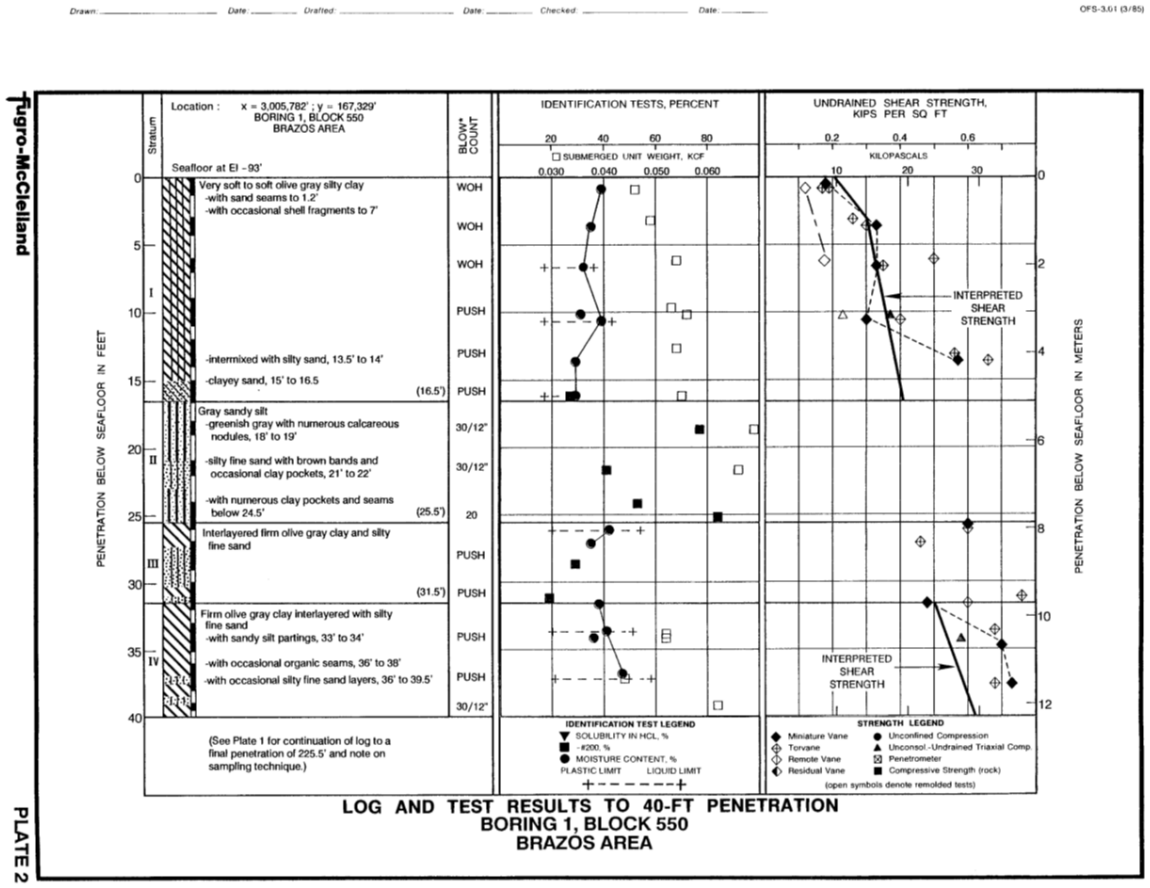
GOM Offshore Sediment Inventory: Processing Industry G&G Data for Inclusion into MMIS



U.S. Department of the Interior
Bureau of Ocean Energy Management
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BOEM
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GOM Offshore Sediment Inventory: Processing Industry G&G Data for Inclusion into MMIS

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Author:
Christopher M. Lowery

Prepared under M21AC00006
By
University Of Texas at Austin
3925 W Braker Ln Ste 3 # 340
Suite 3 340
Austin, TX 78759-5316

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DISCLAIMER

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ABOUT THE COVER

Plate 2 from Fugro-McClelland (1989). *Geotechnical Investigation Boring 1, Block 550, Brazos Area*. Report to Walter Oil and Gas Company, Houston, Texas.

