP_2020_Line_004	**Dimensions and attributes** • Classification1: School of Fish • Description: Small Bait Ball
	**Contact0002** • Sonar Time at Target: 1/14/2020 10:05:19 AM • Click Position 26.5569743180 -82.2202874667 (LocalLL) (X) 584157.69 (Y) 808195.68 (Projected Coordinates) • Map Projection: FL83-WF • Ping Number: 38049 • Range to target: 47.55 (ft) • Heading: 169.690 Degrees • Line Name: RFP_2020_Line_002	**Dimensions and attributes** • Target Length: 17.89 (ft) • Classification1: Unknown Debris • Description: Unknown debris
	**Contact0003** • Sonar Time at Target: 1/14/2020 10:27:18 AM • Click Position 26.5435769467 -82.2143777872 (LocalLL) (X) 586081.35 (Y) 803322.66 (Projected Coordinates) • Map Projection: FL83-WF • Ping Number: 46746 • Range to target: 22.91 (ft) • Heading: 350.200 Degrees • Line Name: RFP_2020_Line_005	**Dimensions and attributes** • Target Width: 25.35 (ft) • Target Length: 20.61 (ft) • Classification1: School of Fish • Description: Bait Ball



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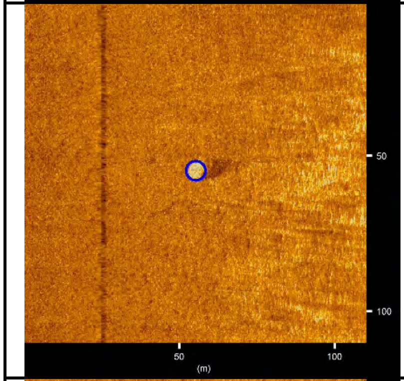

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Dimensions and attributes

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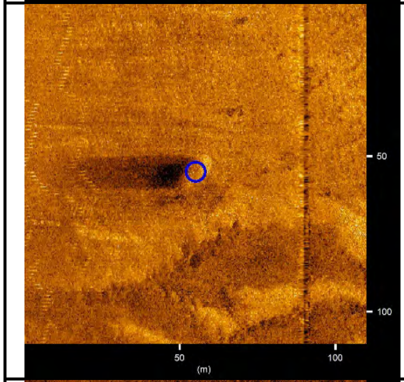
- Description: Bait Ball



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Dimensions and attributes

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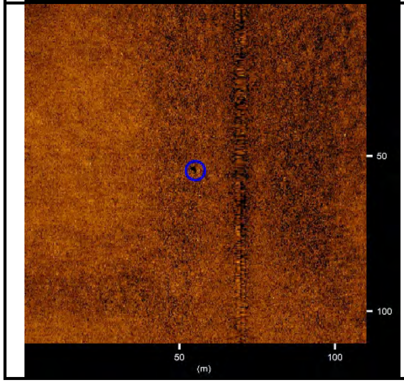
- Description: Bait Ball



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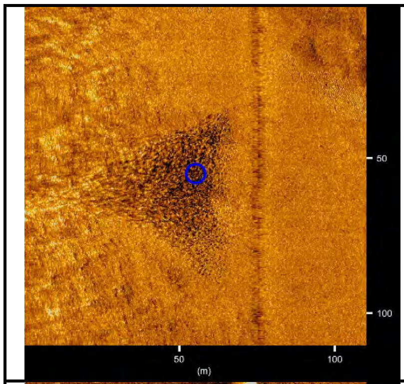
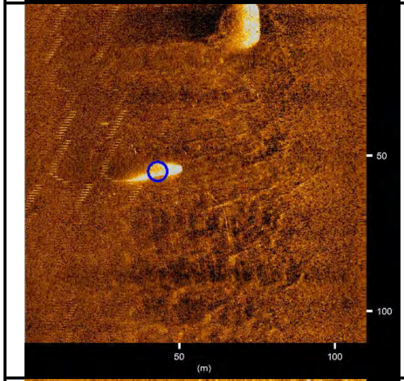
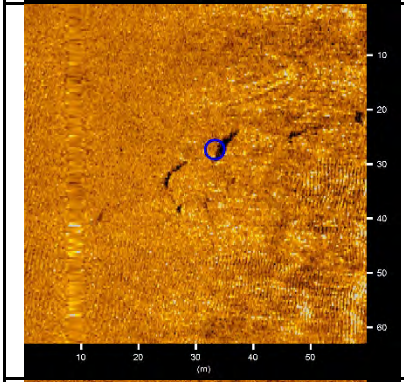
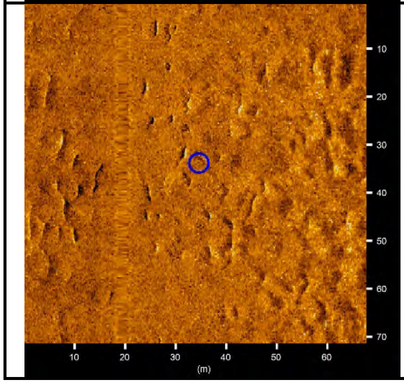
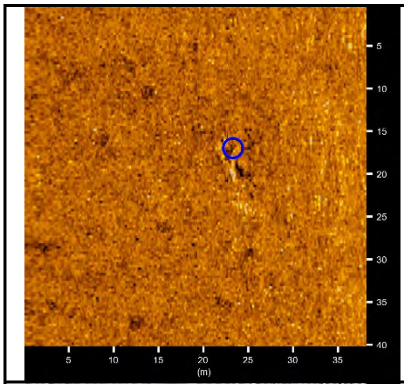
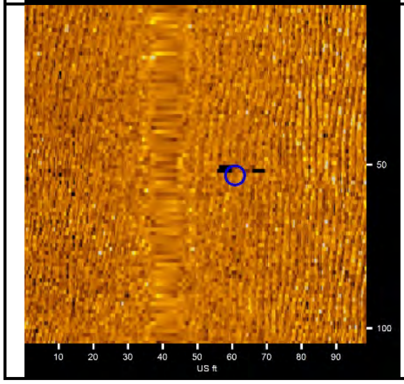
	**Contact0008** • Sonar Time at Target: 1/14/2020 10:15:34 AM • Click Position 26.5469549033 -82.2167450971 (LocalLL) (X) 585309.49 (Y) 804551.80 (Projected Coordinates) • Map Projection: FL83-WF • Ping Number: 42106 • Range to target: 20.10 (ft) • Heading: 169.100 Degrees • Line Name: RFP_2020_Line_002	**Dimensions and attributes** • Classification1: School of Fish • Description: Bait Ball
	**Contact0009** • Sonar Time at Target: 1/14/2020 9:32:32 AM • Click Position 26.5519393300 -82.2185114569 (LocalLL) (X) 584735.13 (Y) 806364.54 (Projected Coordinates) • Map Projection: FL83-WF • Ping Number: 25228 • Range to target: 67.22 (ft) • Heading: 154.100 Degrees • Line Name: RFP_2020_Line_001	**Dimensions and attributes** • Target Length: 63.77 (ft) • Classification1: Unknown Debris • Description: Unknown
	**Contact0010** • Sonar Time at Target: 1/14/2020 4:10:01 PM • Click Position 26.5499149702 -82.2114499089 (LocalLL) (X) 587042.34 (Y) 805624.85 (Projected Coordinates) • Map Projection: FL83-WF • Ping Number: 75102 • Range to target: 24.42 (ft) • Heading: 353.200 Degrees • Line Name: RFP_2020_Line_022	**Dimensions and attributes** • Target Length: 19.33 (ft) • Classification1: Unknown Debris • Description: Unknown
	**Contact0011** • Sonar Time at Target: 1/14/2020 3:11:56 PM • Click Position 26.5532654876 -82.2134669252 (LocalLL) (X) 586384.99 (Y) 806843.80 (Projected Coordinates) • Map Projection: FL83-WF • Ping Number: 52110 • Range to target: 15.13 (ft) • Heading: 344.700 Degrees • Line Name: RFP_2020_Line_020	**Dimensions and attributes** • Target Length: 10.97 (ft) • Classification1: Sand Ripples • Description: Large Sand Ripples

	**Contact0012** • Sonar Time at Target: 1/14/2020 10:14:17 AM • Click Position 26.5481952692 -82.2176677648 (LocalLL) (X) 585008.62 (Y) 805003.16 (Projected Coordinates) • Map Projection: FL83-WF • Ping Number: 41596 • Range to target: 24.86 (ft) • Heading: 160.890 Degrees • Line Name: RFP_2020_Line_002	**Dimensions and attributes** • Target Width: 7.41 (ft) • Target Length: 13.85 (ft) • Classification1: Unknown Debris • Description: Unknown
	**Contact0013** • Sonar Time at Target: 1/14/2020 3:09:10 PM • Click Position 26.5498644344 -82.2122606357 (LocalLL) (X) 586777.28 (Y) 805606.92 (Projected Coordinates) • Map Projection: FL83-WF • Ping Number: 51016 • Range to target: 19.55 US ft • Heading: 353.700 Degrees • Line Name: RFP_2020_Line_020	**Dimensions and attributes** • Target Width: 2.42 US ft • Target Length: 14.29 US ft • Classification1: Potential Buoy and Chain

APPENDIX 9
SHPO APPROVAL LETTER AND DRAFT CULTURAL RESOURCE INVESTIGATION REPORT

DRAFT

MARINE ARCHAEOLOGICAL RESOURCES ASSESSMENT FOR THE PROPOSED REDFISH PASS BORROW AREA, LEE COUNTY, FLORIDA

APRIL 2020

SEARCH

DRAFT

MARINE ARCHAEOLOGICAL RESOURCES ASSESSMENT FOR THE PROPOSED REDFISH PASS BORROW AREA, LEE COUNTY, FLORIDA

Contract Number: 213145 OS
SEARCH Project Number: M19250

Prepared for:

APTIM ENVIRONMENTAL & INFRASTRUCTURE, LLC
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Kyle Lent, MA, And Barry Bleichner, JD, PhD

Samuel P. Turner

Samuel P. Turner, PhD

Principal Investigator

April 2020

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EXECUTIVE SUMMARY

The Captiva Erosion Prevention District (CEPD) is proposing to renourish areas of Captiva Island in Lee County, Florida. The CEPD contracted with Aptim Environmental & Infrastructure, LLC (APTIM) to provide technological support for the project, including sediment search, borrow area design, and permitting. SEARCH was contracted to provide archaeological monitoring and analysis of remote-sensing data, collected by APTIM, in preparation for the proposed collection of geotechnical cores, borrow area design and permitting, and sediment dredging for beach nourishment. This work was completed to identify potential submerged cultural resources within the project area of potential effects (APE). The APE is approximately 157 ha (390 ac), offshore from Redfish Pass in the Gulf of Mexico.

APTIM conducted a marine remote-sensing survey within the proposed Redfish Pass Borrow Area that included collection of side-scan sonar, CHIRP subbottom profiler, magnetometer, and bathymetry data. SEARCH provided on-site archaeological monitoring of the fieldwork and subsequent review of remote-sensing data collected by APTIM to determine the presence/absence of potential submerged cultural resources within the APE. APTIM intends to extract up to 16 geotechnical cores within the APE to assess the suitability of local sediments for beach renourishment projects.

SEARCH reviewed magnetometer data, as well as side-scan sonar and subbottom profiler imagery, to assess the presence or absence of potential submerged cultural resources within the APE. SEARCH also reviewed the precontact, historical, and geological background of the region, with specific attention paid to the maritime history of the Redfish Pass and Captiva Island Area and the Gulf Coast of southwestern Florida. Finally, SEARCH identified previous archaeological investigations and reported sites within the area to guide the development of the project research design and assist with interpreting the remote-sensing data.

SEARCH identified 40 magnetic anomalies, 3 acoustic contacts, and 3 acoustic reflectors in the marine remote-sensing record. None of the anomalies or contacts indicate a potential submerged cultural resource. None of the acoustic surface reflectors in the subbottom record appear to indicate buried paleolandscape features. SEARCH recommends cultural resources clearance for the entirety of the APE, as the remote-sensing data and subsequent archaeological analysis do not indicate the presence of potential submerged cultural resources.

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ACRONYMS AND ABBREVIATIONS

APE	area of potential effects
APTIM	Aptim Environmental & Infrastructure, LLC
bmsl	below mean sea level
BOEM	Bureau of Ocean Energy Management
cal BP	calendar years before present
CEPD	Captiva Erosion Prevention District
FMSF	Florida Master Site File
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
PCI	Panamerican Consultants Inc.
SEARCH	SEARCH Inc.
USCS	US Coast Survey

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1 INTRODUCTION

This report presents the results of SEARCH's archaeological assessment of a marine remote-sensing survey performed by Aptim Environmental & Infrastructure, LLC (APTIM) from January 14 to January 15, 2020. The survey was conducted for the Captiva Erosion Prevention District (CEPD), which is proposing to perform erosion control on Captiva Island in Lee County, Florida. The CEPD contracted APTIM to support the proposed activities, including sediment search, borrow area design, and permitting. APTIM proposes to extract up to 16 geotechnical cores in an area near Redfish Pass (**Figure 1**) to assess the suitability of local sediments for erosion control. Following collection of the cores and assessment of the sediments, APTIM will design a borrow area from which sediments will be dredged and deposited on the shoreline. The area of potential effects (APE) consists of both the core locations and the area from which the borrow area will be selected and proposed dredging will occur (see Figure 1). APTIM contracted SEARCH to conduct the archaeological analysis to identify potential submerged cultural resources within the APE that could be adversely affected, directly or indirectly, by activities associated with the proposed core extraction and sediment dredging.

The survey was designed to comply with the methodology guidelines provided in the Florida Division of Historical Resources' (FDHR) *Performance Standards for Submerged Remote Sensing Survey* (2001). All work was conducted under Permit No. 1920.039, which was issued under the authority of Chapters 267.031 (1) and 267.12, Florida Statutes, and Rule 1A-32, Florida Administrative Code, administered by the Florida Bureau of Archaeological Research (BAR) (Appendix B). The purpose of the survey was to locate, identify, and bound any potential submerged cultural resources within the APE. This study was conducted to comply with Chapter 267 of the Florida Statutes and Rule Chapter 1A-46, Florida Administrative Code. All work was performed in accordance with the FDHR's recommendations for such projects as stipulated in the FDHR's *Cultural Resource Management Standards & Operations Manual, Module Three: Guidelines for Use by Historic Preservation Professionals*. The principal investigator for this project meets the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (48 FR 44716-42). This study also complies with Public Law 113-287 (Title 54 USC), which incorporates the provisions of the National Historic Preservation Act (NHPA) of 1966, as amended, and the Archeological and Historic Preservation Act of 1979, as amended. The study also complies with the regulations for implementing NHPA Section 106 found in 36 CFR Part 800 (Protection of Historic Properties).

The APE is located near the outer entrance to Redfish Pass, approximately 0.8 km (0.5 mi) offshore Captiva Island and entirely within Florida state waters. The project APE has been defined as an area of seafloor measuring 1.9 × 0.9 km (1.2 × 0.6 mi), which equates to approximately 156 ha (390 ac; see Figure 1). Water depths in the APE range from approximately 3 m (10 ft) to 5.5 m (18 ft), and consist primarily of coarse, shell-rich carbonate sand. Captiva Island is one of a series of barrier islands in the Gulf Barrier Chain physiographic province (White 1970). Redfish Pass connects Pine Island Sound to the Gulf of Mexico.

APTIM's remote-sensing investigation included collection of side-scan sonar, CHIRP subbottom profiler, magnetometer, and bathymetry data at 30 m (98 ft) spacing within the APE. APTIM contracted SEARCH to conduct on-site archaeological monitoring of the fieldwork and a subsequent review of APTIM's collected remote-sensing data. SEARCH designed and conducted the investigation in three phases: archival and cartographic research; review of marine remote-sensing survey of the APE; and creation of this technical report. SEARCH reviewed the precontact, historical, and geological background of the region, with specific attention paid to the maritime history of the Redfish Pass and Captiva Island Area and the Gulf Coast of southwestern Florida. SEARCH identified any previous archaeological investigations and reported sites within the area to guide the development of the project research design and assist with interpreting the remote-sensing data.

All phases of work were designed, directed, and managed by professional archaeologists who met the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* and who are listed on the Register of Professional Archaeologists (RPA). Barry Bleichner, JD, PhD, RPA, served as project manager, and Sam Turner, PhD, served as principal investigator and on-site archaeological monitor. Dr. Turner's curriculum vitae is **Appendix A.** Alex DeCaro, MA, RPA; Sam Turner; and Ray Tubby, MA, RPA; analyzed data. Barry Bleichner, Alex DeCaro, Ray Tubby, and Kyle Lent, MA, assisted with report preparation, and Ray Tubby provided GIS services for this project. Carol Rose, BA, and Cari Johnson, BA, edited and produced the document.

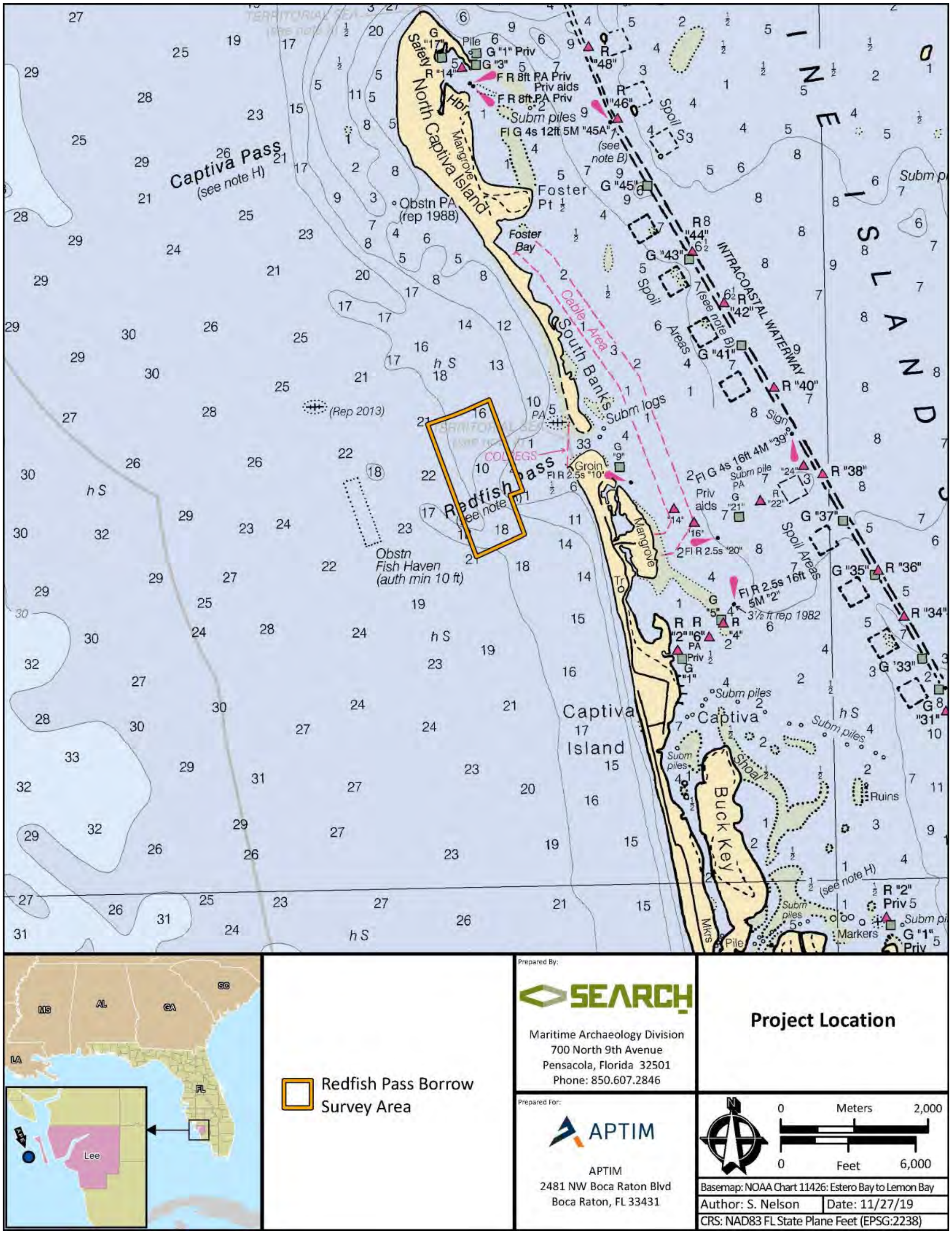

Figure 1. Project location.

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2 PRECONTACT CONTEXT

2.1 PALEOENVIRONMENTAL RECONSTRUCTION

During the last glacial maximum approximately 24,000 calendar years before present (cal BP), a massive amount of Earth's water was locked within ice sheets in the Northern Hemisphere. This caused the lowering of global sea levels by roughly 134 m (440 ft; Lambeck et al. 2014). The reintroduction of freshwater into the oceans radically changed global sea levels and littoral landscapes. During the last 20,000 years, approximately 15 to 20 million km^2 (5,791,532 to 7,722,043 mi^2) of coastal landscape has been submerged worldwide, which is roughly the area of South America (Faure et al. 2002). Three-quarters of Florida's landmass was submerged between 21,000–6000 cal BP (Faught 2004). The reintroduction of freshwater into the oceans also had global climatic ramifications. Oscillations in climate, coupled with sea-level rise, radically changed the landscape and ecosystem. The Southeast experienced several periods of oscillating microclimate shifts from wet climates to arid climates (Faure et al. 2002; Grimm et al. 1993). Florida's aquifer system was also severely affected by the arid conditions during the climatic shifts (Thulman 2009). The shortage of water within the aquifer system limited the expulsion of freshwater to deep inland sinkholes and springs on the continental shelf (Faure et al. 2002). The continental shelf would have been a relative "oasis" in comparison to the upland coastal plains that humans and megafauna would have utilized.

Regional pollen data from the end of the last glacial maximum, roughly 21,000 cal BP, indicate that Florida was in a drier and cooler phase associated with the Late Pleistocene (Grimm et al. 2006). The climate shifted at approximately 19,500 cal BP to a wetter phase associated with the onset of global deglaciation. Temperatures and precipitation then dropped once again at roughly 17,000 cal BP, as Florida entered a second cooler, drier phase. By approximately 16,800 cal BP, global deglaciation conditions returned, and Florida reverted to a warmer and wetter climate. Florida was plunged back into a cooler, drier climate from 14,500–12,000 cal BP associated with a global climatic event called the Younger Dryas (Grimm et al. 2006).

Between 14,000 and 12,000 cal BP, sea levels rose from 100 to 65 m below mean sea level (bmsl; 300 to 195 ft; Joy 2018; Lambeck et al. 2014). The paleocoastline at 14,000 cal BP would have been roughly 85 km (53 mi) west of the APE. At the end of the Younger Dryas, Florida's microclimate underwent a warm/dry phase starting at 11,500 cal BP. This would have created drought conditions, limiting freshwater sources to the continental shelf (Faure et al. 2002; Grimm et al. 1993; Thulman 2009). The warming period caused a massive amount of melt water to flow from glaciers in the north to the Mississippi River Valley, which emptied into the Gulf of Mexico. A distinct increase in sea levels can be identified at 11,200 cal BP where ocean levels rose by 20 m (66 ft) in a 400-year period (Joy 2018). Sea levels had increased to 40 m (131 ft) bmsl, placing the coastline within 80 km (49.7 mi) of the APE. An additional melt water pulse is identified at 8200 cal BP and lasting approximately 700 years. During this time, ocean levels increased by 12 m (36 ft), raising sea levels to 8 m (26 ft) bmsl (Joy 2018). The coastline would have been within 9 km (5.5 mi) from the modern coastline by the end of the melt water pulse (**Figure 2**). The entire APE was submerged by approximately 6000 cal BP, and by 3000 cal BP sea levels would have reached their modern levels. Once sea levels reached their modern depths, coastal geological processes moved massive amounts of marine sediments to form the modern-day barrier islands, such as Captiva and Sanibel on Florida’s west coast.

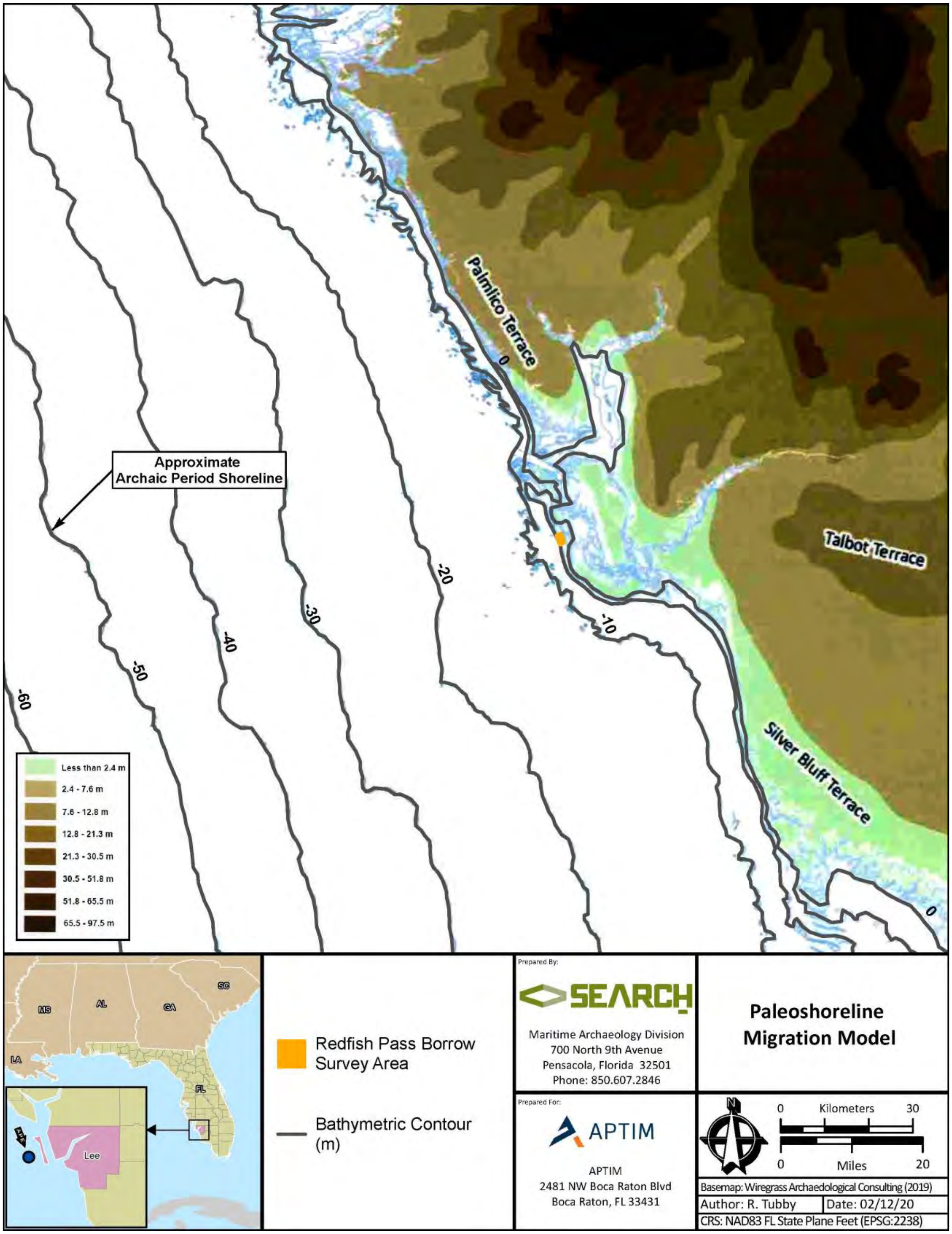

Figure 2. Paleoshoreline migration model along the west coast of Florida off the Redfish Pass APE.

2.2 NATIVE AMERICAN CULTURE HISTORY

The peopling of the New World is a realm of American archaeology that is undergoing continual revision and is the subject of many highly charged articles and publications. The prevailing paradigm argues early Paleoindians arrived to this continent sometime prior to 15,000 cal BP, either via the Beringia land bridge (Smith 1986) or by boat across the Pacific or the Atlantic Ocean (Anderson and Gillam 2000; Bradley and Stanford 2004; Dixon 1993; Faught 2008; Fladmark 1979). Studies and excavations focused on determining arrival and dispersal throughout North and South America continue to be at the forefront of precontact New World archaeology. Continued excavations in Florida challenge the prevailing theories, as many sites yield radiocarbon dates prior to 14,000 cal BP (Dunbar et al. 2006; Faught 2008; Goodyear 2000).

2.2.1 Paleoindian Period (pre-15,000–11,500 cal BP)

Current evidence indicates that the first humans entered Florida approximately 12,000 to 14,000 years BP. Sea level was much lower than today, and the Florida peninsula was wider and drier, particularly in the central interior. Most of the known Paleoindian sites are in north and west-central Florida, where karst springs and chert were readily available. These early native Floridians, known to archaeologists as Paleoindians, may originally have been nomadic hunter-gatherers who relied upon now-extinct Pleistocene animals such as mastodon, ground sloth, camel, and dire wolf, as well as smaller mammals and wild plant foods, for their subsistence (Milanich 1994).

By the Late Paleoindian period, however, it appears that people were spending part of each year in large habitation sites located near freshwater springs and lithic raw material sources (Daniel and Wisenbaker 1987). Archaeologically, Paleoindian sites are recognized by the presence of lanceolate projectile points, blades, bola stones, carinate scrapers, drills, end scrapers, thumbnail scrapers, gouges, and Edgefield scrapers, reflecting both a reliance on hunting and butchering of animals as well as the use of well-made scraping tools for woodworking, hide scraping, and other tasks. Lanceolate Suwannee and Simpson projectile points are commonly found on sites in the karst regions of north and central Florida, although they are sometimes found in south Florida as well. Purdy (1981) suggested that the Paleoindian populations followed the rivers through north Florida, exploiting the resources of the Florida Highlands and the Gulf Coast. A similar pattern has been suggested for Paleoindian groups who inhabited the central Gulf Coast (Goodyear et al. 1983). In the central Gulf Coast region, Paleoindian sites are located along the coast and along various drainages (Goodyear and Warren 1972). These site locations were once on dry land when sea levels were lower, but these locations have become submerged as sea level has risen during the past 10,000 years.

Hundreds of Clovis points have been found in Florida, but Clovis sites with datable stratigraphic information are not common (Purdy 2008). The only dated Clovis-aged artifact from Florida is an ivory fore shaft recovered from Sloth Hole site on the lower Aucilla (12,900 cal BP; Waters and Stafford Jr. 2007). Recreational divers recovered five Clovis points from the site, while professional excavation recovered five potentially Paleoindian broken bifaces and a mastodon fibula with evidence of butchery (Halligan 2012). Clovis-aged points have been identified at eight other sites in the Aucilla. Tools—including pins, points, abraders, and daggers—made from extinct megafauna have been recovered from seven more. Sloth Hole and other locations in the Aucilla River have produced virtually all the ivory shafts known from North America. The only Clovis points identified in secure stratigraphic context in Florida were recovered at Paradise Park site on the Silver River in Marion County (Pevny et al. 2017). Throughout the Paleoindian period, Florida was much drier and ground water level much lower due to reduced sea levels. Water sources would have been a vital resource on the landscape to which Paleoindian peoples would have been drawn (Thulman 2009). Several Middle Paleoindian sites are reported in Florida, with a majority of them located north of Tampa. Middle Paleoindian point types include Suwannee, Simpson, Cumberland, Redstone, Beaver Lake, and Quad (Pevny et al. 2017).

2.2.2 Archaic Period (9000–2500 BP)

During the subsequent Archaic period (9000–2500 BP), human populations began to grow and expand their territories as the climate became wetter and water sources more prevalent. After the demise of Pleistocene fauna, human subsistence strategies became more diverse and included new plant, animal, and aquatic species. People began to live in larger groups, use different types of stone tools, and inhabit more of what is now Florida. The Early Archaic (9000–8000 BP) represented a continuity of the Paleoindian occupation of Florida and occurred during a time of rising sea levels, a gradual warming trend, and the spread of oak hardwood forests and hammocks. The Early Archaic was apparently very arid and warm (Watts and Hansen 1988). Numerous small Early Archaic special activity and campsites have been located throughout west-central Florida (Milanich 1994). However, the characteristic side-notched projectile points that identify this period archaeologically have been found as far south as Dade County (Carr 1986), as well as along the southwest coast (Hazeltine 1983).

The Middle Archaic (8000–4000 BP) was a wetter period with the intrusion of mixed pine and oak into the hardwood forest. As conditions became wetter, large river systems and wetlands developed, and people began to exploit the resources associated with these aquatic habitats (Austin et al. 2004). However, evidence suggests that the environment became slightly drier during this period and that aquatic habitats were fewer and not as deep (Russo 1986). This is probably the result of climatic fluctuations over time. Prehistoric population in the Tampa Bay area may have been smaller and aggregated around springs and sinkholes.

Along the coasts and some of the state’s major rivers, Middle Archaic peoples practiced a relatively sedentary lifestyle (e.g., Russo 1991), but current evidence suggests that the native groups occupying the interior were highly mobile, moving from location to location on a seasonal round (Austin 1996, 1997). Middle Archaic sites identified on the interior of the central Gulf Coast region typically consist of small- to medium-sized scatters of lithic artifacts representing habitation sites, short-term campsites, or extractive locations (e.g., Austin 1990; Janus Research 1995). This pattern of wetland burials seems to have been primarily a South Florida phenomenon (cf. Purdy 1991).

The hallmark of the Late Archaic (4000–2500 BP) is the innovation of pottery. The earliest pottery was tempered with plant fibers and first appeared between about 4000 and 3000 BP (Sassaman 1993). The people who made fiber-tempered pottery practiced an essentially Archaic lifestyle of hunting, gathering, and incipient horticulture. Fiber-tempered pottery was made with naturally occurring clays collected from areas where creeks or rivers had cut down to the clay-bearing layers. Plant fibers were added to the clay as a tempering agent to strengthen it. After being made, pots were left to dry to allow moisture in the clay to escape, and then fired. The terminal Late Archaic period is characterized by the addition of sand with the plant fibers as tempering agents and the introduction of the coiling method of pottery construction (Sassaman 1993). This sand-and-fiber-tempered pottery is referred to as Norwood along the Gulf Coast. The people who made fiber-tempered pottery continued to practice a hunting-and-gathering lifestyle.

In southwest Florida, evidence for preceramic Archaic occupation comes from coastal shell middens (Milanich et al. 1984; Russo 1991), interior lithic scatter sites (Beriault et al. 1981; Clausen et al. 1979), and wetland cemeteries (Beriault et al. 1981; Bureau of Archaeological Research [BAR] 2017; Clausen et al. 1979). The Manasota Key Offshore site (8SO07030) is an Early to Middle Archaic site located offshore of Manasota Key, Sarasota County. To date, the site is the only offshore, indigenous burial site known in the Western Hemisphere (BAR 2020). Organic material preserved on site dates to at least 8,100 years BP. Inundated Middle Archaic–aged occupations are known from several sites in the Gulf (Faught 1988, 1995; Gifford and Koski 1994). Late Archaic sites containing fiber-tempered and sand-and-fiber-tempered pottery are common along the coast (e.g., Bullen and Bullen 1956; McMichael 1982; Widmer 1974).

2.2.3 Caloosahatchee Period (500 BC–AD 1750)

Following the Archaic period, more complex forms of political, social, and religious community life gradually developed throughout much of Florida, including the southwest coast. This was accompanied by the establishment of more formal, settled communities and increased regional diversity. This regional diversity, due primarily to local adaptation to varied ecological conditions within the state, has traditionally been described in terms of cultural periods based on variations in ceramic types. The ceramic tradition for southwest Florida, characterized by sand-tempered bowls with incurvate rims, is known as the Caloosahatchee cultural tradition. A ceramic sequence for greater South Florida was established by John Goggin (1939, 1949, 1952) on the basis of work he conducted during the 1930s, 1940s, and early 1950s. Subsequent research has served to refine his basic chronological framework (Griffin 1988; Griffin et al. 1984; Marquardt 1992).

The Caloosahatchee culture was centered in the Charlotte Harbor and Ten Thousand Islands area. The culture is also recognized as far east as LaBelle as well as north into southern Charlotte County and south into the northern coastal region of Collier County. The historic descendants were the Calusa Native Americans, a politically powerful group that controlled much of South Florida at the time of Spanish contact. The Caloosahatchee culture was adapted to a rich maritime environment, and site density is exceptionally great. Caloosahatchee people built large shell mounds, shell embankments, plazas, and causeways, and dug canals. They were a socially stratified society at the time of Spanish contact and may have reached this level of social and political complexity as early as AD 700–800 (Widmer 1988). Caloosahatchee people were primarily fisherfolk who also gathered plants and occasionally hunted deer and other small game.

Several archaeological sites associated with the Caloosahatchee cultural tradition are located along the southwest coast of Florida, with some of the smaller islands and keys composed almost entirely of shellworks and shell middens with enclosed plazas. The most famous of these is the site at Key Marco, where a large assortment of perishable artifacts was found preserved in the muck of a mangrove swamp (Cushing 1897; Durnford 1895; Gilliland 1975; Widmer 1996). Carved wooden masks and vessels, cordage, netting, bone and shell tools, and the remains of wooden structures were recovered, providing a wealth of information about aspects of prehistoric life that are rarely represented at typical archaeological sites in Florida. The ceramic assemblage indicates a late fifteenth-century, precontact period of occupation. Other Caloosahatchee sites include those at Gordons Pass (Goggin 1939), Goodland Point (Goggin 1949), Useppa Island (Milanich et al. 1984), Horrs Island (McMichael 1982), Sanibel Island (Fradkin 1976), Josselyn Island (Marquardt 1984), Buck Key, and Pineland (Walker and Marquardt n.d.).

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3 HISTORICAL CONTEXT

3.1 CONTACT PERIOD

3.1.1 European Contact Period (AD 1513–1565)

Redfish Pass is located between North Captiva and Captiva Island along the coast of Lee County in southwestern Florida. The region, featuring barrier islands, estuaries, rivers, creeks, and the Gulf of Mexico, was an important theater in the early exchanges of European and Native American culture. While many historical studies would cite the 1513 Juan Ponce de León expedition as the first to make contact with the area, recent scholarship has found evidence that the Calusa, who ruled the region at the time of European contact, already had come into contact with the Spanish. When Ponce de León arrived, at least one of the Calusa he encountered knew some Spanish words, leading anthropologists Victor D. Thompson and John Worth to believe that Spanish slave raiders from the Caribbean may have reached southwest Florida or that Caribbean natives fleeing the Spanish may have entered Calusa territory, bringing the language with them (Thompson and Worth 2018).

The Calusa were “perhaps the most powerful native polity in all of Florida, encompassing over 20,000 people in 50 to 60 communities across an area that included 150 to 200 km of coastal and inland terrain” inclusive of North Captiva, Captiva, and Sanibel Islands (Thompson and Worth 2018). The domain of the Calusa stretched from Charlotte Harbor to Cape Sable; however, they held a strong influence on other native groups far inland (Worth 2006). Mound Key, nearly 48 km south of the APE in Estero Bay, likely was their capital. The 51 ha site is a 9 m high midden mound featuring a central canal system. Fish were the main source of subsistence for the Calusa. They thrived on the bountiful estuaries of the region (Thompson and Worth 2018).

Sailing in three caravels, Ponce de León’s expedition reached the coast of southwest Florida in June 1513. Some historians believe his initial landfall was in the vicinity of Captiva or Sanibel (Tanodi 1971:174–176;Turner 2013:6). There is no doubt, however, that he was in Calusa territory. Perhaps as a result of their knowledge of Spanish brutality, the Calusa sent dozens of war canoes against him after feigning a desire to trade gold for European goods. In the years following Ponce de León’s voyage, it is possible that Spanish slavers raided the Calusa. Then, in 1521, Ponce de León returned to Calusa territory and attempted to establish a settlement. After sometime ashore, Ponce and his men were defeated in a large battle in the interior during which Ponce was struck by an arrow in his thigh. The settlement was abandoned and Ponce retreated to San Cristóbal de la Habana so that he and his men could recover before making another attempt. However, Ponce soon died of an infection in his thigh and the expedition disintegrated (Thompson and Worth 2018).

The Calusa effectively developed a notorious reputation among the Spanish. They had repelled Ponce de León twice. In the years after 1521 when the sea lanes around Florida became more active with vessels, the Calusa were known to capture shipwreck survivors from the lower Atlantic coast and the Florida Keys and hold them at Mound Key, sometimes for as long as 20 years. They frequently used them for sacrifices, a practice that Thompson and Worth (2018) refer to as “a testament to their political power and control in the region” (74).

3.1.2 First Spanish Period, 1565–1763

In the mid-sixteenth century, the Calusa’s hold over the region was shaken by new Spanish incursions that came from the Gulf. Spanish governor of *La Florida* and founder of St. Augustine in 1565, Pedro Menéndez de Avilés, arrived to Calusa territory in February 1566. Traveling in seven ships, he dropped anchor with 500 men aboard. A Spanish shipwreck survivor among the Calusa, Escalante Fontaneda, served as interpreter for Menéndez and Caalus, the ruling *cacique*, or chief, of the Calusa. The two formed an alliance against the Calusa’s enemy based in present-day Tampa, the Tocobaga. Menéndez next established a garrison at Mound Key and one at Safety Harbor. Steps had been taken to improve relations with the Calusa, but the alliance fell apart after Menéndez failed to provide the military assistance that Caalus expected. The relationship was greatly injured when the Spanish executed Caalus (Thompson and Worth 2018).

Menéndez returned his focus to St. Augustine as opposed to the far-flung Calusa territory. However, the Spanish from Cuba maintained a maritime connection to the Calusa and particularly Mound Key, the only remaining garrison along the lower Gulf Coast. The garrison at Mound Key—San Anton de Carlos—was supplied by ships from Havana for several years until Spanish-Calusa relations again soured, leading the Spanish to execute the new *cacique*, Felipe, in 1569. To prevent its use, the Spanish burned San Anton (Thompson and Worth 2018).

While the Spanish had established a settlement at St. Augustine and set up missions to the natives across northern and central Florida, they remained wary of interacting with southwest Florida for a century after the abandonment of Mound Key. The fate of shipwrecked individuals among the natives of southwest Florida remained well known and feared. The Spanish explicitly avoided contact with the Calusa. Although isolated, the Calusa population nevertheless suffered from the transmission of European diseases, but there was not a massive collapse of civilization. When Franciscan missionaries arrived by boat in 1697, the population of Mound Key was estimated at 1,000 people (Thompson and Worth 2018). Documentary evidence from this period indicates that the Calusa lived and fished in the same villages that the Spanish had encountered in 1513. In the 1710s, the isolated Calusa began to decline as a result of Creek and Yamassee slave raids, which also had destroyed native communities in central and northern Florida. Those who were not captured fled to the Keys and to Havana (Worth 2003).

As the Calusa gradually faded from the maritime landscape in the early eighteenth century, a new Spanish influence entered the region in the form of fishermen from Cuba who established fishing settlements, or *ranchos*, along the Gulf Coast. The abundant estuaries supplied them with their catch, which they smoked and transported back to the island. The *ranchos* remained a feature of the southwest Florida coastline into the early nineteenth century. Worth (2003) has found documentation of Creek raids against Spanish fishing outposts at Sanibel and elsewhere in the 1757–1760 period.

3.1.3 British Period, 1763–1784

Similar to the Spanish, the British, who acquired Florida after the end of the French and Indian War in 1763, focused much of their colonial effort on the St. Augustine and St. Johns River region. Southwest Florida remained, then and for over a century to come, a frontier area. With the decline of the Calusa, the region was sparsely inhabited by the occasional Spanish fishing camp. A new native group, consisting of refugee Creeks and a patchwork of other southeastern natives, coalesced in this period to become known as the Seminole. By the end of the period, they had become familiar with the coast of the region and would shape events to come.

Improved cartography by the British of the Gulf Coast of southwest Florida, as well as other coasts of Florida, is key to maritime history. Despite their known existence since the early sixteenth century, Sanibel and Captiva Islands do not specifically appear in maps until the 1760s. In a 1765 map they bore the single, Spanish name *Puerto de S. Nibel* (Port of S. Nibel). Three years later (1768) the islands appeared again in a map authored by a Spanish cartographer. Unlike the 1765 map, the islands in the 1768 map had separate names: *Puerto de San Nibel* and *Boca de el Cautivo*. Historians believe the islands' modern-day names "Sanibel" and "Captiva," respectively, originate from this map (Dormer 1975).

The coastal area including North Captiva, Captiva, and Sanibel was perhaps best known in this period to the Spanish fishermen who were based in rustic, seasonal fish camps across the region. Bernard Romans, a British-period naturalist who was knowledgeable of the geography of Florida, published a detailed description of the Spanish fishermen in 1775. Romans described that about thirty fishing vessels made voyages to the east coast of Florida. They fished for pompano, drum, mullet, and other fish with nets. The fish were smoked and the roe of the mullet and drum was dried. "These roes the Spaniards are very fond of," Romans wrote, "and use them instead of caviar" (Romans 1775).

British cartographer George Gauld also acquired firsthand knowledge of the Spanish fishing *ranchos* of southwest Florida during the British period when he was contracted to chart the shores of the Gulf of Mexico. While surveying the shoreline south of Charlotte Harbor in 1771, Gauld and his crew sighted smoke that turned out to be the crews of three Spanish fishing schooners at anchor in an unnamed, nearby bay. At this camp, Gauld wrote, he found:

> 9 people, and 3 or 4 snug palmetto huts, and plenty of carp and other fish on hooks, a dressing on the stage…They begin by pressing the fish with a great weight after [the fish] is split and salted, then hang it to dry… The last operation is, to pile it up in the huts ready for loading. They supply Havanna [sic], and the other Spanish settlements in the West Indies, in the Lent season, in the same manner as New Foundland supplies those in the Mediterranean. It is a very lucrative branch of trade (Gauld, cited in Ware 1982).

3.1.4 Second Spanish Period, 1784–1821

Spanish rule returned to Florida after the conclusion of the American Revolutionary War in 1783. During the Second Spanish period (1784–1821), coastal southwestern Florida remained a frontier coastline. Spanish fishermen from Cuba continued to frequent the estuaries to haul in and smoke fish for market in Cuba. The Seminole, who had emigrated further into southern Florida as a result of the First Seminole War (1817–1819) and other conflicts in northern Florida, became more familiar with the region. Spain had granted much of central and southwest Florida to the Duke of Alagon; however, no steps had been taken to spread European settlement in southwest Florida by the time the United States came to govern the territory in 1821 (Gannon 2018).

3.1.5 United States Territorial and Early Statehood Period, 1821–1865

Despite the change in ownership over the years, the islands of Sanibel and Captiva remained relatively uninhabited. Captain Isaac Clark of the US Army attempted to survey Florida south of Tampa Bay in 1824, but when he reached the Peace River, he deemed further travel too difficult. The natives he conversed with in the region, likely Seminole, reported that they were able to travel in pirogues in the wet season. They also noted that the region south of the river featured no native settlements. Clark received aid in the form of food from the Spanish fishermen who inhabited the coastal area of the region (Hammond 1973).

American officials were growing increasingly suspicious of the Spanish fishermen in this period. The fishermen came to be viewed as a bad influence on the Seminole whom, the Americans believed, were being supplied liquor, arms, and other goods through the fishermen. The suspicion increased as relations between the Americans and the Seminole grew worse in the 1830s (Hammond 1973).

A US Customs official based in Key West, William A. Whitehead, studied the fisheries of the Gulf Coast in the 1830s. He noted Spanish fisheries where fish were salted and brought to market in Havana, as had been done for about a century. Whitehead noted four main *ranchos* employing some 130 men, including one at Punta Rassa on the Caloosahatchee and another about five miles away on San Carlos Bay (as cited in Hammond 1973). Half were natives, leading some contemporaries to dub them the “Spanish Indians.” Worth (2003) concluded that this group actually were remnants of the Calusa and other southern Florida groups that had diminished in the colonial period. Whitehead also noted seasonal fishermen from New England who came to the coast to collect sea turtles as well as fish that they sold in Havana (as cited in Hammond 1973). Vessels piloted by the aforementioned fisherman and those of passing merchantmen would feature an array of sail plans and include vessels such as sloops, brigantines, schooners, barks, snows, ketches, cutters, as well as early adaptations of steamboats (or “steamers”; Grismer 1949; Toll 2008).

Writings connected with an 1830s colonization effort provide information on the *ranchos* of the Captiva Island vicinity in addition to observations about the island itself. In 1832, a group of New York investors operating under the title of the Florida Peninsular Land Company attempted to establish a colony along the lower Gulf Coast. A representative of the company, Richard Hackley, sailed from New York to Key West where he contracted with the sloop *Associate* to select a site for the settlement. They made a thorough survey of Sanibel Island in 1832 and engaged native and Spanish workers to prepare temporary quarters for the impending colonization of the eastern point of the island. Settlers from New York arrived on the *Associate* and the schooner *Olynthus* in 1833. Dr. Benjamin Strobel accompanied them. His writings alluded to a "Spanish settlement…within three miles" of Sanibel "where there are probably forty or fifty persons… This settlement has been in existence, for twenty-five or thirty years, the employment of the people fishing" (Strobel, quoted in Hammond 1970). Strobel also described a Spanish fishing settlement, operated largely by natives, at Punta Rasa on the Caloosahatchee River.

Strobel also wrote about a visit to "Captive Island," today's Captiva Island. He and his fellow explorers were drawn to the island by the sight of wild hogs running along its shore. The men camped on the island where they discovered an abandoned palmetto house with an overgrown garden. Strobel then sailed northward to Boca Grande and Caldesi Island to the camp of Spanish fisherman José Caldez. Strobel witnessed the Spanish fishermen along Sanibel hauling in nearly 200 sheepshead and other fish from one large seine net (Hammond 1970). Despite laying the foundation for a self-sustaining community, the enterprise to settle Sanibel collapsed following the start of the Second Seminole War in 1835 (Dormer 1975; Hammond 1970).

During the Second Seminole War (1835–1842), US military vessels plied the Gulf waters and journeyed up the Caloosahatchee River to support the campaign to remove the Seminole from Florida. The initial years of the war largely took place in northern and central Florida where the Seminole repeatedly outsmarted the US Army and allied militia and native fighters. The fighting drifted into South Florida as the long war progressed, bringing the waters of southwest Florida into the mix. To help prosecute the war as the Seminole moved into the Everglades, the US Army established Fort Harvie on the Caloosahatchee River on November 4, 1841. The fort often was supplied by US vessels from the Gulf. With the conclusion of the war, the fort was deactivated on March 21, 1842. The remaining Seminole were relegated to a South Florida reservation that included present-day Lee County (Mahon 1985).

Further, the US military broke up the *ranchos* during the war for fear that they were allied with the Seminoles (Buker 1997; Mahon 1992). Lt. Powell of the US ship *Vandalia* reported in December 1836 that he had cruised from Key West to "Synabell" (i.e., Sanibel Island) and explored the island from there northward to Charlotte Harbor. He noted that his boats "were spread over the bay and among the keys"; "All the old 'Ranchos' were visited," he wrote, "but they had been abandoned, and for the most part, destroyed" (Hammond 1973).

In the years after the end of the Second Seminole War, the coast of southwest Florida was sparsely inhabited. After an 1849 Seminole conflict in southeastern Florida threatened to restart the war, the US military invested in the establishment of a short-lived fort on Useppa Island, Fort Casey, but abandoned it in less than a year as tensions subsided (Hammond 1973). Old Fort Harvie served to inspire the creation of Fort Myers in 1850. The military established Fort Myers on February 20, 1850, as part the response to renewed tension in South Florida (Brown 1991; Dovell 1952). In several years, the Third Seminole War (1855–1858) erupted. During the Third

Seminole War, Fort Myers served as the primary base of operation for US troops and was supplied by ships from the Gulf that traveled up the Caloosahatchee (Tebeau 1971). The fort was deactivated shortly after the war's conclusion.

During the brief period of peace between the Third Seminole War and the beginning of the Civil War, American cattlemen began migrating into southern Florida, further fueled by the building of a wharf at Punta Gorda on the Peace River in 1860 for shipping cattle to Cuba. Before long, cattle steamers powered by low-pressure steam engines joined the rank and file of traditional sailing ships plying the waters off Sanibel and Captiva. The Cuban cattle trade was prematurely cut short with the advent of Civil War (Brown 1991). While Sanibel and Captiva Island were not the site of any naval engagements, ships serving both the Confederate and Union causes sailed the nearby Gulf waters. Vessels included rebel blockade-runners and armed commerce raiders, as well as state-of-the-art federal warships propelled by steam and sail (Symonds 2012).

Fort Myers, quiet since the Third Seminole War ended, was reestablished by Union forces in January 1864 as a recruitment base to enlist Union sympathizers. From Fort Myers, Union forces disrupted cattle drives to the north, capturing beef, horses, and supplies essential to the Confederate military. Union forces reached the area by traveling by ship from Key West and then up the Caloosahatchee River. Frustrated with Union success, a Confederate force of 200 men left Fort Meade (Polk County) in February 1865 to attack Fort Myers. The Confederates failed to oust the Union forces. A month later as the war had turned against the Confederates across the South, the Union felt it was feasible to abandon Fort Myers (Buker 1992; Gannon 2018).

3.1.6 Late Nineteenth and Early Twentieth Century Period, 1865–1941

After the Civil War, the islands off the coast of Lee County remained almost deserted. US census takers who counted the population of Sanibel in 1870 found only two inhabitants (Hammond 1970). Cattlemen continued to move into the region of Lee County. In 1870, Francis A. Hendry, the largest cattle owner in the state, settled in one of the abandoned officer's quarters at Fort Myers, moving his herd closer to Punta Rassa, which became an important dock for shipping cattle to Cuba. Five years later, Hendry's herd totaled 25,000 and before his death on February 12, 1917, the herd reached 50,000. With such success, others followed in his footsteps, furthering settlement in the region (Brown 1991; Morris 1995).

While Fort Myers continued its upward trajectory, the barrier islands of Sanibel and Captiva remained largely devoid of inhabitants. Although the islands were open to homesteading, few pioneers took the government up on the offer. Those that did generally settled on Sanibel's easternmost tip, Point Ybel, where fertile soil could be found (Dormer 1975).

From 1885 to 1915, tarpon fishing influenced population growth and the development of the tourist industry in southwest Florida. A rustic fishing lodge at Punta Rassa was followed by larger hotels catering to fishermen in the former cow town of Fort Myers and at the settlement of St. James City across from Sanibel Island. Anglers found their catches along the passes and flats of the region. Their stories and photographs brought the coastal area into the consciousness of the greater country and fueled interest in the region (Kokomoor 2012).

With the continued expansion of the region's maritime industry and subsequent vessel traffic came an amplified call for navigational aids to mitigate the increasing probability of maritime disasters along coastal southwest Florida. In response, Congress supported the establishment of a lighthouse reservation on Sanibel Island across from the budding shipping site, Punta Rassa. As a result, the island as a whole was closed to homesteading in 1878. Point Ybel was chosen as the site for the proposed lighthouse (Dormer 1975).

The United States Light House Board began work on the Sanibel Light Station in 1884. The foundation was laid in March. A 162 ft wharf was completed on the site in early 1884. In the meantime, the Phoenix Iron Company of New Jersey fabricated the skeletal iron tower that the Board had chosen for the site. Such a tower was considered the best option for a region known for hurricanes. The Light House Board also ordered a 900 lb Fresnel lens for the tower (D'Entremont 2001).

The completed iron work for the tower, as well as iron work bound for a similar tower at Cape San Blas in the Florida Panhandle, was almost lost en route to Sanibel after the transport ship grounded in the Gulf about two miles from the island. Either on purpose or by accident, the iron parts went overboard. In the days following, two lighthouse vessels stationed in the Gulf region and workers from the island removed the lost cargo from the water. Assembled thereafter, the 98 ft lighthouse was lit on August 20, 1884 (Cipra 1997:29–31). In addition to the lighthouse, quarters and other support structures complemented the Light Station (LeBuff 2001:104). These three structures, along with the lighthouse, remain standing.

At the turn of the twentieth century, settlement and development in southwest Florida was increasing, largely due to the inland drainage efforts of Hamilton Disston and the completion of railroads into the region, both of which promoted agriculture and tourism (Dovell 1952; Gannon 2018). The barrier islands offshore of Lee County played a small role in the new growth. Reopened for homesteading in 1888, Sanibel and Captiva offered farmers a 9-month growing season (October to June) and produced an array of crops including citrus, peppers, eggplant, watermelons, and most notably tomatoes (Dormer 1975).

Captiva and Sanibel's centuries of relative isolation gradually faded as the twentieth century progressed. The opening of a ferry service in 1923 between Sanibel Island and Punta Rassa provided a link to the growing city of Fort Myers and the burgeoning real estate investment and tourism industries of Florida. The ferry carried passengers as well as automobiles and would serve as the primary means of travel to the islands for the next 35 years (LeBuff 2001). Sanibel connected to Captiva in this period via a bridge (*The Fort Myers Press* 1926.) The increasing traffic, as well as the statewide real estate boom, brought new attention to Captiva Island. A brochure from the period advertised homesites for sale and attempted to lure settlers with glowing descriptions of great fishing, beach swimming, shelling, and sunsets ("Captiva Beach" n.d.).

Unfortunately for island inhabitants two major hurricanes, in 1921 and 1926, swamped the islands, effectively salting the once-nutrient dense earth (Dormer 1975). This succession of hurricanes not only altered the soil, but the shape of the barrier islands. One of the most notable alterations was the opening of a new pass during the 1926 hurricane. Known as Redfish Pass, the new opening was a swath through the northern end of Captiva Island that created what is presently called North Captiva Island. According to a recent environmental study, the pass has maintained a relatively stable channel depth since its inception, approximately 1.67 to 1.82 m (5.5 to 6 ft). As a result, Redfish Pass has not been the subject of federal dredging (United States Army Corps of Engineers 2015).

Another consequence of the 1926 hurricane at Captiva Island was the loss of a barge. The Kinzie Brothers, who operated a steam line along the coast in this period, were the owners. The barge had been anchored to support the construction of a dock at a new residential development near Blind Pass. In the storm, the barge, loaded with piling and iron rods, disappeared. In the aftermath, no one knew if it had gone out into the Gulf or back into the sound, or if it simply had sunk in place (*The Fort Myers Press* 1926).

3.1.7 Mid-Twentieth Century to Early Twenty-First Century Period, 1941–Present

Captiva and Sanibel's evolution as a tourist destination was suspended while the United States fought World War II (1941–1945). During the war years, the Coast Guard conducted shore patrols and reconnaissance activities as the threat of a German U-Boat attack was serious. Such an attack never came although the Atlantic Coast shipping lanes were attacked. Hurricanes again ravaged the coast of Lee County in the 1940s. The Light Station on Sanibel suffered intense damage as a result. During a 1944 hurricane, the surf rushed under the quarters and threatened to wash them away. Two more hurricanes struck the region, one in September 1947 and the other in October. During both incidents, Cuban fishermen sought refuge at the Light Station. Both storms damaged the site's structures and eroded the grounds, leading the Coast Guard to establish a new station in nearby Fort Myers (D'Entremont 2001).

A key feature of the commercial fishing industry of Lee County, which had its start in the colonial period with Spanish fishermen from Cuba, was the emergence of Fort Myers Beach as a leading port in the state for shrimp in the early 1950s. The rise of the shrimp industry here was a consequence of the 1950 discovery of new shrimp beds in the Gulf of Mexico at Campeche Bay and off Key West. The docks at Fort Myers Beach provided a docking area that was adequately sheltered from hurricanes and convenient to ground transportation corridors (Hamilton 1951).

In the last half of the twentieth century, Captiva and Sanibel Islands underwent fairly intensive development in tandem with the general growth in population and development across the region. The small hotels, lodges, and beach cottages of the first half of the century gave way to condominium complexes and, especially on Captiva Island, beachside mansions and a golf resort. The completion of Sanibel Causeway in 1963, the arrival of I-75, the birth of the retirement industry, and the general growth of Florida since World War II brought a tremendous transformation in the latter half of the twentieth century. The waters around Lee County were busy with recreational fishermen and boaters while the beaches attracted visitors from across the world. Additionally, the commercial fishing industry caught 5,011,534 lb of fish and 2,408,395 lb of shellfish in 1991 (Gannon 2018; Lee County Economic Development 2020). Although the pace of development increased in much of Lee County, the government of Captiva and Sanibel Islands sought to preserve natural areas and prevent unbridled development.

3.2 CARTOGRAPHIC REVIEW

SEARCH reviewed historic charts to understand the historic setting of the APE. Located in the Gulf of Mexico, the APE is seaward of Redfish Pass, offshore Captiva Island. The general vicinity appears on a 1775 chart "The Coast of West Florida and Louisiana" by Thomas Jefferys and Robert Sayer. The area is labeled Charlotte Haven and shows what is known today as Boca Grande, the entrance to Charlotte Harbor north of the project area. An island shown to the south is likely Pine Island but no further details nor the islands of Captiva or Sanibel are depicted (**Figure 3**).

The area is shown on an 1848 US Coast Survey (USCS) chart (**Figure 4**). The chart notes both Captiva and Sanibel Islands as well as Pine Island (also called Cayo Costa on other maps and in current usage) and Big Pine Island (later just Pine Island, in current usage) between the barrier islands and the mainland. Boca Grande and Charlotte Harbor feature prominently. An anchorage is shown in 2 fathoms of water behind Sanibel Island. Captiva is shown as a single continuous island at this time between Sanibel Island and Cayo Costa. Soundings and the nature of the seabed are noted seaward of the islands.

A nautical chart dated 1900 shows offshore detail such as depths and seabed types and has a clearly marked 10 fathom line. Sanibel Island and Boca Grande are clearly labeled. However, three islands are depicted, rather than two as on the previous chart. It would seem that sometime between 1845 and 1900 a storm caused an overwash of Captiva Island dividing it into two separate entities. None of the three islands between Sanibel Island and Boca Grande are named. These would be Cayo Costa, North Captiva, and Captiva. The project area is shown off the north end of Captiva Island, which lies north of Sanibel Island (**Figure 5**).

The next chart dates from 1916. This nautical chart has considerably more offshore depth detail and more place-names including Sanibel, Captiva, Cayo Costa, Pine Island, and Pine Sound, which separates Pine Island from Sanibel and Captiva Islands. The chart also includes names for the various passes between the islands. Blind Pass separates Sanibel from Captiva. What formerly appeared as two islands on the 1900 chart has been connected by 1916 by a narrow and straight causeway to create one continuous Captiva Island at whose northern end is Captiva Pass, which separates Captiva from Cayo Costa. This causeway appears to be man-made. The APE is shown in its georeferenced position directly in front of that narrow causeway (**Figure 6**).

The next map dates to 1942 during World War II (**Figure 7**). This chart exhibits the same bathymetry data as the preceding chart of 1916 with the exception of the entrance to Boca Grande, which has a cut channel. Symbols for lighthouses and lit buoy markers have been modified and additional chart details such as adjoining chart numbers have also been added. However, for this study, the most important change since 1916 noted on the 1942 chart is the disappearance of the causeway joining the two halves of Captiva Island. In its place are shown shallows and the name "Redfish Pass." This causeway had been washed away over the course of two major hurricanes in 1921 and 1926.

The next nautical chart dates to 1970 (**Figure 8**). Major changes include updated bathymetry data offshore, the addition of a safety fairway to the approach to Boca Grande inlet, dropping of bathymetry from Pine Sound, and the darkening of the lighthouse in Charlotte Harbor. The symbol for lighthouses has also changed.

The last map in the series is a nautical chart published in 1983 (**Figure 9**). This map carries the same offshore bathymetry as the 1970 chart. The safety fairway approach to Boca Grande has been shifted to the north and an anchorage added just south of the Boca Grande inlet. The Redfish Pass area is shown to be buoyed, which was not the case in 1970.

This map series suggests that the nature of Captiva and North Captiva barrier islands is a changing one; at some times they are naturally, or engineered to be, a single island and at others nature divides the one into two.

Figure 3. Detail of the 1775 Jefferys and Sayer map showing Charlotte Haven, or Boca Grande, just to the north of the project area (Library of Congress).

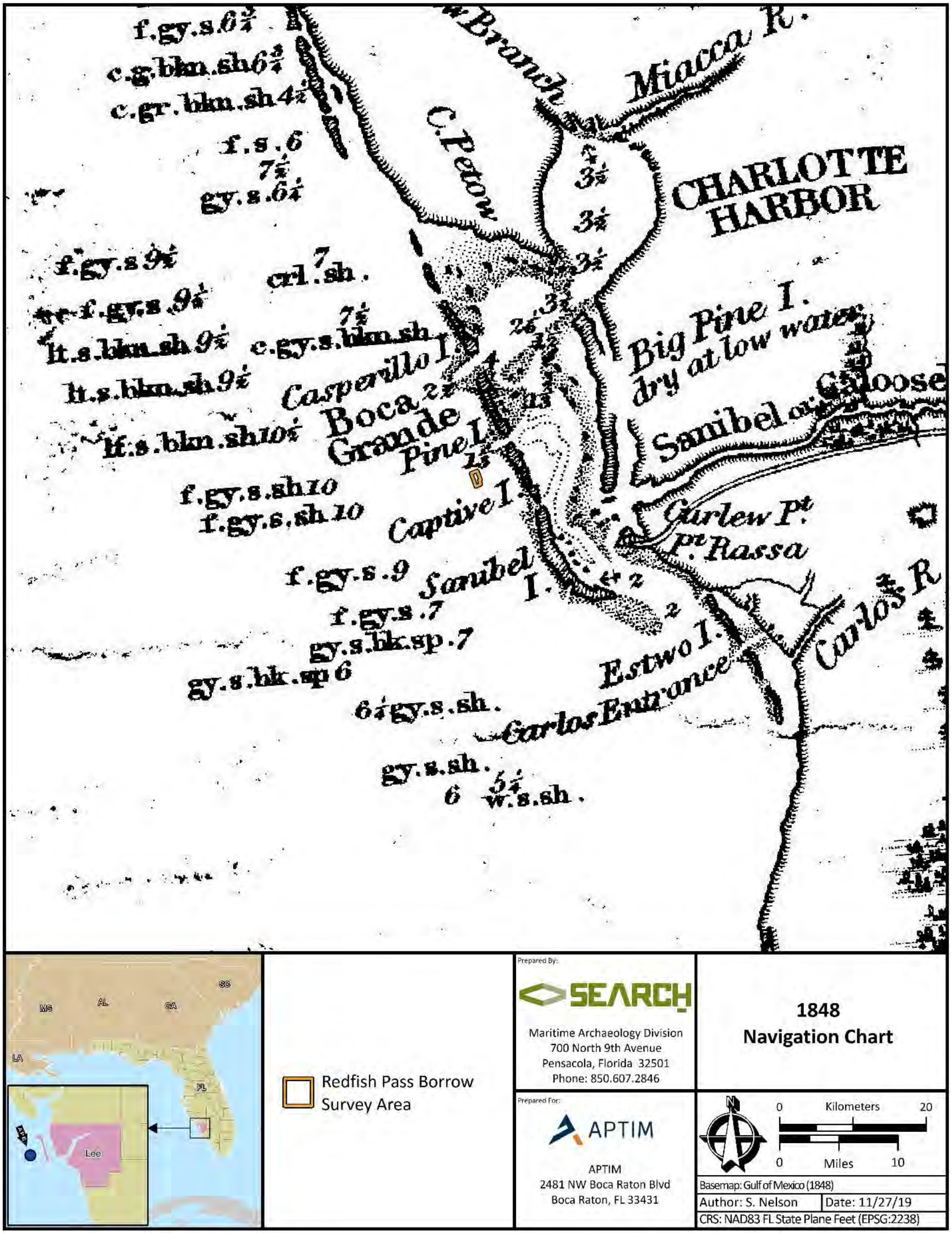

Figure 4. The project area shown on a nautical chart dated 1848.

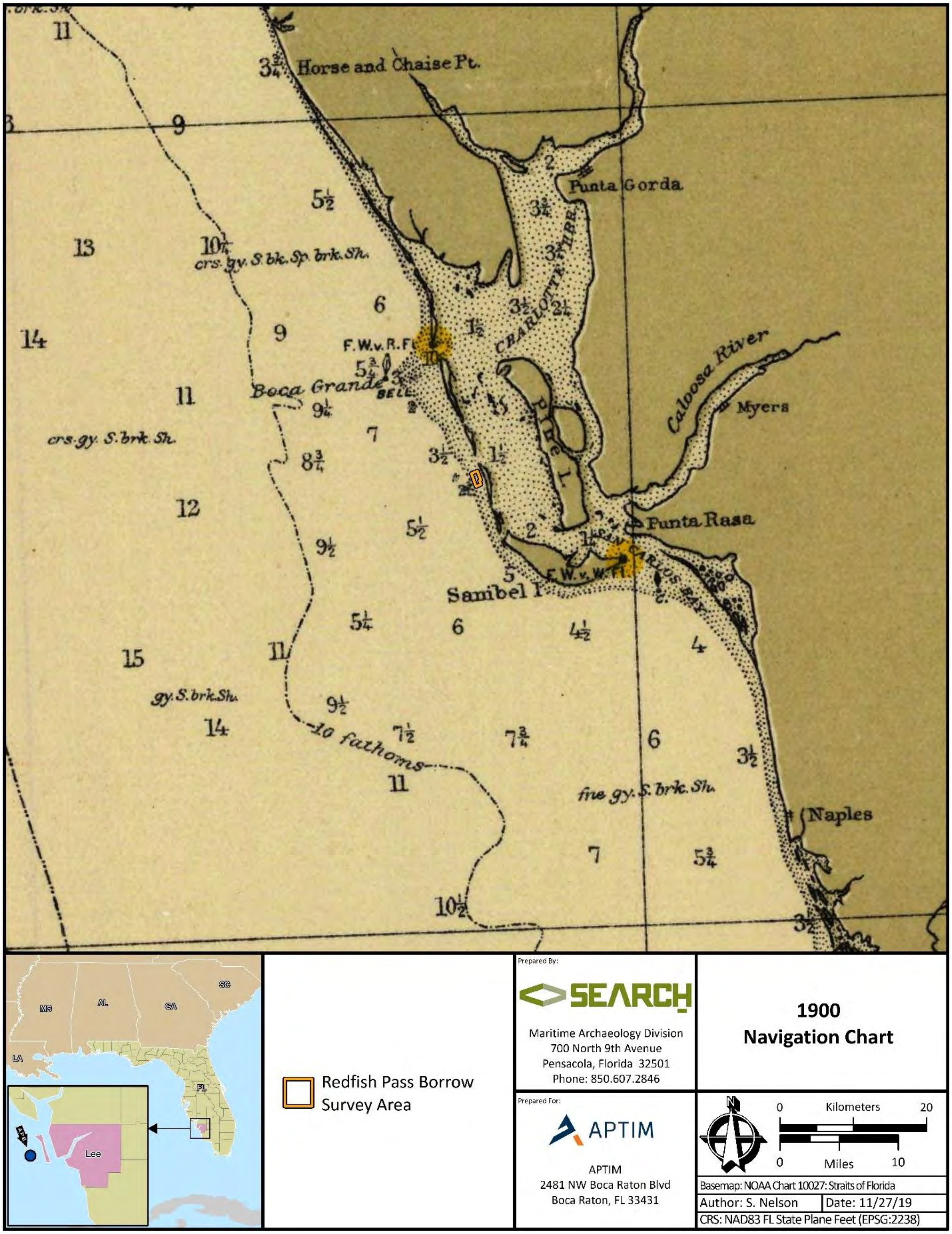

Figure 5. Nautical chart dated 1900 showing three distinct islands between Sanibel and Boca Grande.

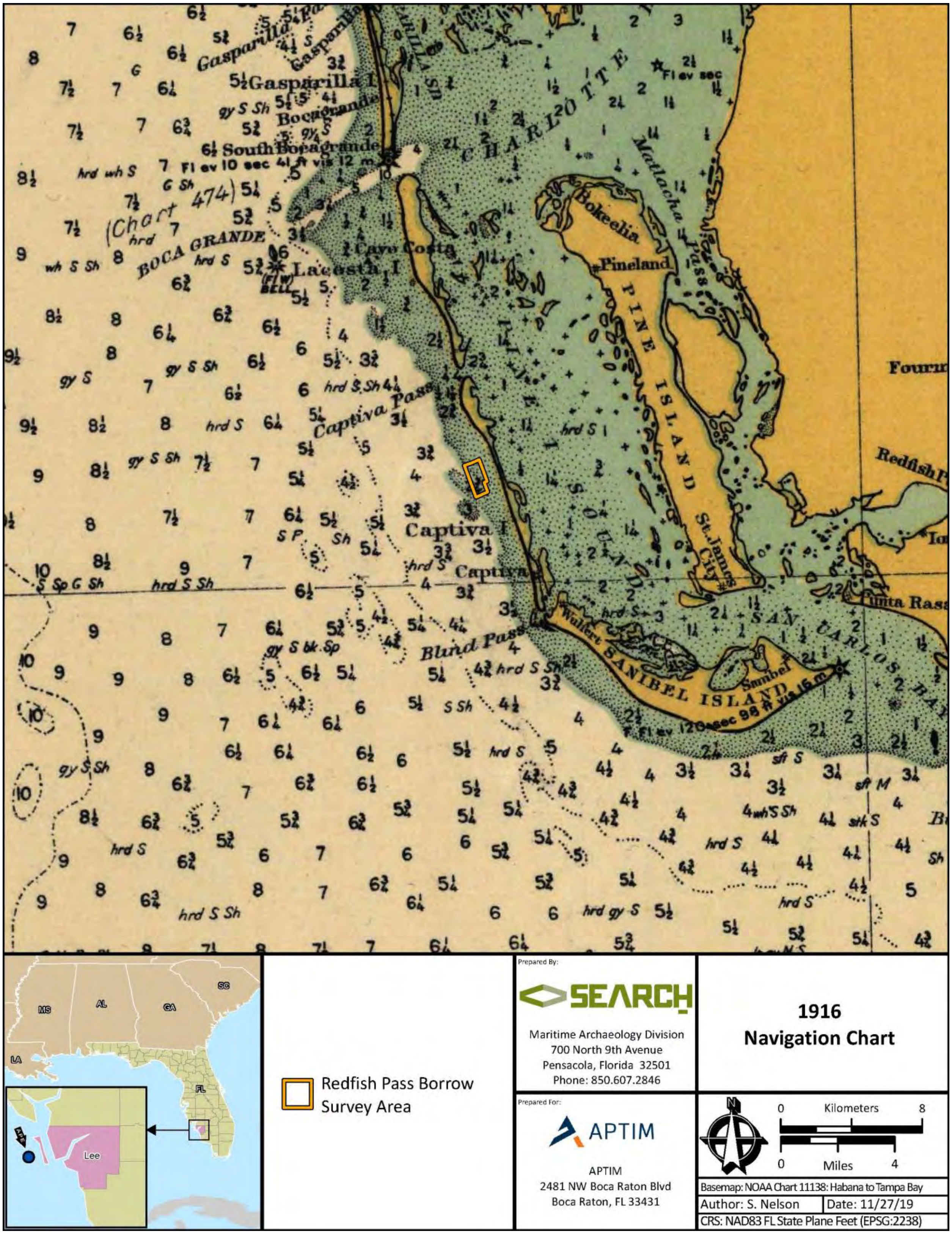

Figure 6. Nautical chart dated 1916 showing a strait causeway connecting Captiva and North Captiva Islands.

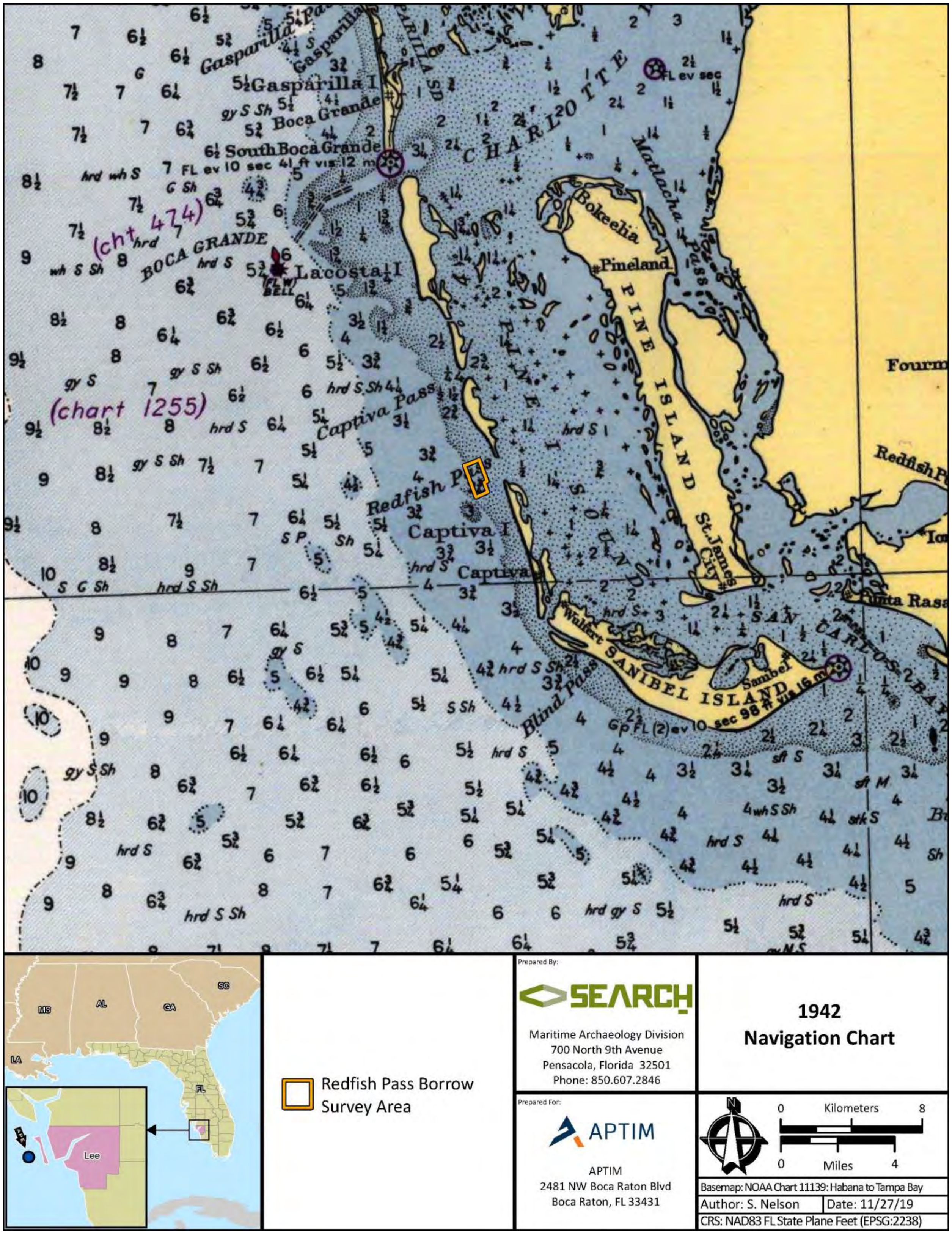

Figure 7. US Coast and Geodetic Survey nautical chart dated 1942 showing posthurricane division of Captiva Island.

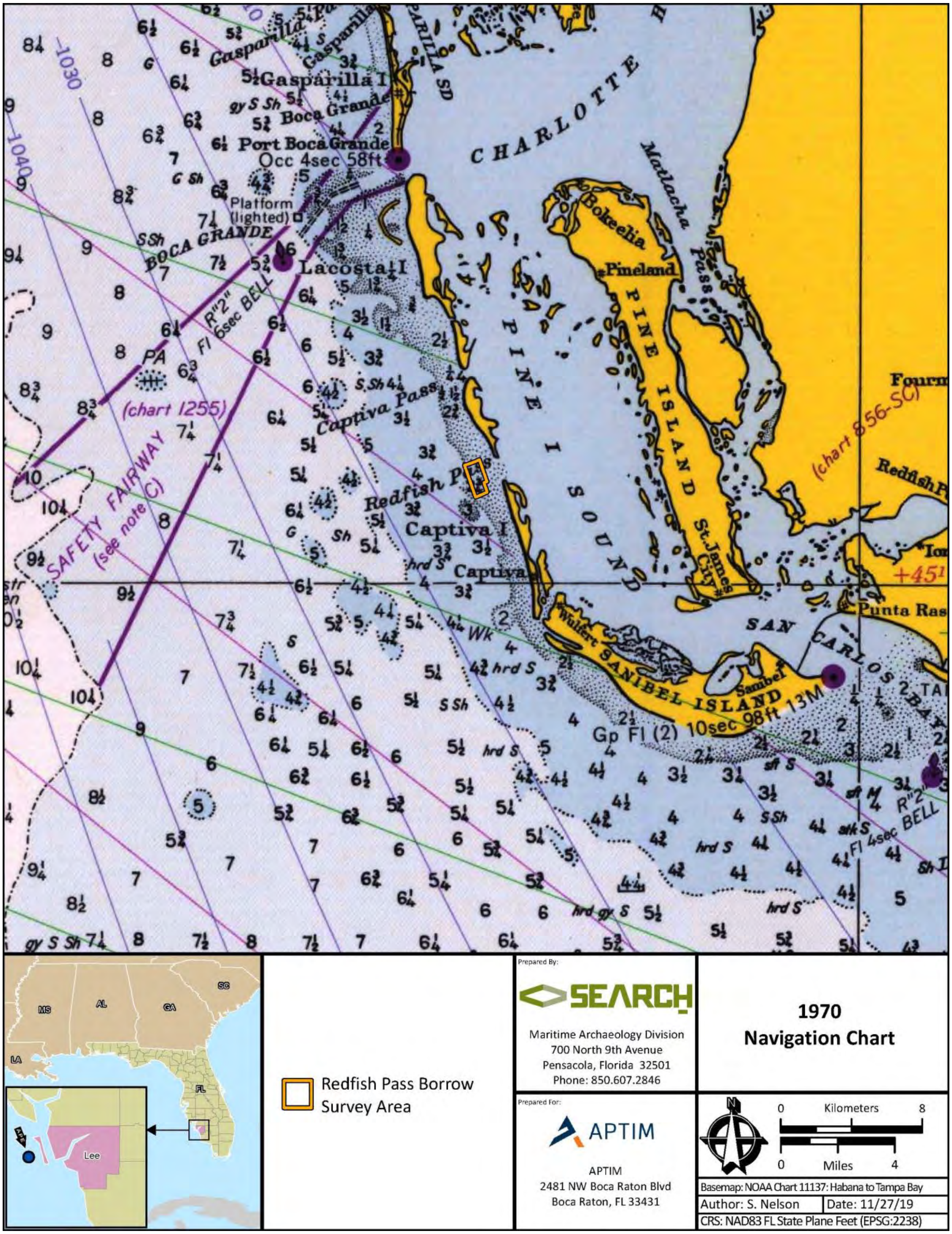

Figure 8. Navigation chart dated 1970.

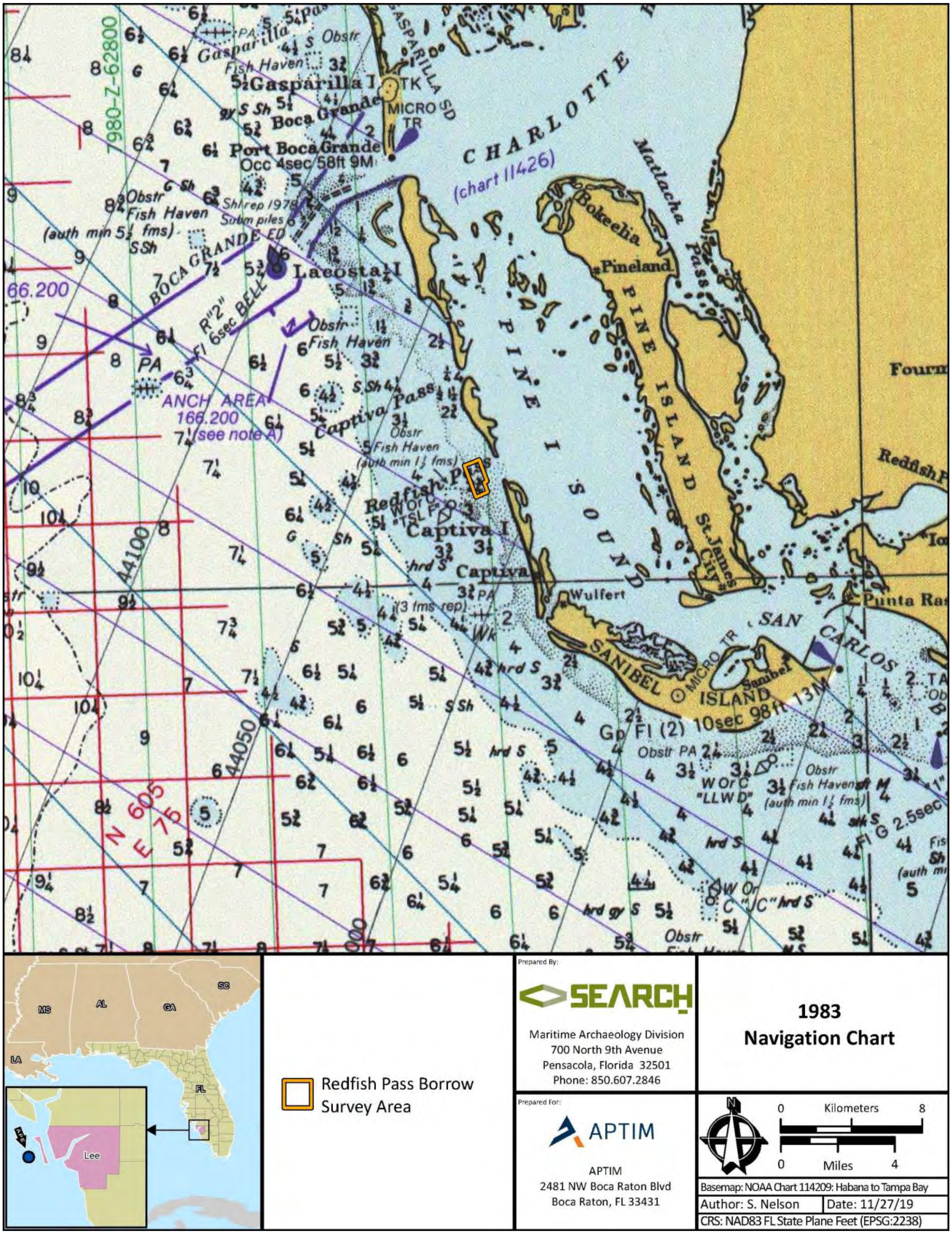

Figure 9. National Oceanic and Atmospheric Administration (NOAA) nautical chart dated 1983.

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4 RESEARCH DESIGN

SEARCH developed a predictive model for potential submerged cultural resources within the APE based on the maritime history of Lee County, Florida. The predictive model was utilized to help determine the potential for historic shipwrecks and structures within the APE, as well as their likely design, composition, and age. The remote-sensing data collected for this project were then processed in a manner that facilitates identifying potential submerged cultural resources. The predictive model provided a historical context for the interpretation of the processed remote-sensing data and a tool to help identify potential submerged cultural resources.

With regard to potential shipwreck sites, SEARCH has improved upon previous remote-sensing data interpretation hypotheses to understand the characteristics that various vessel types and construction ages will produce in the remote-sensing record. SEARCH applied this research to the data collected during the remote-sensing survey, cognizant of those shipwreck types expected offshore of Jacksonville Harbor by the predictive model, to determine whether these potential submerged cultural resources exist within the APE. Finally, SEARCH reviewed databases of reported shipwrecks, cartographic records, secondary sources, and previous maritime archaeological investigations conducted in the region to identify shipwrecks or previously documented magnetic/acoustic signatures potentially indicative of submerged cultural resources. These data were correlated with the current survey data to assist in identifying potential submerged cultural resources.

4.1 POTENTIAL FOR SUBMERGED CULTURAL RESOURCES

Part of predicting the occurrence of historic shipwrecks within the APE and assigning a level of confidence involves reviewing the historic context of the region to determine the likelihood of such events and characterizing the types of vessels involved. Once known, this can be translated to the assessment of remote-sensing signatures that could ultimately identify potential submerged cultural resources within the APE. The following is a predictive exercise that attempts to describe the potential for the occurrence of historic shipwrecks within the APE from varying time periods, which is applied to the remote-sensing results in this report.

The precontact landscape surrounding the Redfish Pass and Captiva Island would have likely supported habitation. Therefore, potential exists for precontact submerged cultural resources to be located in the APE given the precontact occupation of the once-exposed subarea. The preservation potential for submerged archaeological resources within the APE varies and is highly dependent on the duration of exposure and resource composition. Marine transgression and seafloor sedimentation are the main environmental factors affecting preservation (TRC Environmental Corporation 2012). A low sedimentation rate along the continental margin within the last 10,000 years resulted in a seafloor that is highly exposed to erosional forces associated with marine transgression and bottom currents (Goff et al. 2005). For example, Native American dugout wooden canoes, used for fishing and open water transportation, are not likely to exist intact on the seafloor. This expectation results from the propensity for exposed wood to deteriorate in marine environments with high erosional force. The best chance of survival for such submerged cultural resources exists if the resources were buried within marine sediment. Burial is possible in instances of quick, large-scale flooding resulting in rapid sediment accumulation (Uchupi et al. 2001). Additionally, geological resources suggestive of potential precontact occupation sites, such as relict channels and associated paleolandscapes, are protected from erosional forces and have the potential to be recognized beneath the seafloor via a subbottom profiler.

The APE is approximately 0.8 km (0.5 mi) west of Captiva Island. The maritime historical context of the region supports the potential for historic submerged cultural resources to exist. European exploration of Florida in the mid-sixteenth century brought the first European maritime transportation—sailing craft—that is readily detectable with remote-sensing technologies. The area was relatively unexplored until the eighteenth century, however. The occurrence of smaller vernacular craft associated with Cuban, and later American, fishing activity within the APE is possible. Also, a more substantial shipwreck of a vessel engaged in Gulf of Mexico trade may have occurred in the project area during some past storm event. Finally, Captiva Island's establishment as a recreational destination in the latter half of the twentieth century would increase the likelihood that recreational vessels would be discovered within the APE.

4.2 PREVIOUSLY IDENTIFIED SITES AND SURVEYS

One previously recorded archaeological site occurs within 1.6 km (1.0 mi) the APE, and two previous terrestrial archaeological investigations are reported within 1.6 km (1.0 mi) of the APE (see **Figure 10**). Archeological site 8LL01611 is recorded as a historic structure, a fishing cottage that dates to the 1920s. The site is representative of vernacular architecture associated with a vanishing industry, that is, commercial fishing (Florida Master Site File [FMSF] 1992:3). The two archaeological surveys (FMSF Survey Nos. 12991 and 21902) were conducted in 2006 and 2009. Neither of these surveys located or identified any archaeological sites or material.

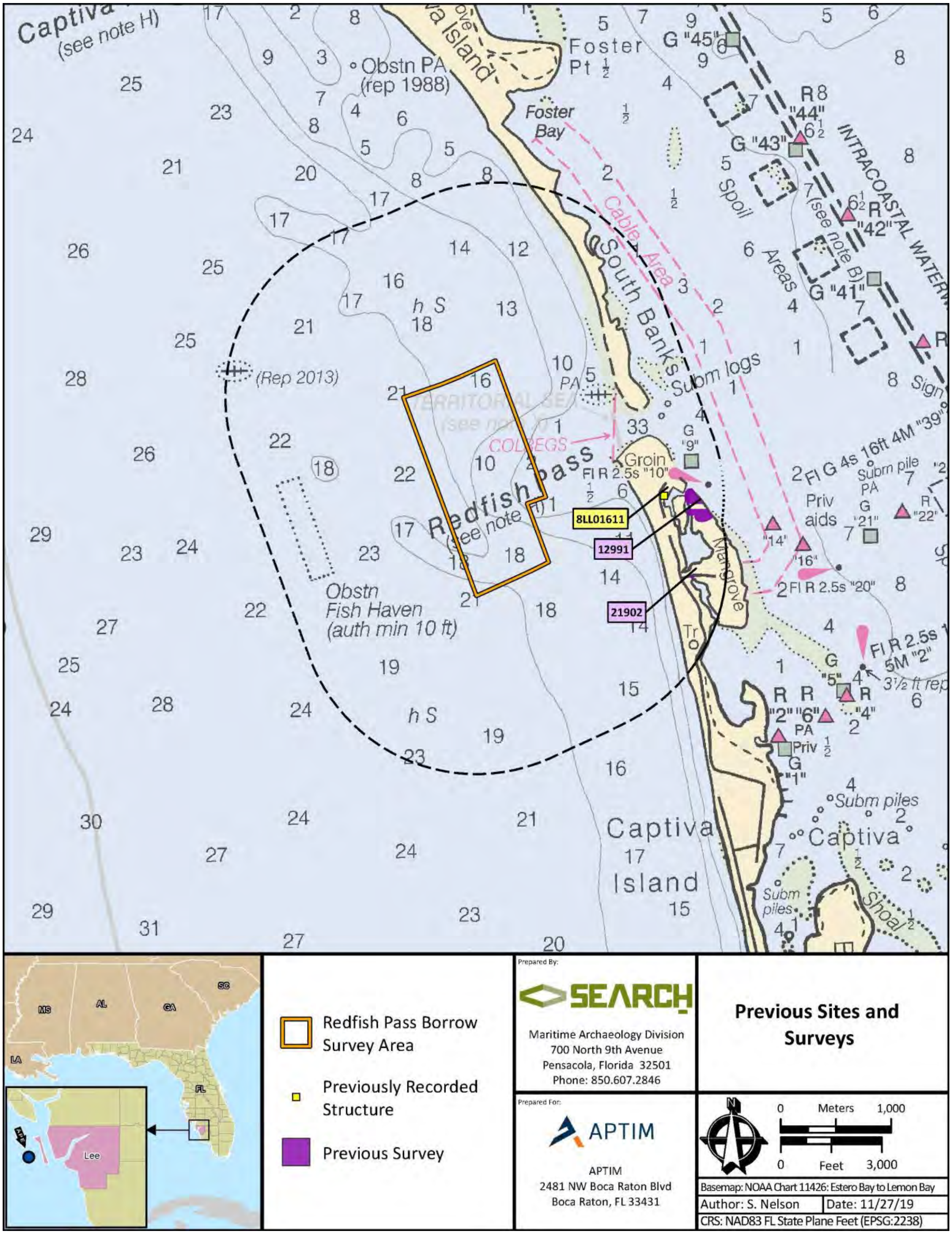

Figure 10. Previously recorded archaeological site and surveys within a 1.6 km (1 mi) radius of the project APE.

4.3 REPORTED SUBMERGED CULTURAL RESOURCES

SEARCH reviewed cartographic images (see **Figures 3-9**), secondary sources, and databases of reported shipwrecks to complement the predictive model by identifying reported submerged cultural resources within or adjacent to the APE. The following database sources were reviewed:

- Bureau of Ocean Energy Management (BOEM) Archaeological Resource Information Database
- Global GIS Data Services LLC, Global Maritime Wrecks Database
- NOAA Automated Wreck and Obstruction Information System
- NOAA nautical charts
- FMSF

Figure 11 and **Table 1** illustrate shipwrecks that have been reported within 1.6 km (1.0 mi) of the APE. Two reported shipwrecks occur within 1.6 km (1.0 mi) of the APE, and two obstructions are reported within 1.6 km (1.0 mi) of the APE (see **Figure 11**). One of the shipwrecks, whose position is charted as approximate, is along the shore of North Captiva Island on the Gulf side of the island, approximately 0.8 km (0.5 mi) northeast of the Redfish Pass APE. The second, first reported in 2013, is located northwest of the APE in approximately 8.0 m (25 feet) of water. The two obstructions are designated as a “fish haven” and “submerged logs,” and both are reported within the mainland side of Redfish Pass.

The position accuracy for historic shipwrecks is tentative at best in most instances. Historic shipwrecks generally are plotted based on contemporary records, maps, or oral histories. Many shipwreck databases provide a range of position accuracy or an accuracy reliability scale. Therefore, **Figure 11** and **Table 1** do not constitute an exhaustive list of reported shipwrecks potentially within the 1.6 km (1.0 mi) buffer zone around the APE, and not every shipwreck necessarily resides where it is depicted.

Table 1. Shipwrecks reported within 1.6 km (1.0 mi) of the APE.

Map ID	Vessel Name	Date Sunk	Comment	ID (Source)
742	Unknown	Unknown	Unknown	742 (BOEM)
7661	Unknown	Unknown	Reported 2013	7661 (BOEM)

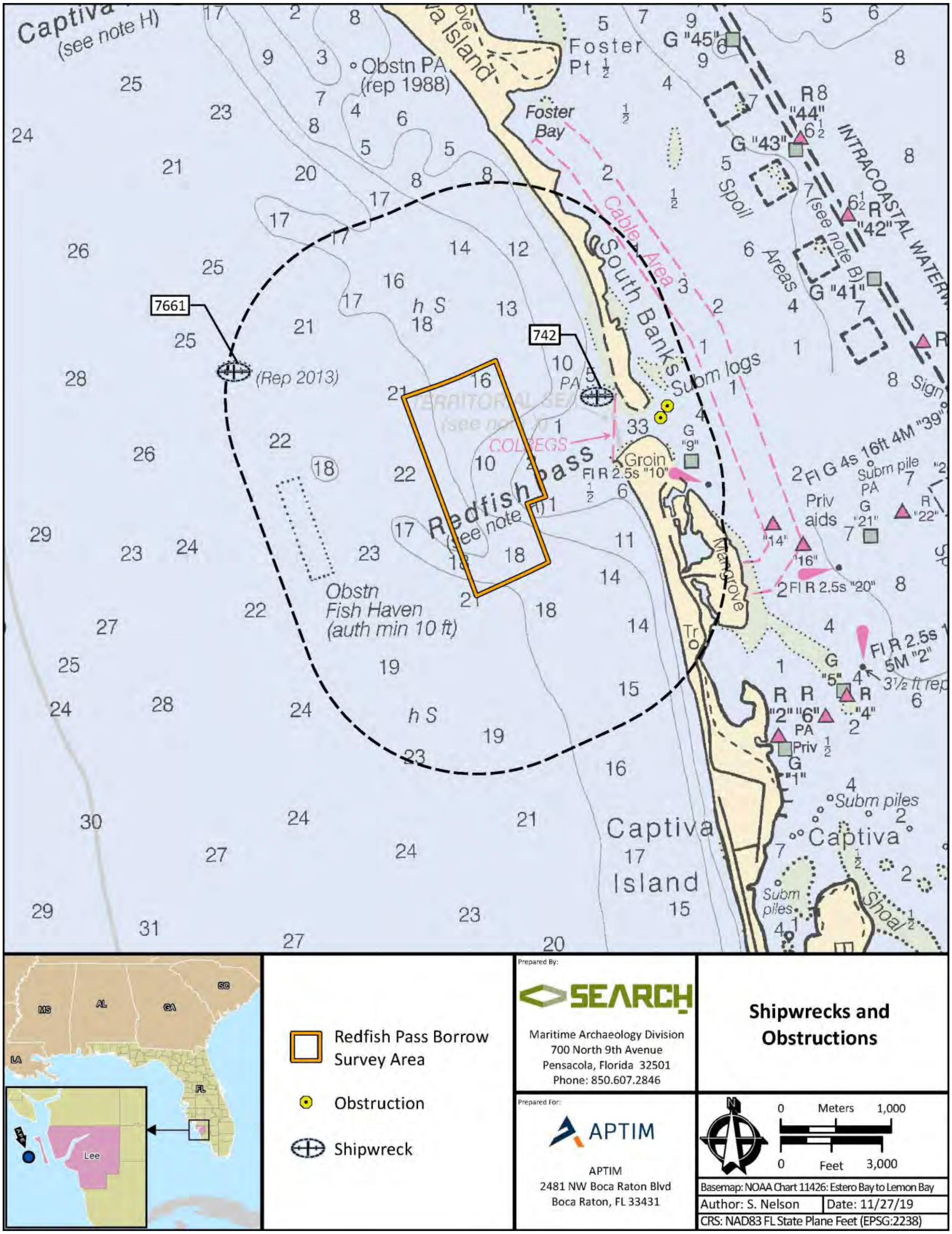

Figure 11. Shipwrecks and obstructions reported in the vicinity of the APE.

4.4 PREVIOUS MARITIME INVESTIGATIONS

No previous maritime archaeological investigations have occurred within 1.6 km (1.0 mi) of the current APE. SEARCH identified two previous maritime archaeological investigations, briefly described below, that have occurred within approximately 1 km (10 mi) of the current APE, and are of note because the objectives, methodology, and environment are similar to the current APE and project goals. The two surveys (Pabdover et al. 2001, FMSF no. 6660; Lydecker et. al 2013, FMSF no. 21237) were conducted for offshore borrow areas proposed for beach renourishment.

In 2001, Tidewater Atlantic Research Inc. (Pabdover et al. 2001, FMSF no. 6660), under contract with Coastal Planning and Engineering Inc., conducted an underwater remote-sensing survey of two proposed sand borrow areas. One area is approximately 3 mi west-northwest of Captiva Pass. The second area is approximately 8 mi west-southwest of Blind Pass. The survey identified a total of two magnetic anomalies in the two borrow areas; neither was determined to have potential association with potentially significant shipwreck remains.

In June 2013, Panamerican Consultants Inc. (PCI) conducted an underwater remote-sensing survey of the proposed Gasparilla borrow area on behalf of the U.S. Army Corps of Engineers (Lydecker et. al 2013, FMSF no. 21237). PCI identified 24 magnetic anomalies, 15 side-scan sonar targets, and 3 subbottom features within the surveyed area. PCI determined that two of the magnetic anomalies and one of the subbottom features have the potential to represent significant cultural resources. PCI conducted diver investigation on two of the magnetic anomalies and did not identify any cultural resources. The subbottom feature was determined to be deeply buried and the Corps determined that the proposed borrow area would have no effect on the subbottom feature.

4.5 REMOTE-SENSING SURVEY METHODOLOGY

A suite of remote-sensing instruments is available to the maritime archaeologist to accomplish this task, including side-scan sonars, subbottom profilers, and marine magnetometers. A side-scan sonar utilizes acoustic signals to produce an image of the seafloor and any objects protruding above it. This image is ideal for detecting and recognizing submerged cultural resources exposed above the sediment. A subbottom profiler utilizes soundwaves to penetrate the seafloor in an effort to illustrate what is buried below the seafloor. The imagery produced is an archaeologist's best resource for detecting density changes potentially indicative of submerged paleolandscapes. The magnetometer detects anomalies in the earth's magnetic field produced by ferrous objects. A magnetometer is best for detecting buried and submerged historic cultural resources not visible in the side-scan sonar record. The copious amount of iron utilized in the construction and operation of historic vessels affords the magnetometer the opportunity to detect most shipwrecks, if the maritime archaeologist designs a proper data collection methodology. Although magnetic detection of buried submerged cultural resources can be accomplished, recognition of a resource in the magnetic record is more complicated. This requires knowledge of magnetic theory and how it applies to maritime archaeology, as well as examples of verified shipwreck magnetic signatures with which to compare current data.


Figure 12. Research vessel *Eugenie Clark*.

SEARCH conducted the marine archaeological monitoring ride-along for the remote-sensing survey on January 14 and January 15, 2020. SEARCH monitored all phases of the survey, which was conducted under the direction of APTIM. The survey was conducted from Mote Marine Laboratory's 14 m (46 ft) shallow draft research vessel *Eugenie Clark*, integrated with Hypack Inc. hydrographic navigation software for vessel guidance (**Figure 12**). APTIM utilized a Trimble 5700 Real Time Kinematic (RTK) global positioning system (GPS), Geometrics G-882 Digital Cesium Marine Magnetometer, Edgetech 4125 dual-frequency (600/1,600 kilohertz [kHz]), an EdgeTech 3200 X-STAR SB-512i subbottom profiler, and an Odom Hydrographic Systems, Inc. "Hydrotrac II" Hydrographic Echo Sounder. The survey was designed to meet current best practices for maritime archaeological investigations and comply with FDHR's *Performance Standards for Submerged Remote Sensing Survey.* All work was conducted under Permit No. 1920.039 (**Appendix B**), which was issued under the authority of Chapters 267.031 (1) and 267.12, Florida Statutes and Rule 1A-32, Florida Administrative Code, administered by the Florida Bureau of Archaeological Research (BAR). As such, APTIM planned lines in accordance with FDHR's *Performance Standards for Submerged Remote Sensing Survey* standards (**Figure 13**). APTIM collected 65.8 line-km (40.9 line-mi) of data during this survey, completely covering the APE.