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List of Abbreviations and Acronyms

BOEM	Bureau of Ocean Energy Management
MMIS	Marine Minerals Information System
OOC	Offshore Operators Commission

1 Executive Summary

Sand deposits on the continental shelf are an important national resource for a variety of coastal projects. There are ongoing efforts to explore for these sand resources and quantify them. Extensive sedimentary data on the continental shelf exists in the form of geotechnical reports from decades of exploratory work and offshore infrastructure installation. Accessing these reports, digitizing them, and putting the data into the Marine Minerals Information System (MMIS) would greatly aid in the search for sand by improving our knowledge of the surficial sedimentology of the continental shelf. The goal of this project was to identify the companies that currently hold this data, gain approval for Fugro to release the data, and add the information to the MMIS, and then explore the quality and extent of the data that exists in the legacy geotechnical reports. I, in collaboration with BOEM, first approached the Offshore Operators Commission (OOC) to ascertain the level of interest and determine potential industry partners to collaborate with. OOC industry members were largely supportive of this effort but lacked the bandwidth to retrieve and process this old data. In coordination with the OOC, the project team worked through Fugro, a geotechnical service company who produced many of these reports and who maintains copies of them, to determine the number, types, and owners of reports in their holdings. Working within an area of interest defined by BOEM, Fugro found >760 geotechnical reports. For a pilot analysis of the data contained therein, Fugro provided access to 17 reports, mostly from the 1980s and 1990s, from two companies: Walter Oil and Gas and W&T Offshore. This process took considerable time because Fugro needed to find the reports, identify the current lease holders (a complicated process that required the assistance of the OOC), and provide us with a scanned pdf of the original paper copy. There were 19 borings described in these reports, six of which had sand at or near the seafloor. The primary data type in these reports is qualitative grain size data (e.g., “silty fine sand,” “clayey silt,” etc.) as well as color (e.g., “olive gray”), general sediment description, and very few quantitative grain size analyses, principally focused on percent sand. Although these data are not at the level of detail required for a modern sand resource study, they represent a significant improvement over our current level of knowledge in unexplored areas and would substantially expand the information available in MMIS. Unlocking these vast datasets would require hiring the relevant geotechnical companies to find data in their holdings, gain permission to share it with BOEM, synthesize it, and create a product that can be integrated into the MMIS. This would involve some investment, but it would be substantially cheaper than conducting new surveys in the same regions.

2 Project Goals and Scope of Work

Offshore sand deposits provide an important national resource for projects ranging from coastal barrier construction to beach nourishment to habitat restoration. Although there are several identified surficial sand deposits in federal waters, there are also extensive buried sand units within < 50 feet below the seafloor deposited in fluvial or estuarine environments that formed as sea level rose at the end of the last glacial period 20,000 years ago. Exploring the continental shelf for these resources is essential to constraining the total offshore sand available for coastal resiliency projects and for ensuring that areas rich in sand are not inadvertently leased for other offshore infrastructure development that would prohibit dredging. However, fully exploring the continental shelf for sand resources is a time consuming and expensive task that could take decades to complete.

Extensive sediment coring has been conducted on the continental shelf by private companies to collect data for oil and gas exploration, pipeline placement, and other infrastructure development. These data represent a potentially significant volume of mineral resource

information for ongoing efforts to identify subsurface sediment deposits offshore, but they are currently archived in analog form by private companies. Digitization of these datasets, and their curation in a central database, is essential for their effective use. The University of Texas has recent experience (e.g., BOEM M16AC00020 Texas Offshore Resources Inventory) digitizing and curating a large core database as part of the historical data collection effort and will process these new core datasets for inclusion into BOEM's spatial database, Marine Minerals Information System (MMIS), for use by BOEM and other researchers. This project is a pilot effort to identify legacy sedimentological datasets in private company holdings, work with companies to gain access to those data, determine how useful they are for sand resource exploration, and incorporate them into the MMIS. This work promotes preservation of biological, cultural, and economic resources to assist in rebuilding coastlines to safeguard the Nation's assets and delineates OCS mineral resources to inform long term planning and ensure protection from activities that might otherwise permanently obstruct access to the resource.