APTIM maintained consistent altitude of all equipment during survey so that data acquisition met optimal archaeological standards. It is ideal to collect magnetic data at an altitude from the seafloor of no greater than approximately 6.1 m (20 ft). Side-scan sonar acoustics should image greater than 100% of the surveyed area, which includes the blank nadir region beneath the towfish, while maintaining an altitude above the seafloor between 10% and 20% of the selected range. This is achieved through a combination of instrument frequency and range, as well as towfish altitude. APTIM towed the magnetometer behind the vessel at distances and speeds that would maintain proper altitude. Cable distance varied, and all changes during the survey were recorded. The subbottom profiler was mounted on the starboard just off the stern; the side-scan sonar was also mounted on the starboard side, approximately midship. The design-level survey incorporated 37 parallel survey lines spaced 30 m (98 ft) apart with five tie lines (**Appendix C**). Vessel speed varied as well, but did not exceed 5 knots whenever possible, and oftentimes was slower to maintain the proper instrument altitudes as detailed above.

HYPACK navigation software, interfaced with the RTK GPS, maintained vessel and equipment positioning with up to centimeter-level accuracy by means of layback calculations and logged real-time positional, magnetic, and bathymetric data. Magnetometer data were collected using

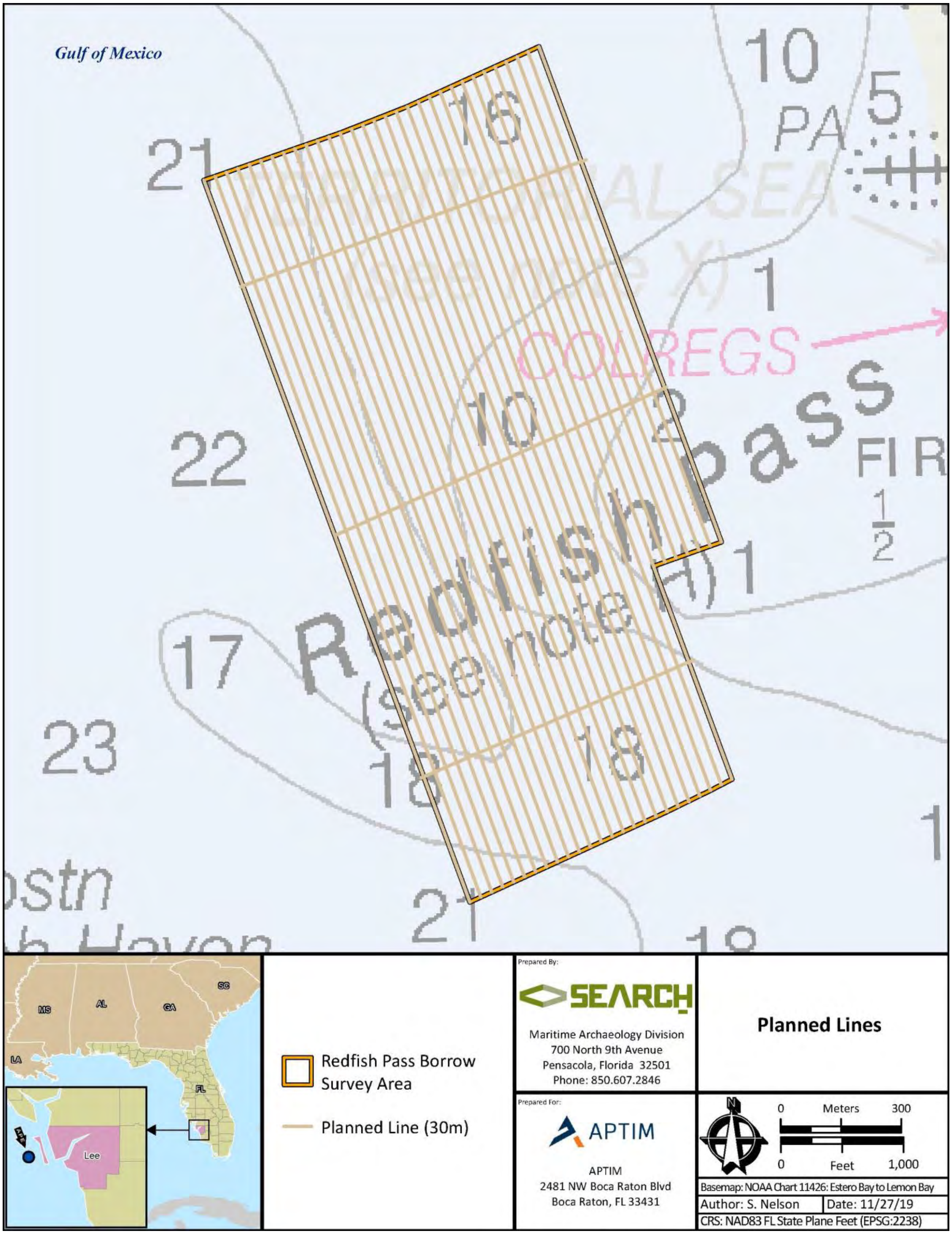

Figure 13. Planned survey lines of the APE.

the factory-set scale and sensitivity settings, 0.004 nT/πHz rms (nT = nanotesla or gamma). Side-scan sonar acoustic imagery was collected at 600 kHz (120 m [394 ft] range) and 1,600 kHz (35 m [115 ft] range). These settings provided a low frequency (600 kHz) swath of 240 m (787 ft) and a high frequency (1,600 kHz) swath of 70 m (230 ft). The subbottom reflector operated using pulse with a frequency sweep of 0.7 kHz to 12.0 kHz and a 20-millisecond (ms) pulse length. The system was set to ping at a rate of 8 Hz and was run with a 10% power level. HYPACK maintained vessel equipment positioning by means of layback calculation with submeter accuracy and logged real-time positional, magnetic, and bathymetric data. Horizontal data were collected in the Florida State Plane coordinate system (Zone Florida West) based on the NAD83 datum in US feet. All project data were incorporated into a GIS geodatabase for organization, scientific analyses, and archiving.

4.6 REMOTE-SENSING DATA PROCESSING AND INTERPRETATION METHODOLOGY

4.6.1 Subbottom Profiler

Raw subbottom profiler imagery was imported into Chesapeake Technology Inc., SonarWiz 7 processing software using settings adjusted for the EdgeTech 3200 acquisition methods. Following importation of the raw imagery, bottom tracking was performed to identify the first acoustic return, thereby setting altitude of the towfish above the seafloor. If excessive swells were encountered during data collection, then the imagery was filtered to smooth the bottom track. Finally, gain, color, and contrast settings were adjusted to produce a desirable image and enhance any buried reflectors. SEARCH reviewed each line of processed imagery in cross-section view to identify man-made and natural features, including potential submerged cultural resources on or buried beneath the seafloor. Each reflector was assigned a unique identifier and descriptive information was tabulated (e.g., water depth, reflector depth, dGPS position, possible identification, etc.).

Subbottom profiler imagery consists of higher and lower amplitude reflections, due to sediment characteristics, observed as darker and lighter areas within the raw imagery. The imagery is fairly limited in scope; data collected represent the narrow swath of seafloor located directly beneath the towfish. To account for these factors, the marine surveyor must determine the appropriate frequency at which the sub-bottom profiler will operate to ensure its effectiveness as an archaeological instrument. A low-frequency setting, such as 4.0–16 kHz, will achieve greater penetration into the seafloor but provides low-resolution imagery. Conversely, a high- frequency setting, such as 4.0–24 kHz, will provide higher resolution imagery but achieves less vertical penetration below the seafloor.

The vertical range of data collection was set prior to acquisition to ensure that the seafloor and secondary return are clearly evident in the data, while limiting the overall depth so that areas beyond the sensor capabilities are not recorded. The range is unique for each survey and dependent on bottom substrate and compactness.

In the strictest sense, subbottom profiler imagery does not identify artifacts or other physical evidence of precontact occupation, but rather aids in the identification of paleolandforms or geomorphological features that have a potential to contain precontact archaeological sites. With regard to historic submerged cultural resources, subbottom profiler imagery can reveal the existence of historic remains buried beneath the seafloor or corroborate side-scan sonar imagery when an object rests atop the seafloor.

4.6.2 Side-Scan Sonar

SEARCH reviewed each line of raw side-scan sonar imagery from the survey to locate acoustic contacts indicative of man-made features and potential submerged cultural resources protruding above the seafloor. Each contact was assigned a unique identifier, and descriptive information was collected and tabulated (e.g., length, width, dGPS position, possible identification, etc.). SEARCH also generated a mosaic image of the APE comprising all raw sonar imagery. The ability to mosaic the imagery was made possible with embedded positional data from the dGPS utilizing Chesapeake Technology Inc. SonarWiz 7 sonar-processing software. High-frequency imagery files (1,600 kHz) were imported into the software at settings adjusted for the EdgeTech 4125 acquisition methods. Following importation of the raw imagery, bottom tracking was performed to identify the first acoustic return, which determines the altitude of the towfish above the seafloor, creates a slant-range-corrected record, and removes the water column from the nadir region. Gain, color, and contrast settings were adjusted for each file to produce an optimal and even image across the entire mosaic. Returns from overlapping files were averaged. Thus, if a contact contrasts well on one track line, but not on an adjacent line, averaged returns from both lines ensure significant contrast for contact detection. The mosaic was exported as multiple georectified images (geotiff format) with a resolution of 0.15 m/pixel (0.5 ft/pixel) and imported into ArcGIS 10.7 so that it could be layered with other project data (e.g., magnetic contour map, APE boundary, etc.) and facilitate archaeological analysis.

4.6.3 Magnetometer

Magnetic data were reviewed in a profile image similar to an echogram to identify and edit errant data. The raw magnetic data (*x, y* positional coordinates + *z* magnetic values) were then processed into a contour map, which allows the best representation of three-dimensional data on a two-dimensional plane and facilitates interpretation of the interaction of a magnetic source with the earth's magnetic field. The process involved with creating this contour map consists of removing the diurnal variation from the data, creating a regularly spaced grid of the irregularly spaced data points, and generating contours that are visually concise and accurately represent anomalies in the earth's magnetic field.

The earth's background magnetic value at any particular geographic location fluctuates slightly from day to day and throughout each day (diurnal variation). This variation is evident in the raw magnetometer data (*z-value*) and results in a cluttered map when contoured. To overcome this, SEARCH filtered the raw magnetometer data through a mathematical algorithm. The algorithm defines each raw *z-value* as either higher than the magnetic background (positive) or lower than the magnetic background (negative). The algorithm replaces the raw *z-value* with this positive or negative number, which is relative to the magnetic background at the particular date, time, and geographic location it was recorded. The diurnal variation is easily identified and removed from the relative *z-value*s, which facilitates contouring and provides a "clean" contour map. More importantly, this process affords a direct one-to-one comparison of magnetic amplitudes and negative-to-positive ratios of anomalies no matter when or where they were recorded—something that is not possible with raw magnetic values.

The *x, y,* and relative *z* data were imported into Golden Software Inc.'s Surfer contouring and three-dimensional surface mapping software (v14). SEARCH instructed the Surfer to grid the processed magnetic data based on data collection methodology and magnetic theory as it applies to the correlation between source amplitude and its distance from the magnetometer sensor. SEARCH first filtered the data to 1.0 Hz, which is a more manageable dataset for the relatively large survey area and sufficient data for archaeological purposes. The inline distance between raw data points, based on the filtered rate of collection (1.0 Hz) and the average survey vessel speed during data collection (5 knots) equates to approximately 2.6 m (8.4 ft). Data were collected along parallel survey lines spaced approximately 30 m (98 ft) apart. Based on these parameters, SEARCH's Surfer gridline geometry was set at 2.6 m (8.4 ft) between nodes, with a search ellipse of 1.5 times the survey line distance (i.e., 23 m [75 ft]). SEARCH selected a gridding interpolation method following the magnetic theory that magnetic amplitude decreases inversely proportional to the cube of the distance between the source and the magnetometer sensor (Breiner 1999). The resulting magnetic data grid consists of regularly spaced data nodes interpolated from the irregularly spaced magnetometer data. SEARCH next contoured the filtered relative magnetometer data using the interpolated magnetic data grid. The initial contour interval was set at 5 gammas with 100-gamma index contours. Positive contours are depicted in orange (5-gamma interval) and red (100-gamma interval), while negative contours are light blue (5-gamma interval) and dark blue (100-gamma interval).

Previous research concerning magnetic theory as it applies to archaeological resources and remote-sensing survey (e.g., Breiner 1999; Enright 2009; Enright et al. 2003, 2006; Garrison et al. 1989; Gearhart 2004, 2011; VonFrese 1986) assisted SEARCH's interpretation of the processed magnetic data and helped to identify the presence or absence of potential shipwreck anomalies. Research has demonstrated that the complex distributions of the many ferromagnetic components of a typical vessel tend to cancel one another in the shipwreck's contoured magnetic signature and present a relatively simple pattern as a whole. The composite magnetic signature of a complex source such as a shipwreck consists of the permanent magnetism of each individual ferromagnetic component plus the relatively weaker induced magnetism caused by the earth's magnetic field. Even though the permanent magnetism of the individual components alone would dominate the weaker earth-induced magnetism, a complex concentration of numerous magnetic anomalies overlapping one another tends to minimize or negate the permanent magnetism of individual ferromagnetic objects, leaving a composite anomaly dominated by the earth-induced signature. Consequently, a shipwreck anomaly tends to exhibit a general dipolar pattern (i.e., a positive lobe and a negative lobe) where the polar axis is dominated by the earth-induced portion of the composite and, therefore, aligns itself with the earth's magnetic field, regardless of site orientation (anomalies are generally characterized as dipolar, monopolar, or multicomponent [**Figure 14**]).

The majority of negative contours are oriented in the northern hemisphere of a shipwreck anomaly, while the majority of positive contours are situated to the south. The polar axis of the principal dipole (the magnetic vector from positive peak to negative peak) is oriented toward magnetic north, within ±26 degrees (the magnetic declination in the APE at the time of survey was 3.98 degrees W, ±0.33 degrees). **Figure 15** illustrates this characteristic. This figure is a collection of verified shipwrecks recorded previously by SEARCH maritime archaeologists. Contour interval is identical in all images, except two (discussed below), and scale is the same in all images.

Site formation processes and decreased distance between sensor and source will alter this arrangement somewhat and induce a more complex anomaly. Surveys that decrease the sensor-to-source distance (e.g., shallow-water survey) will produce a complex, multicomponent anomaly comprising multiple monopoles and dipoles within the induced anomaly pattern. This occurrence is amplified with shipwrecks consisting of copious amounts of cast iron or large ferrous construction features or machinery (e.g., an iron-hull steamship). Gearhart (2011:104) states that when magnetic survey occurs "in close proximity to a shipwreck, localized amplitude peaks associated with large individual ferromagnetic components may contrast with the surrounding induced anomaly pattern of the shipwreck as a whole." However, the anomaly will still exhibit the broader, underlying induced pattern described above. This is illustrated with *Oban Bay* (8OK02864) and *Thomas Sparks* (1MB28) in **Figure 15**, both of which are iron-hull vessels in shallow water that were surveyed with a minimal sensor-to-source distance. *Thomas Sparks* (1MB00028) additionally contains steam engine components, which create localized high and low amplitudes.

Site formation processes also can induce complexity outside of the principal dipole. For example, a large iron feature, such as a boiler, that has been deposited away from the main shipwreck site can produce a separate magnetic signature that adds complexity to the characteristics of the shipwreck anomaly as a whole; a site formation process that has included radical seabed movement (referred to as scrambling devices) that results in what Muckelroy (1978:196) terms a "discontinuous site" also can alter anomaly patterns. Scrambling devices that can produce a discontinuous site include strong tidal currents and extreme wave action, occurrences exacerbated in shallow water, as well as salvage and explosion. Such a site can produce widely distributed ship components and anomalies with large areal extents. Depending on the level of distribution, a principal dipolar anomaly may or may not exist for a discontinuous site.

Polar alignment and complexity of the anomaly are perhaps the most important characteristics to consider when interpreting magnetic data for potential shipwrecks. Other characteristics that help distinguish shipwreck magnetic signatures from other signatures (e.g., capped petroleum wells and debris) include the peak-to-peak amplitude gradient, the negative-to-positive amplitude ratio, and continuity. Continuity helps to differentiate a shipwreck, which is a complex distribution of objects from debris fields, which also are complex distributions of objects.

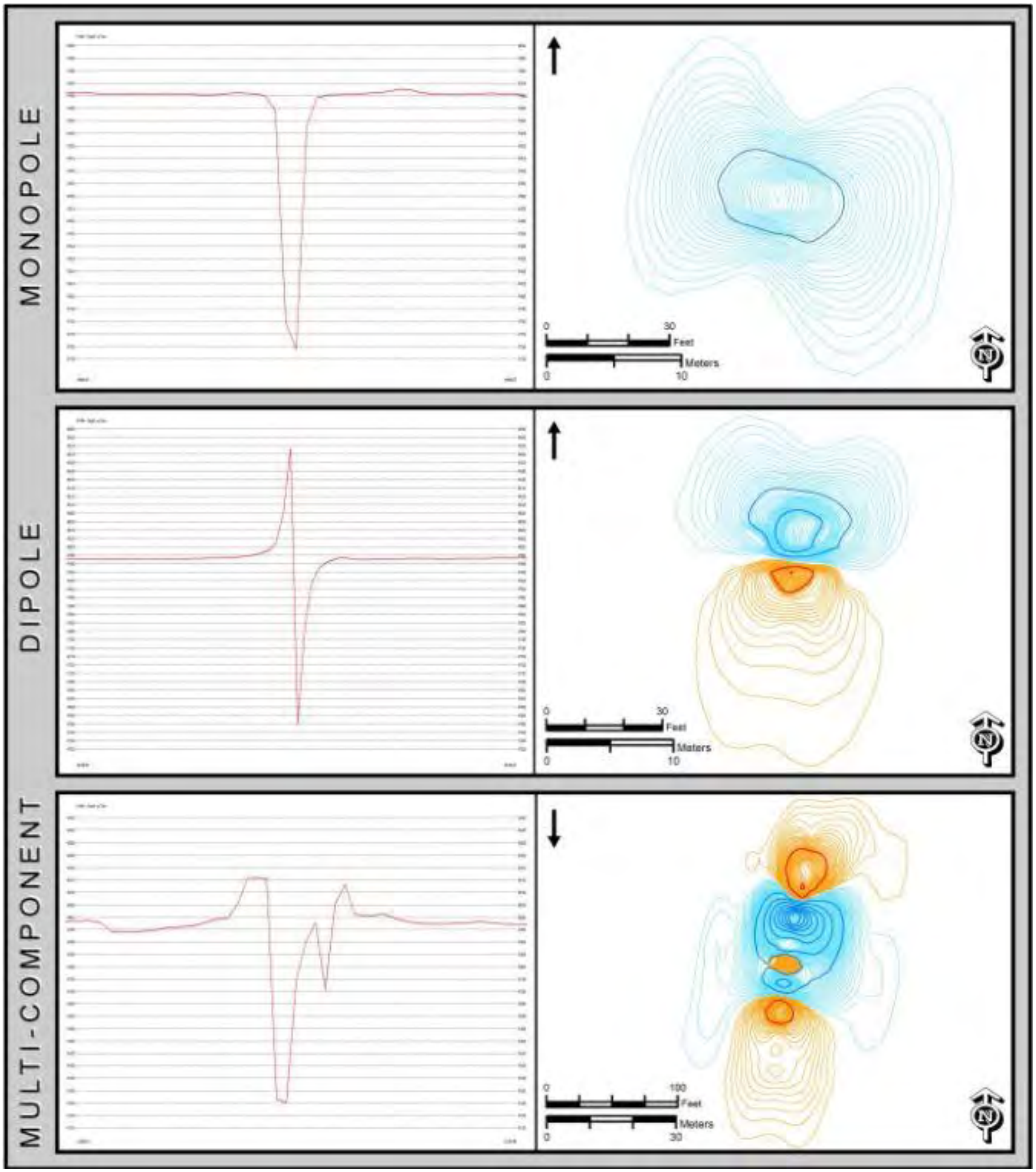

Figure 14. Examples of magnetic anomaly complexity.

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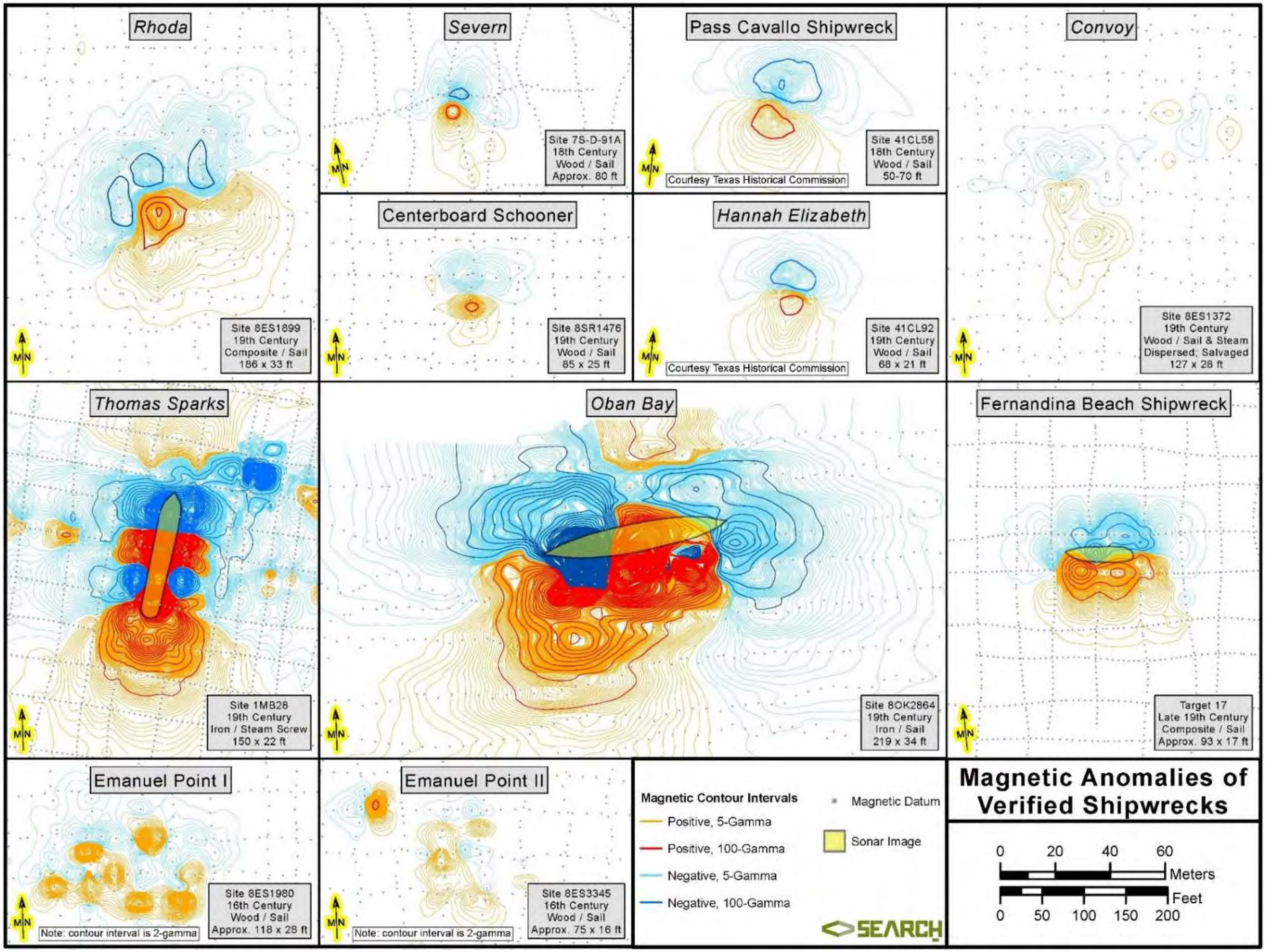

Figure 15. Magnetic anomalies of verified shipwrecks.

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Shipwrecks possess more continuity among their central dipoles than do debris fields. Known examples of shipwreck magnetic signatures from Gearhart (2004) possess relatively even amplitude distribution between their poles (ratios of negative-to-positive amplitudes) of less than 1:4. Examples of wooden-hull sailing vessels possess gradients between their poles from 4.5 to 9 gammas/ft, and examples of iron/steel and/or steam/gasoline-powered vessels possess gradients above 30 gammas/ft (Gearhart 2004). SEARCH has documented wooden-hull sailing vessels with gradients as high as 19 gammas/ft. Finally, Enright et al. (2006:147) have suggested that 20 m (66 ft) survey line spacing, which SEARCH exceeded during survey of the current APE, would result in "detection of a near 100 percent sample of small wooden-hull sailing vessel anomalies on two adjacent lines."

SEARCH has documented magnetic anomalies produced by shipwrecks dating to the early European exploration of the Gulf of Mexico (i.e., sixteenth century). Anomalies from these shipwrecks exhibit the characteristics described above but at markedly weaker amplitudes and lower gradients (see **Figure 15,** *Emanuel Point I* and *II*). A potential cause may be the level of degradation of the sites over more than 450 years and the resulting lack of architectural remains. Smith et al. (1995:58) state that all iron fasteners documented on *Emanuel Point I* (8ES01980) "are heavily encrusted with corrosion products, and most have lost their original metal composition." Concretions had lost the original material, and iron had become "black iron-sulfide slush" over the centuries of submersion in salt water (Smith et al. 1995:125). To compensate, SEARCH contoured these anomalies at a 2-gamma interval. The archaeological excavation of *Emanuel Point I* (8ES01980) also involved the removal of numerous artifacts, including an iron anchor, prior to SEARCH's recent survey of the site. In the case of *Emanuel Point II* (8ES03345), archaeological investigation to date has identified comparable iron ship fittings in the construction but a notable lack of large iron artifacts (e.g., anchors; Dr. Gregory Cook, personal communication, December 5, 2012).

4.7 SURVEY EXPECTATIONS

SEARCH created models of expected remote-sensing signatures related to potential submerged cultural resources, particularly shipwrecks, likely to occur within the APE based upon the maritime context of area, cartographic research, and the potential for occurrence discussed above. Defining the signatures of various potential submerged cultural resources is not meant to insinuate that SEARCH believes all categories may be located within the APE, but rather to prepare for the potential during data processing and interpretation.

Native Americans living in the vicinity of the APE may have employed structures such as fish weirs for nearshore fishing and wooden canoes for open water transportation. This category of submerged cultural resource would not produce an anomaly in the magnetic record. The likelihood of remains surviving intact above the seafloor to produce an acoustic image is extremely low, given the propensity of exposed wood to deteriorate rapidly in a marine environment, particularly in shallow water where wood-boring organisms thrive, and a sufficient passage of time to bury any remaining structure. The best chance of survival is burial within marine sediments. If this occurred, then the subbottom profiler is the only instrument capable of detecting remains of this resource. Recognition, however, would be difficult given that the signature would be relatively small and ambiguous.

Historic research indicates that European colonial activity may have occurred in the vicinity of the APE. Europeans likely relied upon smaller wooden craft, such as ships' boats (e.g., longboat, pinnace, shallop, or yawl), as well as some Cuban fishing craft including small sloops and schooners. This category of small wooden shipwreck, propelled with sail or oar, will appear in the remote-sensing data as relatively smaller, lower-amplitude magnetic anomalies with lower-amplitude gradients.

Maritime activity in the vicinity of the APE increased during the nineteenth century following the annexation of Florida as a US territory. Initially, goods would have been transported on flatboats, pole barges, and rafts from the Fort Meyers area. As with the smaller wooden craft used by Europeans, these craft would produce relatively smaller magnetic anomalies and little acoustic contact. The utilization of steam vessels introduced a new category of potential shipwreck in the nineteenth century. Wooden-hull steamboats, with their iron machinery, will produce a magnetic anomaly that is spatially larger and higher in amplitude with corresponding amplitude gradient and localized high and low amplitudes associated with large, ferrous engine components. An acoustic contact could exist for this vessel type and might consist of exposed individual or complex concentrations of iron steam-engine components. This image may not be identifiable as a shipwreck due to a lack of surviving exposed hull. The use of iron and steel in hull construction soon followed steam technology in the nineteenth century. Whether propelled by sail or steam, a vessel with an iron or steel hull will obviously produce a larger and higher-amplitude magnetic anomaly. It is more likely that the hull has remained intact enough to create a recognizable acoustic contact.

The twentieth-century workboat or fishing craft is another category of shipwreck that could be located within the vicinity of the APE. The magnetic anomaly of an iron or steel vessel propelled with a steam or gasoline engine would be strikingly large and intense, with a much higher amplitude gradient than other historic vessels. The hull and machinery are more likely to have survived in some form above the sediment level; therefore, a high potential of recording a recognizable acoustic contact exists. The modern recreational vessel, although not considered a submerged cultural resource, could be a vessel type documented in the APE. The magnetic signature associated with this vessel type will be relatively small and low in amplitude due to the fiberglass hull and the increased use of aluminum in modern marine motors. An acoustic contact will likely exist for this vessel type due to the recent deposition and durability of fiberglass.

Finally, SEARCH expected some amount of modern debris in the APE owing to the recreational vessels that frequent and transit Redfish Pass. The challenge, which is partially addressed with proper background research and cartographic analysis, is to differentiate between a debris item and a potential historic resource.

5 RESULTS

Remote-sensing data were processed following the methodology described above, and SEARCH applied the knowledge gained from the historical research when interpreting the remote-sensing survey results. The research, methodologies, and hypotheses described in the Research Design section guided the archaeological analysis and developed the results and recommendations presented below. SEARCH established an amplitude threshold of ±5 gammas when analyzing magnetic anomaly significance. Any anomaly not meeting this threshold likely represents noise caused by towfish heading error during inclement weather or an artifact of contouring. Actual sources producing such low-amplitude anomalies likely represent relatively small, insignificant debris sources. For the remaining magnetic anomalies, SEARCH analyzed the characteristics of each and made comparisons to verified examples of shipwreck magnetic signatures. SEARCH reviewed side-scan sonar imagery to identify acoustic contacts and created a mosaic image of the APE to layer with other project data for analysis. Acoustic contacts representing natural features were not captured. SEARCH reviewed subbottom profiler imagery to identify potential paleolandscapes that could contain potential evidence of prehistoric use or occupation within the APE. Upon completion of data analysis, SEARCH archaeologists did not identify any paleolandscapes in the subbottom imagery. Tables depicting survey results, including magnetic anomaly statistics, acoustic contact reports, and buried reflectors, are presented in **Appendix D (Not for Public Disclosure)**. For the following discussion, SEARCH generated unique identifiers for remote-sensing targets that include the letter “M” to designate a magnetic anomaly, “S” for acoustic contact, or “R” for acoustic reflector and a target number. For example, M001 is the first magnetic anomaly identified within the APE.

SEARCH identified 40 magnetic anomalies (meeting the 5-gamma threshold), three acoustic sonar contacts, and three acoustic reflectors in the marine remote-sensing record **(Figures 16** and **17**). The three acoustic contacts are interpreted to represent modern debris, and likely include two crab pots and one buoy mooring. As a result, none of these are representative of potentially significant submerged cultural resources and no further work for any of these sonar contacts is recommended.

The magnetic characteristics (spatial extent, general complexity, and polar declination) and acoustic characteristics (general vessel shape, 3:1 length-to-breadth dimension ratio) of the identified anomalies and contacts in the APE do not resemble remote-sensing signatures of verified submerged cultural resources. A majority of the identified anomalies and contacts likely represent single-source debris objects, such as tires, crab traps, channel marker weights, and submerged cabling. Additionally, no evidence of the reported shipwrecks charted within the APE was observed in the marine remote-sensing record (see **Figure 11**).

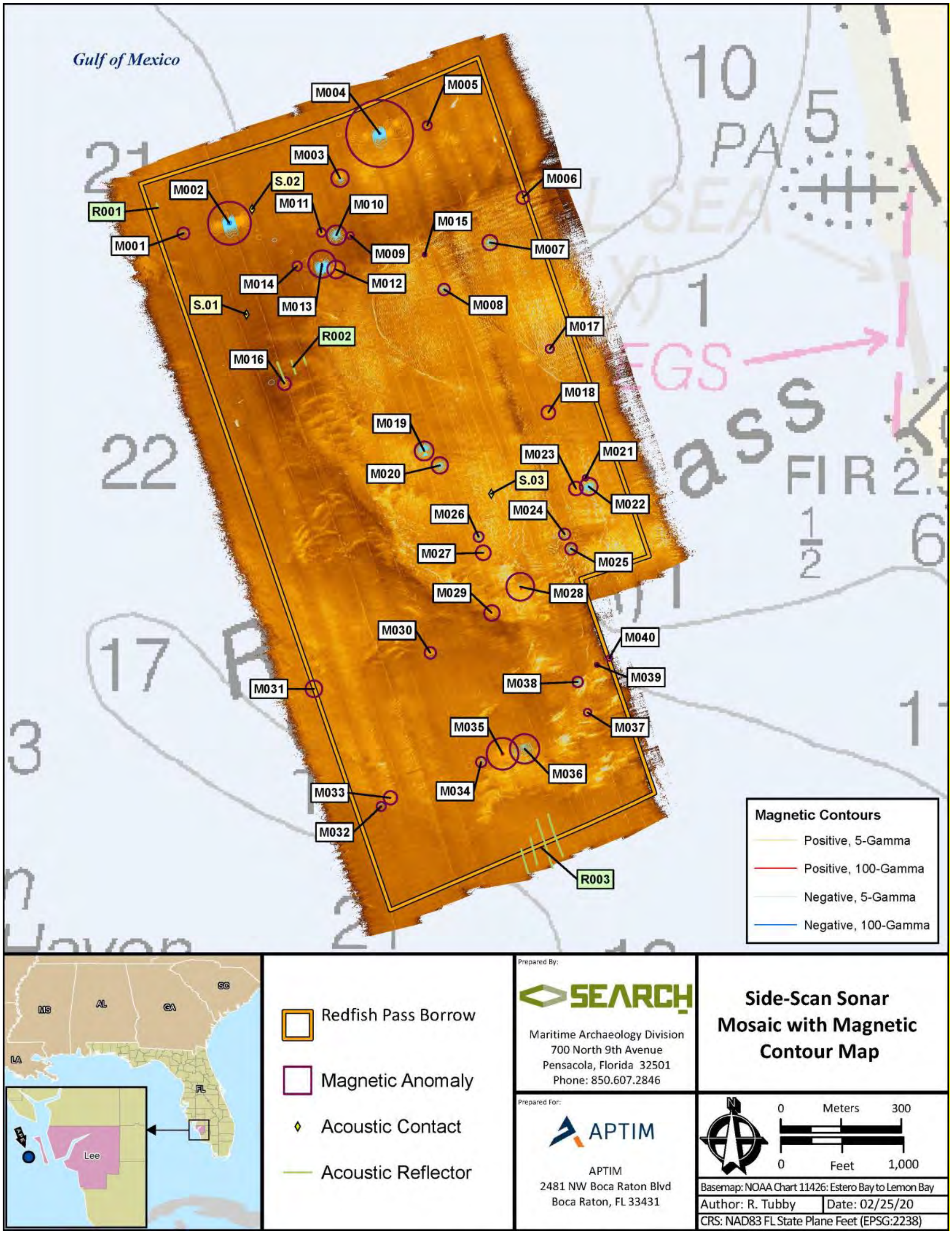

Figure 16. Remote-sensing data overlay within the APE.

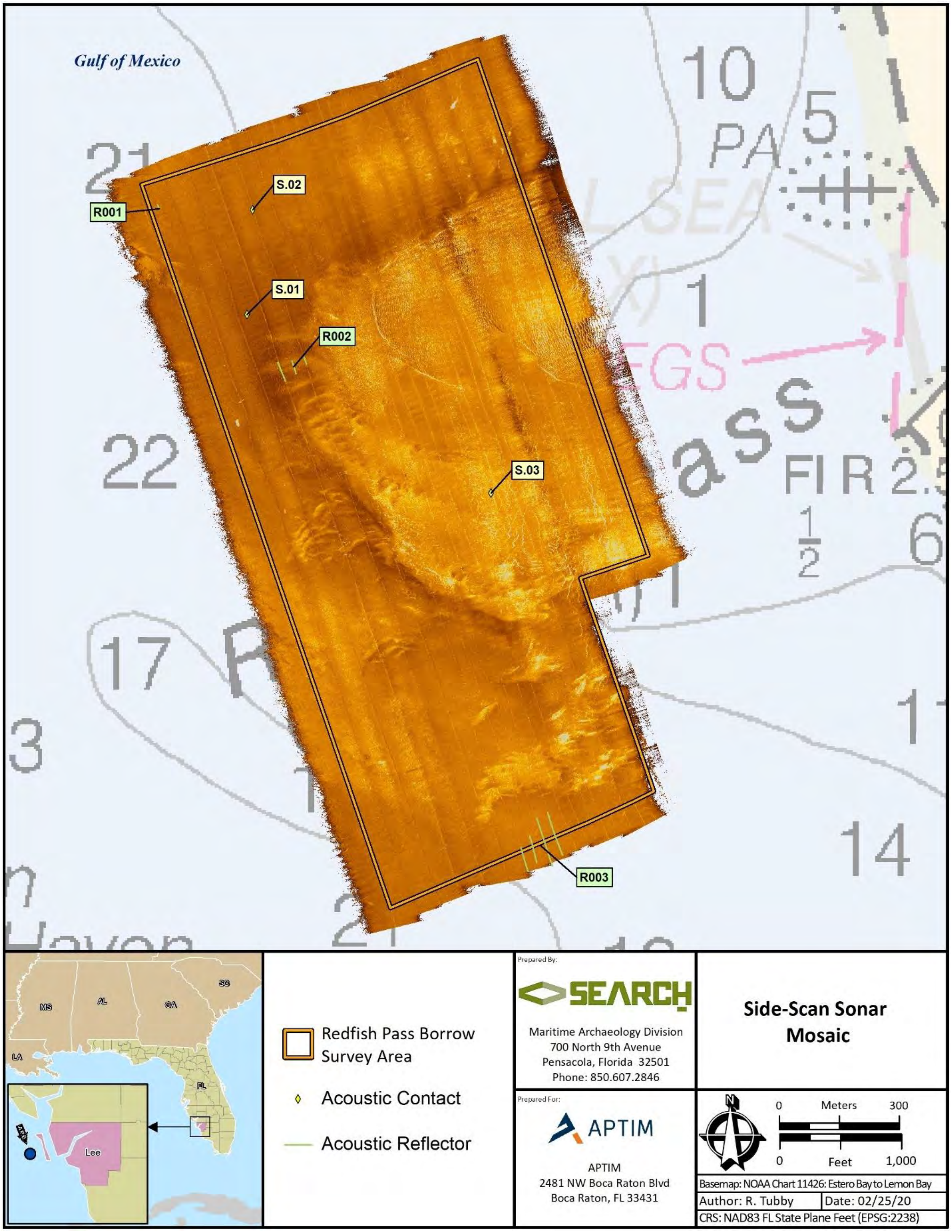

Figure 17. Acoustic contact and acoustic reflector overlay within the APE.

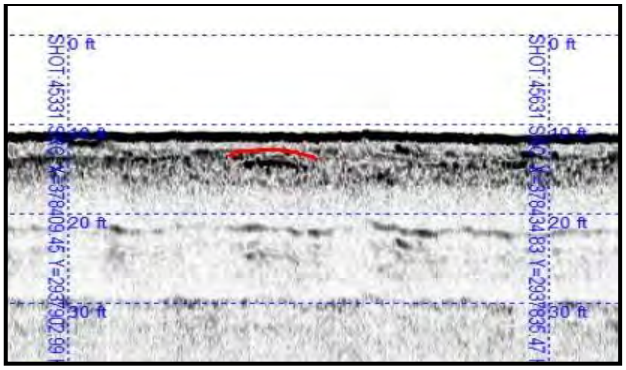

Figure 18. Subbottom profiler acoustic imagery cross-section of R001. Red line indicates reflector highlight.

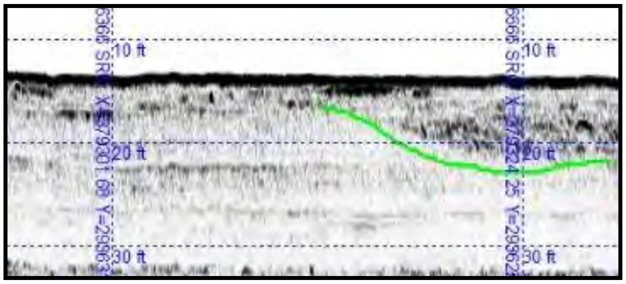

Figure 19. Subbottom profiler acoustic imagery cross-section of R005. Green line indicates the reflector highlight.

SEARCH identified three subbottom features in the APE that represent two unidentified buried reflectors and one geologic horizon (**Figures 18** and **19**). The two unidentified reflectors (R001, R003) lack the characteristics of buried oyster shell middens or any other feature that might be indicative of a prehistoric landscape. The buried horizon observed in the data is relatively deeply buried and extends to a depth of approximately 6.7 m (22 ft) below sediment. The buried horizon observed in the data does not appear to represent a landscape feature that would have once been utilized during precontact settlement.

Of the 40 magnetic anomalies, only three warrant discussion: M002, M004, and M019. Both M002 and M004 occur along the northern edge of the APE and M019 occurs roughly in the middle of the APE (**Figure 20**).

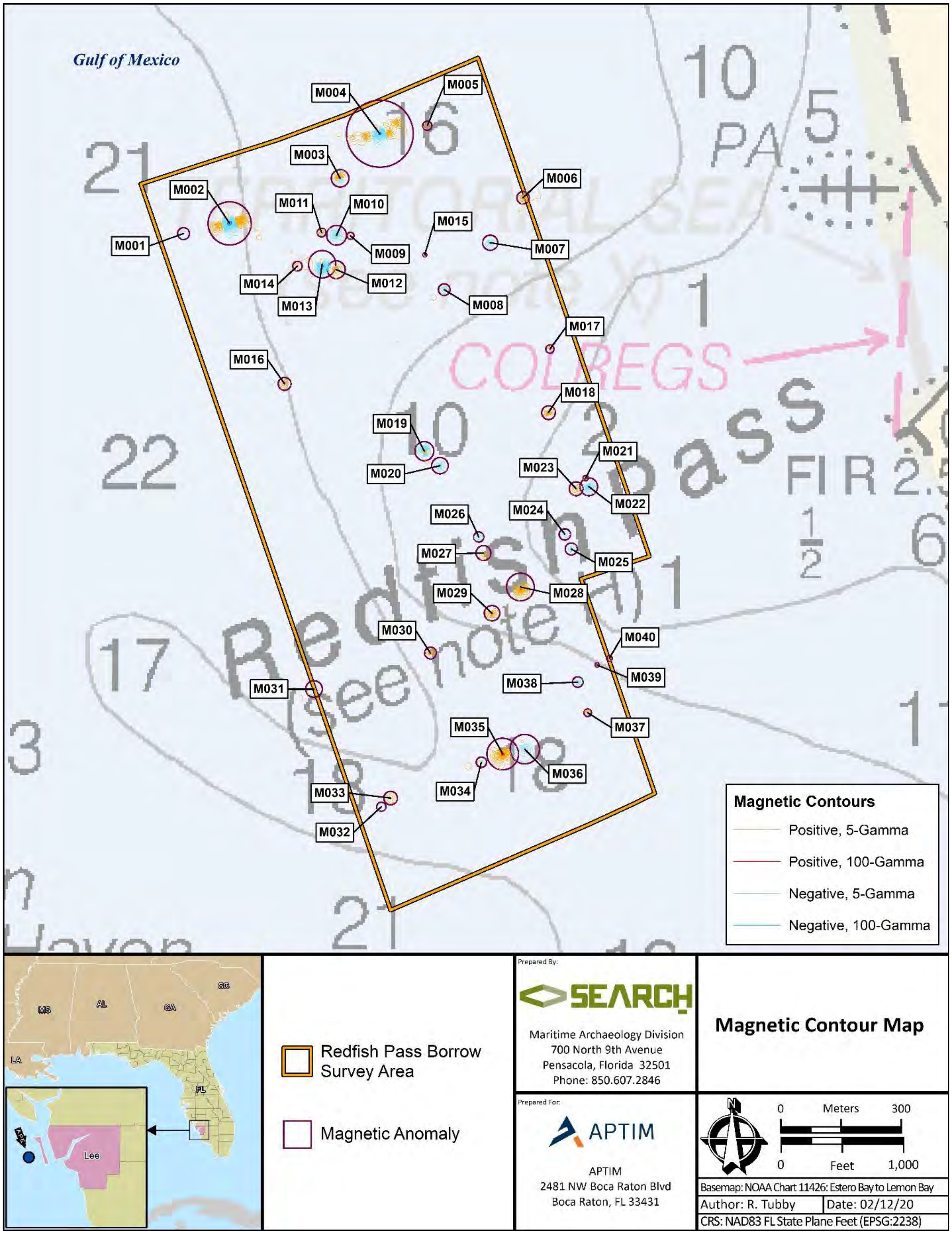

Figure 20. Magnetic contour map of magnetic anomalies in the Redfish Pass APE.

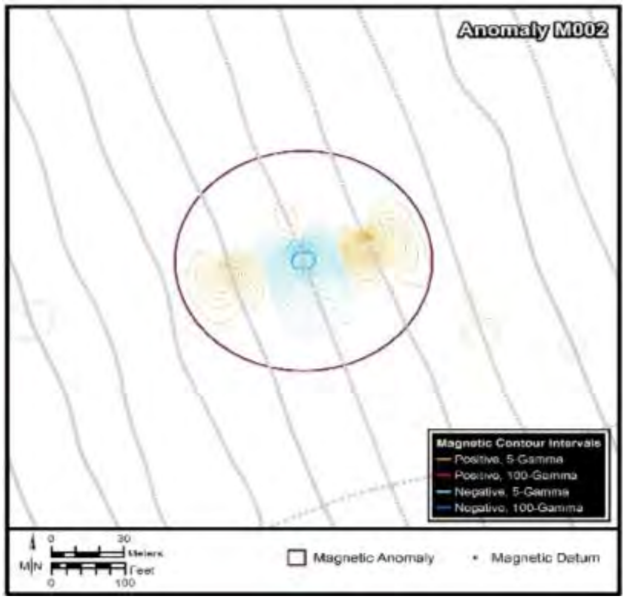

Figure 21. Magnetic anomaly M002.

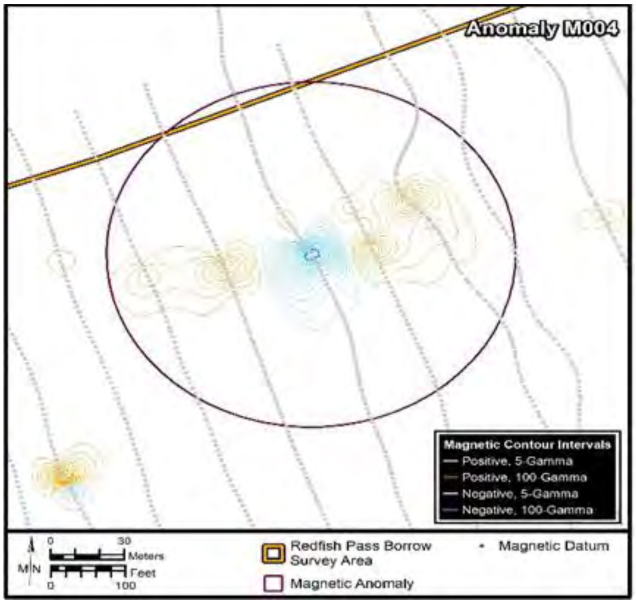

Figure 22. Magnetic anomaly M2004.

5.1 MAGNETIC ANOMALY M002

Magnetic anomaly M002 is a multicomponent deflection with a high amplitude of 243 gammas and a long duration of 64 m (209 ft). This linear anomaly was detected across three track lines and presents three prominent magnetic centers, two positive poles bracketing a negative pole, aligned east to west (**Figure 21**). This magnetic anomaly does not present as a dipolar contour overall with its negative pole aligned with magnetic north as described in the methodology section above. Given this critical factor, M002 is unlikely representative of significant cultural resources but more likely indicative of modern ferrous debris of a linear nature, possibly chain or wire rope, thus accounting for the spatial adjacency across three track lines. No further archaeological work is recommended for this target.

5.2 MAGNETIC ANOMALY M004

Magnetic anomaly M004 is also a multicomponent magnetic perturbation with a high amplitude of 186 gammas and a medium duration of 61 m (199 ft). Like M002 discussed above, it is very linear in nature, being detected across five track lines. It also resembles M002 as it presents three prominent magnetic centers, two positive poles bracketing a negative pole, aligned east to west, and lacks a dipolar magnetic field with its negative pole aligned with magnetic north (**Figure 22**). Magnetic anomaly M004, therefore, is unlikely representative of significant cultural resources. It is more indicative of modern ferrous debris, possibly chain or wire rope, thus accounting for the spatial adjacency across five track lines. No further archaeological work is recommended for magnetic anomaly M004.

5.3 MAGNETIC ANOMALY M019

Magnetic anomaly M019 is a multicomponent magnetic deflection with a high amplitude of 150 gammas and a medium duration of 24 m (80 ft). This magnetic anomaly was detected on a single track line (see **Figure 23**). Though a multicomponent magnetic field, its dominant negative pole has a declination of -6° and is oriented to the north in alignment with Earth's axis, which is typical of shipwrecks as discussed above. However, that methodology was developed utilizing 30 m (100 ft) lane spacing, the same applied to this survey. It was determined that a potential shipwreck would be detectable on at least two track lines. Therefore, this magnetic anomaly is unlikely to represent submerged cultural resources. No further work is recommended for this target.

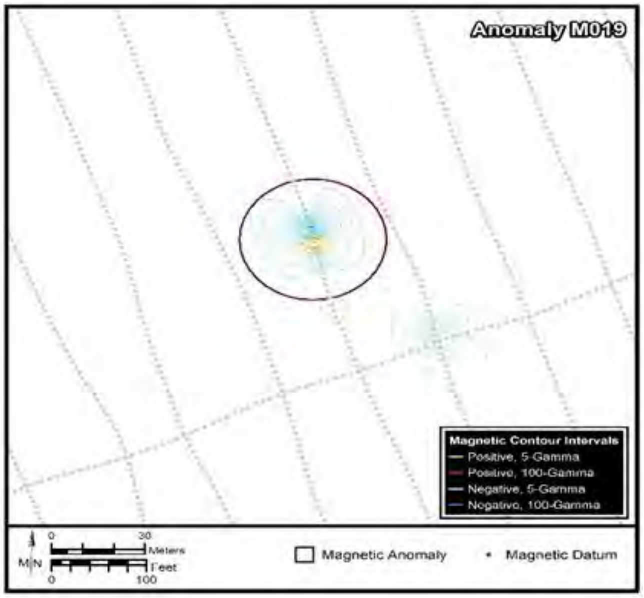

Figure 23. Magnetic anomaly M019.

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6 SUMMARY AND CONCLUSION

SEARCH conducted the marine archaeological resources assessment of the proposed Redfish Pass Borrow Area in anticipation of seafloor impacts during dredging operations by the CEPD. CEPD contracted APTIM to provide technological support for the project, which includes sand search, borrow area design, and permitting support to CEPD. APTIM tasked SEARCH with identifying the presence/absence of potential submerged cultural resources within the APE to assist with its obligation to Section 106 of the NHPA. Recommendations are provided to offer the CEPD a clear, efficient path forward for cultural resources clearance in preparation of project impacts, which could include direct and indirect impacts to the seafloor, such as dredging and coring.

SEARCH reviewed magnetometer data, as well as side-scan sonar and subbottom profiler imagery, to assess the presence or absence of potential submerged cultural resources within the APE. SEARCH also reviewed the precontact, historical, and geological background of the region, with specific attention paid to the maritime history of the Redfish Pass and Captiva Island area and the Gulf Coast of southwestern Florida. Finally, SEARCH identified previous archaeological investigations and reported sites within the area to guide the development of the project research design and assist with interpreting the remote-sensing data.

SEARCH identified 40 magnetic anomalies, 3 acoustic contacts, and 3 acoustic reflectors in the marine remote-sensing record. None of the anomalies or contacts are indicative of a potential submerged cultural resource. None of the acoustic surface reflectors in the subbottom record appear to be indicative of buried paleolandscape features. SEARCH recommends cultural resources clearance for the entirety of the APE, as the remote-sensing data and subsequent archaeological analysis do not indicate the presence of potential submerged cultural resources.

A copy of the FDHR survey log can be found in **Appendix E**.

Every reasonable effort was made during this analysis to identify and evaluate possible locations of archaeological sites; however, the possibility exists that evidence of submerged cultural resources may yet be encountered within the project limits. Should unanticipated cultural finds occur during the project construction phase, SEARCH recommends cessation of work until the SHPO is consulted and a significance determination can be made. A copy of an unanticipated discoveries plan is present in **Appendix F**.

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1971 *Documentos de la Real Hacienda de Puerto Rico, Volumen I (1510–1519)*. Centro de Investigaciones Históricas, Universidad de Puerto Rico, Rio Piedras.

Tebeau, Charlton W.
1971 *A History of Florida*. University of Miami Press, Coral Gables.

The Fort Myers Press
1926 Sanibel and Captiva Flooded. 20 September:1. Fort Myers, Florida.

Thompson, Victor D., and John E. Worth
2018 Political Ecology and the Event: Calusa Social Action in Early Colonial Entanglements. *Archaeological Papers of the American Anthropological Association* 29:68–82.

Thulman, David K.
2009 Freshwater availability as the constraining factor in the Middle Paleoindian occupation of North-Central Florida. *Geoarchaeology* 24(3):243–276. DOI:10.1002/gea.20268.

Toll, Ian W.
2008 *Six Frigates: The Epic History of the Founding of the U.S. Navy.* W. W. Norton, New York.

TRC Environmental Corporation
2012 Inventory and Analysis of Archaeological Site Occurrence on the Atlantic Outer Continental Shelf. US Department of the Interior, Bureau of Ocean Energy, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2012-008. 324 pp.

Turner, Samuel
2013 Juan Ponce de León. *The Florida Historical Quarterly* 92(1):1–31.

Uchupi, E., N. Driscoll, R. D. Ballard, and S. T. Bolmer
2001 Drainage of late Wisconsin glacial lakes and the morphology and late Quaternary stratigraphy of the New Jersey-southern New England Continental Shelf and Slope. *Marine Geology* 172:117–145.

United States Army Corps of Engineers
2015 Draft Environmental Assessment: Additional Sand Sources, Hurricane and Storm Damage Reduction Project, Lido Key, Sarasota County, Florida. US Army Corps of Engineers, Jacksonville District, Florida.

VonFrese, R. R. B.
1986 Magnetic Investigations of Structurally Complex Archaeological Sites. Paper presented at the Annual Meeting of the Geological Society of America, San Antonio.

Walker, K. J., and W. H. Marquardt (editors)

n.d. *The Archaeology of Pineland: A Coastal Southwest Florida Village Complex, A.D. 100–1600*. Institute of Archaeology and Paleoenvironmental Studies. University of Florida, Gainesville. In preparation.

Ware, John D.

1982 George Gauld: Surveyor and Cartographer of the Gulf Coast. Revised and Completed by Robert R. Rea. University Press of Florida, Gainesville, Florida.

Waters, Michael R., and Thomas W. Stafford Jr.

2007 Redefining the Age of Clovis: Implications for the Peopling of the Americas. *Science* 315(5815):1122–1126.

Watts, W. A. and Barbara C. S. Hansen

1988 Enviornments of Florida in the Late Wisconsin and Holocene. In We Site Archaeology, edited by Barbarra A. Purdy, pp 307-323. Caldwell, N. J.:Telford.

Weddle, Robert S.

1991 *The French Thorn: Rival Explorers in the Spanish Sea, 1682–1762*. Texas A&M Press, College Station, Texas.

1995 *Changing Tides: Twilight and Dawn in the Spanish Sea, 1783–1803.* Texas A&M Press, College Station, Texas.

Widmer, Randolph J.

1974 *A Survey and Assessment of Archaeological Resources on Marco Island, Collier County, Florida*. Miscellaneous Project Reports 19. Florida Division of Archives, History and Records Management, Tallahassee.

1988 *The Evolution of the Calusa: A Nonagricultural Chiefdom on the Southwest Coast of Florida*. University of Alabama Press, Tuscaloosa.

1996 Recent Excavations at the Key Marco Site, 8CR48, Collier County, Florida. *The Florida Anthropologist* 49:10–26.

White, W. A.

1970 Geomorphology of the Florida Peninsula. *Florida Geological Survey Bulletin* 51, 164 p.

Worth, John E.

2003 The Evacuation of South Florida, 1704–1760. A Paper presented at the 60th annual Southeastern Archaeological Conference, Charlotte, North Carolina, November 13, 2003.

2006 The Social Geography of South Florida during the Spanish Colonial Era. Paper presented at the 71st annual meeting of the Society for American Archaeology, San Juan, Puerto Rico.

APPENDIX A

CURRICULUM VITAE: SAMUEL P. TURNER, PHD

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SAMUEL P. TURNER, PH.D.

NAUTICAL ARCHEOLOGIST/HISTORIAN

EDUCATION

Ph.D. in Spanish and Spanish American Studies, King's College, University of London, London, UK, 1999.

M.A. in Anthropology (Nautical Archaeology Program), Texas A&M University, College Station, TX, 1994.

B.A. in History as a Social Science, Antioch College, Yellow Springs, Ohio, 1988.

PROFESSIONAL EXPERIENCE

Nautical Archeologist/Historian/Principal Investigator, SEARCH, April 2018 to Present.

Nautical Archeologist/Historian/Director of Heritage Boatworks, Lighthouse Archaeological Maritime Program (LAMP), St. Augustine Lighthouse & Maritime Museum July 2015 – March 2018.

Nautical Archeologist/Historian/Director of Archaeology, Lighthouse Archaeological Maritime Program (LAMP), St. Augustine Lighthouse & Maritime Museum March 1 2006 – June 2015.

Nautical Archeologist/Historian/Project Manager, R. Christopher Goodwin & Associates, Inc., Frederick, Maryland, January 2001 – March 2006.

Maritime Archaeologist, Panamerican Consultants, Inc., Excavation of the Ben Sherrod, an 1830's side-wheel western river steamboat in Natchez, Mississippi, August 29, 2000 – November 28, 2000.

Web and courseware developer and instructor for ProsoftTraining.com, 1999 – 2000.

Member of joint NOAA/UPR (University of Puerto Rico) team mapping the sea floor off the south coast of Puerto Rico using a 300 kHz Marine Sonic side-scan sonar system, La Parguera Coastal Mapping Project. April - May 1999.

Marine Research Manager for Caribe Submarine and Space Technologies, Inc., August 1998 – March 1999.

Ordnance specialist and archeological diver for the Institute of Maritime History, Kingstown Harbour Shipwreck Project, St. Vincent and the Grenadines, December 1997 – January 1998.

Maritime Specialist, Pre-Construct Archaeology, Ltd., London, UK, Excavation of East India Company docks in Deptford, September 1997 - November 1997.

Archaeological reconnaissance of pre-contact and contact period Taino Indian sites in collaboration with Parque del Este, Dominican Republic, and Charles Beeker of the University of Indiana. July 1996 – August 1996.

Project Director, Saona Shipwrecks Project, Dominican Republic. Institute of Maritime History, May 1996 July 1996.

Project Archeologist, Cape Neddick River Project, Institute of Maritime History, Maine, June August 1995.

Saona Island Artillery Study, Dominican Republic. Made scale drawings and took photographs of the 16th century artillery salvaged in 1983. Research consisted of 16th century gun making and gun types, period naval tactics and artillery operation, as well as an historical analysis of the area in which the artillery was discovered, September 1992   May 1994.

Cruz Bay Pier Project, St. John, U.S. Virgin Islands, 18th century, 1992.

Assistant Field Director for the Pan-American Institute of Maritime Archaeology, Monte Cristi Shipwreck Project, Dominican Republic, November 1990- February 1993.

Intern in Maritime History at the National Museum of American History, Smithsonian Institution, Washington D.C., April   August, 1990.

Ma’agan Mikhael Shipwreck Project, Israel. Late 5th century B.C. Engaged in daily site preparation, excavating assigned shifts, recording finds, hull disassembly and transportation of wood and artifacts to University of Haifa laboratory, September- December, 1989.

Museum of Underwater Archaeology, Bodrum, Turkey. Late Bronze Age. Assisted with the conservation of artifacts recovered from the underwater site at Ulu Burun. Carried out mechanical cleaning of amphorae and took lead samples from fish net weights for lead isotope analysis, August 1989.

Tel Nami Land and Sea Regional Project, Israel. Mid to Late Bronze Age. Responsibilities included equipment management and transportation, processing of artifacts, excavating assigned area, and recording walls and stratigraphy, June - July, 1989.

NEWSPAPER COLUMNS

Ponce de León’s Discovery Timeline. This bi-weekly Sunday newspaper column ran in both the St. Augustine Record and the Tallahassee Democrat from January 2013 to March 2014 for a total of 30 columns. This column won an award in the category of Preservation Education / Media from the Florida Trust for Historic Preservation in 2015.

Pedro Menénendez de Avilés Timeline. This bi-weekly Sunday newspaper column ran in both the St. Augustine Record and the Tallahassee Democrat from April 2014 through December 2015 for a total of 34 columns.

PUBLICATIONS

ND Forthcoming- Beyond the Myth: The Story of Juan Ponce de León. Awaiting art work.

ND Forthcoming- Ponce de León Discovery Timeline. Compilation of newspaper columns. Awaiting art work.

2018 Ceramics of the Anniversary Wreck: A Preliminary Analysis. Paper in ACUA Underwater Archaeology Proceedings 2018, With Allyson Ropp, Chuck Meide, Roger, Arrazcaeta, Marcos Acosta, Yoser Martínez. An Advisory Council on Underwater Archaeology Publication.

2018 The Sixteenth-Century Chalupa and the Astillero Del presidio, El Escribano: The St. Augustine Journal of History, Volume Fifty-One, St. Augustine Historical Society.

2017 Tools of the Trade. Paper in ACUA Underwater Archaeology Proceedings 2016, An Advisory Council on Underwater Archaeology Publication.

2016a The Bergantín, a Little-Known Craft from the Early Spanish Period in the New World. Chapter in book titled - The Archaeology of Vernacular Watercraft, published in Springer's SHA/ACUA series -When the Land Meets the Sea.

2016b Progress Report to Historic St. Augustine Research Institute for 2016 FY Research Grant Titled: Artillery and Associated Equipment in St. Augustine 1597-1601. Prepared for the Historic St. Augustine Research Institute.

2013a Juan Ponce de León and the Discovery of Florida Reconsidered, The Florida Historical Quarterly Volume 92, no. 1, Summer 2013.

2013b Artillery of the Strom Wreck. With Charles Meide, paper in ACUA Underwater Archaeology Proceedings 2012, An Advisory Council on Underwater Archaeology Publication.

2012 The Caribbean World of Juan Ponce de León and His Discovery of Florida. In Culturally La Florida: Spain’s New World Legacy, Flagler College, St. Augustine.

2010a Maritime Insights from St. Augustine’s British Period Documentary Records. El Escribano: The St. Augustine Journal of History, Volume Forty-Seven, St. Augustine Historical Society.

2010b LAMP 2009 Remote Sensing Survey. With Kendra Kennedy, paper in ACUA Underwater Archaeology Proceedings 2010, An Advisory Council on Underwater Archaeology Publication.

2006 The Conquest of Higüey: The Eyewitness Account of De Las Casas Examined, and the Archaeological Implications for the Parque Nacional del Este, República Dominicana; in Historia de Nuestra Señora la Virgen de Altagracia; John Fleury, Editora Corripio, C. por A., República Dominicana.

1996 Saona Artillery: Three Sixteenth-Century Sites in the Dominican Republic- A Preliminary Report, Institute of Maritime History Annual Newsletter, Number 1.

ARCHAEOLOGICAL REPORTS

2018 First Coast Maritime Archaeology Project 2013: Report on Archaeological and Investigations (with Charles Meide and P. Brendan Burke, Starr Cox, Olivia McDaniel, Allison Ropp, Andrew Thompson, Eden Andes, Maggie Burkett, Christopher McCarron, Annie E. Carter, Hunter Brendel, Ivor Mollema, Carolane Veilleux). Prepared for the State of Florida.

2016 450th Anniversary Shipwreck Survey: Report on Archaeological Investigations (with Charles Meide, Olivia McDaniel, and P.Brendan Burke). Prepared for the State of Florida.

2015 The Search for the Lost French Fleet of 1565: Report on 2014 Archaeological Investigations (with Charles Meide, P.Brendan Burke, and Olivia McDaniel). Prepared for the National Park Service.

2014 Submerged Cultural Resources Remote Sensing Survey of the Big Sarasota Pass, Sarasota County, Florida (with Charles Meide, P. Brendan Burke, Wendy Drennon, Lillian Azevedo, and Martin Healey). Prepared for the Army Corps of Engineers, Jacksonville District.

2011 First Coast Maritime Archaeology Project: Report on Archaeological Investigations (with Charles Meide, P. Brendan Burke, and Starr Cox). Prepared for the State of Florida.

2010 First Coast Maritime Archaeology Project 2007:2009: Report on Archaeological and Historical Investigations and other Project Activities (with Charles Meide and P. Brendan Burke). Prepared for the State of Florida.

2008 An Archaeological Survey of the Salt Run Dredging Project Options B&C, St. Johns County Florida (with P. Brendan Burke, Lindsay Jones, and Charles Meide). Prepared for Taylor Engineering, Inc.

2007a Economic Relations on a Nineteenth Century Irish Maritime Landscape: Achill Island Maritime Archaeology Project 2006 Final Report. (with Charles Meide). Prepared for The Heritage Council, Republic of Ireland.

2007b Cultural Resource Survey and Inventory of The Guana Tolomato Matanzas National Estuarine Research Reserve Tolomato River Data Sonde Replacement Project (with P. Brendan Burke, Charles Meide, Karson Winslow, and Deanna Sundling). Prepared for The Guana Tolomato Matanzas National Estuarine Research Reserve.

2007c An Archaeological Survey of the St. Augustine Lighthouse Boat Ramp Dredging Project Area (with P. Brendan Burke and Charles Meide). Prepared for Taylor Engineering, Inc.

2005a Cultural Resources Survey and Inventory Results of the Proposed Compass Port Anchorage Area, Federal Waters; Technical Addendum to Cultural Resources Survey and Inventory Results of the Proposed Compass Port Terminal and Compass Port Pipeline Proposed 36-inch Gas Pipeline Route, Federal Waters (with Anthony G. Randolph, R. Christopher Goodwin, and Jean B. Pelletier). Prepared for ENSR International.

2005b Additional Phase I Cultural Resource Survey of Two Survey Blocks and Archaeological Diver Investigation of Two Targets Adjacent to Poplar Island, MD; Technical Addendum to: Phase I Cultural Resource Survey for the Poplar Island Expansion Supplemental Environmental Impact Statement (SEIS) Project (with Jean B. Pelletier, Anthony G. Randolph, and K. Harley Meier). Prepared for EA Engineering, Science, And Technology.

2005c Additional Phase I Cultural Resource Survey of One Survey Block and Archaeological Diver Investigation of Two Targets Adjacent to Poplar Island, MD; Technical Addendum to: Phase I Cultural Resource Survey for the Poplar Island Expansion Supplemental Environmental Impact Statement (SEIS) Project (with Jean B. Pelletier, Anthony G. Randolph, and K. Harley Meier). Prepared for EA Engineering, Science, and Technology.

2004a Phase I Cultural Resources Survey and Archeological Inventory of the Proposed Carrollton Revetment Project in Orleans Parish, Louisiana (with Jean B. Pelletier, Katy Coyle, and Kari Krouse). Prepared for the Army Corps of Engineers, New Orleans District.

2004b Technical Addendum to Archeological Testing at Site 18AN1206 for the Proposed Marvista (Osprey Landing) Development, Anne Arundel County, Maryland Archaeological Testing of Wharf Structure and Phase I Marine Archeological Remote Sensing Survey of Osprey Landing (with Jean B. Pelletier and Christopher Polglase). Prepared for Mandrin Construction Company, Inc.

2004c Phase I Cultural Resources Marine Remote Sensing Survey for the Proposed Pensacola Bay Bridge Replacement project, Escambia and Santa Rosa Counties, Florida (with Jean B. Pelletier, K. Harley Meier). Prepared for PBS&J, Inc.

2004d Cultural Resources Survey and Inventory Results for the Compass Port Pipeline Proposed 36-inch Gas Pipeline Route, Alabama Waters (with R. Christopher Goodwin). Prepared for ENSR International.

2004e Cultural Resources Survey and Inventory Results for the Proposed Compass Port Terminal and Compass Port Proposed Pipeline 36-inch Gas Pipeline Route, Federal Waters (with R. Christopher Goodwin). Prepared for ENSR International.

2004f Cultural Resources Survey and Inventory of the Seafarer U.S. Pipeline System, Inc.'s Proposed 26-inch Gas Pipeline, Florida State Waters Boundary to the Florida Mainland (with R. Christopher Goodwin, Jean B. Pelletier, K. Harley Meier, Frank Vento, and David Duncan). Prepared for Seafarer U.S. Pipeline System, Inc.

2004g Cultural Resources Investigation of the Onshore and Offshore Portions of the Shell Bahamas Facilities Upgrade Project Area, Clifton Pier, New Providence, Bahamas (with R. Christopher Goodwin, Jean B. Pelletier, Jason Coffey, with contributions by Julian Granberry). Prepared for Shell Bahamas/Islands by Design Inc.

2004h Historic Assessment and Remote Sensing Survey of the Duval County Shore Protection Sand Source, Duval County, Florida (with Jean B. Pelletier, Christopher R. Polglase, Anthony Randolph, Greg Brooks, and Martha R. Williams). Prepared for the Army Corps of Engineers, Jacksonville District.

2003a Cultural Resources Survey and Inventory of the Seafarer U.S. Pipeline System, Inc.'s Proposed 26-inch Gas Pipeline from the Limits of the Exclusive Economic Zone to Florida State Waters (with R. Christopher Goodwin, Jean B. Pelletier, K. Harley Meier, and David Duncan). Prepared for Seafarer U.S. Pipeline System, Inc.

2003b Cultural Resources Survey and Inventory of the Seafarer U.S. Pipeline System, Inc.'s Proposed 26-inch Gas Pipeline from Grand Bahama Island to the Limits of the Bahamian Exclusive Economic Zone (with R. Christopher Goodwin, Jean B. Pelletier, and David Duncan). Prepared for Seafarer U.S. Pipeline System, Inc.

2003c Cultural Resources Survey and Inventory of the Seafarer U.S. Pipeline System, Inc.'s Proposed 26-inch Gas Pipeline, Florida State Waters to Florida Mainland (with R. Christopher Goodwin, Jean B. Pelletier, K. Harley Meier, Frank Vento, and David Duncan). Prepared for Seafarer U.S. Pipeline System, Inc.

2003d Unanticipated Discoveries of Submerged Cultural Resources for the Proposed BP Mardi Gras Transportation System, Inc., Endymion Oil Pipeline Company, LLC Jefferson and Lafourche Parishes, Louisiana (with Jean B. Pelletier). Prepared for T. Baker Smith & Sons, Inc.

2002a Phase I Underwater Archeological Survey: Construction of 32 Berth MWR Marina at Mill Creek, U.S. Naval Academy, Anne Arundel County, Maryland (with Jean B. Pelletier and Martha R. Williams). Prepared for A. Morton Thomas and Associates, Inc.

2002b Phase I Archeological Remote Sensing Survey of the Hunts Point East River Approach of the Eastchester Marine Pipeline NY, (with Jean B. Pelletier, and K Harley Meier). Prepared for ENSR International.

2002c Anchoring Clearance and Avoidance Study for the Eastchester Natural Gas Pipeline from Hunts Point (East River), to Northport, Long Island, NY, (with Jean B. Pelletier, K. Harley Meier, and Walter L. Graves). Prepared for ENSR International.

2002d Phase I Data Analysis for El Paso Energy's Seafarer Natural Gas Pipeline, West Palm Beach, FLA to the Three Mile Limit (with Jean B. Pelletier, K. Harley Meier, and Walter L. Graves). Prepared for El Paso Energy.

2002e Submerged Cultural Resources Evaluation of a Bifurcated Relict Channel in Florida State Waters within the Gulfstream Natural Gas Pipeline Corridor (with Jean B. Pelletier, K Harley Meier, and R. Christopher Goodwin). Prepared for ENSR, 1538 Metropolitan Blvd., Suite C-2, Tallahassee, Florida 32308.

2002f Phase I Survey of Underwater Cultural Resources for the Proposed Breakwater at Town Point, Rockhold Creek, Anne Arundel County, Maryland (with Jean B. Pelletier and Christopher Polglase). Prepared for Andrews, Miller & Associates, Inc.

2001a Phase I Remote Sensing Marine Archeological Survey for the Coan River Navigation Improvement Project, Coan River, Northumberland County, Virginia – Addendum (with Jean B. Pelletier). Prepared for Advanced Technology Systems, Inc.

2001b Phase I Archeological Remote Sensing Survey of the Proposed Southern Natural Gas (SNG) Elba Island Turning Basin in the Savannah River, Chatham County Georgia, and including portions of the South Carolina Bankline in Jasper County, South Carolina, (with R. Christopher Goodwin, Jean B. Pelletier, Martha R. Williams, and Frank Vento). Prepared for Southern Natural Gas.

2001c Interim Report on Cultural Resource Survey for the Proposed Eastern Long Island Extension Pipeline, New Haven County, Connecticut and Suffolk County, New York – OPRHP Project No. 01PR3569 (with Jeffrey H. Maymon, Jean B. Pelletier, Martha Williams, Daniel Grose, Nathaniel Workman, Emmett Brown, Joel Evans). Prepared for ENSR International.

2001d Phase I Underwater Archeological Diving Survey: Civil and Structural Engineering Services Replacement Pier, Cultural Resource Reconnaissance and Identification of Obstructions, Contract No. N62477-99-D-0546, U.S. Naval Academy, Annapolis, MD (With Jean B. Pelletier, and K. Harley Meier). Prepared for A. Morton Thomas Associates, Inc.

2001e Addendum to Cultural Resources Survey and Inventory Results for the Proposed 36-inch Gulfstream Natural Gas System, L.L.C., Mobile Bay to Florida Three League Line Reroutes in Federal Waters, (with R. Christopher Goodwin and Jean B. Pelletier). Prepared for ENSR International.

2001f Addendum to Cultural Resources Inventory of the Gulfstream Natural Gas System, L.L.C. Pipeline Proposed 36-Inch Gas pipeline Route, Port Manatee to the Three League Line: Reroutes in Florida State Waters, (with R. Christopher Goodwin and Jean B. Pelletier). Prepared for ENSR International.

DOCUMENTARIES

2018 Secrets of Spanish Florida. Historian. A four-episode documentary which examines St. Augustine and its impact on American history. Produced by Robbie Gordon of Small Planet Pictures being pitched to PBS for national viewing. Was interviewed on camera in St. Augustine for the documentary and travelled with production crew to England where I assisted in setting up interviews with scholars at King's College and the Maritime Museum in Greenwich. Was interviewed on camera in the British National Archives in Kew, London. Aired on PBS January 2018.

2013 Shadows of the Past: Mysteries from Florida History. Historian. Documentary by WJCT – PBS, Jacksonville, January -August 2013. Aired August 22, 2013. Shadows of the Past" is on line at: http://www.wjct.tv/video/2365071206/

2011 Search for the Jefferson Davis. Historian, Archaeologist and co-author. Documentary by PEPE Productions, Great Falls New York in collaboration with LAMP, June 2009 to March 2011.

1996 The Columbus Mystery. Historian, Translator, and Archeologist. Documentary by Nineteenth-Star Television of Bloomington Indiana in collaboration with Charles Beeker of the University of Indiana, March 16-25, 1996.

INSTITUTIONAL AFFILIATIONS

Historic St. Augustine Research Institute (HSARI), Flagler College -Research Associate July 2015–Present. The Historic St. Augustine Research Institute is a collaborative project of Flagler College and the University of Florida, supported by the St. Augustine Foundation, Inc. Its purpose is to encourage, coordinate and disseminate active academic research related to the history, archaeology and historical architecture of St. Augustine, Florida, and to apply this research in support of historic preservation in the city.

Institute of Maritime History (IMH) -founding board member and current President. This 501(c)3 not for profit was founded in 1995 (http://www.maritimehistory.org/), to serve as an institutional home for graduate students and at-large scholars whose research would be facilitated by such an affiliation. Many projects have been carried out by IMH. IMH collaborates with LAMP at the St. Augustine Lighthouse & Maritime Museum by providing a 36-foot research vessel for their summer field program.

The St. Augustine Maritime Heritage Foundation (SAMHF) -founding board member and lead Historian and Archaeologist. This 501(c)3 was founded in St. Augustine in 2010 (http://staugmaritimeheritage.org/) as a grass roots community effort to showcase St. Augustine's maritime heritage during the 2013-2015 commemorative period and beyond. Its principal focus is the ongoing development and operation of an authentic 16th century Spanish boatyard and chalupa (a 16th century watercraft) on the grounds of the Fountain of Youth Archaeological Park where docents and volunteers interpret St. Augustine's 16th century maritime past as part of its Public History Program. This was one of the principal legacy projects of St. Augustine's 450th commemorative year.

HERITAGE BOATBUILDING

LAMP Heritage Boatworks:

I founded this wooden boat building program in 2007 at the St. Augustine Lighthouse & Museum to recover and keep alive the time-honoured craft of traditional boat carpentry in St. Augustine. Twelve builds have been completed so far and two are in construction. LAMP Boatworks has also refurbished two craft including the ship's boat of the War of 1812 privateer replica Lynx.

Galveztown Replica Project:

This is a collaborative project with Astilleros Nereo a traditional shipyard in Malaga, Spain. The project consists of building a full-scale replica (56 ft. on deck) of a sailing brig from the American Revolutionary War period called the Galveztown. Collaboration has consisted of organizing the shipment of over 400 tons of Live Oak logs from St. Augustine, Florida and Galveston, Texas to Malaga, Spain as well as supplying archaeological data and reports to inform the design and construction. In addition, the Gaveztown's ship's boat (lines from British archives dated 1760) was built at the LAMP Boatworks and launched May 5th 2016. It will be delivered when the Galveztown makes her first port of call in St. Augustine upon completion.

St. Augustine Chalupa Project:

This is a collaborative project between the St. Augustine Lighthouse & Museum's LAMP program, the St. Augustine Maritime Heritage Foundation (SAMHF), and the Fountain of Youth Archaeological Park. The project consists of combining iconographic, and archival research I have carried out over the past years and combine it with archaeological data obtained by Parks Canada to produce a completely accurate and authentic replica of a 16th century Spanish sailing craft known as a chalupa that was documented as having been built in St. Augustine circa 1597. The craft was launched and christened the San Agustín on March 22nd, 2015. Sea trials have been successfully completed and the craft is rowed on a regular basis. The two masted lug rig has been installed and preliminary sail trials are underway to finalize optimum sail shapes.

TEACHING EXPERIENCE

2013 Adjunct Faculty, Spring Semester
University of North Florida, Construction Management Department
Taught a course titled "The History of Ship Construction" (BCN 4990 Maritime Construction). The course offered relevant instruction to UNF students who went to a shipyard Astilleros Nereo, in Malaga, Spain to work on historic ship reproductions.

2013 Adjunct Faculty, Fall Semester
Flagler College, Department of Social Sciences
Taught "Introduction to Nautical Archaeology" (ANT340c). This course offered an overview of the field of Nautical Archaeology as well some instruction in basic underwater methodology.

2014 Adjunct Faculty, Spring Semester
Flagler College, Department of Social Sciences
Taught “Methods in Nautical Archaeology” (ANT340af). This course provided students with an introduction to a number of submerged archaeological sites and some of the field methods used in Nautical Archaeology. The course also covered relevant topics such as cultural resource management (CRM) and marine remote sensing.

2014 Adjunct Faculty, Fall Semester
Flagler College, Department of Social Sciences
Taught “Introduction to Nautical Archaeology” (ANT340c). This course offered an overview of the field of Nautical Archaeology as well as instruction in basic underwater methodology.

GRANTS

2016 Historic St. Augustine Research Institute for $10,000.00 for the St. Augustine Artillery study.

2018 Historic St. Augustine Research Institute for $5,000.00 for a continuation of the St. Augustine Artillery study.

APPENDIX B
EXECUTED 1A-32 PERMIT

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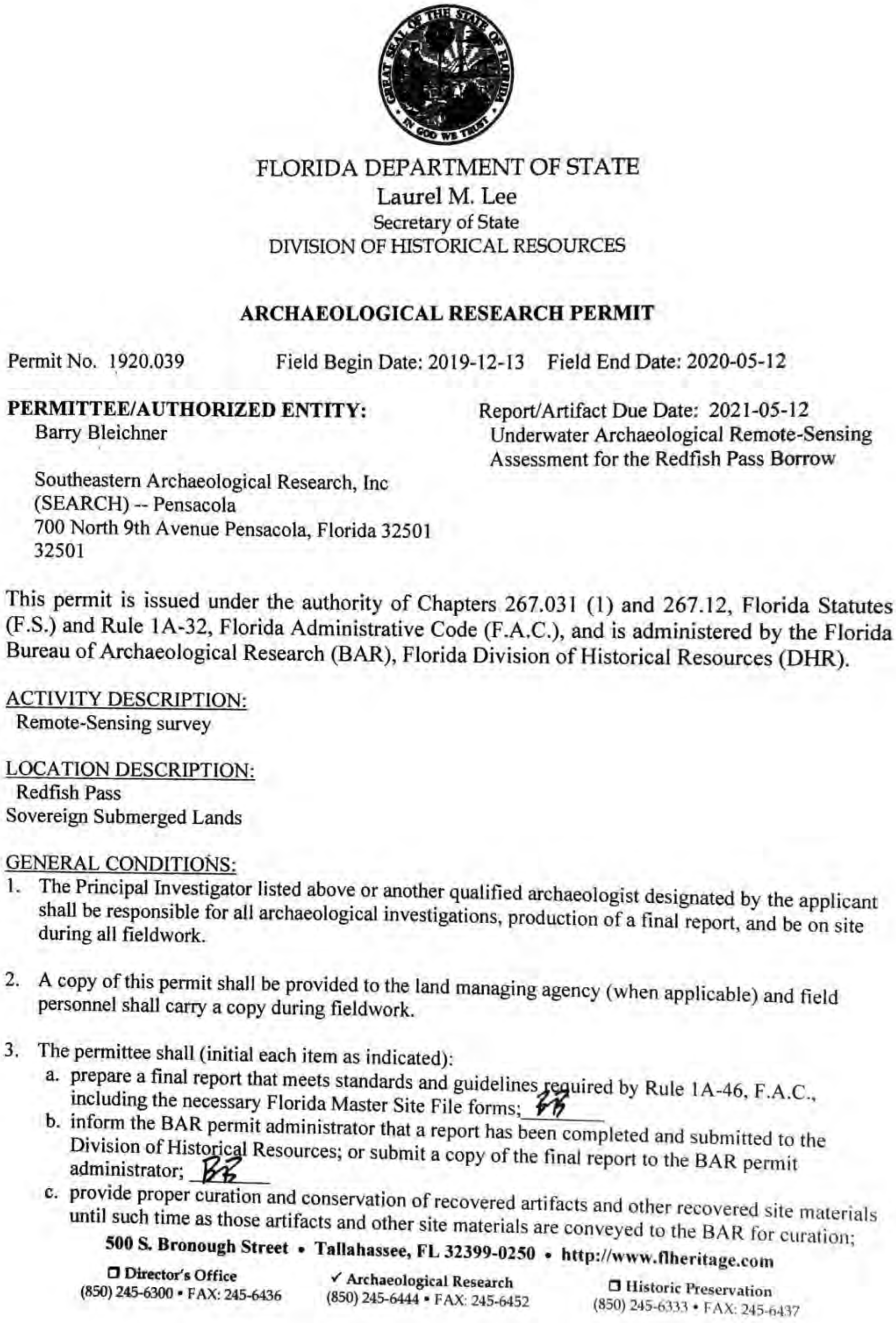


FLORIDA DEPARTMENT OF STATE
Laurel M. Lee
Secretary of State
DIVISION OF HISTORICAL RESOURCES

ARCHAEOLOGICAL RESEARCH PERMIT

Permit No. 1920.039 Field Begin Date: 2019-12-13 Field End Date: 2020-05-12

PERMITTEE/AUTHORIZED ENTITY:
Barry Bleichner

Southeastern Archaeological Research, Inc
(SEARCH) -- Pensacola
700 North 9th Avenue Pensacola, Florida 32501
32501

Report/Artifact Due Date: 2021-05-12
Underwater Archaeological Remote-Sensing
Assessment for the Redfish Pass Borrow

This permit is issued under the authority of Chapters 267.031 (1) and 267.12, Florida Statutes (F.S.) and Rule 1A-32, Florida Administrative Code (F.A.C.), and is administered by the Florida Bureau of Archaeological Research (BAR), Florida Division of Historical Resources (DHR).

ACTIVITY DESCRIPTION:
Remote-Sensing survey

LOCATION DESCRIPTION:
Redfish Pass
Sovereign Submerged Lands

GENERAL CONDITIONS:

1. The Principal Investigator listed above or another qualified archaeologist designated by the applicant shall be responsible for all archaeological investigations, production of a final report, and be on site during all fieldwork.

2. A copy of this permit shall be provided to the land managing agency (when applicable) and field personnel shall carry a copy during fieldwork.

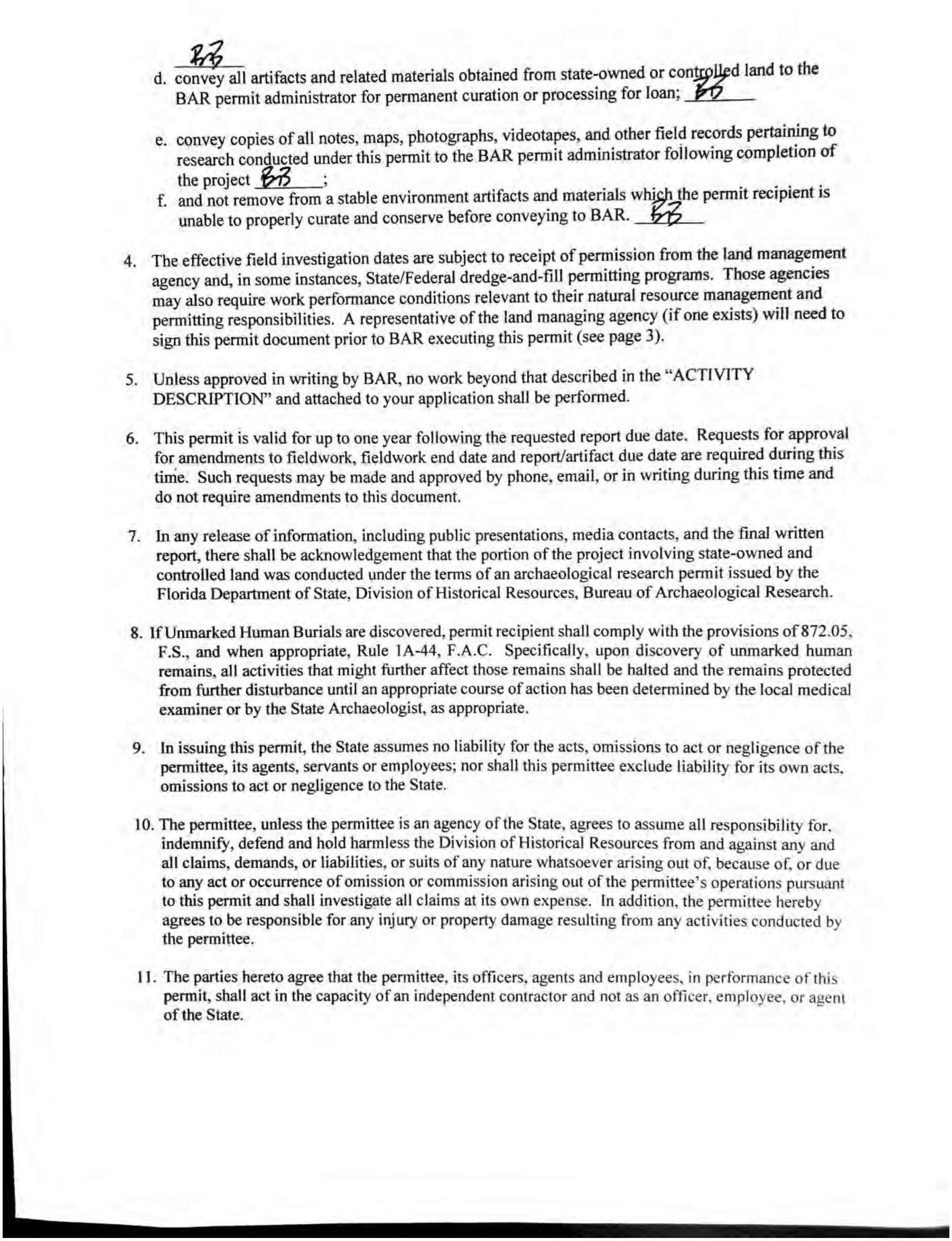
3. The permittee shall (initial each item as indicated):
   a. prepare a final report that meets standards and guidelines required by Rule 1A-46, F.A.C., including the necessary Florida Master Site File forms; BB
   b. inform the BAR permit administrator that a report has been completed and submitted to the Division of Historical Resources; or submit a copy of the final report to the BAR permit administrator; BB
   c. provide proper curation and conservation of recovered artifacts and other recovered site materials until such time as those artifacts and other site materials are conveyed to the BAR for curation;

500 S. Bronough Street • Tallahassee, FL 32399-0250 • http://www.flheritage.com

☐ Director's Office
(850) 245-6300 • FAX: 245-6436

✓ Archaeological Research
(850) 245-6444 • FAX: 245-6452

☐ Historic Preservation
(850) 245-6333 • FAX: 245-6437



BB
d. convey all artifacts and related materials obtained from state-owned or controlled land to the BAR permit administrator for permanent curation or processing for loan; BB

e. convey copies of all notes, maps, photographs, videotapes, and other field records pertaining to research conducted under this permit to the BAR permit administrator following completion of the project BB;

f. and not remove from a stable environment artifacts and materials which the permit recipient is unable to properly curate and conserve before conveying to BAR. BB

4. The effective field investigation dates are subject to receipt of permission from the land management agency and, in some instances, State/Federal dredge-and-fill permitting programs. Those agencies may also require work performance conditions relevant to their natural resource management and permitting responsibilities. A representative of the land managing agency (if one exists) will need to sign this permit document prior to BAR executing this permit (see page 3).

5. Unless approved in writing by BAR, no work beyond that described in the "ACTIVITY DESCRIPTION" and attached to your application shall be performed.

6. This permit is valid for up to one year following the requested report due date. Requests for approval for amendments to fieldwork, fieldwork end date and report/artifact due date are required during this time. Such requests may be made and approved by phone, email, or in writing during this time and do not require amendments to this document.

7. In any release of information, including public presentations, media contacts, and the final written report, there shall be acknowledgement that the portion of the project involving state-owned and controlled land was conducted under the terms of an archaeological research permit issued by the Florida Department of State, Division of Historical Resources, Bureau of Archaeological Research.

8. If Unmarked Human Burials are discovered, permit recipient shall comply with the provisions of 872.05, F.S., and when appropriate, Rule 1A-44, F.A.C. Specifically, upon discovery of unmarked human remains, all activities that might further affect those remains shall be halted and the remains protected from further disturbance until an appropriate course of action has been determined by the local medical examiner or by the State Archaeologist, as appropriate.

9. In issuing this permit, the State assumes no liability for the acts, omissions to act or negligence of the permittee, its agents, servants or employees; nor shall this permittee exclude liability for its own acts, omissions to act or negligence to the State.

10. The permittee, unless the permittee is an agency of the State, agrees to assume all responsibility for, indemnify, defend and hold harmless the Division of Historical Resources from and against any and all claims, demands, or liabilities, or suits of any nature whatsoever arising out of, because of, or due to any act or occurrence of omission or commission arising out of the permittee's operations pursuant to this permit and shall investigate all claims at its own expense. In addition, the permittee hereby agrees to be responsible for any injury or property damage resulting from any activities conducted by the permittee.

11. The parties hereto agree that the permittee, its officers, agents and employees, in performance of this permit, shall act in the capacity of an independent contractor and not as an officer, employee, or agent of the State.

The undersigned, as representative of the Permittee/Authorized Entity, understands and accepts the terms of this 1A-32 Archaeological Research Permit.

Signature

Date: 12/17/19

This permit will not become effective until it has been executed by the Chief of BAR. Before BAR can execute this permit, the Permittee must have a land management representative (if applicable) sign in the space provided above. Please send the signed permit to the Permit Administrator at the address above.

A copy of the executed permit will be sent to you prior to commencing fieldwork.

Executed in Tallahassee, Florida

STATE OF FLORIDA
DEPARTMENT OF STATE

Mary Glowacki, Ph.D.
Chief, Bureau of Archaeological Research

Date of Issue

Enclosures:
- DHR Curation Guidelines
- DHR Conservation Field Guide
- DHR Destructive Analysis Protocol
- DHR Florida Master Site File Requirements
- DHR Report Compliance Requirements

Copies furnished to:
MG

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APPENDIX C
SURVEY NOTES

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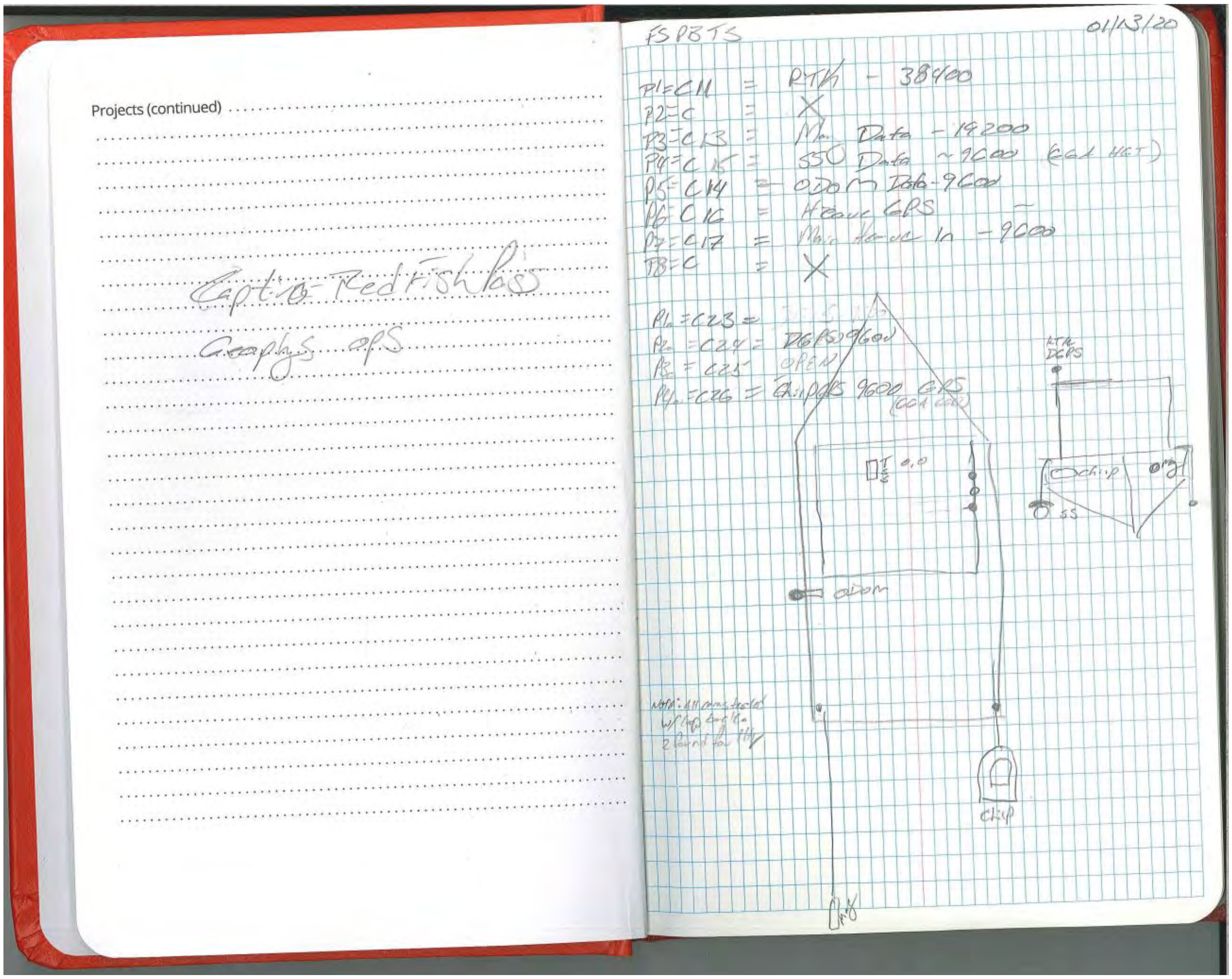


Projects (continued)

Captiva-Redfish Pass

Geophys ops

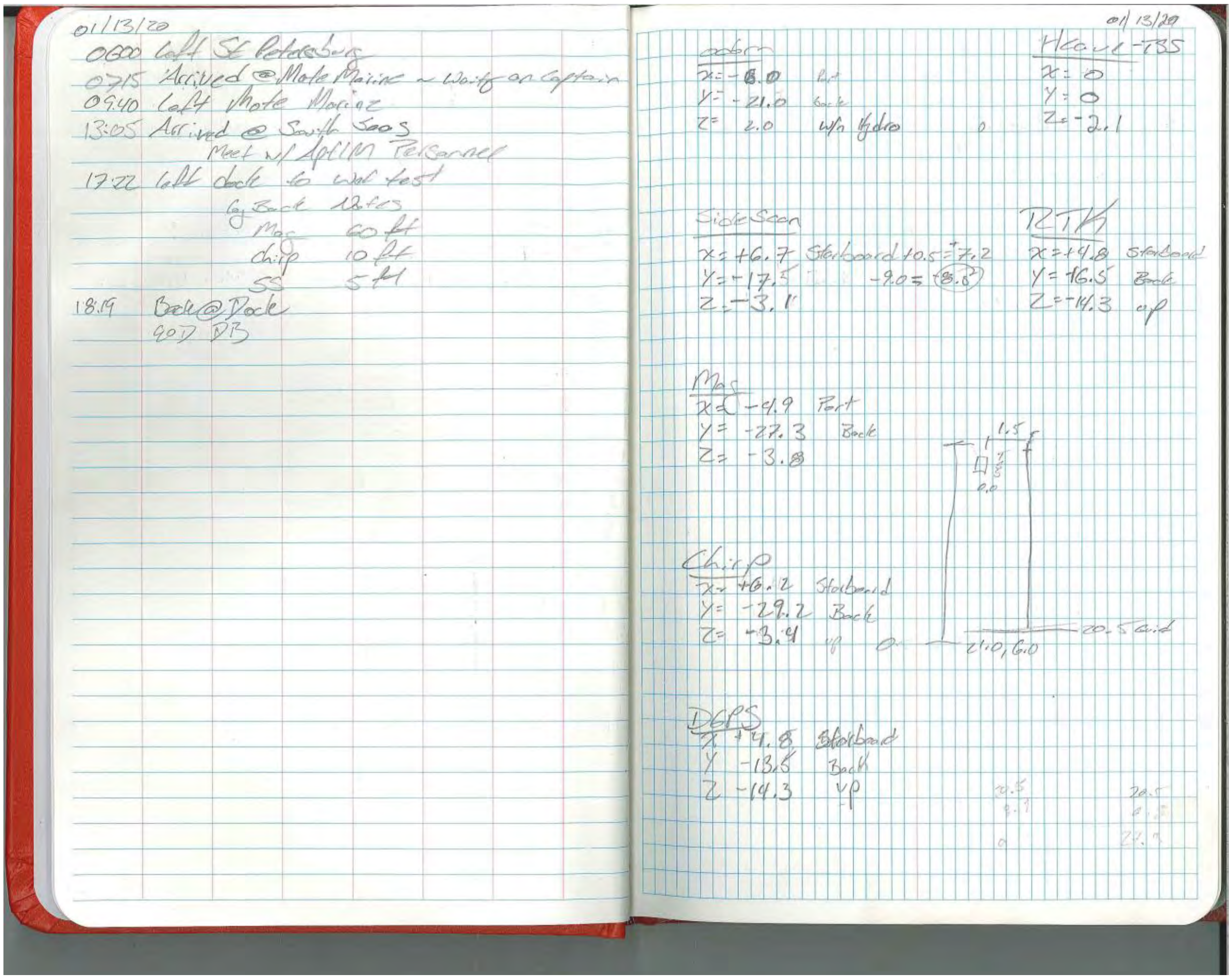
FSPBTS

01/13/20

P1=C11 = RTK - 38400
P2=C = X
P3=C13 = Mag Data - 19200
P4=C15 = SSO Data ~9600 (GGA HGT)
P5=C14 = ODOM Data-9600
P6=C16 = Heave GPS
P7=C17 = Mag Heave In - 9600
P8=C = X

P1=C23 =
P2=C24 = DGPS 9600
P3=C25 OPEN
P4=C26 = ChipGPS 9600 GPS (GGA [illegible])

Note: All coms tested
w/ laptop [illegible]
2 [illegible]



01/13/20
0600 Left St Petersburg
0715 Arrived @ Mote Marine ~ Waiting on Captain
09:40 Left Mote Marine
13:05 Arrived @ South Seas
Meet w/ ApCIM Personnel
17:22 Left dock to wat test
Lay Back Notes
Mag 60 ft
chirp 10 ft
SS 5 ft
18:19 Back @ Dock
90D DB