3 Acquisition of Industry Data

To gain access to legacy data we worked closely with industry partners, first through the OOC and then directly through Fugro. To narrow the scope of the request for this pilot project we focused on several areas of interest on the eastern Texas continental shelf, offshore Galveston and Matagorda bays (Figure 1).

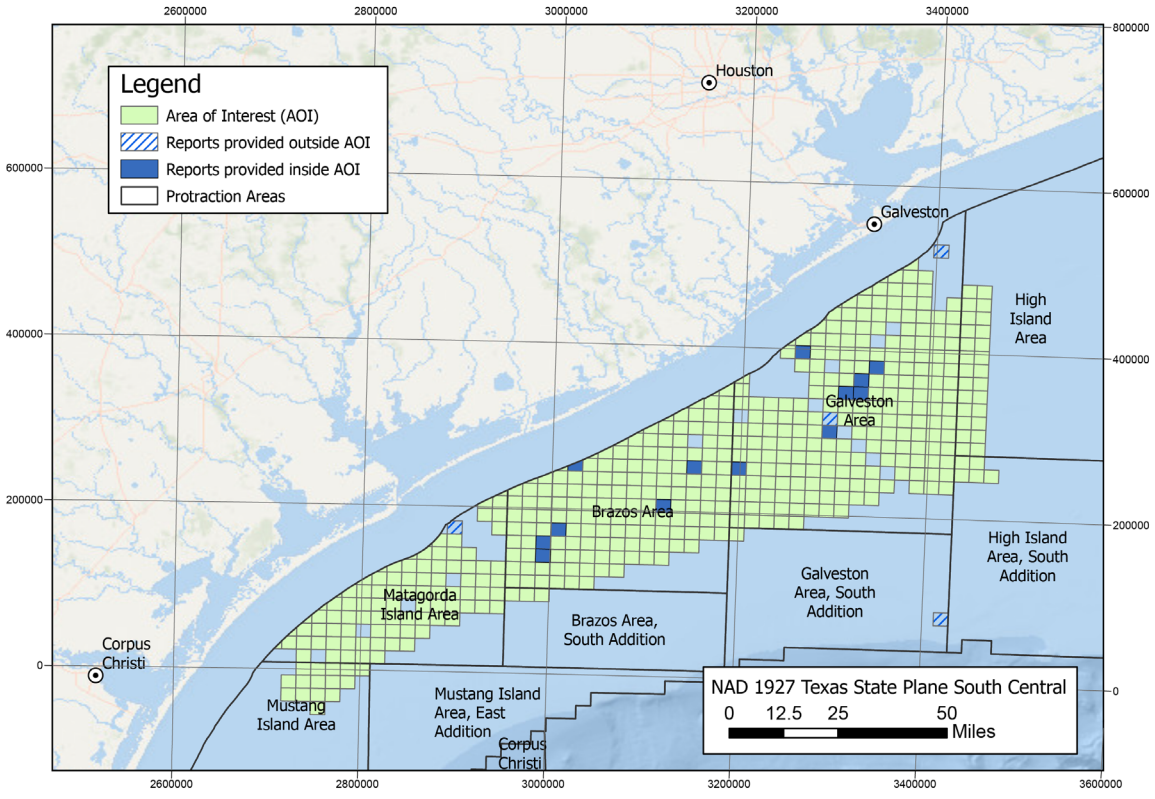

Figure 1. Location map showing protraction blocks in the area of interest (green) and protraction blocks with reports provided for this study (blue).