01/13/20

[illegible]
x = -8.0 Port
Y = -21.0 Back
Z = 2.0 w/n Hydro 0

Heave-TSS
x = 0
Y = 0
Z = -2.1

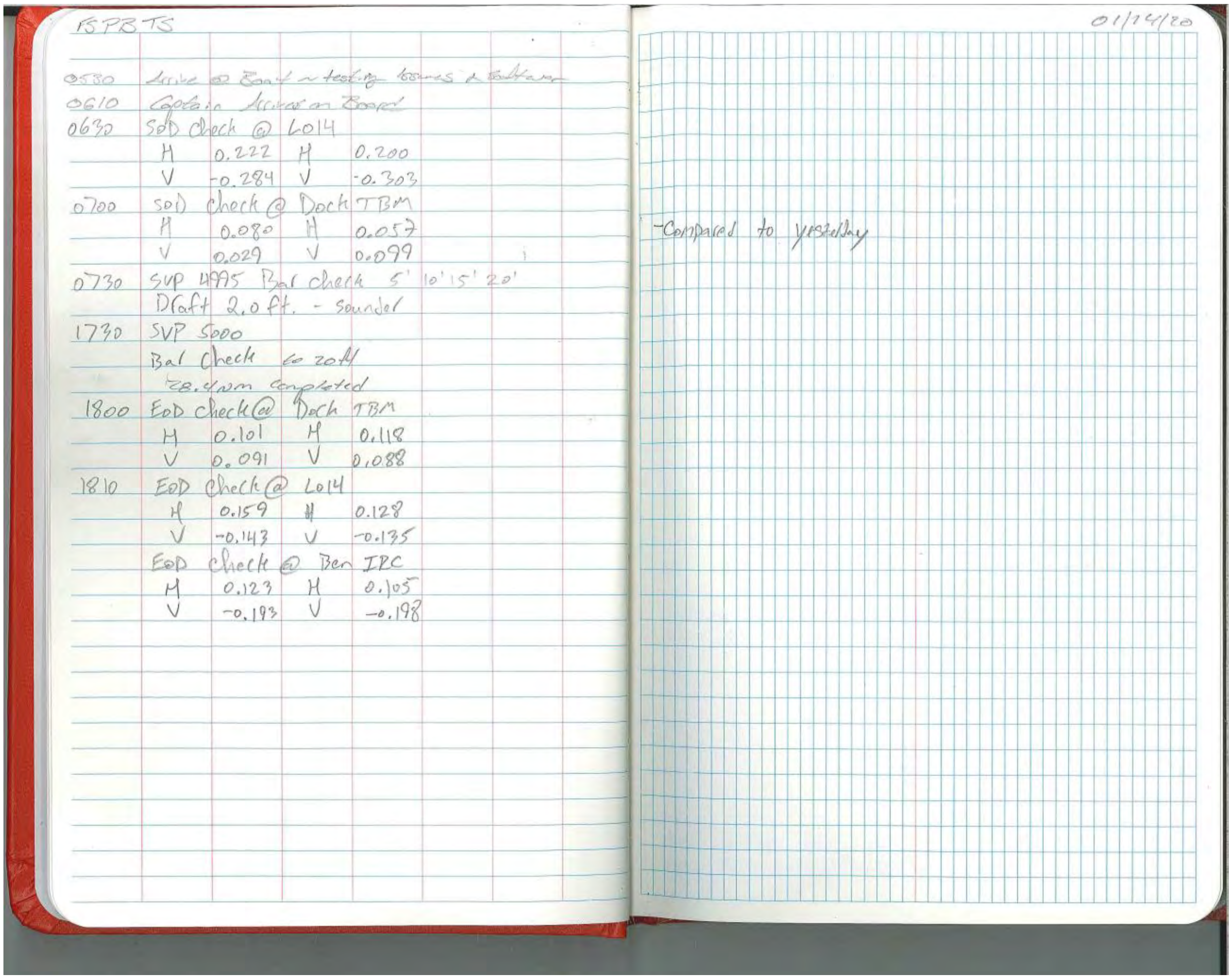
Side Scan
x = +6.7 Starboard +0.5 = 7.2
Y = -17.5 -9.0 = -8.5
Z = -3.1

RTK
x = +4.8 Starboard
Y = +16.5 Back
Z = -14.3 up

Mag
x = -4.9 Port
Y = -27.3 Back
Z = -3.8

Chirp
x = +6.2 Starboard
Y = -29.2 Back
Z = -3.4 up 0

DGPS
X +4.8 Starboard
Y -13.5 Back
Z -14.3 up

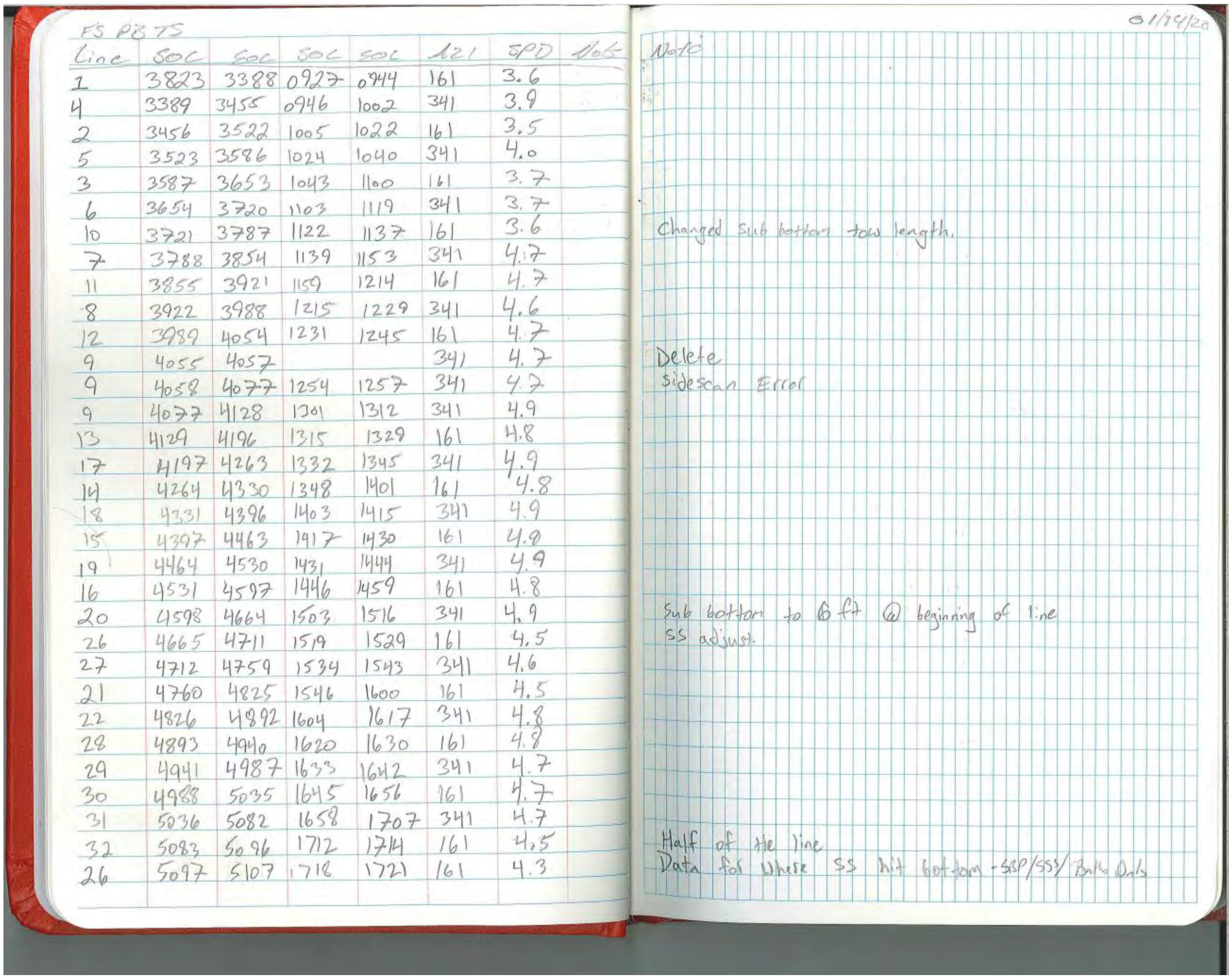


RSPB TS

0530 Arrive @ Boat ~ testing issues & software
0610 Captain Arrives on Board
0630 SoD check @ L014
H 0.222 H 0.200
V -0.284 V -0.303
0700 SoD check @ Dock TBM
H 0.080 H 0.057
V 0.029 V 0.099
0730 SVP 4995 Bar check 5' 10' 15' 20'
Draft 2.0 ft. - sounder
1730 SVP 5000
Bar Check to 20ft
28.4nm completed
1800 EoD check @ Dock TBM
H 0.101 H 0.118
V 0.091 V 0.088
1810 EoD Check @ L014
H 0.159 H 0.128
V -0.143 V -0.135
EoD check @ Ben IPC
H 0.123 H 0.105
V -0.193 V -0.198

01/14/20

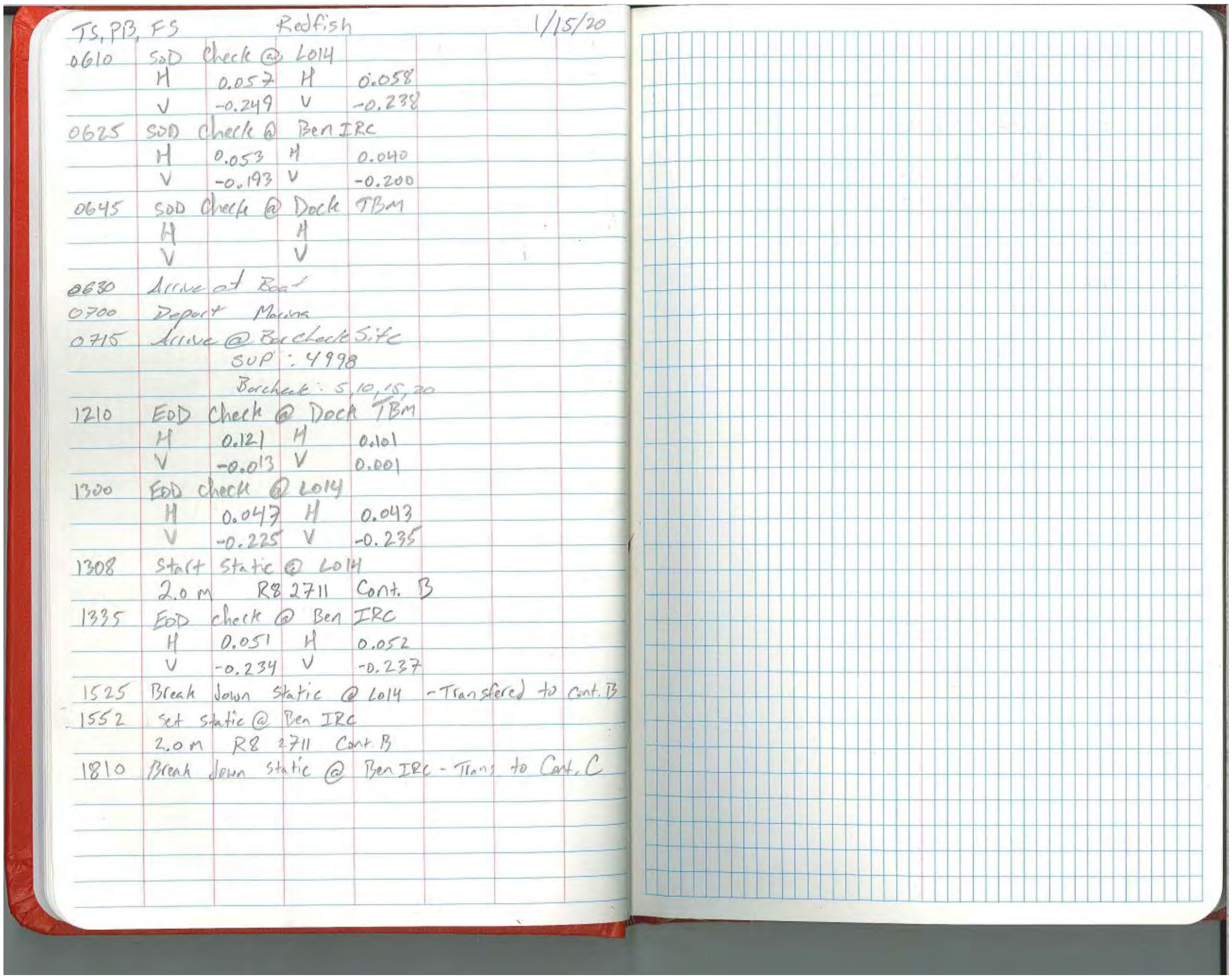
-Compared to yesterday



FS PB TS

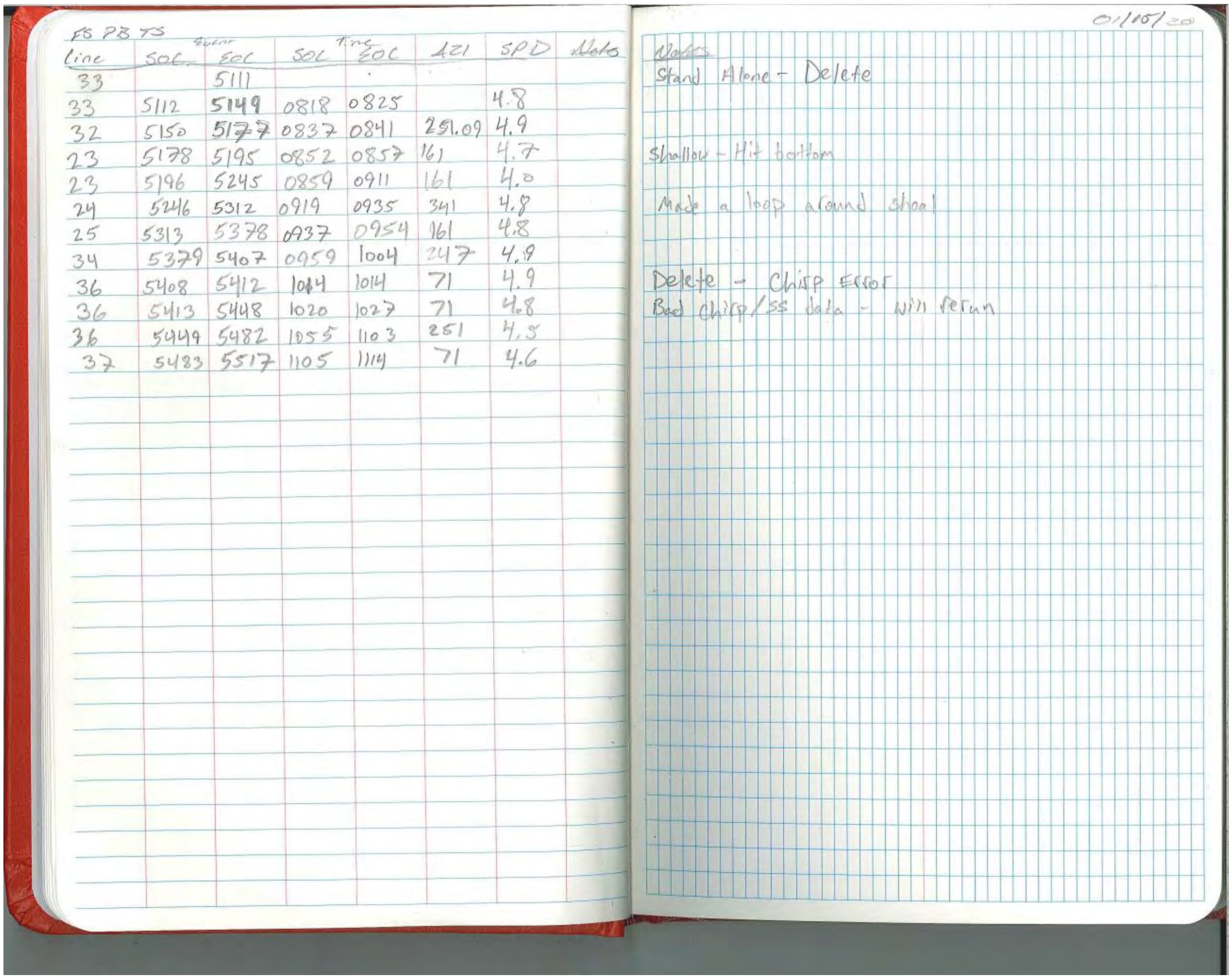
01/14/20

Line	SOL	EOL	SOL	EOL	AZI	SPD	Vol	Note
1	3823	3388	0927	0944	161	3.6		
4	3389	3455	0946	1002	341	3.9		
2	3456	3522	1005	1022	161	3.5		
5	3523	3586	1024	1040	341	4.0		
3	3587	3653	1043	1100	161	3.7		
6	3654	3720	1103	1119	341	3.7		
10	3721	3787	1122	1137	161	3.6		Changed sub bottom tow length.
7	3788	3854	1139	1153	341	4.7		
11	3855	3921	1159	1214	161	4.7		
8	3922	3988	1215	1229	341	4.6		
12	3989	4054	1231	1245	161	4.7		
9	4055	4057			341	4.7		Delete
9	4058	4077	1254	1257	341	4.7		sidescan Error
9	4077	4128	1301	1312	341	4.9		
13	4129	4196	1315	1329	161	4.8		
17	4197	4263	1332	1345	341	4.9		
14	4264	4330	1348	1401	161	4.8		
18	4331	4396	1403	1415	341	4.9		
15	4397	4463	1417	1430	161	4.9		
19	4464	4530	1431	1444	341	4.9		
16	4531	4597	1446	1459	161	4.8		
20	4598	4664	1503	1516	341	4.9		Sub bottom to 6 ft @ beginning of line
26	4665	4711	1519	1529	161	4.5		SS adjust.
27	4712	4759	1534	1543	341	4.6		
21	4760	4825	1546	1600	161	4.5		
22	4826	4892	1604	1617	341	4.8		
28	4893	4940	1620	1630	161	4.8		
29	4941	4987	1633	1642	341	4.7		
30	4988	5035	1645	1656	161	4.7		
31	5036	5082	1658	1707	341	4.7		
32	5083	5096	1712	1714	161	4.5		Half of the line
26	5097	5107	1718	1721	161	4.3		Data for where SS hit bottom - SBP/SSS/Bath Only



TS, PB, FS Redfish 1/15/20

0610	SOD Check @ L014			
	H	0.057	H	0.058
	V	-0.249	V	-0.238
0625	SOD Check @ Ben IRC			
	H	0.053	H	0.040
	V	-0.193	V	-0.200
0645	SOD Check @ Dock TBM			
	H		H	
	V		V	
0630	Arrive at Boat			
0700	Depart Marina			
0715	Arrive @ Barcheck Site			
		SUP : 4998		
		Barcheck : 5, 10, 15, 20		
1210	EOD Check @ Dock TBM			
	H	0.121	H	0.101
	V	-0.013	V	0.001
1300	EOD check @ L014			
	H	0.047	H	0.043
	V	-0.225	V	-0.235
1308	Start Static @ L014			
	2.0 m	R8 2711	Cont. B	
1335	EOD check @ Ben IRC			
	H	0.051	H	0.052
	V	-0.234	V	-0.237
1525	Break down Static @ L014 - Transfered to Cont. B			
1552	Set static @ Ben IRC			
	2.0 m	R8 2711	Cont. B	
1810	Break down static @ Ben IRC - Trans to Cont. C			



FS PB TS

01/10/20

	Sonar		Time				
Line	SOL	EOL	SOL	EOL	AZI	SPD	Notes
33		5111					Stand Alone - Delete
33	5112	5149	0818	0825		4.8	
32	5150	5177	0837	0841	251.09	4.9	
23	5178	5195	0852	0857	161	4.7	Shallow - Hit bottom
23	5196	5245	0859	0911	161	4.0	
24	5246	5312	0919	0935	341	4.8	Made a loop around shoal
25	5313	5378	0937	0954	161	4.8	
34	5379	5407	0959	1004	247	4.9	
36	5408	5412	1004	1014	71	4.9	Delete - Chirp Error
36	5413	5448	1020	1027	71	4.8	Bad chirp/SS data - will rerun
36	5449	5482	1055	1103	251	4.5	
37	5483	5517	1105	1114	71	4.6	

APPENDIX D

REMOTE-SENSING SURVEY RESULTS—NOT FOR PUBLIC DISCLOSURE

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Name	Centroid (NAD83 SP FL-W)		Priority	Composition	Lines Crossed	Declination	Distance (ft)			Amplitude Raw		Amplitude Rel		Amplitude Ratio	Amplitude Gradient (g/ft)	SSS Contact	SBP Reflector	Diver Verified	Source
	Easting	Northing					Major Poles	Along Track	Across Track	Pos	Neg	Pos	Neg						
M001	584262.8161	807734.2798	N	MP	1	N/A	N/A	56	66	N/A	44413	N/A	-11	N/A	0	no	no	no	Unknown
M002	584639.0291	807817.3243	Y	MC	3	N/A	71	209	330	44496	44253	88	-155	01:00.6	0.2	no	no	no	Unknown
M003	585542.5013	808184.6854	N	DP	1	165	24	80	98	44502	44380	94	-27	01:03.5	0	no	no	no	Unknown
M004	585866.7635	808549.4944	Y	MC	5	153	60	199	483	44486	44300	54	-129	01:00.4	4.9	no	no	no	Unknown
M005	586255.0037	808614.4883	N	MP	1	N/A	N/A	31	65	44446	N/A	16	N/A	N/A	0	no	no	no	Unknown
M006	587035.8173	808025.8399	N	MP	1	N/A	N/A	59	84	44465	N/A	30	N/A	N/A	0.2	no	no	no	Unknown
M007	586767.6749	807659.1731	N	MP	1	N/A	N/A	66	90	N/A	44397	N/A	-27	N/A	0	no	no	no	Unknown
M008	586392.5013	807276.708	N	MP	1	N/A	N/A	57	69	N/A	44410	N/A	-19	N/A	0	no	no	no	Unknown
M009	585626.5315	807716.9187	N	MP	1	N/A	N/A	41	42	44427	N/A	11	N/A	N/A	0	no	no	no	Unknown
M010	585512.9873	807719.9371	N	DP	2	-103	52	113	87	44440	44367	9	-63	01:00.1	0	no	no	no	Unknown
M011	585391.1123	807742.333	N	MP	1	N/A	N/A	34	63	44431	N/A	21	N/A	N/A	0	no	no	no	Unknown
M012	585510.9041	807439.208	N	DP	1	-15	51	124	91	44443	44404	33	-5	01:06.6	0.1	no	no	no	Unknown
M013	585395.2791	807483.9997	N	DP	1	169	39	111	134	44417	44295	10	-112	01:00.1	0.1	no	no	no	Unknown
M014	585193.4585	807468.3727	N	MP	1	N/A	N/A	47	60	44425	N/A	14	N/A	N/A	0.2	no	no	no	Unknown
M015	586234.3439	807561.1896	N	MP	1	N/A	N/A	19	26	44435	N/A	12	N/A	N/A	0	no	no	no	Unknown
M016	585088.8553	806507.4371	N	MP	1	N/A	N/A	55	89	44438	N/A	28	N/A	N/A	0	no	R002.1	no	Unknown
M017	587255.9851	806790.8862	N	DP	1	174	23	49	43	44449	44426	15	-7	01:02.1	0.1	no	no	no	Unknown
M018	587244.3531	806271.9626	N	MP	1	N/A	N/A	37	95	44479	N/A	55	N/A	N/A	0	no	no	no	Unknown
M019	586230.1169	805957.5528	N	MC	1	-6	21	80	112	44453	44303	35	-115	01:00.3	0.1	no	no	no	Unknown
M020	586357.8947	805839.4973	N	MP	2	N/A	N/A	51	68	N/A	44370	N/A	-37	N/A	0	no	no	no	Unknown
M021	587548.4065	805738.6201	N	MP	1	N/A	N/A	27	40	44447	N/A	12	N/A	N/A	0	no	no	no	Unknown
M022	587573.8669	805667.275	N	MP	1	N/A	N/A	74	102	N/A	44379	N/A	-54	N/A	0.6	no	no	no	Unknown
M023	587469.7003	805651.3029	N	MP	1	N/A	N/A	67	89	44452	N/A	28	N/A	N/A	0	no	no	no	Unknown
M024	587377.8335	805278.5508	N	MP	1	N/A	N/A	48	81	N/A	44412	N/A	-15	N/A	0.1	no	no	no	Unknown
M025	587430.4643	805158.5944	N	MP	1	N/A	N/A	36	88	N/A	44399	N/A	-28	N/A	0.5	no	no	no	Unknown
M026	586674.9087	805256.5111	N	MP	1	N/A	N/A	45	75	N/A	44391	N/A	-19	N/A	1.4	no	no	no	Unknown
M027	586712.4087	805126.65	N	DP	1	-13	29	72	83	44435	44403	25	-7	01:03.6	0	no	no	no	Unknown
M028	587015.1865	804849.5668	N	DP	1	-12	35	109	141	44526	44407	109	-10	01:10.9	0.2	no	no	no	Unknown
M029	586783.2419	804634.9834	N	MP	1	N/A	N/A	56	105	44454	N/A	48	N/A	N/A	0	no	no	no	Unknown
M030	586279.9435	804309.8098	N	DP	1	176	38	67	84	44453	44402	44	-7	01:06.3	0	no	no	no	Unknown
M031	585329.3959	804015.3563	N	MP	1	N/A	N/A	50	100	44441	N/A	12	N/A	N/A	0	no	no	no	Unknown
M032	585879.1357	803055.3736	N	MP	1	N/A	N/A	51	61	N/A	44409	N/A	-11	N/A	0	no	no	no	Unknown
M033	585954.4225	803125.6082	N	MP	1	N/A	N/A	69	91	44450	N/A	24	N/A	N/A	0.1	no	no	no	Unknown
M034	586696.0893	803417.7958	N	DP	2	64	26	48	72	44417	44395	11	-11	1:01	0	no	no	no	Unknown
M035	586870.5685	803485.5043	N	MP	1	N/A	N/A	109	165	44547	N/A	140	N/A	N/A	0.1	no	no	no	Unknown
M036	587050.2559	803525.8687	N	MC	2	165	59	168	163	44423	44388	6	-29	01:00.2	0.9	no	no	no	Unknown
M037	587564.6655	803822.7438	N	DP	1	N/A	N/A	37	49	44451	44417	25	-8	01:03.1	0	no	no	no	Unknown
M038	587483.9365	804072.4834	N	MP	1	N/A	N/A	38	79	N/A	44396	N/A	-29	N/A	0	no	no	no	Unknown
M039	587641.7225	804211.6237	N	DP	1	-175	16	29	16	44434	44419	7	-8	01:00.9	0	no	no	no	Unknown
M040	587742.4169	804266.7451	N	DP	1	-13	17	34	19	44434	44418	8	-7	01:01.1	0	no	no	no	Unknown

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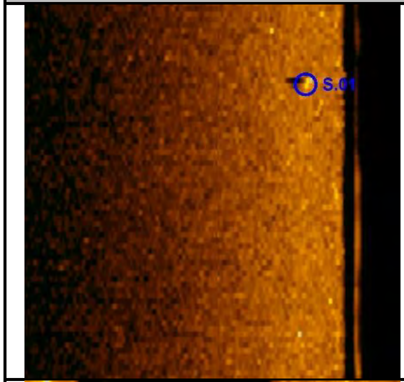
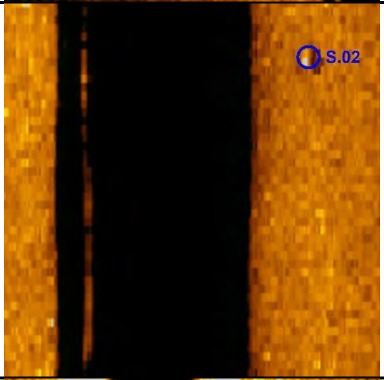
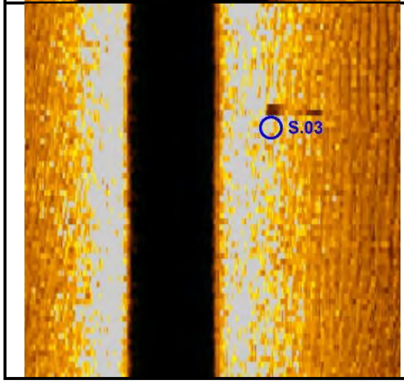
REDFISH PASS SIDE-SCAN SONAR CONTACTS

Generated on 1/30/2020 10:23:00 AM

Target Image	Target Info	User Entered Info
	**S.01** • Sonar Time at Target: 1/14/2020 11:15:28 AM • Click Position 26.5538894755 -82.2183827188 (WGS84) 26.5535344746 -82.2185652850 (NAD27LL) 26.5538894755 -82.2183827188 (LocalLL) (X) 584778.4 (Y) 807073.3 (Projected Coordinates) • Map Projection: NAD1983 State Plane Florida West • Acoustic Source File: P:\Maritime\M19250_TO1_Redfish Pass_APTIM_Lee_BJB\Survey\APTIM_Redfish_Pass_2020\Sidescan_Redfish\RFP_2020_Line_006.jsf • Ping Number: 65814 • Range to target: 5.73 Meters • Fish Height: 0.00 Meters • Heading: 352.200 Degrees • Event Number: (-1) • Line Name: RFP_2020_Line_006 • Water Depth: 1.47 Meters	**Dimensions and attributes** • Target Width: 0.60 Meters • Target Height: 0.00 Meters • Target Length: 0.59 Meters • Target Shadow: 1.30 Meters • Mag Anomaly: N/A • Avoidance Area: • Classification1: Crab Pot • Classification2: • Area: • Block: • Description:
	**S.02** • Sonar Time at Target: 1/14/2020 12:27:21 PM • Click Position 26.5556251037 -82.2182481032 (WGS84) 26.5552701710 -82.2184306867 (NAD27LL) 26.5556251037 -82.2182481032 (LocalLL) (X) 584823.9 (Y) 807931.6 (Projected Coordinates) • Map Projection: NAD1983 State Plane Florida West • Acoustic Source File: P:\Maritime\M19250_TO1_Redfish Pass_APTIM_Lee_BJB\Survey\APTIM_Redfish_Pass_2020\Sidescan_Redfish\RFP_2020_Line_008.jsf • Ping Number: 94263 • Range to target: 6.66 Meters • Fish Height: 0.00 Meters • Heading: 347.790 Degrees • Event Number: (-1) • Line Name: RFP_2020_Line_008 • Water Depth: 1.45 Meters	**Dimensions and attributes** • Target Width: 0.59 Meters • Target Height: 0.00 Meters • Target Length: 0.55 Meters • Target Shadow: 0.55 Meters • Mag Anomaly: N/A • Avoidance Area: • Classification1: Crab Pot • Classification2: • Area: • Block: • Description:
	**S.03** • Sonar Time at Target: 1/14/2020 3:09:10 PM • Click Position 26.5498688054 -82.2122571835 (WGS84) 26.5495136690 -82.2124398597 (NAD27LL) 26.5498688054 -82.2122571835 (LocalLL) (X) 586778.4 (Y) 805608.5 (Projected Coordinates) • Map Projection: NAD1983 State Plane Florida West • Acoustic Source File: P:\Maritime\M19250_TO1_Redfish Pass_APTIM_Lee_BJB\Survey\APTIM_Redfish_Pass_2020\Sidescan_Redfish\RFP_2020_Line_020.jsf • Ping Number: 51017 • Range to target: 6.43 Meters • Fish Height: 0.00 Meters • Heading: 352.600 Degrees • Event Number: (-1) • Line Name: RFP_2020_Line_020 • Water Depth: 1.44 Meters	**Dimensions and attributes** • Target Width: 0.88 Meters • Target Height: 0.00 Meters • Target Length: 0.73 Meters • Target Shadow: 3.64 Meters • Mag Anomaly: N/A • Avoidance Area: • Classification1: Possible Bouy and Chain • Classification2: • Area: • Block: • Description:

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APPENDIX E
FDHR SURVEY LOG SHEET

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Ent D (FMSF only) ____________

Survey Log Sheet

Florida Master Site File
Version 5.0 3/19

Survey # (FMSF only) ____________

Consult *Guide to the Survey Log Sheet* for detailed instructions.

Manuscript Information

Survey Project (name and project phase)
Redfish Pass Marine Remote Sensing Survey, Phase I.

Report Title (exactly as on title page)
MARINE ARCHAEOLOGICAL RESOURCES ASSESSMENT FOR THE PROPOSED
REDFISH PASS BORROW AREA,

Report Authors (as on title page)
1. Sam Turner
2. Barry Bleichner
3. Kyle Lent
4. Raymond Tubby

Publication Year 2020 **Number of Pages in Report** (do not include site forms) 107

Publication Information (Give series, number in series, publisher and city. For article or chapter, cite page numbers. Use the style of *American Antiquity*.)
N/A

Supervisors of Fieldwork (even if same as author) Names Frnaky Stankiewicz (APTIM)

Affiliation of Fieldworkers: Organization Archaeological Consultants Inc City Tampa, Florida

Key Words/Phrases (Don't use county name, or common words like *archaeology*, *structure*, *survey, architecture, etc.*)
1. Redfish Pass
2. Captiva Island
3. North Captiva Island
4. Sanibbel Island
5. Remote Sensing Survey
6. Sand Borrow Area
7. Marine Archaeological
8. Resource Assessment

Survey Sponsors (corporation, government unit, organization, or person funding fieldwork)
Name Captiva Erosion Prevention District (CE Organization ____________
Address/Phone/E-mail 11513 ANDY ROSSE LANE,3RD FLOOR,UNIT 4,CAPTIVA FL 33924,(239)472-2472

Recorder of Log Sheet Sam Turner **Date Log Sheet Completed** 3-10-2020

Is this survey or project a continuation of a previous project? ☒No ☐Yes: **Previous survey #s (FMSF only)** ____________

Project Area Mapping

Counties (select every county in which field survey was done; attach additional sheet if necessary)
1. Lee
2. ____________
3. ____________
4. ____________
5. ____________
6. ____________

USGS 1:24,000 Map Names/Year of Latest Revision (attach additional sheet if necessary)
1. Name CAPTIVA Year 2011
2. Name CAPTIVA Year 2011
3. Name ____________ Year ______
4. Name ____________ Year ______
5. Name ____________ Year ______
6. Name ____________ Year ______

Field Dates and Project Area Description

Fieldwork Dates: Start 1-14-2020 **End** 1-15-2020 **Total Area Surveyed** (fill in one) 156.00 hectares ________ acres

Number of Distinct Tracts or Areas Surveyed 1

If Corridor (fill in one for each) **Width:** ________ meters ________ feet **Length:** ________ kilometers ________ miles

Survey Log Sheet

Survey #__________

Research and Field Methods

Types of Survey (select all that apply): ☒archaeological ☐architectural ☐historical/archival ☒underwater
☐damage assessment ☐monitoring report ☐other(describe): __________

Scope/Intensity/Procedures

Preliminary Methods (select as many as apply to the project as a whole)

- ☒Florida Archives (Gray Building)
- ☐Florida Photo Archives (Gray Building)
- ☐Site File property search
- ☐Site File survey search
- ☒library research- *local public*
- ☐library-special collection
- ☐Public Lands Survey (maps at DEP)
- ☐local informant(s)
- ☐local property or tax records
- ☒newspaper files
- ☒literature search
- ☐Sanborn Insurance maps
- ☒other historic maps
- ☐soils maps or data
- ☐windshield survey
- ☐aerial photography
- ☐LIDAR
- ☐other remote sensing

☐other (describe): __________

Archaeological Methods (select as many as apply to the project as a whole)

☐Check here if **NO** archaeological methods were used.

- ☐surface collection, controlled
- ☐surface collection, uncontrolled
- ☐shovel test-1/4"screen
- ☐shovel test-1/8" screen
- ☐shovel test 1/16"screen
- ☐shovel test-unscreened
- ☐shovel test-other screen size
- ☐water screen
- ☐posthole tests
- ☐auger tests
- ☐coring
- ☐test excavation (at least 1x2 m)
- ☐block excavation (at least 2x2 m)
- ☐soil resistivity
- ☒magnetometer
- ☒side scan sonar
- ☐ground penetrating radar (GPR)
- ☐LIDAR
- ☐metal detector
- ☒other remote sensing
- ☐pedestrian survey
- ☐unknown

☐other (describe): Sub-bottom Profiler

Historical/Architectural Methods (select as many as apply to the project as a whole)

☒Check here if **NO** historical/architectural methods were used.

- ☐building permits
- ☐commercial permits
- ☐interior documentation
- ☐demolition permits
- ☐windshield survey
- ☐local property records
- ☐neighbor interview
- ☐occupant interview
- ☐occupation permits
- ☐subdivision maps
- ☐tax records
- ☐unknown

☐other (describe): __________

Survey Results

Resource Significance Evaluated? ☐Yes ☒No

Count of Previously Recorded Resources 3 **Count of Newly Recorded Resources** 0

List Previously Recorded Site ID#s with Site File Forms Completed (attach additional pages if necessary)

8LL01611

List Newly Recorded Site ID#s (attach additional pages if necessary)

N/A

Site Forms Used: ☐Site File Paper Forms ☒Site File PDF Forms

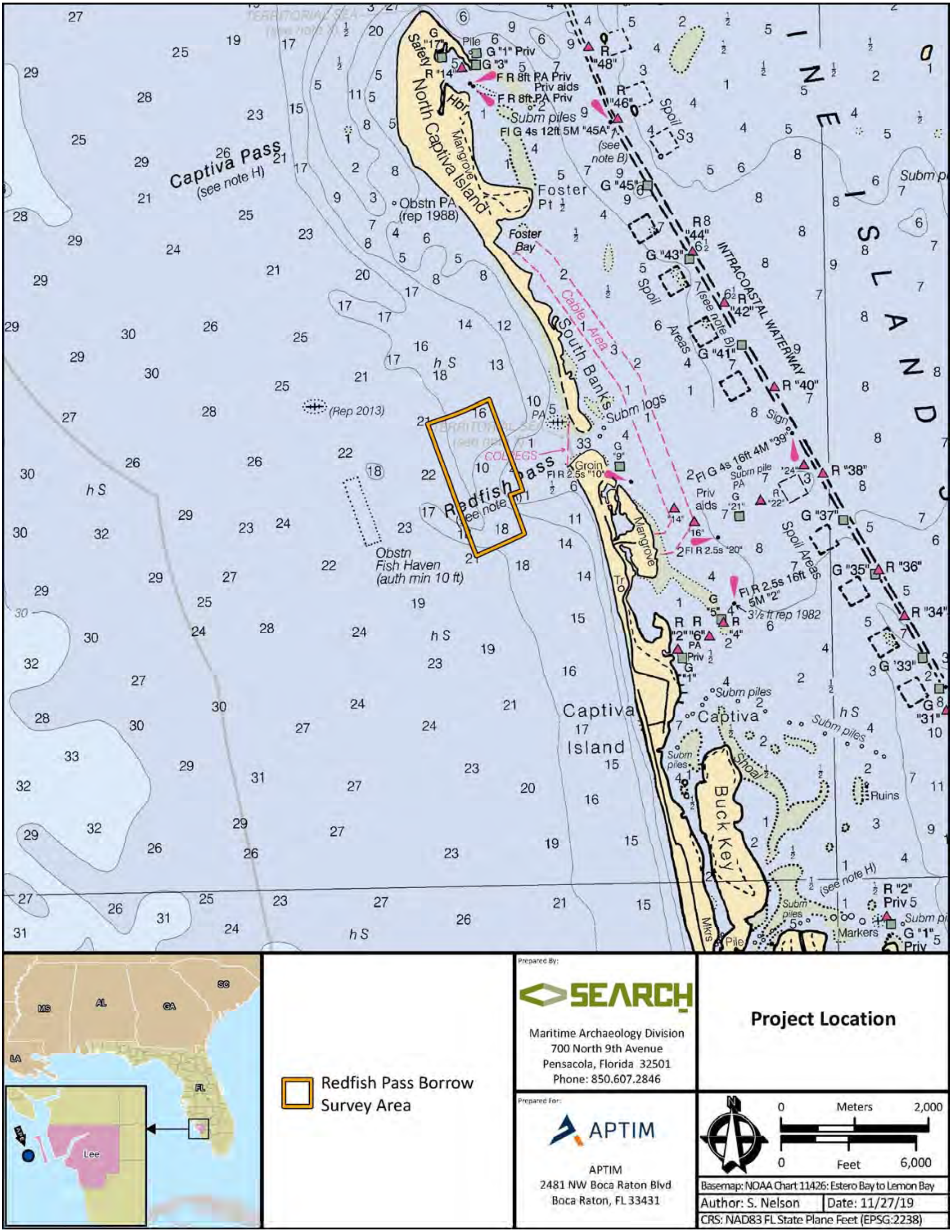
REQUIRED: Attach Map of Survey or Project Area Boundary

SHPO USE ONLY SHPO USE ONLY SHPO USE ONLY

Origin of Report: ☐872 ☐Public Lands ☐UW ☐1A32 # __________ ☐Academic ☐Contract ☐Avocational
☐Grant Project # __________ ☐Compliance Review: CRAT # __________

Type of Document: ☐Archaeological Survey ☐Historical/Architectural Survey ☐Marine Survey ☐Cell Tower CRAS ☐Monitoring Report
☐Overview ☐Excavation Report ☐Multi-Site Excavation Report ☐Structure Detailed Report ☐Library, Hist. or Archival Doc
☐Desktop Analysis ☐MPS ☐MRA ☐TG ☐Other: __________

Document Destination: Plottable Projects **Plotability:** __________



☐ Redfish Pass Borrow Survey Area

Prepared By:

SEARCH

Maritime Archaeology Division
700 North 9th Avenue
Pensacola, Florida 32501
Phone: 850.607.2846

Prepared For:

APTIM

APTIM
2481 NW Boca Raton Blvd
Boca Raton, FL 33431

Project Location

Basemap: NOAA Chart 11426: Estero Bay to Lemon Bay

Author: S. Nelson

Date: 11/27/19

CRS: NAD83 FL State Plane Feet (EPSG:2238)

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APPENDIX F
UNANTICIPATED DISCOVERIES PLAN

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UNANTICIPATED DISCOVERIES OF ARCHAEOLOGICAL SITES, HISTORIC SITES, and SUBMERGED CULTURAL RESOURCES INCLUDING HUMAN REMAINS

Although a project area may receive a complete cultural resource assessment survey, it is impossible to ensure that all cultural resources will be discovered. Even at sites that have been previously identified and assessed, there is a potential for the discovery of previously unidentified archaeological components, features, or human remains that may require investigation and assessment. Therefore, a procedure has been developed for the treatment of any unexpected discoveries that may occur during site development.

If unexpected cultural resources are discovered, the following steps should be taken:

1) Initially, all work in the immediate area of the discovery should cease and reasonable efforts should be made to avoid or minimize impacts to the cultural resources.
2) The Captiva Erosion Prevention District (CEPD) should be contacted immediately and should evaluate the nature of the discovery.
3) The CEPD should then contact the State Historic Preservation Officer (SHPO) and if necessary, the State Archaeologist.
4) As much information as possible concerning the cultural resource, such as resource type, location, and size, as well as any information on its significance, should be provided to the SHPO.
5) Consultation with the SHPO should occur in order to obtain technical advice and guidance for the evaluation of the discovered cultural resource.
6) If necessary, a mitigation plan should be prepared for the discovered cultural resource. This plan should be sent to the SHPO for review and comment. The SHPO should be expected to respond with preliminary comments within two working days, with final comments to follow as quickly as possible.
7) If a formal data recovery mitigation plan is required, development activities in the near vicinity of the cultural resource should be avoided to ensure that no adverse impact to the resource occurs until the mitigation plan can be executed.

In the event that unrecorded shipwreck sites and/or other underwater archaeological resources are discovered *(adapted from The Commonwealth of Massachusetts, Board of Underwater Archaeological Resources, Office of Coastal Zone Management)***:**

1) In the event that a suspected shipwreck or other site is uncovered during construction activity, that activity shall immediately be halted in the area of the find until it can be determined whether the object is a shipwreck or other underwater archaeological resource and if it represents a potentially significant feature or site.
2) The project field staff will immediately notify CEPD upon the suspension of work activities in the area of the find. Notification will include the specific location in which the potential feature or site is located.

3) The CEPD will immediately contact its cultural resource management consultant to review the information. On-site personnel will provide information on the location and any discernable characteristics of the potential cultural resource (the target), and any survey data depicting the find. This information will be forwarded for review by the CEPD for the cultural resource management consultant.

4) If the project archaeologist determines that the site, feature, or target is not potentially cultural, the project field staff through the CEPD will be notified by the project archaeologist that work may resume. The project archaeologist will notify the CEPD of this determination.

5) If, based upon both previously acquired and current remote-sensing survey data, or other indications (e.g., timbers, etc.), it is determined that the new target is possibly a shipwreck or other potential submerged cultural resource, the project archaeologist will inform the CEPD, who will inform the project field staff that work may not resume at the given location until notified in writing by the CEPD. The cognizant review agencies, SHPO, and Advisory Council (if applicable) will be notified of this determination within two working days.

6) A visual inspection by archaeological divers or remotely operated vehicle (ROV) will be conducted to determine if the site is potentially eligible for listing in the National Register. The results of the survey will be formally submitted to cognizant review agencies, SHPO, and the Advisory Council (if applicable) for final review and comment. The SHPO and CEPD will endeavor to respond within two working days of receiving the inspection results and recommendations.

7a) If it is determined that the target, feature, or site does not represent a potentially significant resource, and CEPD is in receipt of written comment from the review agency(s), work may resume in that area.

7b) If a National Register determination cannot be made in accordance with Step 6, CEPD may either undertake additional research to satisfy Step 6 or exercise Step 8 (avoidance).

8) If agency review concurs or concludes that the site may be important and is potentially National Register-eligible, the CEPD will develop avoidance measures to eliminate the site from the Area of Potential Effects. Any proposed avoidance measures will be made available to the cognizant review agencies for review and comment.

9) If avoidance measures cannot be developed and executed, the resource may be excavated and/or removed only under a memorandum of agreement with all interested parties including the State Archaeologist, SHPO, CEPD, and, if applicable, the Advisory Council subject to appropriate state permits. This memorandum will outline an adequate data recovery plan that specifies a qualified research team and an appropriate research design. The appropriate permits must also be secured from the Florida Bureau of Archaeological Research (BAR) prior to conducting any further disturbance to the site.

If HUMAN REMAINS are encountered on a site during development, the stipulations of Chapter 872.05 (*Offenses Concerning Dead Bodies and Graves*) should be followed. All work in the near vicinity of the human remains should cease and reasonable efforts should be made to avoid and protect the remains from additional impact. A qualified Professional Archaeologist should be retained to investigate the reported discovery, inventory the remains and any associated artifacts, and assist in coordinating with state and local officials.

The County Medical Examiner should be immediately notified as to the findings. If the remains are found to be other than human, any construction will be cleared to proceed. If the remains are human, and are less than 75 years old, the Medical Examiner and local law enforcement officials will assume jurisdiction. If the remains are found to be human and older than 75 years, the State Archaeologist should be notified and may assume jurisdiction of the remains.

If jurisdiction is assumed by the State Archaeologist, he will (a) determine whether the human remains represent a significant archaeological resource, and (b) make a reasonable effort to identify and locate persons who can establish direct kinship, tribal community, or ethnic relationship with the remains. If such a relationship cannot be established, then the State Archaeologist may consult with a committee of four to determine the proper disposition of the remains. This committee shall consist of a human skeletal analyst, two Native American members of current state tribes recommended by the Governor's Council on Indian Affairs, and "an individual who has special knowledge or expertise regarding the particular type of the unmarked human burial."

A plan for the avoidance of any further impact to the human remains and/or mitigative excavation, reinterment, or a combination of these treatments will be developed in consultation with the State Archaeologist, the SHPO, and, if applicable, appropriate Native American tribes or closest lineal descendants. All parties will be expected to respond with advice and guidance in an efficient time frame. Once the plan is agreed to by all parties, the plan will be implemented.

The points of contact for Florida are:

Timothy A. Parsons, Director and State Historic Preservation Officer
Florida Division of Historical Resources
R.A. Gray Building
500 S. Bronough St.
Tallahassee, FL 32399-0250
PH: 850-245-6300

Mary Glowacki, Ph.D., Chief and State Archaeologist
Bureau of Archaeological Research
B. Calvin Jones Center for Archaeology at the Governor Martin House
1001 de Soto Park Drive
Tallahassee, FL 32301
PH: 850-245-6301

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FLORIDA DEPARTMENT *of* STATE

RON DESANTIS
Governor

LAUREL M. LEE
Secretary of State

Barry Bleichner, Ph.D.
SEARCH, Inc.
912 Louisiana Ave.
New Orleans, LA 70115

August 10, 2020

RE: DHR Project File No.: 2019-4033-A, Received by DHR: July 17, 2020
Marine Archaeological Resource Assessment for the Proposed Redfish Pass Borrow Area, Lee County, Florida

Dear Dr. Bleichner:

We note that the Captiva Erosion Prevention District (CEPD) is proposing to renourish areas of Captiva Island in Lee County, Florida. The CEPD contracted with Aptim Environmental & Infrastructure, LLC (APTIM) to provide technological support for the proposed Captiva Island renourishment areas. SEARCH was contracted to provide archaeological monitoring and analysis of remote-sensing data, collected by APTIM, in preparation for the proposed collection of geotechnical cores, borrow area design and permitting, and sediment dredging for beach renourishment. This work was completed in January of 2020, to identify potential submerged cultural resources within the project area of potential effects (APE). The project is subject to compliance with Bureau of Archaeological Research 1A-32 Permit No. 1920.039.

Our office proceeded to review this report with the expectation that CEPD will be engaging in permitting processes that will require this office to comment on possible adverse impacts to cultural resources listed or eligible for listing in the *National Register of Historic Places (NRHP)*, or otherwise of historical, architectural, or archaeological significance. We recommend at the time such actions are taken, a copy of this letter be forwarded to the permitting agency(ies) with the application. This letter does not constitute a review under Section 106 of the *National Historic Preservation Act.*

The survey area consisted of approximately 390 acres, offshore from Redfish Pass in the Gulf of Mexico. SEARCH identified 40 magnetic anomalies, 3 acoustic contacts, and 3 acoustic reflectors in the marine remote-sensing record. None of the anomalies or contacts indicate a potential submerged cultural resource. None of the acoustic surface reflectors in the subbottom record appear to indicate buried paleolandscape features. SEARCH proposes that this project will have no effect on cultural resources listed, or eligible for listing in the NRHP, or otherwise of archaeological, historical, or architectural significance within the survey area, and recommends no additional work in the APE.

We find the submitted report complete and sufficient in accordance with Chapter 1A-46, *Florida Administrative Code*. Because this project is not yet subject to permitting requirements from a state or federal agency, our office abstains from supplying a determination of effects until such time that permitting agencies (and associated permit requirements) are identified for this project.

If I can be of any further help, or if you have any questions about this letter, please feel free to contact Clete Rooney at *Cletus.Rooney@dos.myflorida.com*.

Sincerely,

Jason Aldridge
For

Timothy A. Parsons, Ph.D.
Director, Division of Historical Resources
and State Historic Preservation Officer

APPENDIX 10
BORROW AREA COMPOSITE SUMMARY TABLES

COMPOSITE SUMMARY TABLE
REDFISH PASS 2020 SAND SEARCH

VIBRACORE I. D.	EFFECTIVE LENGTH (FT)	PHI MEDIAN	MEDIAN (mm)	MEAN (mm)	PHI MEAN	PHI SORTING	% FINES	% CARBONATE	% SHELL CONTENT	WET MUNSELL VALUE	DRY MUNSELL VALUE	WASHED MUNSELL VALUE
RPVC-20-01 Composite	1.4	2.83	0.14	0.14	2.82	0.43	2.00	3	2	7	8	8
RPVC-20-02 Composite	1.3	2.93	0.13	0.14	2.87	0.63	4.01	6	1	7	8	8
RPVC-20-03 Composite	2.7	2.51	0.18	0.19	2.40	0.63	1.47	13	24	7	8	8
RPVC-20-04 Composite	3.1	1.53	0.35	0.57	0.82	1.95	1.59	50	37	7	8	8
RPVC-20-05 Composite	4.5	2.22	0.22	0.25	2.01	0.86	1.39	24	30	7	8	8
RPVC-20-06 Composite	2.8	2.68	0.16	0.18	2.45	0.88	1.84	17	6	6	8	8
RPVC-20-07 Composite	1.9	1.36	0.39	0.54	0.88	1.84	1.19	53	40	7	8	8
RPVC-20-08 Composite	4.0	0.72	0.61	0.69	0.54	1.97	1.67	57	50	7	8	8
RPVC-20-09 Composite	4.2	-0.69	1.61	1.54	-0.62	1.78	1.78	82	54	6	8	8
RPVC-20-10 Composite	5.9	0.43	0.74	0.84	0.26	1.72	1.86	64	48	6	8	8
RPVC-20-11 Composite	5.7	0.12	0.92	0.95	0.07	1.89	1.43	68	50	6	8	8
RPVC-20-12 Composite	4.1	2.26	0.21	0.24	2.07	0.87	1.53	20	35	7	8	8
RPVC-20-15 Composite	1.6	2.78	0.15	0.18	2.48	1.15	2.55	14	30	6	7	8
RPVC-20-16 Composite	3.9	2.75	0.15	0.17	2.56	0.90	2.09	12	21	7	8	8
C-25 Composite	3.8	2.71	0.15	0.18	2.45	1.03	1.33	ND	ND	ND	ND	ND
C-26 Composite	4.8	2.20	0.22	0.23	2.11	0.71	0.66	ND	ND	ND	ND	ND
C-29 Composite	5.8	2.58	0.17	0.20	2.35	0.86	0.88	ND	ND	ND	ND	ND
C-30 Composite	4.8	2.24	0.21	0.24	2.06	0.85	0.64	ND	ND	ND	ND	ND
C-31 Composite	3.8	2.74	0.15	0.15	2.69	0.58	2.09	ND	ND	ND	ND	ND
RPVC-20-13 Composite					VIBRACORE NOT USED IN BORROW AREA DESIGN							
RPVC-20-14 Composite					VIBRACORE NOT USED IN BORROW AREA DESIGN							
C-24 Composite					VIBRACORE NOT USED IN BORROW AREA DESIGN							
C-27 Composite					VIBRACORE NOT USED IN BORROW AREA DESIGN							
C-28 Composite					VIBRACORE NOT USED IN BORROW AREA DESIGN							
C-36 Composite					VIBRACORE NOT USED IN BORROW AREA DESIGN							
C-37 Composite					VIBRACORE NOT USED IN BORROW AREA DESIGN							
REDFISH PASS BORROW AREA	70.1	2.23	0.21	0.34	1.56	1.66	1.44	41	36	7	8	8

COMPOSITE DATA TABLE
REDFISH PASS 2020 SAND SEARCH (1 of 1)

																				PHI SIZES													
VIBRACORE I. D.	EFFECTIVE LENGTH (FT)	PHI MEDIAN	MEDIAN (mm)	MEAN (mm)	PHI MEAN	PHI SORTING	% FINES	% CARBONATE	% SHELL CONTENT	WET MUNSELL VALUE	DRY MUNSELL VALUE	WASHED MUNSELL VALUE	-4.25	-4.0	-3.50	-3.0	-2.50	-2.25	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	3.75	4.0	PAN
RPVC-20-01 Composite	1.4	2.83	0.14	0.14	2.82	0.43	2.00	3	2	7	8	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.6	1.0	2.1	12.5	69.8	94.3	96.9	98.0	100.0
RPVC-20-02 Composite	1.3	2.93	0.13	0.14	2.87	0.63	4.01	6	1	7	8	8	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.6	0.6	0.8	1.0	1.4	1.9	3.1	10.4	56.7	91.3	91.6	95.9	99.9
RPVC-20-03 Composite	2.7	2.51	0.18	0.19	2.40	0.63	1.47	13	24	7	8	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.1	2.1	3.8	6.6	15.4	49.5	89.4	97.8	98.3	98.4	99.9
RPVC-20-04 Composite	3.1	1.53	0.35	0.57	0.82	1.95	1.59	50	37	7	8	8	0.0	0.1	3.2	4.5	7.0	8.3	10.0	14.8	20.3	27.4	33.5	39.3	44.6	49.5	56.0	74.5	93.6	98.0	98.2	98.4	99.9
RPVC-20-05 Composite	4.5	2.22	0.22	0.25	2.01	0.86	1.39	24	30	7	8	8	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.8	2.0	4.1	7.3	11.8	18.6	34.6	70.4	94.5	98.4	98.5	98.6	99.9
RPVC-20-06 Composite	2.8	2.68	0.16	0.18	2.45	0.88	1.84	17	6	6	8	8	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.5	0.8	1.8	3.3	5.2	7.6	10.1	14.3	33.3	80.8	96.9	97.2	98.1	100.0
RPVC-20-07 Composite	1.9	1.36	0.39	0.54	0.88	1.84	1.19	53	40	7	8	8	0.00	0.00	2.39	4.45	5.12	6.05	7.38	11.36	16.89	24.59	31.68	38.37	45.04	51.82	61.00	74.48	92.80	98.30	98.52	98.65	99.81
RPVC-20-08 Composite	4.0	0.72	0.61	0.69	0.54	1.97	1.67	57	50	7	8	8	0.00	0.00	2.24	4.56	7.98	9.51	11.37	17.17	24.25	33.44	40.88	47.68	52.98	57.63	64.20	76.15	92.90	98.03	98.25	98.35	99.99
RPVC-20-09 Composite	4.2	-0.69	1.61	1.54	-0.62	1.78	1.78	82	54	6	8	8	0.95	3.23	5.06	9.19	15.14	17.76	21.71	31.16	42.15	54.93	64.66	72.68	79.19	83.75	88.52	93.04	96.91	98.05	98.13	98.20	99.97
RPVC-20-10 Composite	5.9	0.43	0.74	0.84	0.26	1.72	1.86	64	48	6	8	8	0.00	0.00	1.71	4.12	7.27	9.34	11.92	16.76	23.40	32.34	41.18	51.40	61.63	70.93	79.67	88.66	96.41	97.99	98.06	98.13	99.99
RPVC-20-11 Composite	5.7	0.12	0.92	0.95	0.07	1.89	1.43	68	50	6	8	8	0.00	0.00	3.27	7.46	10.38	12.29	15.18	21.52	29.96	40.17	48.15	55.97	63.60	70.58	78.48	87.84	95.64	98.36	98.51	98.57	99.98
RPVC-20-12 Composite	4.1	2.26	0.21	0.24	2.07	0.87	1.53	20	35	7	8	8	0.00	0.00	0.00	0.00	0.00	0.01	0.09	0.38	1.08	2.27	4.00	6.19	9.73	16.47	35.12	64.09	93.43	98.27	98.36	98.40	99.95
RPVC-20-15 Composite	1.6	2.78	0.15	0.18	2.48	1.15	2.55	14	30	6	7	8	0.00	0.00	0.98	0.98	1.34	1.49	1.70	2.06	2.59	3.41	4.48	6.12	8.14	10.55	14.30	24.67	69.83	95.18	96.90	97.43	99.98
RPVC-20-16 Composite	3.9	2.75	0.15	0.17	2.56	0.90	2.09	12	21	7	8	8	0.00	0.00	0.00	0.27	0.54	0.66	0.79	1.22	1.87	2.80	3.57	4.42	5.27	6.27	8.81	21.73	78.68	97.06	97.70	97.87	99.95
C-25 Composite	3.8	2.71	0.15	0.18	2.45	1.03	1.33	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.51	2.00	2.72	3.67	4.82	6.42	8.42	9.83	13.14	26.15	82.27	96.26	97.18	98.67	100.00
C-26 Composite	4.8	2.20	0.22	0.23	2.11	0.71	0.66	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.48	1.13	2.88	7.53	15.08	38.12	67.33	94.10	98.41	98.59	99.24	99.90
C-29 Composite	5.8	2.58	0.17	0.20	2.35	0.86	0.88	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.23	0.51	1.08	1.99	3.21	5.02	7.77	10.70	18.36	42.95	89.05	97.28	98.11	99.11	100.00
C-30 Composite	4.8	2.24	0.21	0.24	2.06	0.85	0.64	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.11	0.37	1.15	2.64	5.88	12.29	19.62	36.66	64.97	93.89	98.12	98.68	99.36	100.00
C-31 Composite	3.8	2.74	0.15	0.15	2.69	0.58	2.09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.16	0.40	0.81	1.51	2.70	4.80	8.48	13.07	25.22	53.24	90.89	97.62	98.22	99.13	100.00
RPVC-20-13 Composite															VIBRACORE NOT USED IN BORROW AREA DESIGN																		
RPVC-20-14 Composite															VIBRACORE NOT USED IN BORROW AREA DESIGN																		
C-24 Composite															VIBRACORE NOT USED IN BORROW AREA DESIGN																		
C-27 Composite															VIBRACORE NOT USED IN BORROW AREA DESIGN																		
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C-36 Composite															VIBRACORE NOT USED IN BORROW AREA DESIGN																		
C-37 Composite															VIBRACORE NOT USED IN BORROW AREA DESIGN																		
REDFISH PASS BORROW AREA	70.1	2.23	0.21	0.34	1.56	1.66	1.44	41	36	7	8	8	0.06	0.20	1.07	2.13	3.34	4.02	5.05	7.33	10.30	14.22	17.85	21.89	26.52	31.57	41.25	60.47	89.90	97.58	98.01	98.51	99.96

CUMULATIVE PERCENTS AND COMPUTED DISTRIBUTIONS
REDFISH PASS 2020 SAND SEARCH (1 of 3)

SAMPLE I. D.	ELEVATION (NAVD88 FT)	EFFECTIVE LENGTH (FT)	PHI MEDIAN	MEDIAN (mm)	MEAN (mm)	PHI MEAN	PHI SORTING	% FINES	% CARBONATE	% SHELL CONTENT	WET MUNSELL VALUE	DRY MUNSELL VALUE	WASHED MUNSELL VALUE	-4.25	-4.0	-3.50	-3.0	-2.50	-2.25	-2.0	PHI SIZES -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	3.75	4.00	PAN
RPVC-20-01#1	-16.6	1.4	2.83	0.14	0.14	2.82	0.43	2.01	3	2	7	8	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.07	0.13	0.23	0.37	0.60	0.98	2.09	12.54	69.79	94.34	96.90	97.99	99.98
RPVC-20-01#2	-21.6	0.0	2.22	0.22	0.27	1.88	1.25	2.53	27	25	7	8	8	0.00	0.00	0.45	1.19	2.04	2.39	2.62	3.40	4.52	6.19	8.22	10.64	13.95	19.11	37.14	66.74	91.48	97.18	97.25	97.47	99.82
Cut to -16.0ft NAVD (Cut Ia)																																		
RPVC-20-01 Composite		**1.4**	**2.83**	**0.14**	**0.14**	**2.82**	**0.43**	**2.00**	**3**	**2**	**7**	**8**	**8**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.07**	**0.13**	**0.23**	**0.37**	**0.60**	**0.98**	**2.09**	**12.54**	**69.79**	**94.34**	**96.90**	**97.99**	**99.98**
RPVC-20-02#1	-18.5	1.3	2.93	0.13	0.14	2.87	0.64	4.13	6	1	7	8	8	0.00	0.00	0.00	0.00	0.51	0.51	0.51	0.55	0.59	0.64	0.75	1.00	1.38	1.89	3.14	10.43	56.71	91.31	91.58	95.87	99.88
RPVC-20-02#2	-20.5	0.0	3.14	0.11	0.16	2.67	1.38	13.28	14	10	6	7	8	0.00	0.00	0.00	1.28	1.59	2.14	2.56	3.52	4.47	5.49	6.25	7.19	8.01	8.70	9.58	11.87	38.91	79.11	79.23	86.72	99.75
Cut to -18.0ft NAVD (Cut Ib)																																		
RPVC-20-02 Composite		**1.3**	**2.93**	**0.13**	**0.14**	**2.87**	**0.63**	**4.01**	**6**	**1**	**7**	**8**	**8**	**0.00**	**0.00**	**0.00**	**0.00**	**0.51**	**0.51**	**0.51**	**0.55**	**0.59**	**0.64**	**0.75**	**1.00**	**1.38**	**1.89**	**3.14**	**10.43**	**56.71**	**91.31**	**91.58**	**95.87**	**99.88**
RPVC-20-03#1	-16.1	1.6	2.39	0.19	0.21	2.28	0.66	1.45	16	30	7	8	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.17	0.51	1.36	2.68	5.04	9.07	20.93	58.44	93.35	98.19	98.44	98.55	99.87
RPVC-20-03#2	-17.8	1.1	2.64	0.16	0.17	2.57	0.55	1.78	8	15	7	8	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.11	0.36	0.69	1.16	1.91	3.11	7.39	36.39	83.60	97.22	97.99	98.22	99.91
RPVC-20-03#3	-20.3	0.0	2.76	0.15	0.15	2.70	0.56	4.17	8	10	6	7	8	0.00	0.00	0.00	0.00	0.06	0.06	0.12	0.40	0.47	0.65	0.88	1.08	1.33	1.69	3.03	22.31	74.91	93.64	95.06	95.83	99.94
Cut to -18.0ft NAVD (Cut Ib)																																		
RPVC-20-03 Composite		**2.7**	**2.51**	**0.18**	**0.19**	**2.40**	**0.63**	**1.47**	**13**	**24**	**7**	**8**	**8**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.05**	**0.15**	**0.45**	**1.09**	**2.06**	**3.76**	**6.64**	**15.41**	**49.46**	**89.38**	**97.79**	**98.26**	**98.42**	**99.89**
RPVC-20-04#1	-13.4	1.1	-0.08	1.06	1.02	-0.03	1.96	1.39	69	40	7	8	8	0.00	0.00	4.92	7.42	11.99	14.01	16.66	24.33	32.27	42.80	51.44	60.22	67.09	72.47	76.98	84.03	94.91	98.35	98.52	98.61	99.88
RPVC-20-04#2	-14.4	1.0	2.43	0.19	0.24	2.08	1.12	1.93	22	25	7	8	8	0.00	0.00	0.00	0.00	0.09	0.36	0.79	1.73	3.14	5.35	7.58	10.38	13.60	17.76	25.41	53.85	89.77	97.53	97.90	98.07	99.98
RPVC-20-04#3	-15.8	0.0	2.29	0.20	0.24	2.07	0.95	1.69	23	30	6	8	8	0.00	0.00	0.00	0.23	0.23	0.23	0.42	1.36	2.17	3.76	5.09	6.86	9.45	14.31	27.97	66.28	93.49	98.12	98.25	98.31	100.00
RPVC-20-04#4	-17.0	0.0	2.87	0.14	0.16	2.64	1.02	7.67	10	10	6	7	8	0.00	0.00	0.00	0.56	0.79	0.81	0.91	1.40	2.12	3.00	3.98	4.79	5.56	7.53	10.40	12.79	62.71	88.78	90.87	92.33	99.95
RPVC-20-04#5	-18.4	0.0	3.05	0.12	0.3	1.75	2.24	10.23	32	25	5	7	8	0.00	0.00	4.41	5.75	6.92	8.63	9.54	11.98	14.77	17.60	20.22	22.81	25.73	27.81	29.37	32.78	46.67	82.06	86.67	89.77	99.96
RPVC-20-04#6	-12.1	0.3	-0.19	1.14	1.03	-0.04	1.67	1.28	73	55	6	8	8	0.00	0.00	4.06	4.80	6.31	7.78	9.55	15.92	26.86	42.07	54.80	64.17	72.44	78.41	83.64	89.20	97.15	98.55	98.61	98.72	99.98
RPVC-20-04#7	-12.5	0.6	1.99	0.25	0.55	0.87	2.01	1.85	47	40	6	8	8	0.00	0.00	4.63	5.86	9.05	10.55	12.49	17.26	21.92	26.35	30.30	33.63	37.54	42.05	50.24	81.33	95.45	97.92	98.06	98.15	99.98
RPVC-20-04#8	-15.1	0.1	-0.03	1.02	1.03	-0.04	1.86	1.31	71	50	6	8	8	0.00	2.35	3.77	7.27	11.24	12.62	14.98	21.25	30.61	41.49	50.52	57.90	65.38	73.32	81.88	90.61	97.05	98.54	98.61	98.69	99.89
Cut to -15.0ft NAVD (Cut Ic)																																		
RPVC-20-04 Composite		**3.1**	**1.53**	**0.35**	**0.57**	**0.82**	**1.95**	**1.59**	**50**	**37**	**7**	**8**	**8**	**0.00**	**0.08**	**3.16**	**4.47**	**7.01**	**8.29**	**9.99**	**14.76**	**20.29**	**27.42**	**33.50**	**39.30**	**44.58**	**49.54**	**55.97**	**74.48**	**93.64**	**98.03**	**98.24**	**98.36**	**99.94**
RPVC-20-05#1	-17.0	4.5	2.22	0.21	0.25	2.01	0.86	1.45	24	30	7	8	8	0.00	0.00	0.00	0.00	0.00	0.09	0.14	0.26	0.75	1.96	4.13	7.34	11.76	18.59	34.55	70.40	94.49	98.35	98.49	98.55	99.93
RPVC-20-05#2	-21.1	0.0	2.86	0.14	0.20	2.30	1.26	15.76	21	20	5	7	8	0.00	0.00	0.00	0.39	0.59	0.74	0.90	1.65	2.52	3.96	5.92	9.13	12.97	17.00	20.85	28.67	58.55	80.91	83.06	84.24	99.90
Cut to -18.0ft NAVD (Cut Ib)																																		
RPVC-20-05 Composite		**4.5**	**2.22**	**0.22**	**0.25**	**2.01**	**0.86**	**1.39**	**24**	**30**	**7**	**8**	**8**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.09**	**0.14**	**0.26**	**0.75**	**1.96**	**4.13**	**7.34**	**11.76**	**18.59**	**34.55**	**70.40**	**94.49**	**98.35**	**98.49**	**98.55**	**99.93**
RPVC-20-06#1	-16.0	1.5	2.75	0.15	0.16	2.64	0.64	1.72	13	2	6	8	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.12	0.37	0.85	1.77	3.42	5.65	9.79	23.04	76.74	96.86	96.89	98.28	99.92
RPVC-20-06#2	-17.7	1.3	2.56	0.17	0.21	2.23	1.06	2.06	21	10	6	8	8	0.00	0.00	0.00	0.34	0.34	0.38	0.50	0.96	1.61	3.48	6.20	9.25	12.42	15.29	19.41	45.06	85.50	96.93	97.64	97.94	100.00
RPVC-20-06#3	-19.8	0.0	2.66	0.16	0.19	2.41	0.88	1.97	17	5	7	8	8	0.00	0.00	0.00	0.24	0.24	0.24	0.39	0.61	0.95	2.06	3.52	5.24	7.65	10.38	15.06	33.56	86.30	97.16	97.54	98.03	100.00
RPVC-20-06#4	-21.9	0.0	2.85	0.14	0.15	2.73	0.8	4.42	8	10	5	7	8	0.00	0.00	0.00	0.30	0.46	0.66	0.76	0.99	1.21	1.60	2.05	2.74	3.54	4.44	5.69	11.60	66.42	93.06	94.93	95.58	100.00
RPVC-20-06#5	-24.3	0.0	2.92	0.13	0.37	1.43	2.16	21.62	38	40	4	6	8	0.00	0.00	0.00	1.39	4.02	5.69	7.33	12.18	16.60	20.98	24.61	26.92	28.64	29.61	30.78	34.87	52.68	73.62	76.43	78.38	99.99
Cut to -18.0ft NAVD (Cut Ib)																																		
RPVC-20-06 Composite		**2.8**	**2.68**	**0.16**	**0.18**	**2.45**	**0.88**	**1.84**	**17**	**6**	**6**	**8**	**8**	**0.00**	**0.00**	**0.00**	**0.16**	**0.16**	**0.18**	**0.23**	**0.48**	**0.81**	**1.81**	**3.33**	**5.24**	**7.60**	**10.13**	**14.26**	**33.26**	**80.81**	**96.89**	**97.24**	**98.12**	**99.96**
RPVC-20-07#1	-16.1	1.9	1.37	0.39	0.54	0.88	1.84	1.35	53	40	7	8	8	0.00	0.00	2.39	4.45	5.12	6.05	7.38	11.36	16.89	24.59	31.68	38.37	45.04	51.82	61.00	74.48	92.80	98.30	98.52	98.65	99.81
RPVC-20-07#2	-17.7	0.0	2.78	0.15	0.19	2.41	1.39	3.07	14	5	7	8	8	0.00	0.00	1.10	1.96	3.01	3.32	3.94	4.83	5.79	6.57	7.11	7.63	8.19	8.90	11.00	21.41	72.16	95.50	96.65	96.93	99.90
RPVC-20-07#3	-18.5	0.0	2.24	0.21	0.39	1.35	1.86	3.02	39	30	6	7	8	0.00	0.00	1.32	3.91	5.19	6.34	7.10	9.25	12.86	18.21	23.71	28.71	34.12	38.93	44.41	56.25	86.20	95.91	96.20	96.98	99.94
RPVC-20-07#4	-19.3	0.0	2.87	0.14	0.15	2.74	0.84	3.74	9	2	7	8	8	0.00	0.00	0.00	0.30	0.30	0.49	0.66	1.14	1.54	2.19	2.70	3.24	3.71	4.17	5.12	11.71	63.40	94.29	95.55	96.26	99.91
RPVC-20-07#5	-20.5	0.0	3.29	0.10	0.13	2.94	1.1	20.53	13	5	6	7	8	0.00	0.00	0.00	0.95	1.20	1.47	1.51	1.79	2.20	2.67	3.07	3.51	3.88	4.14	4.44	5.35	24.27	68.91	75.22	79.47	99.90
Cut to -17.0ft NAVD (Cut Id)																																		
RPVC-20-07 Composite		**1.9**	**1.36**	**0.39**	**0.54**	**0.88**	**1.84**	**1.19**	**53**	**40**	**7**	**8**	**8**	**0.00**	**0.00**	**2.39**	**4.45**	**5.12**	**6.05**	**7.38**	**11.36**	**16.89**	**24.59**	**31.68**	**38.37**	**45.04**	**51.82**	**61.00**	**74.48**	**92.80**	**98.30**	**98.52**	**98.65**	**99.81**
RPVC-20-08#1	-13.6	1.2	-0.14	1.10	1.06	-0.08	1.64	1.42	74	60	6	7	8	0.00	0.00	2.16	5.15	7.77	9.15	11.16	17.67	27.54	41.68	53.21	64.75	72.96	79.34	85.85	91.70	96.76	98.39	98.52	98.58	100.00
RPVC-20-08#2	-14.6	0.8	0.73	0.60	0.70	0.51	1.93	1.37	58	50	7	8	8	0.00	0.00	2.10	3.37	7.16	9.16	10.78	17.70	25.30	34.41	41.66	47.78	52.57	57.72	65.69	79.63	94.64	98.36	98.53	98.63	99.99
RPVC-20-08#3	-15.5	0.6	2.62	0.16	0.23	2.11	1.39	2.72	20	30	7	8	8	0.00	0.00	0.00	0.91	1.98	2.44	2.92	3.95	5.65	7.90	10.01	12.61	15.11	17.82	22.79	40.16	81.12	96.55	97.11	97.28	99.97
RPVC-20-08#4	-16.3	0.9	-0.70	1.62	1.36	-0.44	2.02	1.14	73	60	7	8	8	0.00	0.00	5.22	9.81	17.25	20.02	23.61	33.50	43.26	54.52	63.05	69.09	73.59	76.54	79.90	84.77	94.84	98.69	98.80	98.86	100.00
RPVC-20-08#5	-17.3	0.5	2.32	0.20	0.25	2	1.09	2.31	27	35	7	8	8	0.00	0.00	0.00	0.00	0.27	0.52	0.94	1.62	2.81	4.85	7.21	10.13	14.00	19.09	31.28	60.94	91.52	97.24	97.50	97.69	100.00
RPVC-20-08#6	-18.5	0.0	3.25	0.11	0.13	3	0.93	8.58	9	10	6	7	8	0.00	0.00	0.00	0.00	0.00	0.20	0.50	0.87	1.54	2.39	3.15	3.78	4.45	5.03	5.92	8.49	23.72	76.47	86.59	91.42	99.80
RPVC-20-08#7	-21.0	0.0	3.18	0.11	0.32	1.66	2.57	18.55	28	25	4	6	8	0.00	5.50	7.35	8.27	10.97	11.76	12.13	13.74	16.00	18.32	19.97	21.44	22.54	23.69	25.14	28.70	39.85	67.83	76.06	81.45	99.93
Cut to -17.0ft NAVD (Cut Id)																																		
RPVC-20-08 Composite		**4.0**	**0.72**	**0.61**	**0.69**	**0.54**	**1.97**	**1.67**	**57**	**50**	**7**	**8**	**8**	**0.00**	**0.00**	**2.24**	**4.56**	**7.98**	**9.51**	**11.37**	**17.17**	**24.25**	**33.44**	**40.88**	**47.68**	**52.98**	**57.63**	**64.20**	**76.15**	**92.90**	**98.03**	**98.25**	**98.35**	**99.99**

CUMULATIVE PERCENTS AND COMPUTED DISTRIBUTIONS
PROJECT YEAR SAND SEARCH (2 of 3)

SAMPLE I. D.	ELEVATION (NAVD88 FT)	EFFECTIVE LENGTH (FT)	PHI MEDIAN	MEDIAN (mm)	MEAN (mm)	PHI MEAN	PHI SORTING	% FINES	% CARBONATE	% SHELL CONTENT	WET MUNSELL VALUE	DRY MUNSELL VALUE	WASHED MUNSELL VALUE	-4.25	-4.0	-3.50	-3.0	-2.50	-2.25	-2.0	PHI SIZES -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	3.75	4.00	PAN
RPVC-20-09#1	-11.3	0.8	-1.46	2.75	2.66	-1.41	1.72	1.97	89	70	6	8	8	4.97	4.97	11.28	17.96	27.07	30.74	36.36	49.13	61.06	72.67	79.57	85.69	89.58	91.73	93.34	94.72	96.83	97.89	97.90	98.03	99.96
RPVC-20-09#2	-13.8	3.4	-0.53	1.44	1.36	-0.44	1.75	1.76	80	50	6	8	8	0.00	2.82	3.60	7.13	12.33	14.70	18.26	26.93	37.70	50.75	61.15	69.62	76.75	81.87	87.39	92.64	96.93	98.09	98.19	98.24	99.97
RPVC-20-09#3	-15.4	0.0	0.89	0.54	0.62	0.69	1.46	1.76	62	45	6	8	8	0.00	0.00	0.00	1.51	2.79	3.50	4.41	7.52	12.47	21.14	31.54	41.30	52.36	64.24	77.30	89.83	96.35	98.10	98.18	98.24	99.97
RPVC-20-09#4	-16.3	0.0	1.9	0.27	0.37	1.45	1.44	2.09	40	35	7	8	8	0.00	0.00	0.69	1.23	2.55	3.12	3.68	5.27	7.83	11.57	15.65	20.11	25.98	33.54	53.94	76.50	93.82	97.64	97.81	97.91	100.00
RPVC-20-09#5	-20.9	0.0	2.73	0.15	0.19	2.43	1.2	7.63	13	20	7	8	8	0.00	0.00	0.67	0.86	1.81	2.10	2.25	2.80	3.49	4.34	5.21	6.03	6.97	8.20	10.70	30.98	71.48	88.39	90.59	92.37	99.97
Cut to -15.0ft NAVD (Cut Ic)																																		
RPVC-20-09 Composite		**4.2**	**-0.69**	**1.61**	**1.54**	**-0.62**	**1.78**	**1.78**	**82**	**54**	**6**	**8**	**8**	**0.95**	**3.23**	**5.06**	**9.19**	**15.14**	**17.76**	**21.71**	**31.16**	**42.15**	**54.93**	**64.66**	**72.68**	**79.19**	**83.75**	**88.52**	**93.04**	**96.91**	**98.05**	**98.13**	**98.20**	**99.97**
RPVC-20-10#1	-8.9	1.7	0.25	0.84	0.91	0.14	1.68	3.08	68	50	6	8	8	0.00	0.00	0.00	3.20	6.60	9.49	12.51	17.88	25.41	35.10	44.57	55.25	65.05	73.39	80.54	88.28	95.06	96.67	96.80	96.92	99.98
RPVC-20-10#2	-10.0	0.9	-0.92	1.89	1.83	-0.87	1.53	0.86	83	65	6	8	8	0.00	0.00	3.17	7.35	15.29	19.70	25.67	35.63	48.05	60.66	70.32	80.49	88.13	92.84	95.34	96.81	98.24	99.07	99.12	99.14	99.99
RPVC-20-10#3	-11.4	1.5	0.15	0.90	1.10	-0.14	1.67	1.43	74	55	6	8	8	0.00	0.00	5.00	8.43	11.30	12.87	15.28	20.14	26.92	36.41	46.17	58.60	71.87	84.12	91.69	94.69	97.59	98.48	98.53	98.57	100.00
RPVC-20-10#4	-12.5	1.3	1.59	0.33	0.42	1.26	1.32	1.63	45	30	6	8	8	0.00	0.00	0.00	0.00	0.59	0.82	1.41	3.19	5.83	11.92	19.43	27.53	37.28	47.51	62.15	79.49	95.93	98.27	98.28	98.37	99.99
RPVC-20-10#5	-13.4	0.6	1.58	0.33	0.44	1.17	1.43	1.55	43	35	6	8	8	0.00	0.00	0.00	0.00	1.29	2.56	3.37	5.39	8.81	14.78	21.15	29.16	38.14	47.98	61.17	82.09	95.64	98.32	98.41	98.45	100.00
Cut to -15.0ft NAVD (Cut Ic)																																		
RPVC-20-10 Composite		**5.9**	**0.43**	**0.74**	**0.84**	**0.26**	**1.72**	**1.86**	**64**	**48**	**6**	**8**	**8**	**0.00**	**0.00**	**1.71**	**4.12**	**7.27**	**9.34**	**11.92**	**16.76**	**23.40**	**32.34**	**41.18**	**51.40**	**61.63**	**70.93**	**79.67**	**88.66**	**96.41**	**97.99**	**98.06**	**98.13**	**99.99**
RPVC-20-11#1	-11.9	4.1	-0.54	1.45	1.43	-0.52	1.7	1.28	80	55	6	8	8	0.00	0.00	4.43	9.92	13.70	16.19	19.91	27.98	38.43	50.99	60.61	69.80	78.53	85.70	91.43	95.41	97.80	98.62	98.69	98.72	99.99
RPVC-20-11#2	-14.0	1.2	2.24	0.21	0.28	1.86	1.3	1.96	29	35	7	8	8	0.00	0.00	0.38	0.94	1.17	1.35	1.95	3.19	5.25	7.60	9.76	12.78	16.71	23.29	37.89	63.58	88.17	97.47	97.90	98.04	99.96
RPVC-20-11#3	-15.8	0.0	2.43	0.19	0.26	1.97	1.45	1.6	22	25	7	8	8	0.00	0.00	1.12	1.40	2.88	3.25	4.04	5.48	7.03	8.98	10.73	12.59	14.85	17.64	24.32	53.93	88.38	97.78	98.23	98.40	99.97
RPVC-20-11#4	-14.9	0.4	0.92	0.53	0.61	0.71	1.68	1.4	60	50	6	8	8	0.00	0.00	0.00	1.81	4.04	5.09	6.34	10.28	17.29	26.91	35.67	43.78	51.27	57.46	67.50	83.01	95.87	98.38	98.51	98.60	99.95
Cut to -15.0ft NAVD (Cut Ic)																																		
RPVC-20-11 Composite		**5.7**	**0.12**	**0.92**	**0.95**	**0.07**	**1.89**	**1.43**	**68**	**50**	**6**	**8**	**8**	**0.00**	**0.00**	**3.27**	**7.46**	**10.38**	**12.29**	**15.18**	**21.52**	**29.96**	**40.17**	**48.15**	**55.97**	**63.60**	**70.58**	**78.48**	**87.84**	**95.64**	**98.36**	**98.51**	**98.57**	**99.98**
RPVC-20-12#1	-11.5	1.2	2.35	0.20	0.22	2.16	0.83	1.68	18	35	7	8	8	0.00	0.00	0.00	0.00	0.00	0.04	0.13	0.27	0.71	1.71	3.00	5.02	8.20	14.75	32.47	57.40	91.41	98.17	98.20	98.32	99.91
RPVC-20-12#2	-14.3	2.9	2.22	0.21	0.24	2.03	0.88	1.56	21	35	7	8	8	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.42	1.23	2.50	4.41	6.67	10.37	17.18	36.21	66.86	94.27	98.31	98.42	98.44	99.96
RPVC-20-12#3	-16.1	0.0	1.22	0.43	0.50	1.01	1.43	1.44	53	50	6	7	8	0.00	0.00	0.00	0.93	2.29	2.70	3.44	5.02	8.49	15.29	24.25	34.26	44.98	56.14	68.88	82.79	95.53	98.42	98.53	98.56	100.00
RPVC-20-12#4	-16.5	0.0	2.20	0.22	0.25	1.98	1	1.21	20	30	7	8	8	0.00	0.00	0.00	0.00	0.22	0.32	0.56	1.01	2.01	3.53	5.89	8.47	12.38	20.45	40.76	63.93	92.67	98.38	98.67	98.79	99.98
RPVC-20-12#5	-17.5	0.0	2.41	0.19	0.20	2.35	0.57	1.66	10	25	7	8	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.07	0.22	0.45	0.96	2.15	5.68	20.75	56.21	90.47	97.79	98.21	98.34	99.93
RPVC-20-12#6	-18.6	0.0	1.81	0.29	0.38	1.41	1.43	1.64	37	35	7	8	8	0.00	1.83	1.83	2.67	3.19	3.42	3.88	4.76	6.12	8.76	13.21	18.79	27.05	36.89	58.07	80.54	95.46	98.08	98.27	98.36	99.89
RPVC-20-12#7	-19.4	0.0	2.84	0.14	0.14	2.82	0.44	3.48	6	5	7	8	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.15	0.23	0.33	0.43	0.56	0.82	1.83	13.41	67.59	94.70	96.00	96.52	100.00
RPVC-20-12#8	-20.4	0.0	2.76	0.15	0.15	2.69	0.64	4.03	6	8	7	8	8	0.00	0.00	0.00	0.34	0.34	0.62	0.71	0.85	0.97	1.09	1.20	1.34	1.57	1.83	2.73	14.95	81.47	94.18	95.21	95.97	99.99
RPVC-20-12#9	-21.7	0.0	2.92	0.13	0.14	2.86	0.59	6.9	5	10	6	7	8	0.00	0.00	0.00	0.00	0.18	0.18	0.25	0.45	0.60	0.79	0.94	1.16	1.36	1.58	2.14	9.24	57.27	90.11	91.45	93.10	99.92
Cut to -15.0ft NAVD (Cut Ie)																																		
RPVC-20-12 Composite		**4.1**	**2.26**	**0.21**	**0.24**	**2.07**	**0.87**	**1.53**	**20**	**35**	**7**	**8**	**8**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.09**	**0.38**	**1.08**	**2.27**	**4.00**	**6.19**	**9.73**	**16.47**	**35.12**	**64.09**	**93.43**	**98.27**	**98.36**	**98.40**	**99.95**
RPVC-20-13#1	-21.0	0.0	2.96	0.13	0.17	2.58	1.18	10.18	14	25	6	7	8	0.00	0.00	0.00	0.00	0.18	0.51	1.14	1.75	2.99	4.64	6.00	7.72	9.41	10.69	11.76	14.86	53.30	85.61	88.61	89.82	99.99
RPVC-20-13#2	-22.0	0.0	2.88	0.14	0.33	1.62	2.15	13.65	34	45	5	6	8	0.00	0.00	2.62	4.78	6.31	7.08	8.50	11.01	13.75	17.31	20.28	23.50	27.31	29.68	31.33	35.18	54.57	81.32	84.51	86.35	99.93
RPVC-20-13 Composite														**VIBRACORE NOT USED IN BORROW AREA DESIGN**																				
RPVC-20-14#1	-20.8	0.0	2.74	0.15	0.31	1.68	2.1	8.47	30	40	6	7	8	0.00	0.00	3.22	5.71	7.22	8.23	9.63	11.52	13.87	16.62	19.07	21.59	24.41	27.23	29.77	34.81	66.26	88.01	90.21	91.53	99.98
RPVC-20-14#2	-22.2	0.0	2.92	0.13	0.16	2.67	0.93	9.34	11	30	6	7	8	0.00	0.00	0.00	0.00	0.11	0.19	0.28	0.56	1.06	2.00	3.03	4.41	6.43	8.32	10.45	17.00	55.99	85.41	88.71	90.66	99.98
RPVC-20-14 Composite														**VIBRACORE NOT USED IN BORROW AREA DESIGN**																				
RPVC-20-15#1	-16.1	1.2	2.84	0.14	0.17	2.53	1.17	2.83	14	30	6	7	8	0.00	0.00	0.88	0.88	1.24	1.44	1.65	2.08	2.72	3.66	4.84	6.67	8.75	10.98	13.74	19.52	64.72	94.49	96.56	97.17	100.00
RPVC-20-15#2	-17.9	0.4	2.61	0.16	0.20	2.35	1.06	1.81	15	30	7	8	8	0.00	0.00	1.28	1.28	1.62	1.62	1.84	1.99	2.19	2.65	3.40	4.45	6.30	9.24	15.99	40.10	85.17	97.25	97.92	98.19	99.91
RPVC-20-15#3	-20.0	0.0	3.07	0.12	0.15	2.73	1.19	10.99	11	20	5	7	8	0.00	0.00	0.82	0.86	1.78	1.88	2.27	2.61	3.03	3.46	4.03	4.56	5.18	5.77	6.78	14.37	44.39	83.54	83.77	89.01	99.94
RPVC-20-15#4	-21.5	0.0	2.74	0.15	0.44	1.18	2.66	8.47	38	40	5	7	8	8.29	8.29	10.38	12.85	14.24	14.77	15.71	17.62	19.86	23.24	26.03	29.37	32.48	34.17	35.59	40.07	60.73	86.89	89.90	91.53	99.97
Cut to -17.0ft NAVD (Cut Id)																																		
RPVC-20-15 Composite		**1.6**	**2.78**	**0.15**	**0.18**	**2.48**	**1.15**	**2.55**	**14**	**30**	**6**	**7**	**8**	**0.00**	**0.00**	**0.98**	**0.98**	**1.34**	**1.49**	**1.70**	**2.06**	**2.59**	**3.41**	**4.48**	**6.12**	**8.14**	**10.55**	**14.30**	**24.67**	**69.83**	**95.18**	**96.90**	**97.43**	**99.98**
RPVC-20-16#1	-13.3	2.4	2.77	0.15	0.15	2.73	0.43	2.12	7	15	7	8	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.10	0.19	0.30	0.47	0.79	1.31	3.52	16.65	78.59	97.09	97.72	97.88	100.00
RPVC-20-16#2	-15.4	1.3	2.73	0.15	0.21	2.28	1.35	2.24	19	30	7	8	8	0.00	0.00	0.00	0.82	1.54	1.89	2.25	3.33	5.05	7.52	9.45	11.45	13.14	14.77	17.19	27.04	77.10	96.82	97.54	97.76	99.86
RPVC-20-16#3	-16.5	0.2	2.52	0.17	0.21	2.27	0.96	1.49	17	35	7	8	8	0.00	0.00	0.00	0.00	0.45	0.57	0.83	1.62	2.40	3.50	4.66	6.09	7.88	10.63	17.84	48.10	90.09	98.21	98.44	98.51	99.90
RPVC-20-16#4	-18.6	0.0	3.09	0.12	0.15	2.71	1.22	12.7	13	25	5	7	8	0.00	0.00	1.00	1.00	1.26	1.50	1.66	2.17	2.87	3.67	4.46	5.41	6.33	7.32	8.75	12.97	43.56	80.29	80.51	87.30	99.93
Cut to -16.0ft NAVD (Cut Ia)																																		
RPVC-20-16 Composite		**3.9**	**2.75**	**0.15**	**0.17**	**2.56**	**0.90**	**2.09**	**12**	**21**	**7**	**8**	**8**	**0.00**	**0.00**	**0.00**	**0.27**	**0.54**	**0.66**	**0.79**	**1.22**	**1.87**	**2.80**	**3.57**	**4.42**	**5.27**	**6.27**	**8.81**	**21.73**	**78.68**	**97.06**	**97.70**	**97.87**	**99.95**

CUMULATIVE PERCENTS AND COMPUTED DISTRIBUTIONS
PROJECT YEAR SAND SEARCH (3 of 3)

																					PHI SIZES													
SAMPLE I. D.	ELEVATION (NAVD88 FT)	EFFECTIVE LENGTH (FT)	PHI MEDIAN	MEDIAN (mm)	MEAN (mm)	PHI MEAN	PHI SORTING	% FINES	% CARBONATE	% SHELL CONTENT	WET MUNSELL VALUE	DRY MUNSELL VALUE	WASHED MUNSELL VALUE	-4.25	-4.0	-3.50	-3.0	-2.50	-2.25	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	3.75	4.00	PAN
C-24#1	-20.2	0.0	3.20	0.11	0.20	2.32	0.55	13.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.88	5.77	7.03	7.97	8.39	8.91	9.75	10.36	11.20	13.41	31.32	77.50	86.87	94.68	100.00
C-24#2	-21.7	0.0	2.99	0.13	0.13	2.94	0.44	5.99	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.00	0.18	0.32	0.81	1.44	3.24	9.33	51.10	86.75	94.01	97.77	99.95
C-24 Composite													**VIBRACORE NOT USED IN BORROW AREA DESIGN**																					
C-25#1	-15.7	3.8	2.71	0.15	0.21	2.25	0.48	2.82	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.51	2.00	2.72	3.67	4.82	6.42	8.42	9.83	13.14	26.15	82.27	96.26	97.18	98.67	100.00
C-25#2	-19.2	0.0	2.80	0.14	0.14	2.84	0.48	10.91	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	1.49	2.00	2.54	2.95	3.42	4.03	4.54	5.69	17.38	72.04	86.72	89.09	94.63	99.97
Cut to -17.0ft NAVD (Cut Id)																																		
C-25 Composite		**3.8**	**2.71**	**0.15**	**0.18**	**2.45**	**1.03**	**1.33**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**1.51**	**2.00**	**2.72**	**3.67**	**4.82**	**6.42**	**8.42**	**9.83**	**13.14**	**26.15**	**82.27**	**96.26**	**97.18**	**98.67**	**100.00**
C-26#1	-10.6	2.4	1.80	0.29	0.31	1.69	0.62	1.16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.59	1.58	4.64	12.99	26.57	65.14	91.60	98.37	98.81	98.84	99.35	99.88
C-26#2	-14.7	2.4	2.57	0.17	0.18	2.47	0.43	1.67	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.36	0.67	1.12	2.06	3.58	11.09	43.05	89.83	98.00	98.33	99.12	99.91
C-26#3	-17.0	0.0	1.39	0.38	0.49	1.03	1.33	1.46	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.03	3.04	6.33	12.89	20.28	30.72	42.63	52.08	70.98	88.26	96.96	98.42	98.54	99.27	100.00
Cut to -15.0ft NAVD (Cut Ic)																																		
C-26 Composite		**4.8**	**2.20**	**0.22**	**0.23**	**2.11**	**0.71**	**0.66**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**0.00**	**0.00**	**0.00**	**0.48**	**1.13**	**2.88**	**7.53**	**15.08**	**38.12**	**67.33**	**94.10**	**98.41**	**98.59**	**99.24**	**99.90**
C-27#1	-18.9	1.8	2.86	0.14	0.16	2.64	0.43	7.55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.50	1.01	1.69	2.56	3.48	4.48	5.58	6.36	7.78	14.23	64.09	89.98	92.45	96.48	100.00
C-27#2	-21.7	0.0	3.08	0.12	0.17	2.56	0.65	21.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.52	3.44	4.67	5.93	6.79	7.65	8.42	8.97	9.86	12.22	45.82	71.87	78.87	90.20	100.00
C-27 Composite													**VIBRACORE NOT USED IN BORROW AREA DESIGN**																					
C-28#1	-24.2	0.0	3.26	0.10	0.20	2.30	0.96	20.76	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.27	5.32	7.77	9.84	11.35	12.55	13.74	14.61	16.23	21.19	22.00	75.26	79.24	90.18	100.00
C-28 Composite													**VIBRACORE NOT USED IN BORROW AREA DESIGN**																					
C-29#1	-11.7	3.0	2.25	0.21	0.28	1.84	0.80	1.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.44	0.72	1.59	3.15	5.42	8.73	13.78	19.28	33.11	66.41	95.50	98.84	98.96	99.48	100.00
C-29#2	-16.2	2.8	2.75	0.15	0.15	2.74	0.31	2.80	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.29	0.54	0.75	0.84	1.05	1.34	1.51	2.55	17.82	82.14	95.61	97.20	98.72	100.00
Cut to -15.0ft NAVD (Cut Ie)																																		
C-29 Composite		**5.8**	**2.58**	**0.17**	**0.20**	**2.35**	**0.86**	**0.88**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**0.23**	**0.51**	**1.08**	**1.99**	**3.21**	**5.02**	**7.77**	**10.70**	**18.36**	**42.95**	**89.05**	**97.28**	**98.11**	**99.11**	**100.00**
C-30#1	-14.2	3.5	2.01	0.25	0.30	1.74	0.83	0.99	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.15	0.51	1.47	3.48	7.85	16.54	26.45	49.19	79.93	96.81	98.94	99.01	99.50	100.00
C-30#2	-18.2	1.3	2.71	0.15	0.15	2.74	0.34	2.20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.00	0.00	0.27	0.37	0.58	0.85	1.22	2.91	24.70	86.03	95.91	97.80	99.00	100.00
Cut to -17.0ft NAVD (Cut Id)																																		
C-30 Composite		**4.8**	**2.24**	**0.21**	**0.24**	**2.06**	**0.85**	**0.64**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**0.00**	**0.11**	**0.37**	**1.15**	**2.64**	**5.88**	**12.29**	**19.62**	**36.66**	**64.97**	**93.89**	**98.12**	**98.68**	**99.36**	**100.00**
C-31#1	-16.2	3.5	2.39	0.19	0.23	2.12	0.66	1.58	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.17	0.40	0.84	1.62	2.90	5.16	9.14	14.09	27.21	56.24	91.40	97.88	98.42	99.21	100.00
C-31#2	-19.2	0.3	2.74	0.15	0.15	2.74	0.28	4.11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	0.34	0.52	0.20	0.40	0.60	0.80	1.16	1.95	18.19	85.00	94.58	95.89	98.17	100.00
Cut to -18.0ft NAVD (Cut Ib)																																		
C-31 Composite		**3.8**	**2.74**	**0.15**	**0.15**	**2.69**	**0.58**	**2.09**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**0.16**	**0.40**	**0.81**	**1.51**	**2.70**	**4.80**	**8.48**	**13.07**	**25.22**	**53.24**	**90.89**	**97.62**	**98.22**	**99.13**	**100.00**
C-36#1	-19.2	0.0	2.74	0.15	0.15	2.74	0.31	4.22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.45	0.52	0.78	0.90	1.05	1.31	1.57	1.87	2.84	18.49	82.93	94.62	95.78	97.91	100.00
C-36 Composite													**VIBRACORE NOT USED IN BORROW AREA DESIGN**																					
C-37#1	-18.9	0.0	2.40	0.19	0.38	1.40	1.44	1.71	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.63	6.59	9.26	12.56	15.47	18.96	23.08	26.70	34.56	53.65	86.49	97.21	98.29	99.18	100.00
C-37#2	-20.2	0.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND															
C-37#3	-21.7	0.0	2.68	0.16	0.19	2.40	0.50	3.54	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.80	1.20	1.79	2.39	3.09	4.14	6.23	8.17	13.80	31.74	82.51	95.37	96.46	98.23	100.00
C-37 Composite													**VIBRACORE NOT USED IN BORROW AREA DESIGN**																					

APPENDIX 11
BORROW AREA COMPOSITE GRANULARMETRIC REPORTS

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-01
Analysis Date: 09-17-20
Analyzed By: BF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,775	807,850	Florida State Plane West	

USCS:	Munsell:	Comments:
SP		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.98	99.98	1.99	0.00	#200 - 3.09 #230 - 2.00			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.01	0.01	0.01	0.01
10	-1.00	2.00	0.06	0.06	0.07	0.07
14	-0.50	1.41	0.06	0.06	0.13	0.13
18	0.00	1.00	0.10	0.10	0.23	0.23
25	0.50	0.71	0.14	0.14	0.37	0.37
35	1.00	0.50	0.23	0.23	0.60	0.60
45	1.50	0.35	0.38	0.38	0.98	0.98
60	2.00	0.25	1.11	1.11	2.09	2.09
80	2.50	0.18	10.45	10.45	12.54	12.54
120	3.00	0.13	57.25	57.26	69.79	69.80
170	3.50	0.09	24.55	24.55	94.34	94.35
200	3.75	0.07	2.56	2.56	96.90	96.91
230	4.00	0.06	1.09	1.09	97.99	98.00

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.56	3.29	3.11	2.83	2.61	2.53	2.14

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.82	0.14	0.43	-1.99	17.37

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-02
Analysis Date: 09-22-20
Analyzed By: BF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,049	807,556	Florida State Plane West	

USCS:	Munsell:	Comments:
SP-SM		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.88	99.88	4.01	0.00	#200 - 8.31 #230 - 4.01			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.51	0.51	0.51	0.51
4	-2.25	4.76	0.00	0.00	0.51	0.51
5	-2.00	4.00	0.00	0.00	0.51	0.51
7	-1.50	2.83	0.04	0.04	0.55	0.55
10	-1.00	2.00	0.04	0.04	0.59	0.59
14	-0.50	1.41	0.05	0.05	0.64	0.64
18	0.00	1.00	0.11	0.11	0.75	0.75
25	0.50	0.71	0.25	0.25	1.00	1.00
35	1.00	0.50	0.38	0.38	1.38	1.38
45	1.50	0.35	0.51	0.51	1.89	1.89
60	2.00	0.25	1.25	1.25	3.14	3.14
80	2.50	0.18	7.29	7.30	10.43	10.44
120	3.00	0.13	46.28	46.34	56.71	56.78
170	3.50	0.09	34.60	34.64	91.31	91.42
200	3.75	0.07	0.27	0.27	91.58	91.69
230	4.00	0.06	4.29	4.30	95.87	95.99

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.94	3.39	3.26	2.93	2.66	2.56	2.13

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.87	0.14	0.63	-4.51	37.83

BA_COMPOSITES.GPJ 9/22/20

Granularmetric Report

Depths and elevations based on measured values

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-03

Analysis Date: 09-22-20

Analyzed By: BF

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,257	806,648	Florida State Plane West	

USCS:	Munsell:	Comments:
SP		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.89	99.89	1.47	0.00	#200 - 1.63 #230 - 1.47			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.05	0.05	0.05	0.05
10	-1.00	2.00	0.10	0.10	0.15	0.15
14	-0.50	1.41	0.30	0.30	0.45	0.45
18	0.00	1.00	0.64	0.64	1.09	1.09
25	0.50	0.71	0.97	0.97	2.06	2.06
35	1.00	0.50	1.70	1.71	3.76	3.77
45	1.50	0.35	2.88	2.88	6.64	6.65
60	2.00	0.25	8.77	8.78	15.41	15.43
80	2.50	0.18	34.04	34.08	49.46	49.51
120	3.00	0.13	39.92	39.97	89.38	89.48
170	3.50	0.09	8.42	8.43	97.79	97.91
200	3.75	0.07	0.46	0.46	98.26	98.37
230	4.00	0.06	0.16	0.16	98.42	98.53

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.33	2.93	2.82	2.51	2.14	2.01	1.21

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.4	0.19	0.63	-1.84	8.98

Granularmetric Report

Depths and elevations based on measured values

APTIM

2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-04

Analysis Date: 09-22-20

Analyzed By: BF

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,097	806,318	Florida State Plane West	

USCS:	Munsell:	Comments:
SW		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.94	99.94	1.58	0.00	#200 - 1.71 #230 - 1.59			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.08	0.08	0.08	0.08
7/16"	-3.50	11.31	3.08	3.08	3.16	3.16
5/16"	-3.00	8.00	1.31	1.31	4.47	4.47
3.5	-2.50	5.66	2.54	2.54	7.01	7.01
4	-2.25	4.76	1.28	1.28	8.29	8.29
5	-2.00	4.00	1.70	1.70	9.99	9.99
7	-1.50	2.83	4.77	4.77	14.76	14.76
10	-1.00	2.00	5.53	5.54	20.29	20.30
14	-0.50	1.41	7.13	7.13	27.42	27.43
18	0.00	1.00	6.07	6.08	33.50	33.51
25	0.50	0.71	5.81	5.81	39.30	39.32
35	1.00	0.50	5.27	5.28	44.58	44.60
45	1.50	0.35	4.96	4.96	49.54	49.56
60	2.00	0.25	6.44	6.44	55.97	56.00
80	2.50	0.18	18.51	18.52	74.48	74.52
120	3.00	0.13	19.16	19.17	93.64	93.69
170	3.50	0.09	4.39	4.39	98.03	98.08
200	3.75	0.07	0.21	0.21	98.24	98.29
230	4.00	0.06	0.12	0.12	98.36	98.41