3.1 Offshore Operators Commission

Our initial approach was to work through the OOC. The project was pitched to companies as mutually beneficial for the BOEM Marine Minerals Program and for companies, as knowledge of where the sand is and is not would affect regulatory measures (e.g., a decommissioning a pipeline over a sand resource would need to be removed, but if there is no sand in the area the pipeline could possibly be left in place). Preliminary meetings were full of positive responses indicating a willingness to help, but individual company representatives did not know what data they had or where they could find it. This problem was not overcome, and we were unable to gain traction with OOC members individually, as unearthing decades old data in an unknown format is a time-consuming task that is completely unrelated to present business activities.

After roughly six months of intermittent meetings and discussions through the OOC the project team decided a different approach was required. We considered pipeline archaeological reports, which involve multibeam and magnetometer surveys over pipeline routes to ensure that they don't disturb shipwrecks or other submerged archeological resources. Backscatter data from the multibeam record was correlated with the hardness of the seafloor, with harder surfaces typically correlating to sand. But without seafloor samples to calibrate the backscatter maps it is impossible to say whether hard patches are sand or just firm clay on the bottom, so these data were not pursued.

We concluded that the best approach would be to work through geotechnical service companies, which originally collected the relevant data on contracts with the operators, and would have them stored and cataloged for relatively easy retrieval.

3.2 Geotechnical Services Companies

With this goal in mind we reached out to Fugro, which has been working with BOEM on other projects (e.g., BAA 140M0121R0006 https://www.boem.gov/sites/default/files/documents//BOEM-GG-DTS.pdf). Fugro in general is an advocate for open data, but works on contracts with operators which stipulate that the contracting company owns the data. For this reason, Fugro cannot turn over data without permission, and in many cases cannot even say where they have data. Companies are generally agreeable to sharing this type of data (see above positive responses from OOC) but getting written agreements to release the data adds a level of complexity to the project. Additionally, digging up old data can be time consuming, and Fugro, like the members of the OOC, does not have the inclination for a project that they are not being compensated for. These are both significant hurdles to overcome, but in order to carry out the present pilot project, Fugro agreed to work with BOEM to overcome them.

Specifically, Fugro agreed to find a small number of geotechnical reports within BOEM's area of interest and secure permission from the companies who own the data to share them with us. Fugro identified ~ 760 reports in BOEM's area of interest, going back to 1970s. We had to narrow this down to a manageable pilot dataset, and decided to focus on a few extant companies represented on the OOC executive committee to simplify the process. The OOC was instrumental in getting permission to access these data. We ultimately received 17 reports from Walter Oil and Gas (14 reports) and W&T Offshore (3 reports) in the Galveston and Brazos Protraction Areas.

This process took longer than expected, as the first discussion with Fugro was in October 2021 and we received the first dataset in April 2023. This was due to the need to find the data, identify the operators, and obtain written permission to share the reports. A key problem was that many offshore

leases have changed hands in the decades since the data were collected, and it took a long time to determine the current owner of the lease (and thus the data). Although BOEM has an internal database of ownership history there were still some complicating factors that required working through the OOC. The time this took was extended by the fact that this was a side project carried out as an in-kind contribution by Fugro and the relevant operators. A key lesson here is that unlocking legacy data from industry geotechnical surveys is not a fast process, and a significant part of any future project timeline needs to be dedicated to the time it takes to simply get permission to access to the data.

4 Contents of Data Reports

The geotechnical reports provided by Fugro were primarily from the 1980s and early 1990s. As such the image quality varies, and individual figures can sometimes be somewhat blurry, with small text being difficult to read. A single report from 2007 (0201-6148) differed primarily in more legible text and figures from a native pdf rather than a scan. Reports are in pdf format and describe the sedimentology ("soil characteristics") and physical properties of the seafloor and subseafloor sediments encountered by the boring. The bulk of the reports are given over to physical properties data (density, water content, shear strength, natural gamma ray, etc.) and related calculations that would be used to place pilings on the site for offshore infrastructure. The sedimentological information is typically limited to qualitative grain size descriptions of sediments encountered in the boring and, sometimes, one or two quantitative grain size measurements (typically of the clay, silt, and sand fractions). Qualitative data are presented as both broad summaries in table form (Figure 2) and more detailed stratigraphic logs (Figure 3). General color (e.g., "olive gray") is also commonly included. These data were easily extracted and put into a MMIS formatted spreadsheet.