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.15	2.75	2.51	1.53	-0.67	-1.39	-2.90

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	0.82	0.57	1.95	-0.67	2.33

BA_COMPOSITES.GPJ 9/22/20

Granularmetric Report

Depths and elevations based on measured values

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-05
Analysis Date: 09-22-20
Analyzed By: BF

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,458	805,750	Florida State Plane West	

USCS:	Munsell:	Comments:
SW		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.93	99.93	1.38	0.00	#200 - 1.45 #230 - 1.39			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.09	0.09	0.09	0.09
5	-2.00	4.00	0.05	0.05	0.14	0.14
7	-1.50	2.83	0.12	0.12	0.26	0.26
10	-1.00	2.00	0.49	0.49	0.75	0.75
14	-0.50	1.41	1.21	1.21	1.96	1.96
18	0.00	1.00	2.17	2.17	4.13	4.13
25	0.50	0.71	3.21	3.21	7.34	7.34
35	1.00	0.50	4.42	4.42	11.76	11.76
45	1.50	0.35	6.83	6.83	18.59	18.59
60	2.00	0.25	15.96	15.97	34.55	34.56
80	2.50	0.18	35.85	35.88	70.40	70.44
120	3.00	0.13	24.09	24.11	94.49	94.55
170	3.50	0.09	3.86	3.86	98.35	98.41
200	3.75	0.07	0.14	0.14	98.49	98.55
230	4.00	0.06	0.06	0.06	98.55	98.61

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.06	2.78	2.59	2.22	1.70	1.31	0.14

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.01	0.25	0.86	-1.51	5.77

BA_COMPOSITES.GPJ 9/22/20

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-06

Analysis Date: 09-22-20

Analyzed By: BF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,845	804,924	Florida State Plane West	

USCS:	Munsell:	Comments:
SW		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.96	99.96	1.84	0.00	#200 - 2.72 #230 - 1.84			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.16	0.16	0.16	0.16
3.5	-2.50	5.66	0.00	0.00	0.16	0.16
4	-2.25	4.76	0.02	0.02	0.18	0.18
5	-2.00	4.00	0.06	0.06	0.23	0.24
7	-1.50	2.83	0.25	0.25	0.48	0.49
10	-1.00	2.00	0.33	0.33	0.81	0.82
14	-0.50	1.41	1.00	1.00	1.81	1.82
18	0.00	1.00	1.52	1.52	3.33	3.34
25	0.50	0.71	1.91	1.91	5.24	5.25
35	1.00	0.50	2.36	2.36	7.60	7.61
45	1.50	0.35	2.53	2.53	10.13	10.14
60	2.00	0.25	4.13	4.13	14.26	14.27
80	2.50	0.18	19.01	19.01	33.26	33.28
120	3.00	0.13	47.54	47.56	80.81	80.84
170	3.50	0.09	16.09	16.09	96.89	96.93
200	3.75	0.07	0.35	0.35	97.24	97.28
230	4.00	0.06	0.88	0.88	98.12	98.16

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.44	3.10	2.94	2.68	2.28	2.05	0.43

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.45	0.18	0.88	-2.38	10.25

BA_COMPOSITES.GPJ 9/22/20

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-07
Analysis Date: 09-22-20
Analyzed By: BF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,392	805,456	Florida State Plane West	

USCS:	Munsell:	Comments:
SW		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.81	99.81	1.16	0.00	#200 - 1.32 #230 - 1.19			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	2.39	2.39	2.39	2.39
5/16"	-3.00	8.00	2.06	2.06	4.45	4.45
3.5	-2.50	5.66	0.67	0.67	5.12	5.12
4	-2.25	4.76	0.93	0.93	6.05	6.05
5	-2.00	4.00	1.33	1.33	7.38	7.38
7	-1.50	2.83	3.98	3.99	11.36	11.37
10	-1.00	2.00	5.53	5.54	16.89	16.91
14	-0.50	1.41	7.70	7.71	24.59	24.62
18	0.00	1.00	7.09	7.10	31.68	31.72
25	0.50	0.71	6.69	6.70	38.37	38.42
35	1.00	0.50	6.67	6.68	45.04	45.10
45	1.50	0.35	6.78	6.79	51.82	51.89
60	2.00	0.25	9.18	9.20	61.00	61.09
80	2.50	0.18	13.48	13.51	74.48	74.60
120	3.00	0.13	18.32	18.35	92.80	92.95
170	3.50	0.09	5.50	5.51	98.30	98.46
200	3.75	0.07	0.22	0.22	98.52	98.68
230	4.00	0.06	0.13	0.13	98.65	98.81

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.19	2.76	2.51	1.36	-0.47	-1.08	-2.59

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	0.88	0.54	1.84	-0.68	2.56

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-08

Analysis Date: 09-22-20

Analyzed By: BF

APTIM

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft): 587,228

Northing (ft): 805,426

Coordinate System: Florida State Plane West

Elevation (ft):

USCS: SW

Munsell:

Comments: Composite

Dry Weight (g): 99.99

Wash Weight (g): 99.99

Pan Retained (g): 1.64

Sieve Loss (%): 0.00

Fines (%): #200 - 1.77
#230 - 1.67

Organics (%):

Carbonates (%):

Shell Hash (%):

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	2.24	2.24	2.24	2.24
5/16"	-3.00	8.00	2.32	2.32	4.56	4.56
3.5	-2.50	5.66	3.41	3.41	7.98	7.97
4	-2.25	4.76	1.54	1.54	9.51	9.51
5	-2.00	4.00	1.86	1.86	11.37	11.37
7	-1.50	2.83	5.80	5.80	17.17	17.17
10	-1.00	2.00	7.08	7.08	24.25	24.25
14	-0.50	1.41	9.19	9.19	33.44	33.44
18	0.00	1.00	7.44	7.44	40.88	40.88
25	0.50	0.71	6.80	6.80	47.68	47.68
35	1.00	0.50	5.29	5.29	52.98	52.97
45	1.50	0.35	4.65	4.65	57.63	57.62
60	2.00	0.25	6.57	6.57	64.20	64.19
80	2.50	0.18	11.95	11.95	76.15	76.14
120	3.00	0.13	16.75	16.75	92.90	92.89
170	3.50	0.09	5.13	5.13	98.03	98.02
200	3.75	0.07	0.21	0.21	98.25	98.23
230	4.00	0.06	0.10	0.10	98.35	98.33

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.21	2.73	2.45	0.72	-0.96	-1.60	-2.94

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	0.54	0.69	1.97	-0.35	1.98

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-09
Analysis Date: 09-22-20
Analyzed By: BF

APTIM

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,656	807,097	Florida State Plane West	

USCS:	Munsell:	Comments:
SW		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.97	99.97	1.77	0.00	#200 - 1.85 #230 - 1.78			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
1"	-4.64	24.93	0.00	0.00	0.00	0.00
3/4"	-4.25	19.03	0.95	0.95	0.95	0.95
5/8"	-4.00	16.00	2.28	2.28	3.23	3.23
7/16"	-3.50	11.31	1.83	1.83	5.06	5.06
5/16"	-3.00	8.00	4.13	4.13	9.19	9.19
3.5	-2.50	5.66	5.94	5.95	15.14	15.14
4	-2.25	4.76	2.62	2.62	17.76	17.76
5	-2.00	4.00	3.95	3.95	21.71	21.71
7	-1.50	2.83	9.45	9.45	31.16	31.16
10	-1.00	2.00	10.99	10.99	42.15	42.15
14	-0.50	1.41	12.78	12.78	54.93	54.93
18	0.00	1.00	9.73	9.74	64.66	64.67
25	0.50	0.71	8.02	8.02	72.68	72.69
35	1.00	0.50	6.51	6.51	79.19	79.20
45	1.50	0.35	4.55	4.56	83.75	83.76
60	2.00	0.25	4.78	4.78	88.52	88.54
80	2.50	0.18	4.51	4.51	93.04	93.05
120	3.00	0.13	3.87	3.88	96.91	96.93
170	3.50	0.09	1.14	1.14	98.05	98.07
200	3.75	0.07	0.08	0.08	98.13	98.15
230	4.00	0.06	0.07	0.07	98.20	98.22

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.75	1.53	0.68	-0.69	-1.83	-2.42	-3.52

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	-0.62	1.54	1.78	0.12	2.47

Granularmetric Report
Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-10
Analysis Date: 09-17-20
Analyzed By: BF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,913	807,149	Florida State Plane West	

USCS:	Munsell:	Comments:
SW		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.99	99.99	1.86	0.00	#200 - 1.93 #230 - 1.86			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	1.71	1.71	1.71	1.71
5/16"	-3.00	8.00	2.40	2.40	4.12	4.11
3.5	-2.50	5.66	3.15	3.15	7.27	7.26
4	-2.25	4.76	2.07	2.07	9.34	9.33
5	-2.00	4.00	2.58	2.58	11.92	11.91
7	-1.50	2.83	4.84	4.84	16.76	16.75
10	-1.00	2.00	6.64	6.64	23.40	23.39
14	-0.50	1.41	8.95	8.95	32.34	32.34
18	0.00	1.00	8.84	8.84	41.18	41.18
25	0.50	0.71	10.21	10.22	51.40	51.40
35	1.00	0.50	10.23	10.23	61.63	61.63
45	1.50	0.35	9.30	9.30	70.93	70.93
60	2.00	0.25	8.75	8.75	79.67	79.68
80	2.50	0.18	8.99	8.99	88.66	88.67
120	3.00	0.13	7.75	7.75	96.41	96.42
170	3.50	0.09	1.58	1.58	97.99	98.00
200	3.75	0.07	0.07	0.07	98.06	98.07
230	4.00	0.06	0.07	0.07	98.13	98.14

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.91	2.24	1.73	0.43	-0.91	-1.58	-2.86

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	0.26	0.84	1.72	-0.33	2.32

BA_COMPOSITES.GPJ 9/22/20

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-11

Analysis Date: 09-17-20

Analyzed By: BF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,946	806,237	Florida State Plane West	

USCS:	Munsell:	Comments:
SW		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.98	99.98	1.41	0.00	#200 - 1.49 #230 - 1.43			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	3.27	3.27	3.27	3.27
5/16"	-3.00	8.00	4.19	4.19	7.46	7.46
3.5	-2.50	5.66	2.92	2.92	10.38	10.38
4	-2.25	4.76	1.90	1.90	12.29	12.28
5	-2.00	4.00	2.89	2.89	15.18	15.17
7	-1.50	2.83	6.34	6.34	21.52	21.51
10	-1.00	2.00	8.44	8.44	29.96	29.95
14	-0.50	1.41	10.20	10.21	40.17	40.16
18	0.00	1.00	7.99	7.99	48.15	48.15
25	0.50	0.71	7.82	7.82	55.97	55.97
35	1.00	0.50	7.63	7.63	63.60	63.60
45	1.50	0.35	6.98	6.98	70.58	70.58
60	2.00	0.25	7.90	7.90	78.48	78.48
80	2.50	0.18	9.36	9.36	87.84	87.84
120	3.00	0.13	7.80	7.80	95.64	95.64
170	3.50	0.09	2.72	2.72	98.36	98.36
200	3.75	0.07	0.15	0.15	98.51	98.51
230	4.00	0.06	0.06	0.06	98.57	98.57

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.96	2.29	1.78	0.12	-1.29	-1.93	-3.29

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	0.07	0.95	1.89	-0.18	2.09

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-12

Analysis Date: 09-22-20

Analyzed By: BF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,788	804,609	Florida State Plane West	

USCS:	Munsell:	Comments:
SW		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.95	99.95	1.55	0.00	#200 - 1.58 #230 - 1.53			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.01	0.01	0.01	0.01
5	-2.00	4.00	0.08	0.08	0.09	0.09
7	-1.50	2.83	0.29	0.29	0.38	0.38
10	-1.00	2.00	0.70	0.70	1.08	1.08
14	-0.50	1.41	1.19	1.19	2.27	2.27
18	0.00	1.00	1.73	1.73	4.00	4.00
25	0.50	0.71	2.19	2.19	6.19	6.19
35	1.00	0.50	3.55	3.55	9.73	9.74
45	1.50	0.35	6.73	6.74	16.47	16.48
60	2.00	0.25	18.65	18.66	35.12	35.14
80	2.50	0.18	28.98	28.99	64.09	64.13
120	3.00	0.13	29.34	29.36	93.43	93.49
170	3.50	0.09	4.84	4.84	98.27	98.33
200	3.75	0.07	0.09	0.09	98.36	98.42
230	4.00	0.06	0.05	0.05	98.40	98.47

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.16	2.84	2.69	2.26	1.73	1.46	0.23

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.07	0.24	0.87	-1.63	6.4

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: RPVC-20-15
Analysis Date: 09-22-20
Analyzed By: BF

APTIM
APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
587,092	803,710	Florida State Plane West	

USCS:	Munsell:	Comments:
SW		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.98	99.98	2.56	0.00	#200 - 3.08 #230 - 2.55			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.98	0.98	0.98	0.98
5/16"	-3.00	8.00	0.00	0.00	0.98	0.98
3.5	-2.50	5.66	0.36	0.36	1.34	1.34
4	-2.25	4.76	0.15	0.15	1.49	1.49
5	-2.00	4.00	0.21	0.21	1.70	1.70
7	-1.50	2.83	0.36	0.36	2.06	2.06
10	-1.00	2.00	0.53	0.53	2.59	2.59
14	-0.50	1.41	0.82	0.82	3.41	3.41
18	0.00	1.00	1.07	1.07	4.48	4.48
25	0.50	0.71	1.64	1.64	6.12	6.12
35	1.00	0.50	2.02	2.02	8.14	8.14
45	1.50	0.35	2.41	2.41	10.55	10.55
60	2.00	0.25	3.76	3.76	14.30	14.31
80	2.50	0.18	10.36	10.36	24.67	24.67
120	3.00	0.13	45.17	45.18	69.83	69.85
170	3.50	0.09	25.35	25.35	95.18	95.20
200	3.75	0.07	1.72	1.72	96.90	96.92
230	4.00	0.06	0.52	0.53	97.43	97.45

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.50	3.28	3.10	2.78	2.50	2.08	0.16

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.48	0.18	1.15	-3.06	14.09

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: RPVC-20-16

Analysis Date: 09-22-20

Analyzed By: BF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,334	808,074	Florida State Plane West	

USCS:	Munsell:	Comments:
SW		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.95	99.95	2.08	0.00	#200 - 2.27 #230 - 2.09			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.27	0.27	0.27	0.27
3.5	-2.50	5.66	0.26	0.26	0.54	0.53
4	-2.25	4.76	0.12	0.12	0.66	0.65
5	-2.00	4.00	0.13	0.13	0.79	0.78
7	-1.50	2.83	0.43	0.43	1.22	1.21
10	-1.00	2.00	0.64	0.64	1.87	1.85
14	-0.50	1.41	0.94	0.94	2.80	2.79
18	0.00	1.00	0.77	0.77	3.57	3.56
25	0.50	0.71	0.84	0.85	4.42	4.41
35	1.00	0.50	0.85	0.85	5.27	5.26
45	1.50	0.35	1.00	1.00	6.27	6.26
60	2.00	0.25	2.54	2.54	8.81	8.80
80	2.50	0.18	12.92	12.92	21.73	21.72
120	3.00	0.13	56.96	56.99	78.68	78.71
170	3.50	0.09	18.37	18.38	97.06	97.09
200	3.75	0.07	0.64	0.64	97.70	97.73
230	4.00	0.06	0.18	0.18	97.87	97.91

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.44	3.14	2.97	2.75	2.53	2.28	0.85

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.56	0.17	0.9	-3.51	17.47

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: C-25

Analysis Date: 09-22-20

Analyzed By: BF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,519	804,336	Florida State Plane West	

USCS:	Munsell:	Comments:
SW		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
100.00	100.00	1.33	0.00	#200 - 2.82 #230 - 1.33			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	1.51	1.51	1.51	1.51
7	-1.50	2.83	0.49	0.49	2.00	2.00
10	-1.00	2.00	0.72	0.72	2.72	2.72
14	-0.50	1.41	0.95	0.95	3.67	3.67
18	0.00	1.00	1.15	1.15	4.82	4.82
25	0.50	0.71	1.60	1.60	6.42	6.42
35	1.00	0.50	2.00	2.00	8.42	8.42
45	1.50	0.35	1.41	1.41	9.83	9.83
60	2.00	0.25	3.31	3.31	13.14	13.14
80	2.50	0.18	13.01	13.01	26.15	26.15
120	3.00	0.13	56.12	56.12	82.27	82.27
170	3.50	0.09	13.99	13.99	96.26	96.26
200	3.75	0.07	0.92	0.92	97.18	97.18
230	4.00	0.06	1.49	1.49	98.67	98.67

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.45	3.06	2.94	2.71	2.46	2.11	0.06

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.45	0.18	1.03	-2.68	10.73

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: C-26

Analysis Date: 09-22-20

Analyzed By: BF

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,908	806,439	Florida State Plane West	

USCS:	Munsell:	Comments:
SP		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.90	99.90	0.67	0.00	#200 - 1.31 #230 - 0.66			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.00	0.00	0.00	0.00
10	-1.00	2.00	0.00	0.00	0.00	0.00
14	-0.50	1.41	0.48	0.48	0.48	0.48
18	0.00	1.00	0.65	0.65	1.13	1.13
25	0.50	0.71	1.76	1.76	2.88	2.89
35	1.00	0.50	4.65	4.65	7.53	7.54
45	1.50	0.35	7.55	7.56	15.08	15.10
60	2.00	0.25	23.04	23.06	38.12	38.16
80	2.50	0.18	29.21	29.24	67.33	67.40
120	3.00	0.13	26.78	26.80	94.10	94.20
170	3.50	0.09	4.31	4.31	98.41	98.51
200	3.75	0.07	0.18	0.18	98.59	98.69
230	4.00	0.06	0.65	0.65	99.24	99.34

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.09	2.81	2.64	2.20	1.71	1.52	0.73

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.11	0.23	0.71	-0.87	4.42

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: C-29
Analysis Date: 09-22-20
Analyzed By: BF

APTIM

APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,993	804,211	Florida State Plane West	

USCS:	Munsell:	Comments:
SW		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
100.00	100.00	0.89	0.00	#200 - 1.88 #230 - 0.88			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.23	0.23	0.23	0.23
7	-1.50	2.83	0.28	0.28	0.51	0.51
10	-1.00	2.00	0.57	0.57	1.08	1.08
14	-0.50	1.41	0.91	0.91	1.99	1.99
18	0.00	1.00	1.22	1.22	3.21	3.21
25	0.50	0.71	1.81	1.81	5.02	5.02
35	1.00	0.50	2.75	2.75	7.77	7.77
45	1.50	0.35	2.93	2.93	10.70	10.70
60	2.00	0.25	7.66	7.66	18.36	18.36
80	2.50	0.18	24.60	24.60	42.95	42.96
120	3.00	0.13	46.10	46.10	89.05	89.06
170	3.50	0.09	8.23	8.23	97.28	97.29
200	3.75	0.07	0.83	0.83	98.11	98.12
230	4.00	0.06	1.00	1.00	99.11	99.12

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.36	2.95	2.85	2.58	2.13	1.85	0.49

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.35	0.20	0.86	-2.14	8.9

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: C-30

Analysis Date: 09-22-20

Analyzed By: BF

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Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
586,381	805,016	Florida State Plane West	

USCS:	Munsell:	Comments:
SP		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
100.00	100.00	0.64	0.00	#200 - 1.32 #230 - 0.64			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.11	0.11	0.11	0.11
10	-1.00	2.00	0.26	0.26	0.37	0.37
14	-0.50	1.41	0.77	0.77	1.15	1.14
18	0.00	1.00	1.49	1.49	2.64	2.63
25	0.50	0.71	3.24	3.24	5.88	5.87
35	1.00	0.50	6.41	6.41	12.29	12.28
45	1.50	0.35	7.33	7.33	19.62	19.61
60	2.00	0.25	17.04	17.04	36.66	36.65
80	2.50	0.18	28.32	28.32	64.97	64.97
120	3.00	0.13	28.92	28.92	93.89	93.89
170	3.50	0.09	4.23	4.23	98.12	98.12
200	3.75	0.07	0.56	0.56	98.68	98.68
230	4.00	0.06	0.68	0.68	99.36	99.36

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.13	2.83	2.67	2.24	1.66	1.25	0.37

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.06	0.24	0.85	-1.1	4.5

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search

Sample Name: C-31

Analysis Date: 09-22-20

Analyzed By: BF

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Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
585,879	805,358	Florida State Plane West	

USCS:	Munsell:	Comments:
SP		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
100.00	100.00	2.09	0.00	#200 - 4.22 #230 - 2.09			

Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.45	0.45	0.45	0.45
7	-1.50	2.83	0.07	0.07	0.52	0.52
10	-1.00	2.00	0.26	0.26	0.78	0.78
14	-0.50	1.41	0.12	0.12	0.90	0.90
18	0.00	1.00	0.15	0.15	1.05	1.05
25	0.50	0.71	0.26	0.26	1.31	1.31
35	1.00	0.50	0.26	0.26	1.57	1.57
45	1.50	0.35	0.30	0.30	1.87	1.87
60	2.00	0.25	0.97	0.97	2.84	2.84
80	2.50	0.18	15.65	15.65	18.49	18.49
120	3.00	0.13	64.44	64.44	82.93	82.93
170	3.50	0.09	11.69	11.69	94.62	94.62
200	3.75	0.07	1.16	1.16	95.78	95.78
230	4.00	0.06	2.13	2.13	97.91	97.91

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.58	3.05	2.94	2.74	2.55	2.42	2.07

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.69	0.15	0.58	-4.26	33.37

Granularmetric Report

Depths and elevations based on measured values

Project Name: Redfish Pass Sand Search
Sample Name: REDFISH PASS BA I
Analysis Date: 09-22-20
Analyzed By: BF

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Easting (ft):	Northing (ft):	Coordinate System:	Elevation (ft):
		Florida State Plane West	

USCS:	Munsell:	Comments:
SW		Composite

Dry Weight (g):	Wash Weight (g):	Pan Retained (g):	Sieve Loss (%):	Fines (%):	Organics (%):	Carbonates (%):	Shell Hash (%):
99.96	99.96	1.45	0.00	#200 - 1.94 #230 - 1.44			

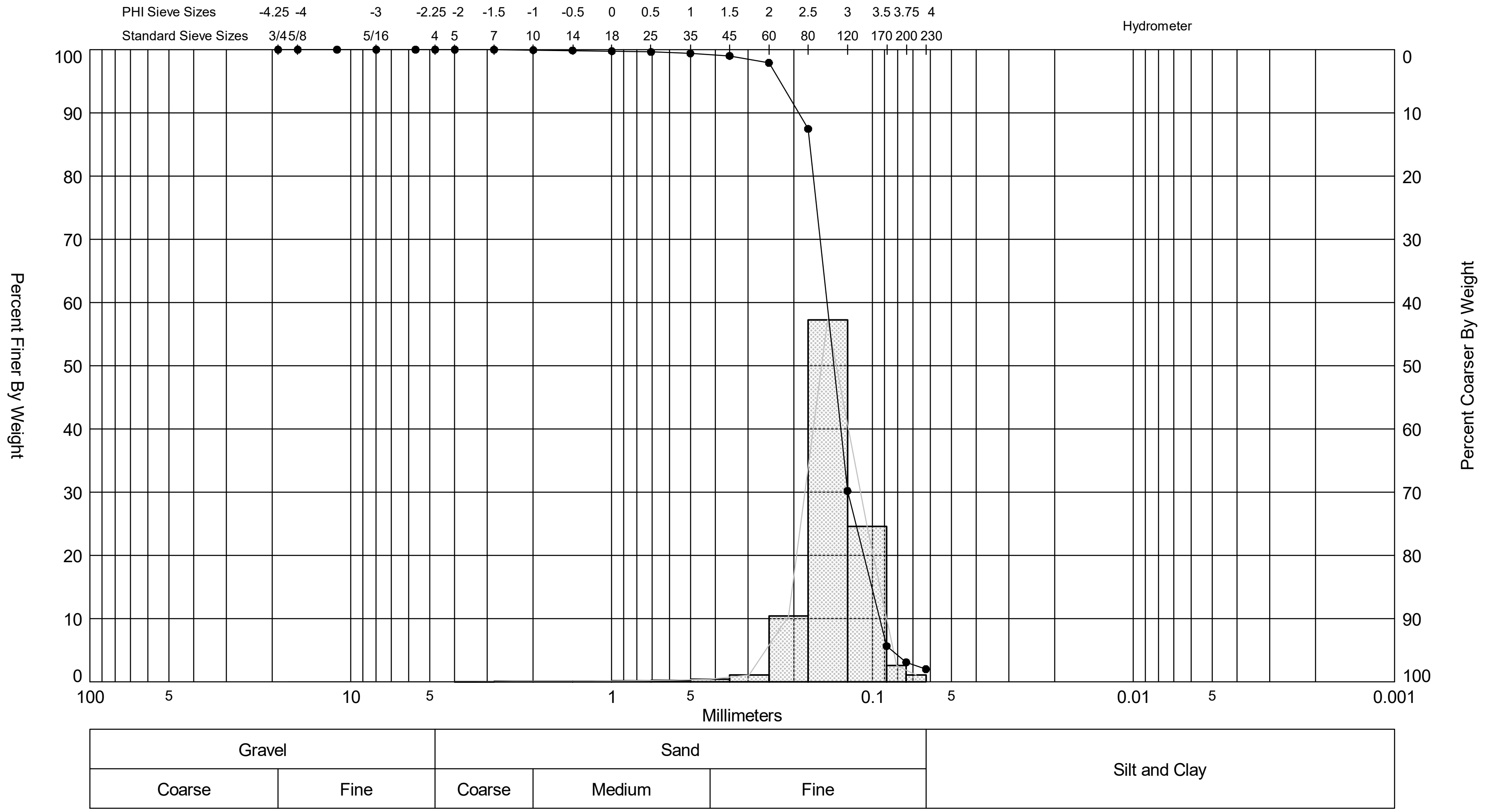
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
1"	-4.64	24.93	0.00	0.00	0.00	0.00
3/4"	-4.25	19.03	0.06	0.06	0.06	0.06
5/8"	-4.00	16.00	0.14	0.14	0.20	0.20
7/16"	-3.50	11.31	0.87	0.87	1.07	1.07
5/16"	-3.00	8.00	1.06	1.06	2.13	2.13
3.5	-2.50	5.66	1.22	1.22	3.34	3.35
4	-2.25	4.76	0.67	0.67	4.02	4.02
5	-2.00	4.00	1.04	1.04	5.05	5.06
7	-1.50	2.83	2.28	2.28	7.33	7.34
10	-1.00	2.00	2.97	2.97	10.30	10.31
14	-0.50	1.41	3.92	3.92	14.22	14.23
18	0.00	1.00	3.63	3.64	17.85	17.87
25	0.50	0.71	4.03	4.04	21.89	21.91
35	1.00	0.50	4.64	4.64	26.52	26.55
45	1.50	0.35	5.05	5.05	31.57	31.60
60	2.00	0.25	9.68	9.68	41.25	41.28
80	2.50	0.18	19.22	19.23	60.47	60.51
120	3.00	0.13	29.43	29.44	89.90	89.95
170	3.50	0.09	7.68	7.68	97.58	97.63
200	3.75	0.07	0.43	0.43	98.01	98.06
230	4.00	0.06	0.50	0.50	98.51	98.56

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.33	2.90	2.75	2.23	0.83	-0.26	-2.01

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	1.56	0.34	1.66	-1.34	4.04

APPENDIX 12

BORROW AREA COMPOSITE GRAIN SIZE DISTRIBUTION CURVES/HISTOGRAMS



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-01	—●—		SP	#200 - 3.09 #230 - 2.00			2.83	2.82	-1.99	17.37	0.43

Comments: Composite

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-17-20
Analyzed By:	BF
Easting (X, ft):	585,775
Northing (Y, ft):	807,850
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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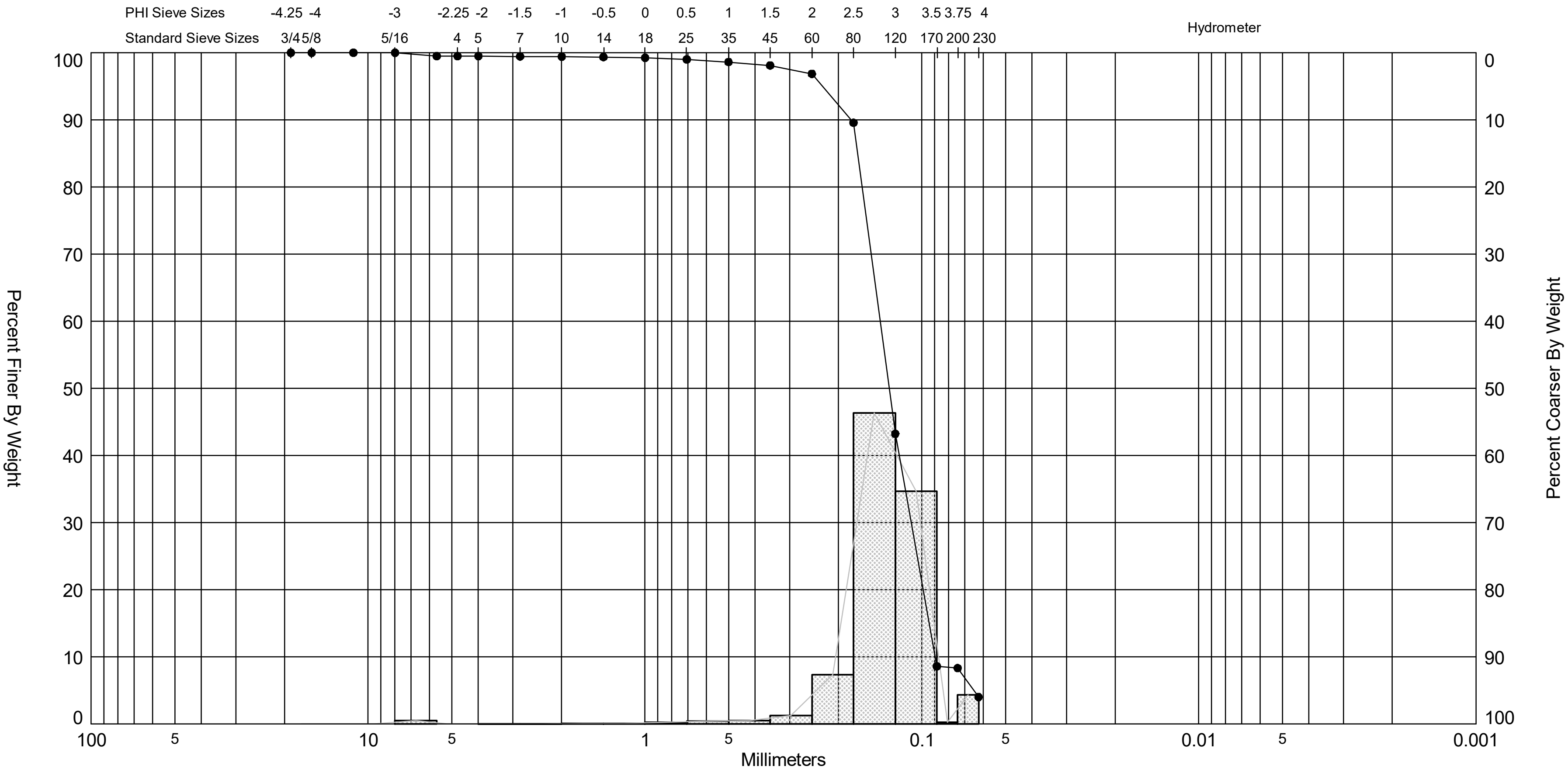

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-02	●		SP-SM	#200 - 8.31 #230 - 4.01			2.93	2.87	-4.51	37.83	0.63

Comments: Composite

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	585,049
Northing (Y, ft):	807,556
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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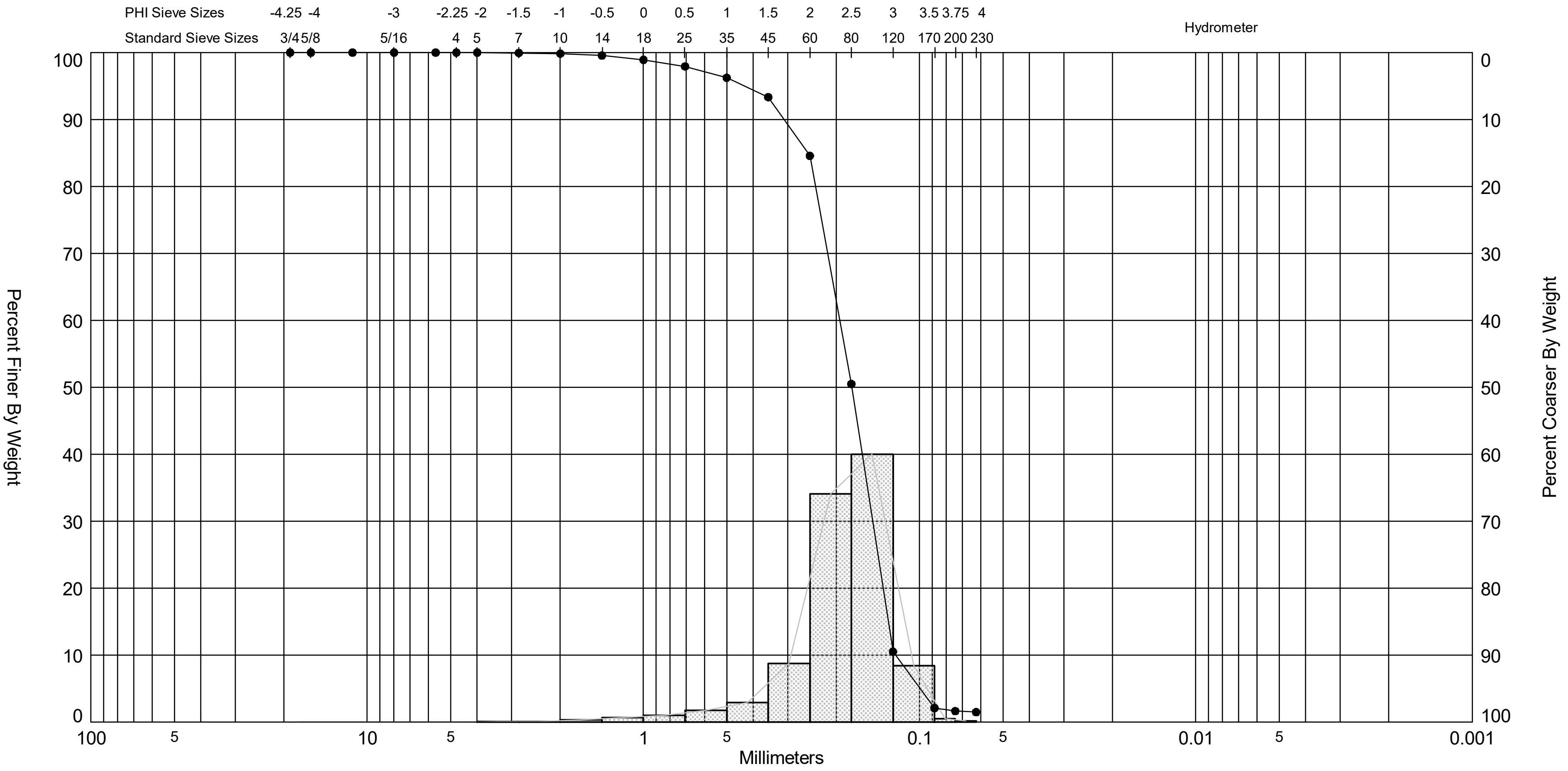

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-03	—●—		SP	#200 - 1.63 #230 - 1.47			2.51	2.4	-1.84	8.98	0.63

Comments: Composite

Depths and elevations based on measured values

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Boca Raton, FL 33431
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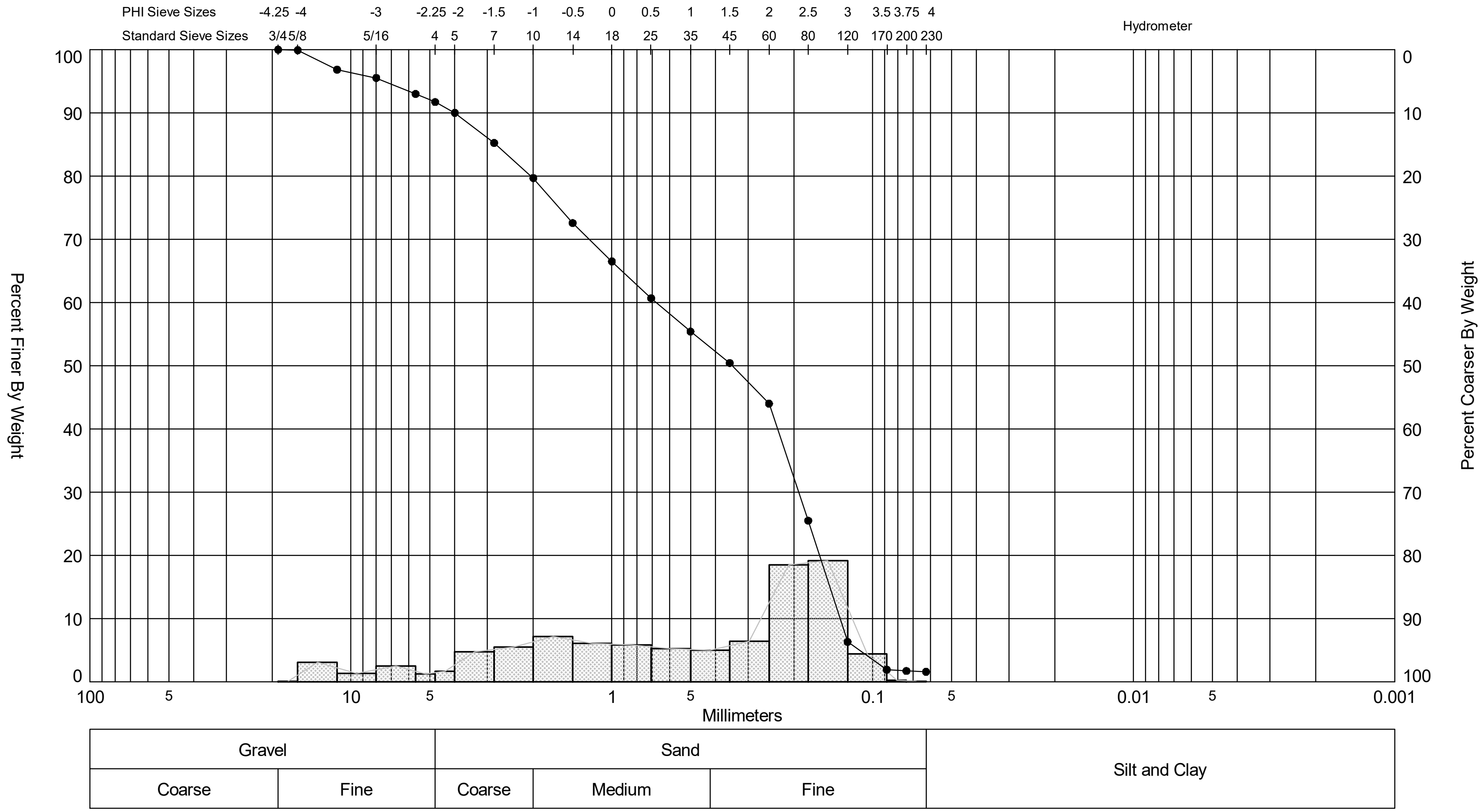
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	585,257
Northing (Y, ft):	806,648
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-04	—●—		SW	#200 - 1.71 #230 - 1.59			1.53	0.82	-0.67	2.33	1.95

Comments: Composite

Depths and elevations based on measured values

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Boca Raton, FL 33431
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Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	586,097
Northing (Y, ft):	806,318
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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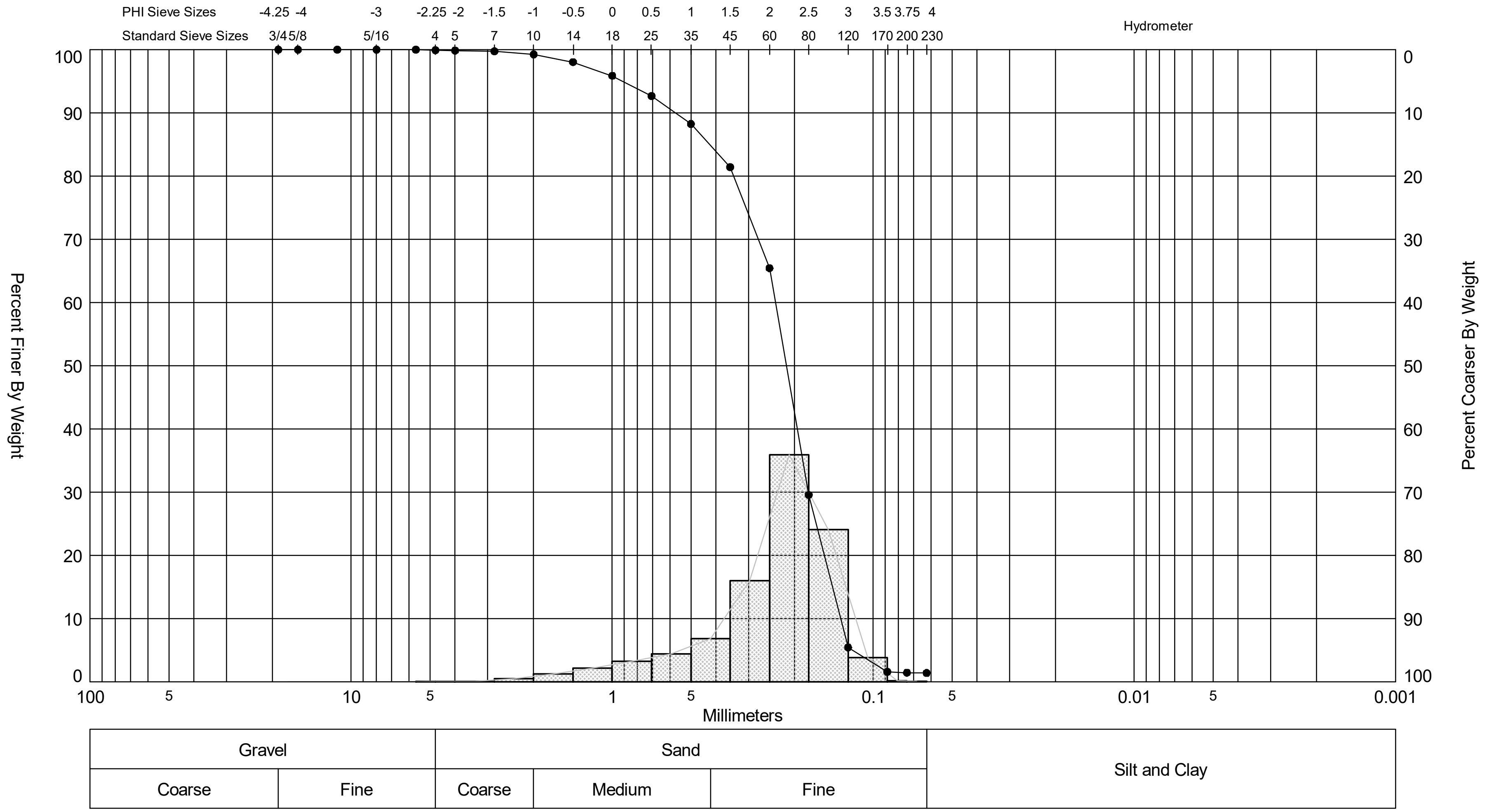

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-05	—●—		SW	#200 - 1.45 #230 - 1.39			2.22	2.01	-1.51	5.77	0.86

Comments: Composite

Depths and elevations based on measured values

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Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	585,458
Northing (Y, ft):	805,750
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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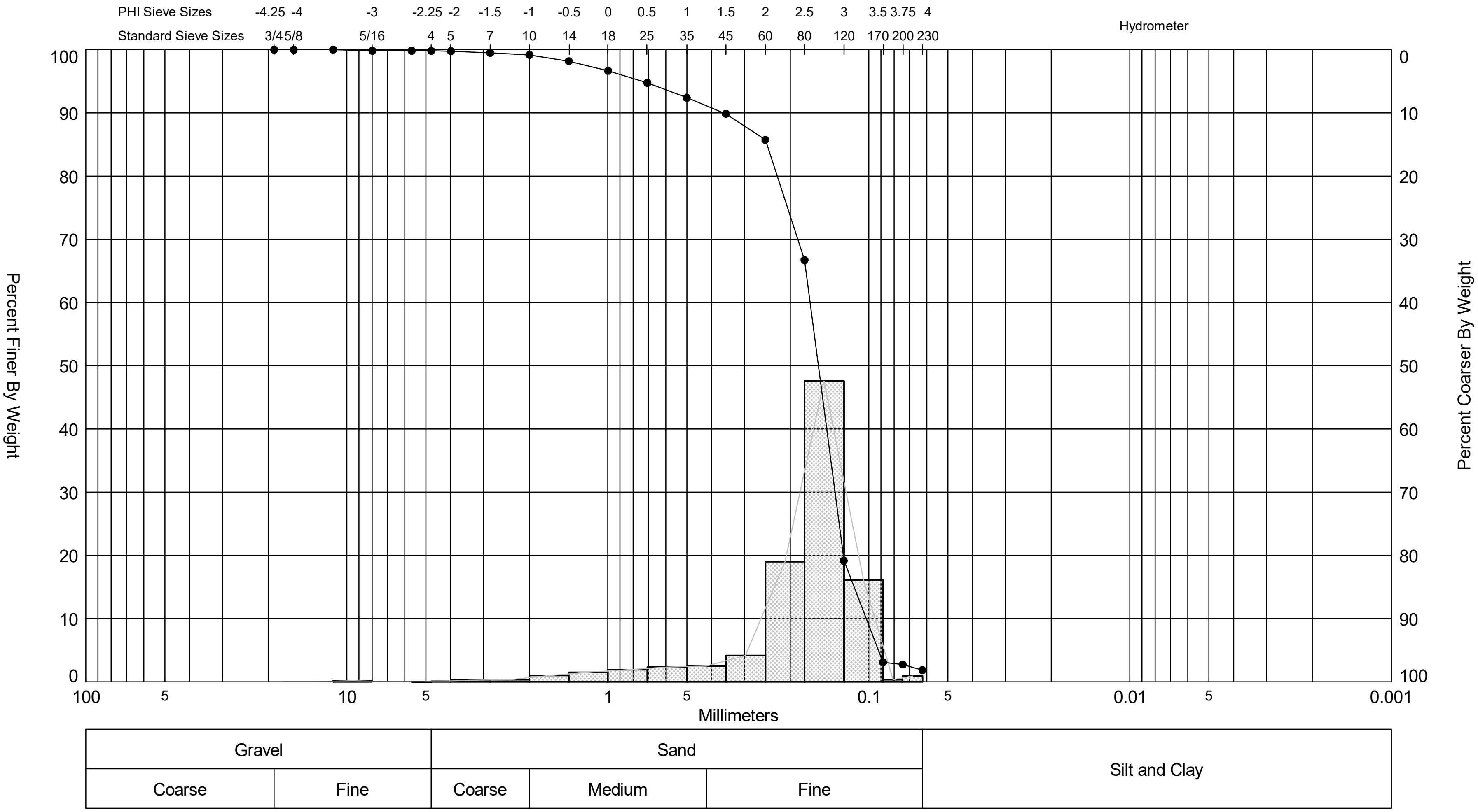

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-06	—●—		SW	#200 - 2.72 #230 - 1.84			2.68	2.45	-2.38	10.25	0.88

Comments: Composite

Depths and elevations based on measured values

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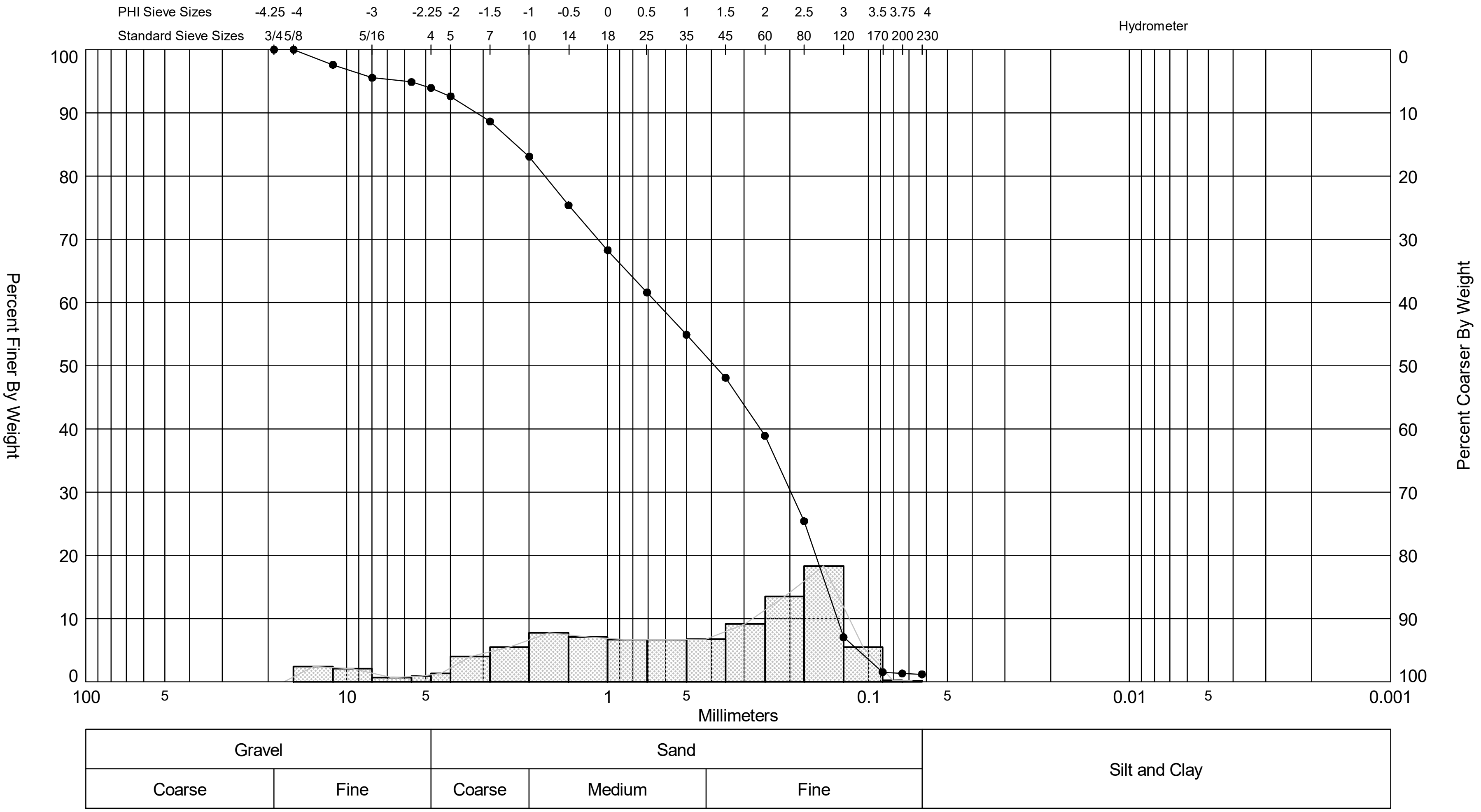
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	585,845
Northing (Y, ft):	804,924
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-07	—●—		SW	#200 - 1.32 #230 - 1.19			1.36	0.88	-0.68	2.56	1.84