Boring 1

Stratum	Penetration, Ft From	To	Description
I	0	12	Silty fine sand
II	12	18	Firm clay
III	18	33	Intermixed sandy silt and clay
IV	33	44	Silty fine sand
V	44	125	Stiff to very stiff clay
VI	125	158	Fine sand
VII	158	206	Very stiff clay
VIII	206	228	Interlayered clay and silty sand
IX	228	299+	Very stiff to hard clay

Boring 2

Stratum	Penetration, Ft From	To	Description
I	0	12.5	Very soft to firm clay
II	12.5	38	Interlayered clay and fine sand
III	38	132	Stiff to very stiff clay
IV	132	142	Fine sand
V	142	201.5	Very stiff clay
VI	201.5	210.5	Fine sand
VII	210.5	302+	Very stiff clay

Detailed soil descriptions that include textural variations and inclusions within each stratum are noted on the boring logs.

Figure 2. Stratigraphic summary of dominant sediment type from report 0184-2072, Block 389, Galveston Area. As the original caption states, more detailed descriptions can be found in the stratigraphic log which is often included in these reports. Note that this report contains two separate borings with different seafloor sediments (sand in Boring 1, clay in Boring 2). Also note poor quality of the original scan, which is somewhat blurry.

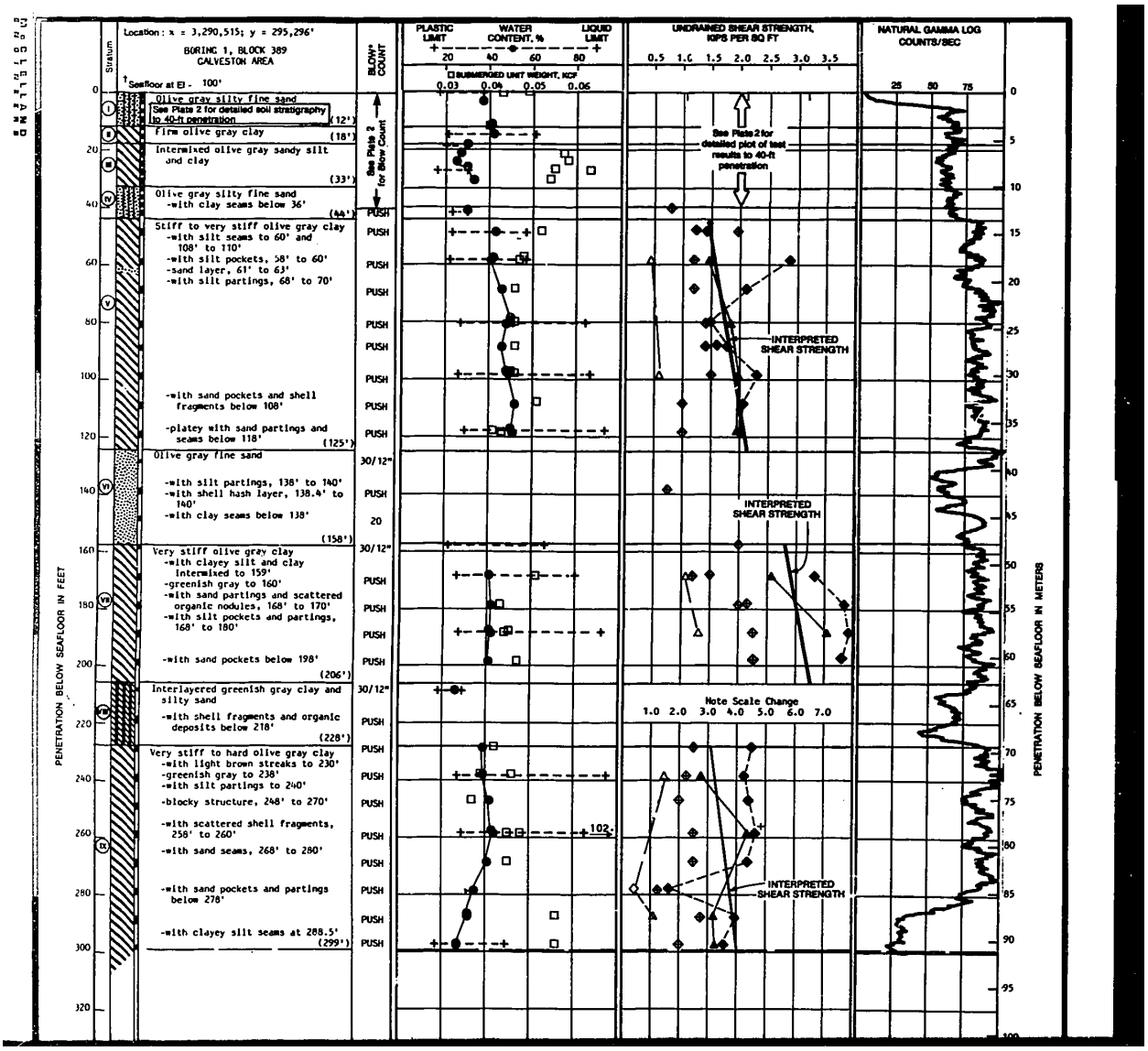

Figure 3. Stratigraphic log, sediment description (left), and associated physical properties data (right) from report 0184-2072, Boring 1, Block 389, Galveston Area.

Location data in these reports are provided in US Survey Feet (e.g., "Louisiana South Lambert coordinates x = 3,290,515 ft, y= 295,296 ft"). A NOAA website used to convert non-standard coordinate systems into latitude and longitude did not work on these coordinates, and instead we used a conversion provided by BOEM.