Comments: Composite

Depths and elevations based on measured values

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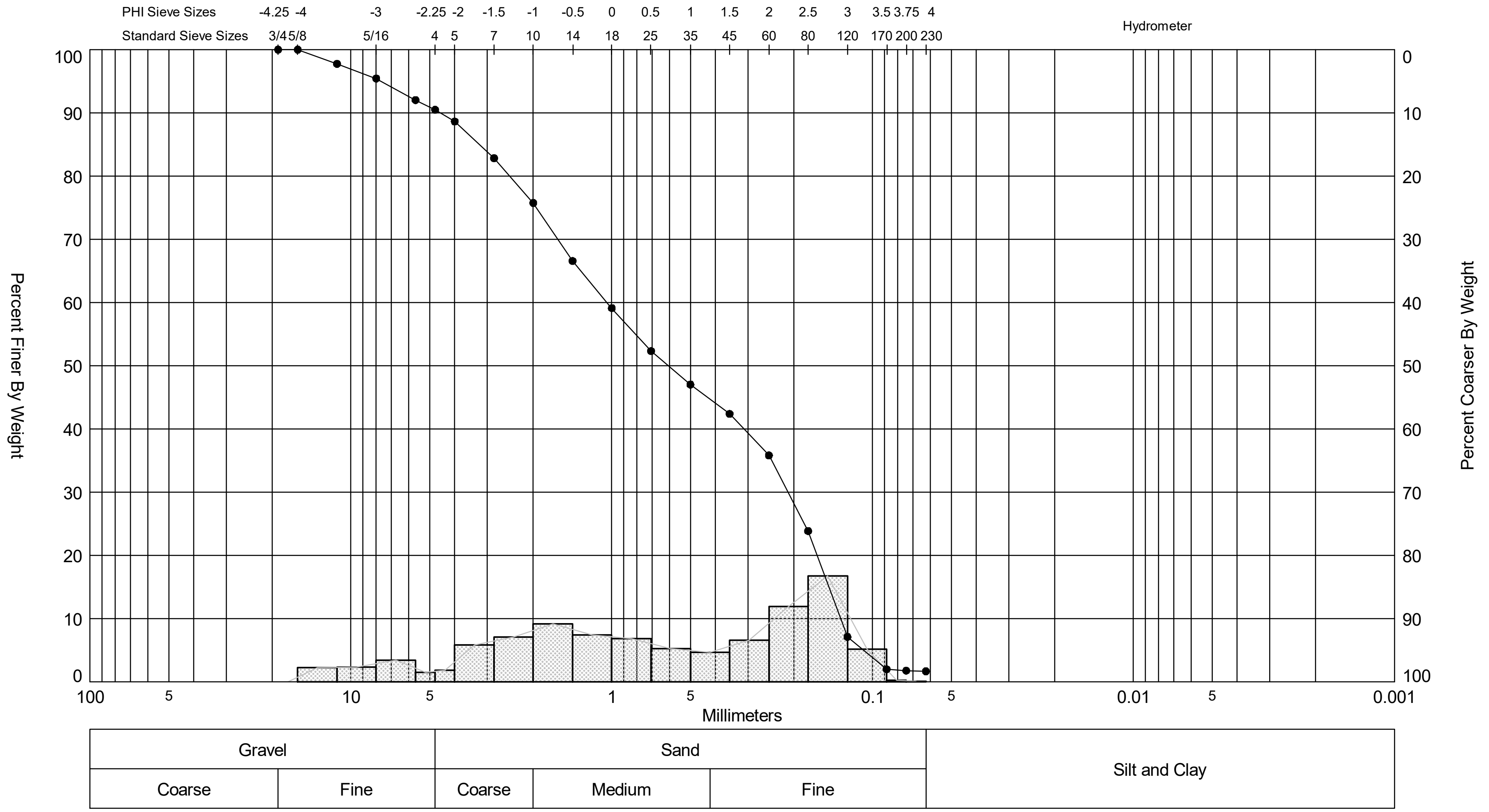
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	586,392
Northing (Y, ft):	805,456
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-08	—●—		SW	#200 - 1.77 #230 - 1.67			0.72	0.54	-0.35	1.98	1.97

Comments: Composite

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	587,228
Northing (Y, ft):	805,426
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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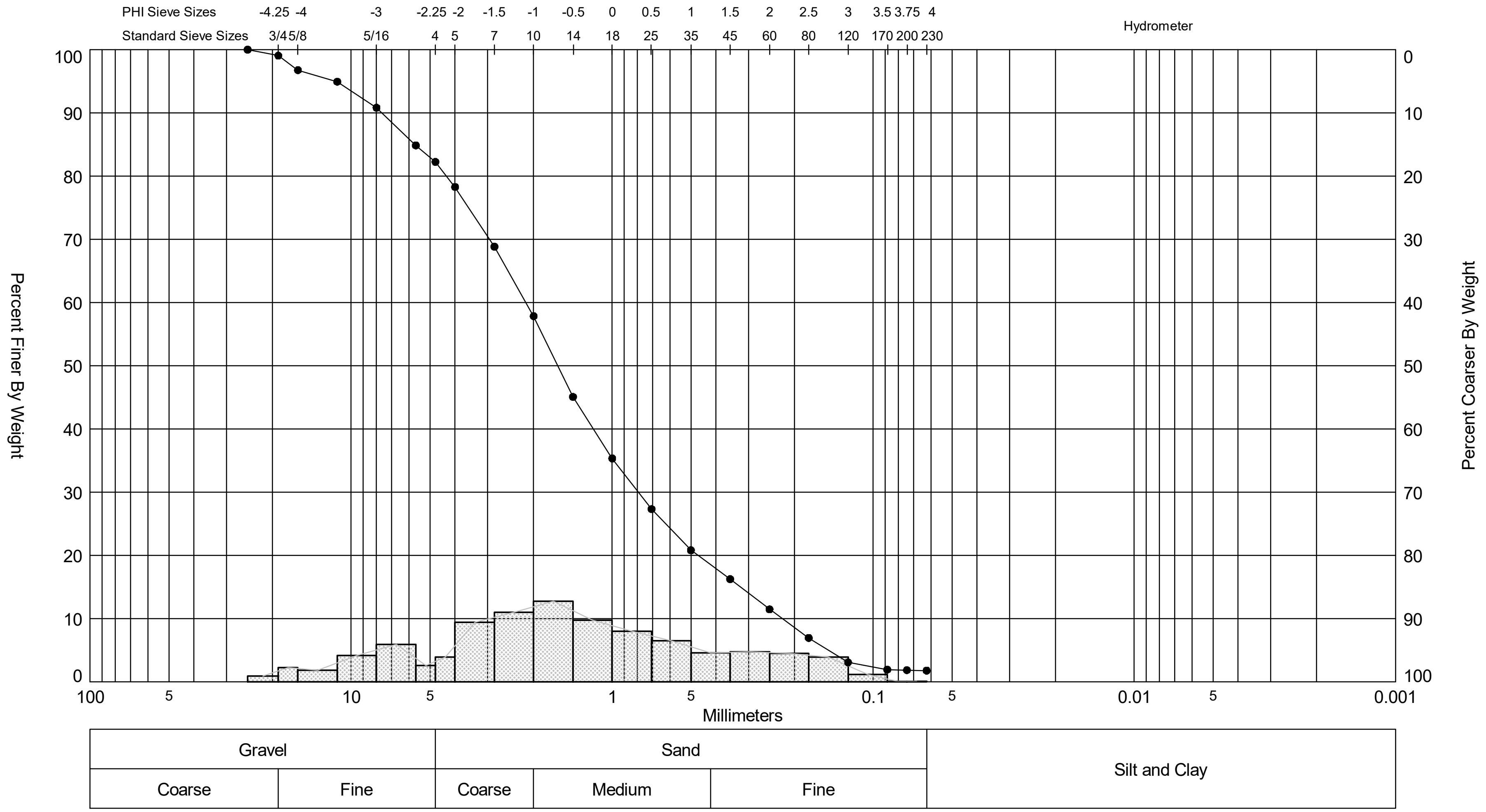

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-09	—●—		SW	#200 - 1.85 #230 - 1.78				-0.62	0.12	2.47	1.78

Comments: Composite

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	586,656
Northing (Y, ft):	807,097
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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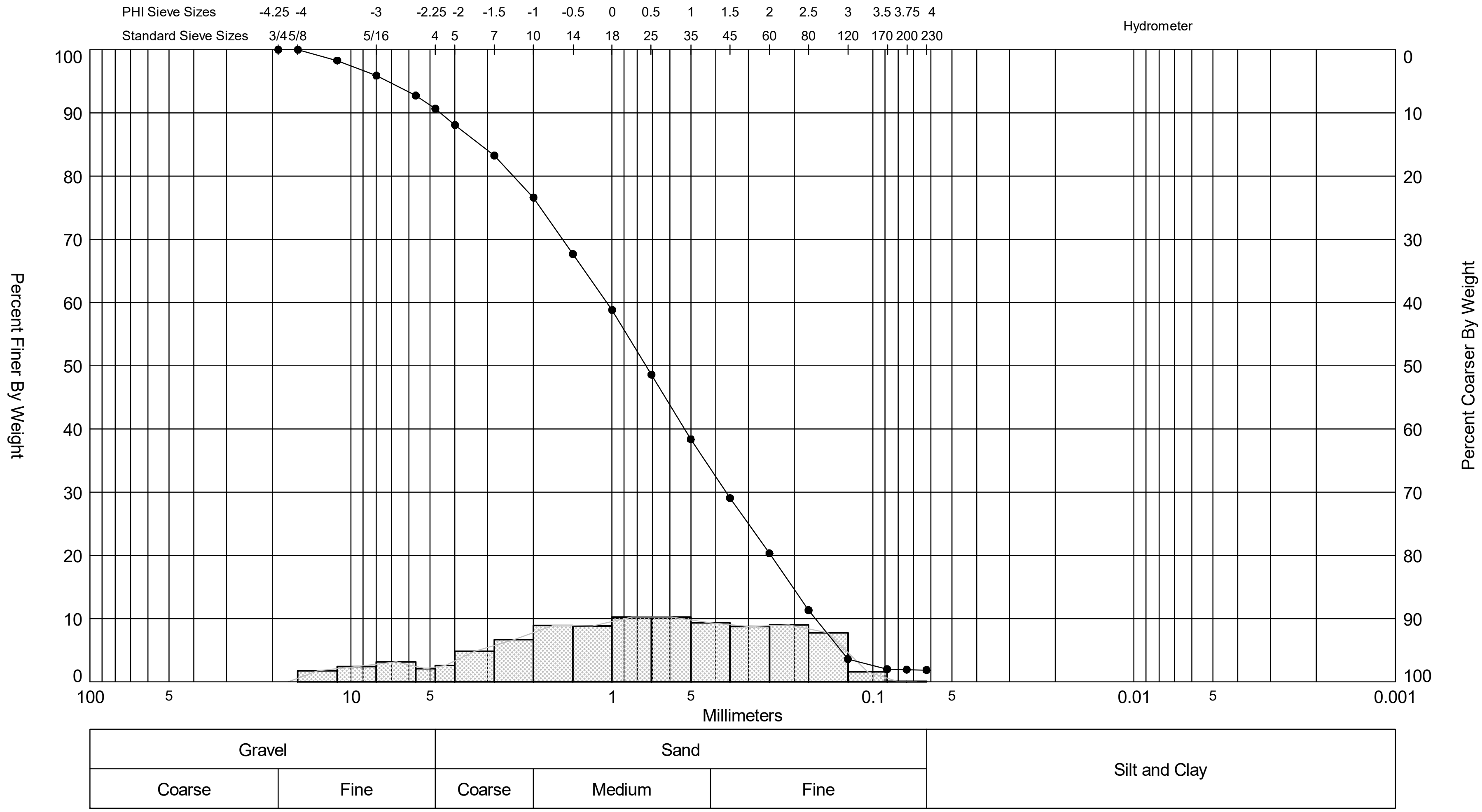

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-10	—●—		SW	#200 - 1.93 #230 - 1.86			0.43	0.26	-0.33	2.32	1.72

Comments: Composite

Depths and elevations based on measured values

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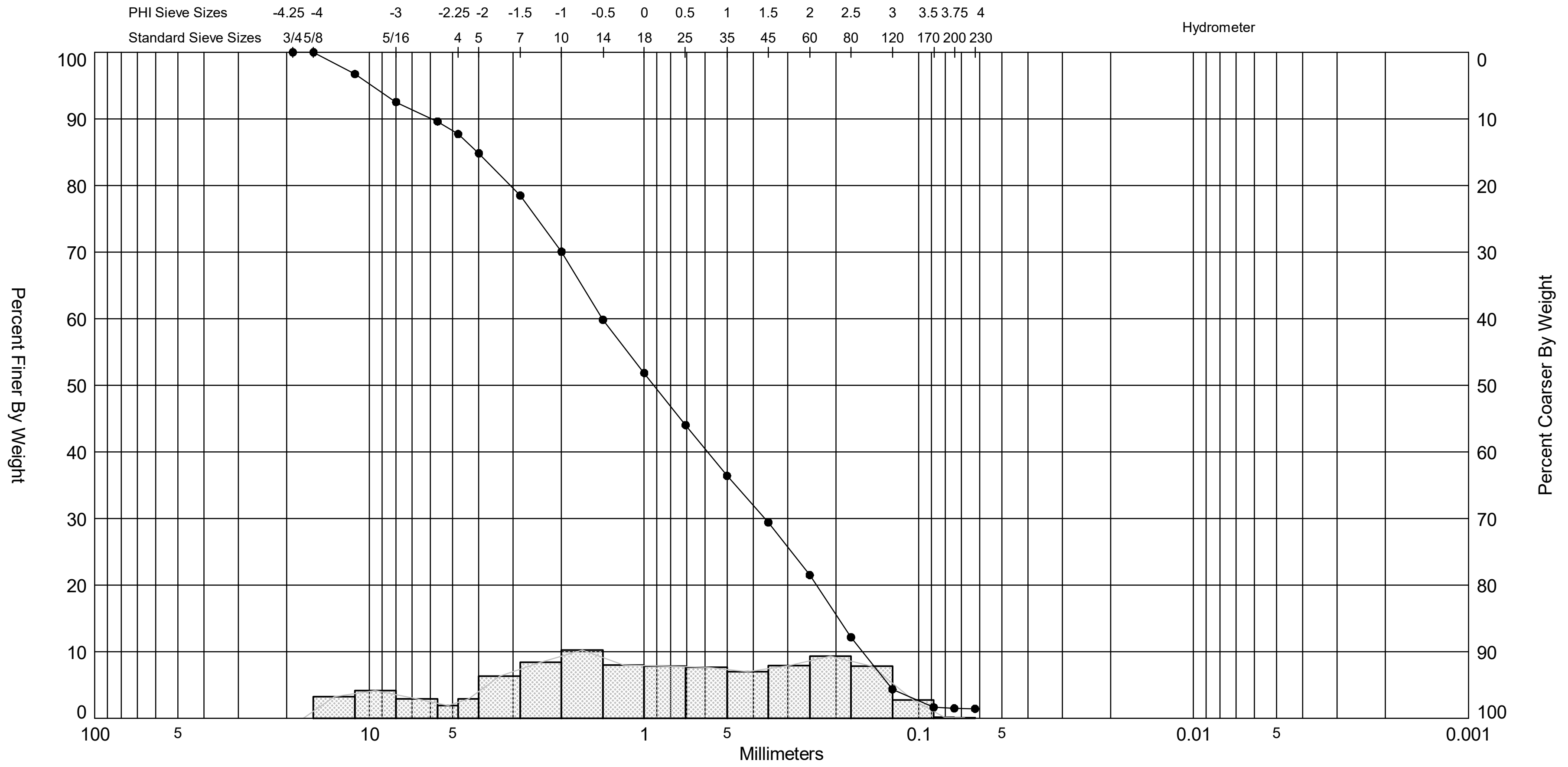
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-17-20
Analyzed By:	BF
Easting (X, ft):	585,913
Northing (Y, ft):	807,149
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-11	—●—		SW	#200 - 1.49 #230 - 1.43			0.12	0.07	-0.18	2.09	1.89

Comments: Composite

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-17-20
Analyzed By:	BF
Easting (X, ft):	586,946
Northing (Y, ft):	806,237
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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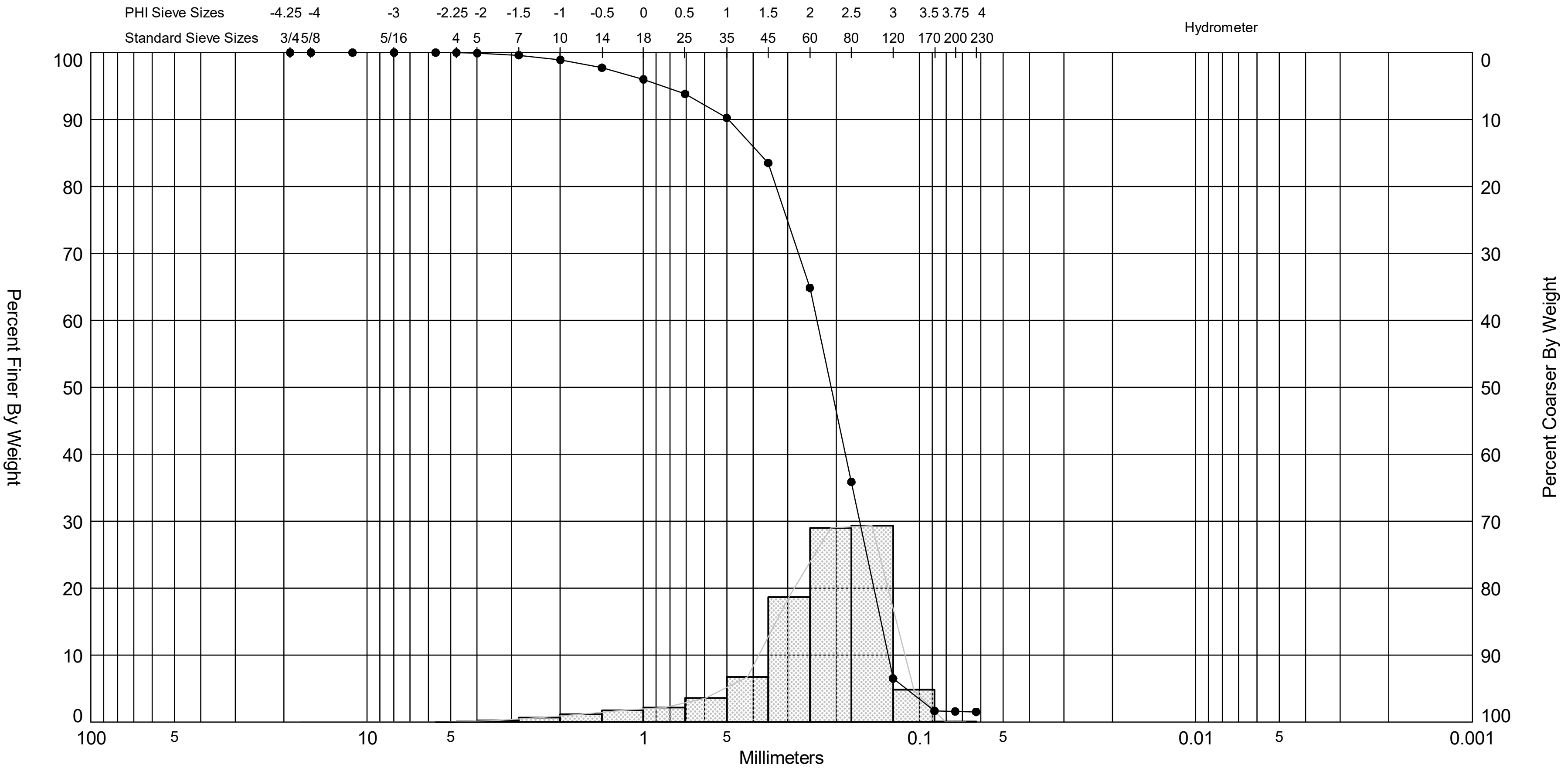

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-12	—●—		SW	#200 - 1.58 #230 - 1.53			2.26	2.07	-1.63	6.4	0.87

Comments: Composite

Depths and elevations based on measured values

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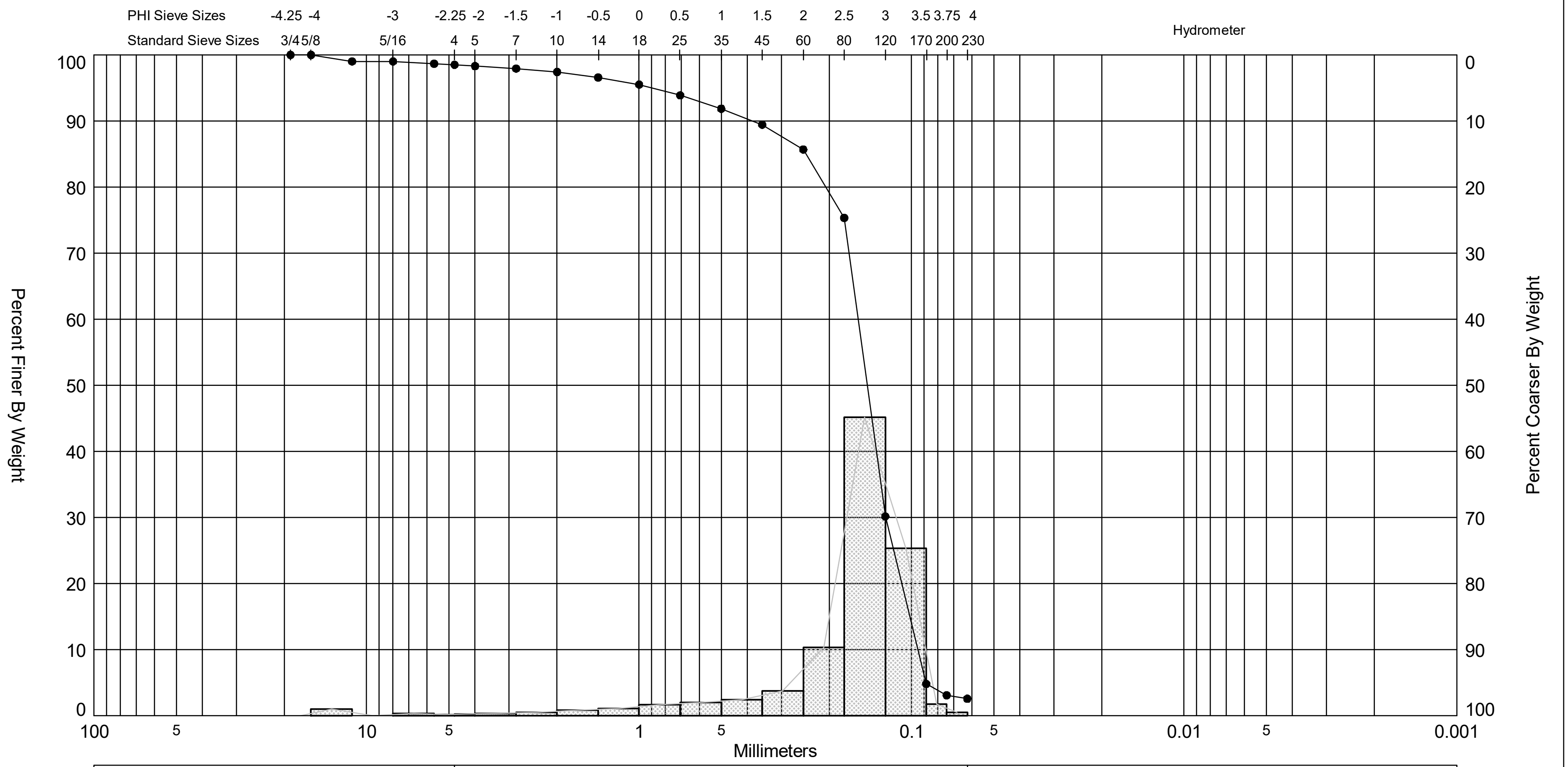
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	586,788
Northing (Y, ft):	804,609
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-15	─●─		SW	#200 - 3.08 #230 - 2.55			2.78	2.48	-3.06	14.09	1.15

Comments: Composite

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	587,092
Northing (Y, ft):	803,710
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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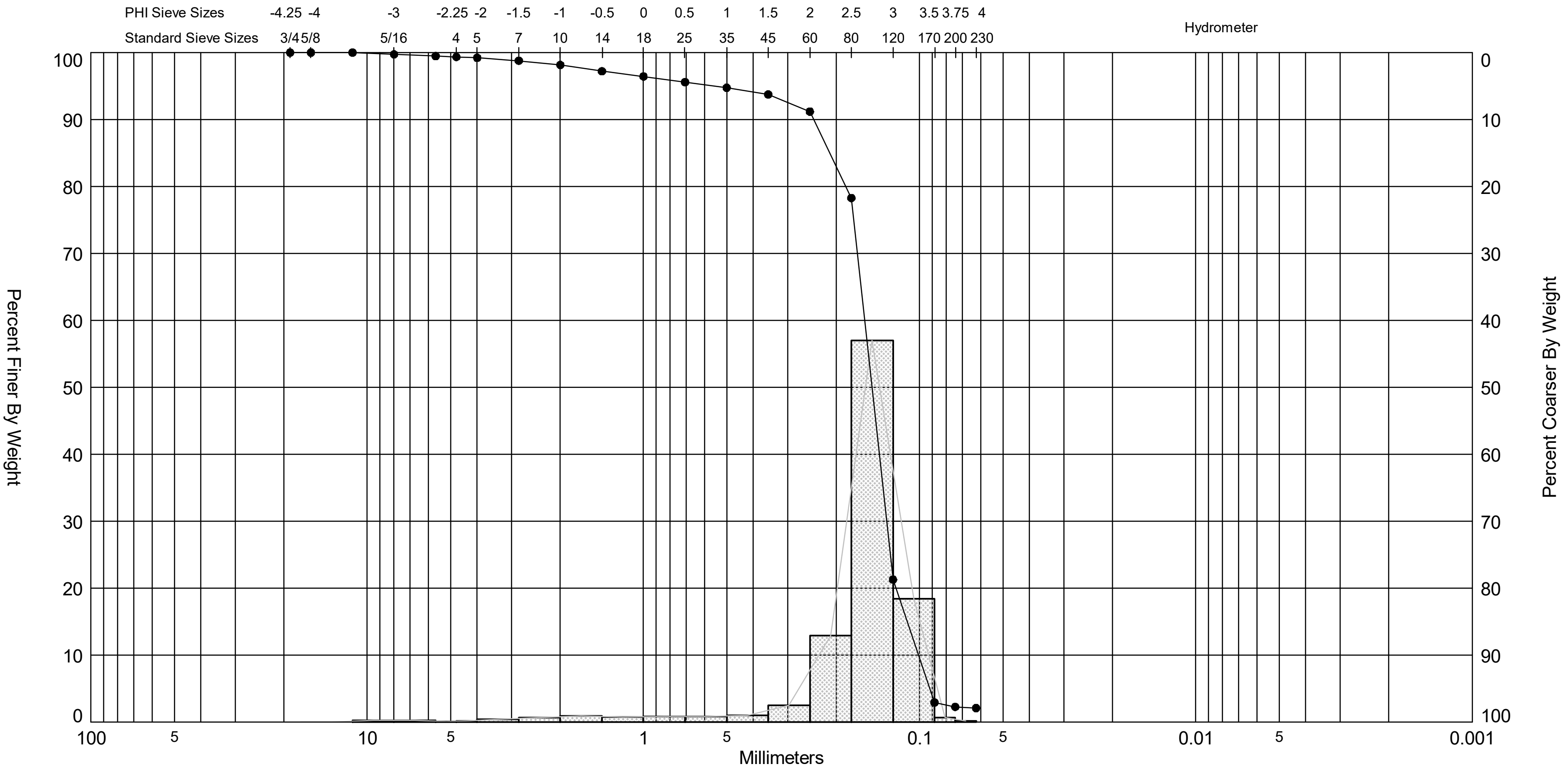

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
RPVC-20-16	—●—		SW	#200 - 2.27 #230 - 2.09			2.75	2.56	-3.51	17.47	0.9

Comments: Composite

Depths and elevations based on measured values

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Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	586,334
Northing (Y, ft):	808,074
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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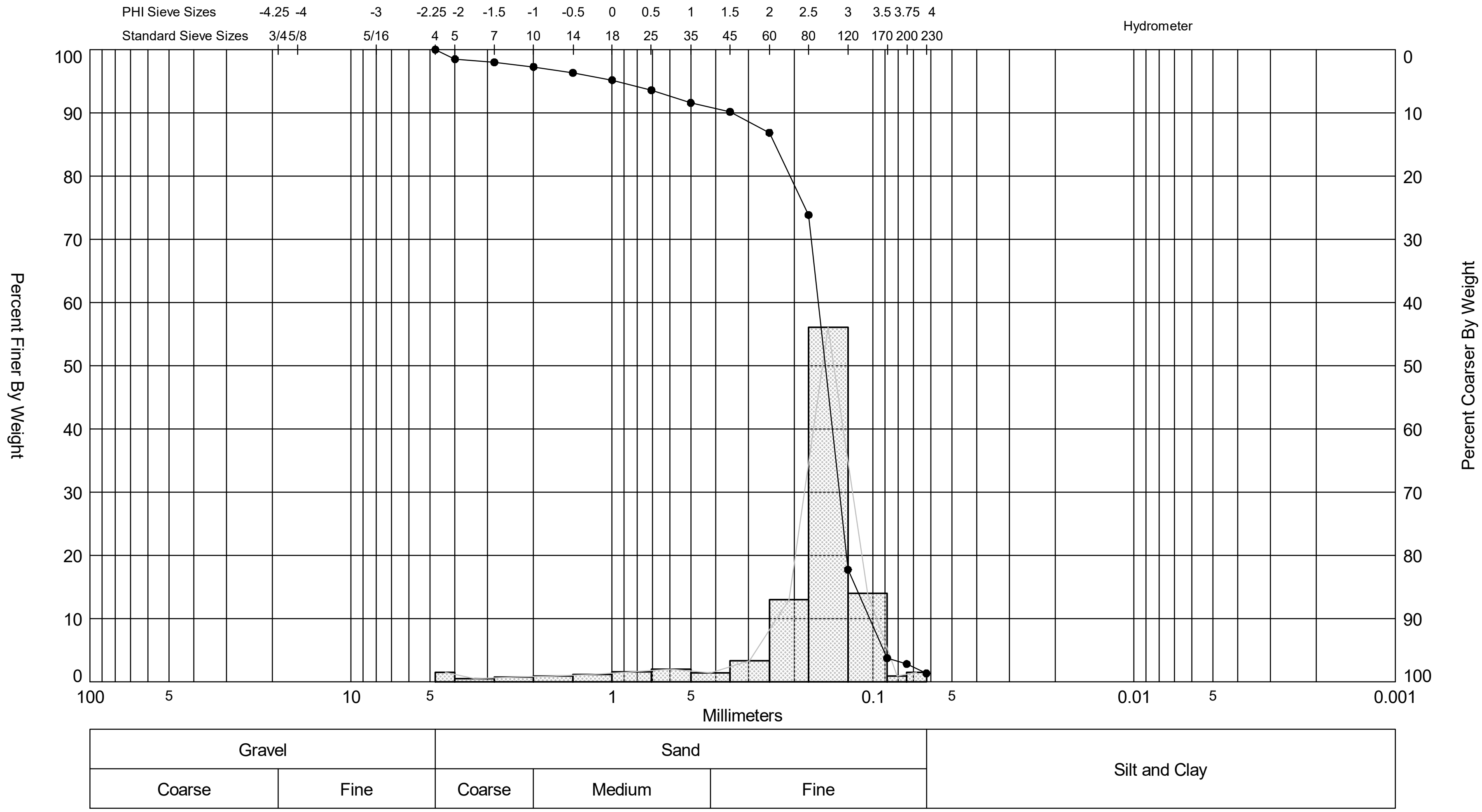

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
C-25	—●—		SW	#200 - 2.82 #230 - 1.33			2.71	2.45	-2.68	10.73	1.03

Comments: Composite

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	586,519
Northing (Y, ft):	804,336
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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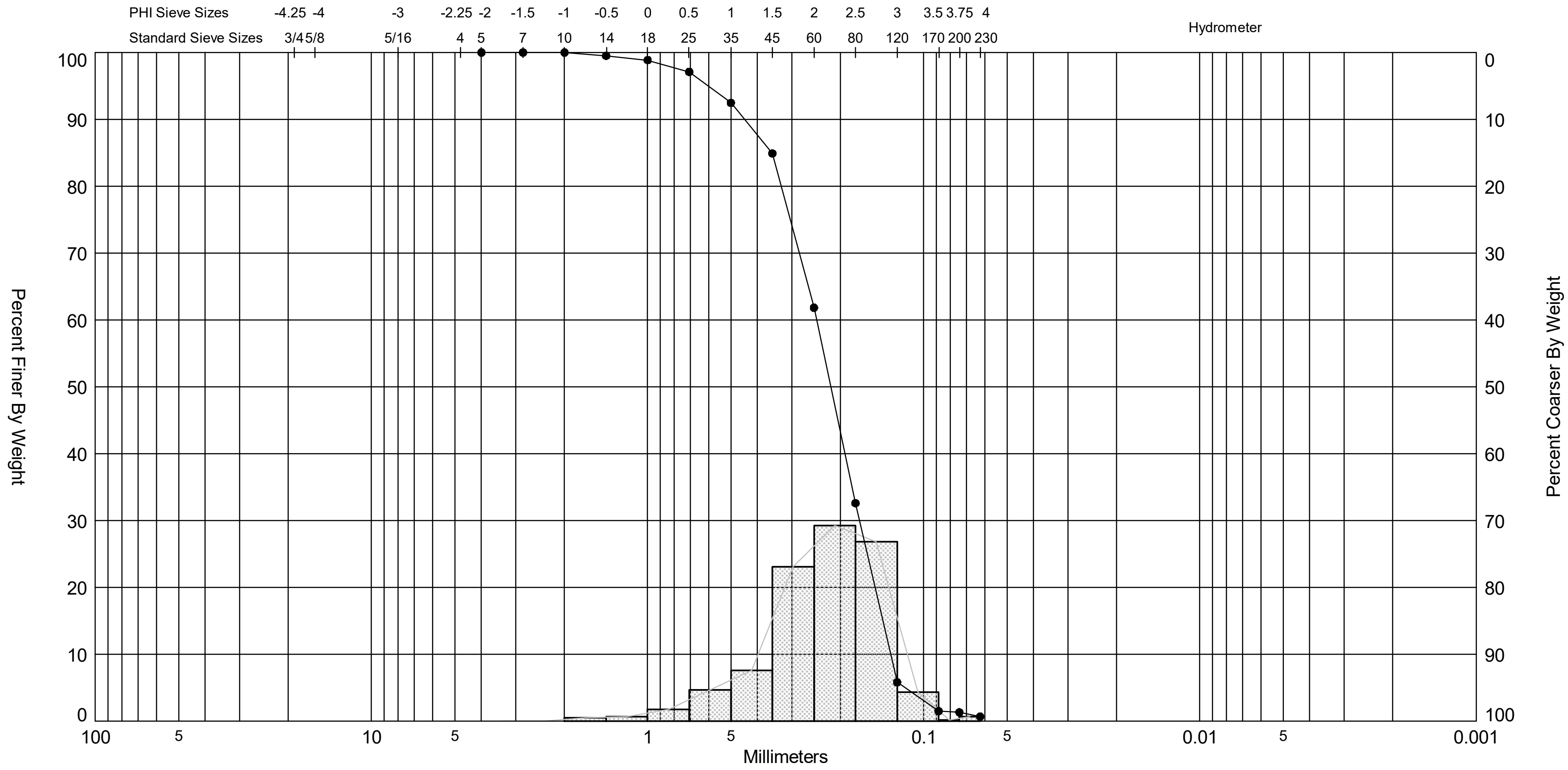

<table>
<tr><td colspan="2">Gravel</td><td colspan="3">Sand</td><td rowspan="2">Silt and Clay</td></tr>
<tr><td>Coarse</td><td>Fine</td><td>Coarse</td><td>Medium</td><td>Fine</td></tr>
</table>

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
C-26	—●—		SP	#200 - 1.31 #230 - 0.66			2.2	2.11	-0.87	4.42	0.71

Comments: Composite

Depths and elevations based on measured values

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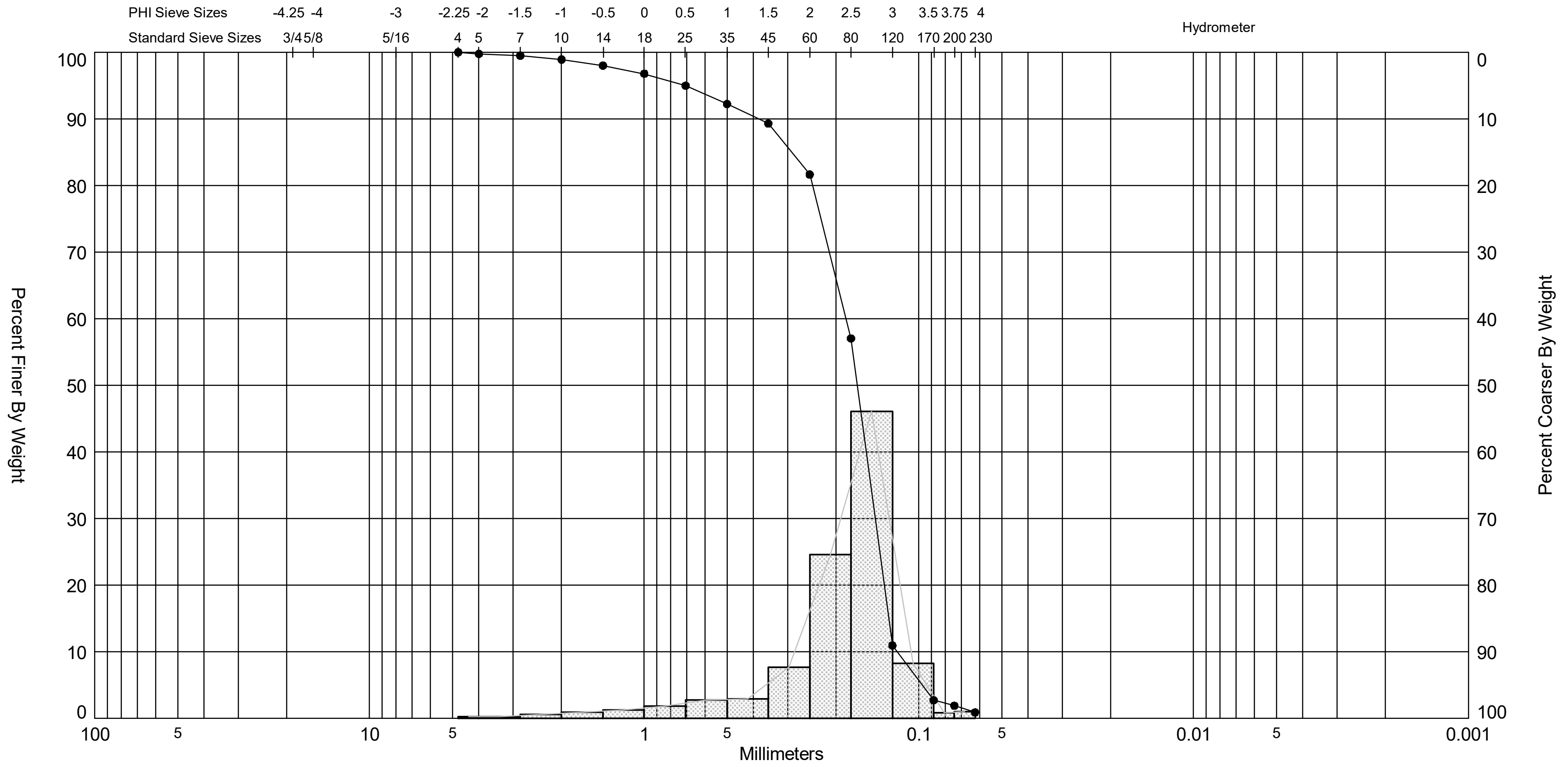
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	585,908
Northing (Y, ft):	806,439
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

BA_COMPOSITES.GPJ 9/22/20



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
C-29	—●—		SW	#200 - 1.88 #230 - 0.88			2.58	2.35	-2.14	8.9	0.86

Comments: Composite

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	586,993
Northing (Y, ft):	804,211
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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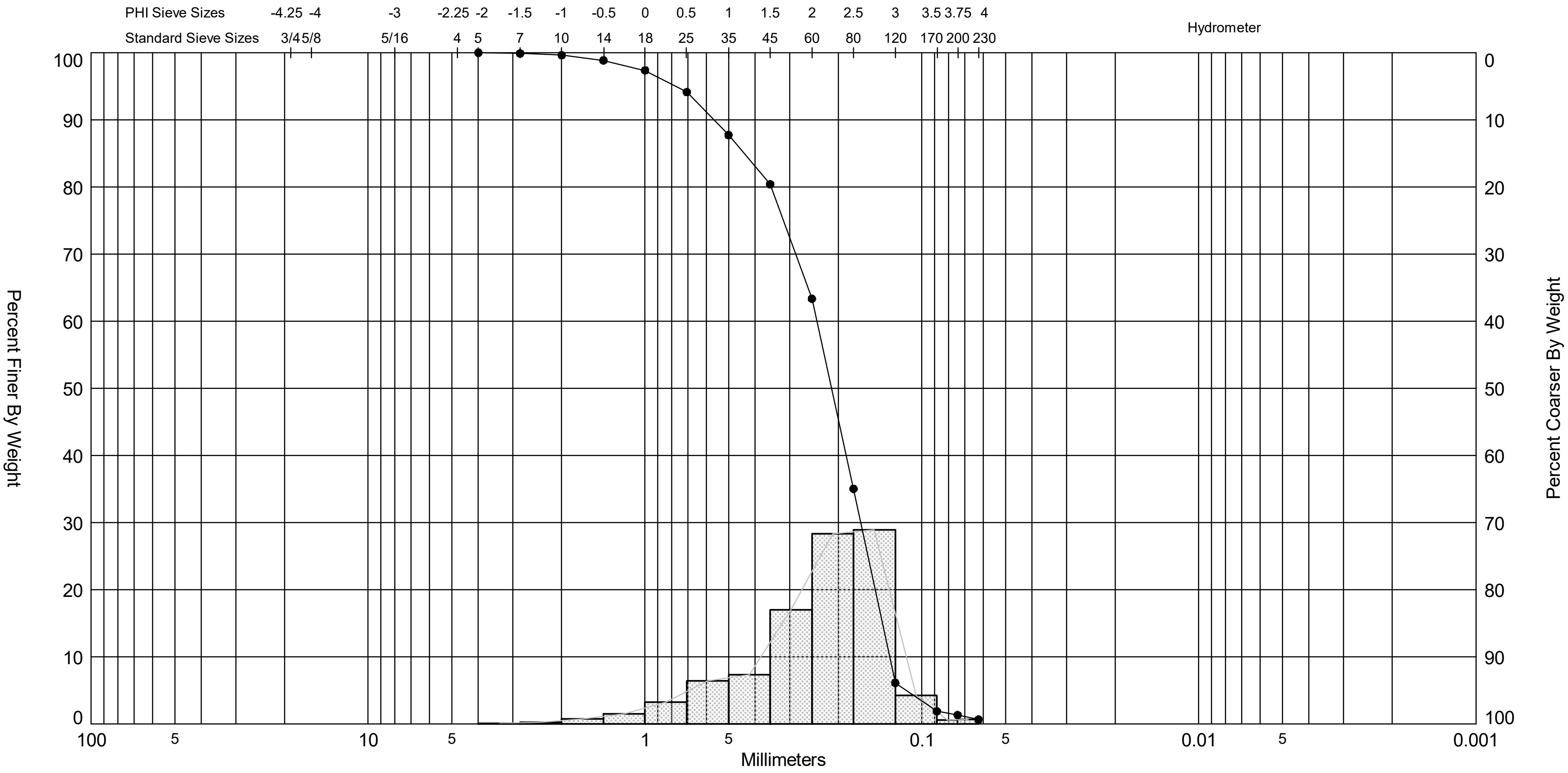

Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
C-30	—●—		SP	#200 - 1.32 #230 - 0.64			2.24	2.06	-1.1	4.5	0.85

Comments: Composite

Depths and elevations based on measured values

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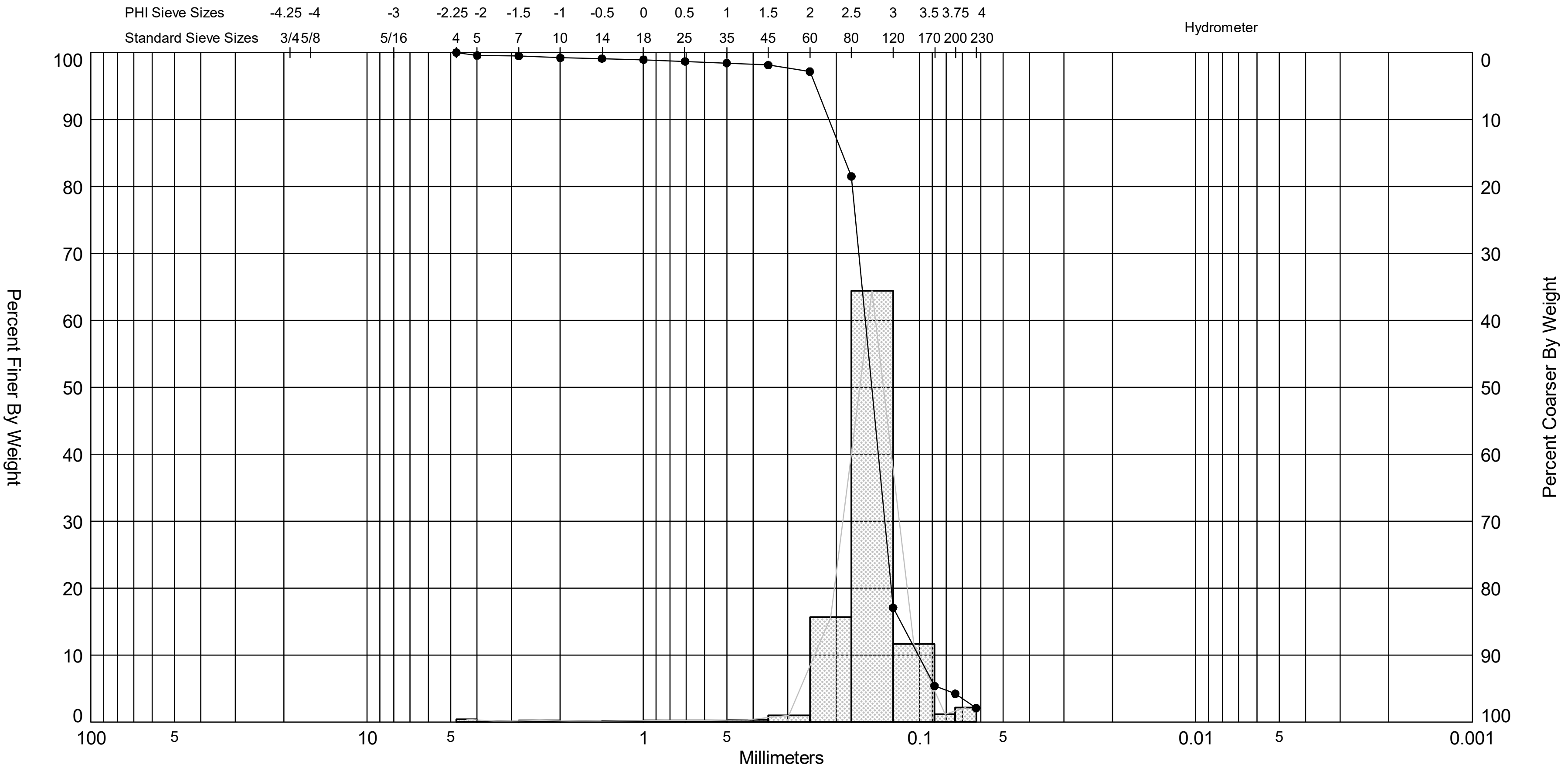
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	586,381
Northing (Y, ft):	805,016
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
C-31	—●—		SP	#200 - 4.22 #230 - 2.09			2.74	2.69	-4.26	33.37	0.58

Comments: Composite

Depths and elevations based on measured values

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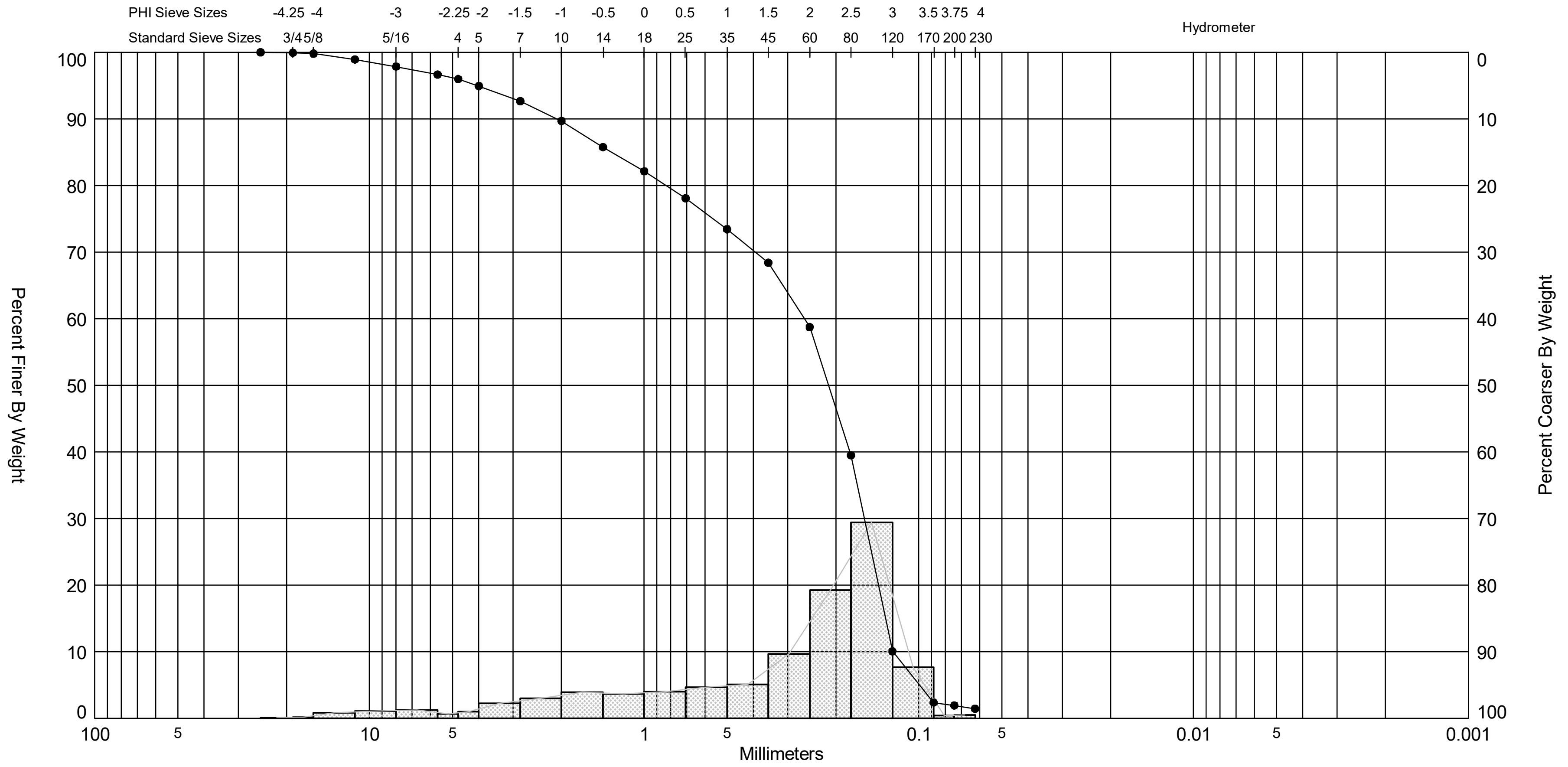
Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	585,879
Northing (Y, ft):	805,358
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort
REDFISH PASS BA I	—●—		SW	#200 - 1.94 #230 - 1.44			2.23	1.56	-1.34	4.04	1.66

Comments: Composite

Depths and elevations based on measured values

Sample Information	
Project Name:	Redfish Pass Sand Search
Analysis Date:	09-22-20
Analyzed By:	BF
Easting (X, ft):	
Northing (Y, ft):	
Horizontal Datum:	NAD 1983
Vertical Datum:	NAVD 88

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