The data included in these reports are not at the level of detail required for comprehensive sand resource evaluations. They lack highly resolved grain size data (both in terms of number of samples and number of grain size intervals) and quantitative color limit the usefulness of these legacy datasets. However, they are an extremely valuable resource because they provide information about the presence or absence of sand at or near the seafloor in areas that are currently unexplored. Highly resolved quantitative data is not necessary if there is no sand to evaluate, and these geotechnical reports can provide the basis of a first-order analysis to identify the areas with sand that warrant more detailed characterization and those without sand which can be de-prioritized for sediment investigation areas.

Table 1. Borings evaluated in this study. Those with sand at/near the seafloor are highlighted.

Boring	Operator	Report #	Lat/Long (NAD83)	Sandy Interval(s)
Boring 1, Block 389 Galveston Area	Walter Oil and Gas	0184-2072	28.58470128 -94.97838017	silty fine sand from 0-12'
Boring 2, Block 389 Galveston Area	Walter Oil and Gas	0184-2072	28.6012965 -94.97804502	N/A
Boring 1, Block 583 Brazos Area	Walter Oil and Gas	0201-3075-1	28.19721470 -95.92999578	silty sand from 16.5-25' & fine sand from 25-38'
Boring 1, Block 385 Galveston Area	Walter Oil and Gas	0201-0670	28.65780928 -94.9664897	silty to clayey find sand from 21-30' (with numerous clay pockets and seams below 27')
Boring 1, Block 449 Brazos Area	Walter Oil and Gas	0201-1040	28.47214276 -95.79519215	fine sand from 12-29'
Boring 3, Block 460 Galveston Area	Walter Oil and Gas	201-1066	28.48228923 -95.26477960	silty fine sand from 12-20'
Boring 1, Block 457 Brazos Area	Walter Oil and Gas	1188-1193	28.47091711 -95.41381244	fine sand from 7-20'
Boring 1, Block 557 Matagorda Island Area	Walter Oil and Gas	0187-1038	28.28359283 -96.2023007	N/A
Boring 1, Block 583 Brazos Area	Walter Oil and Gas	0201-0375-1	28.19721470 -95.92999578	N/A
Boring 1, Block 572 Brazos Area	Walter Oil and Gas	0201-0375-2	28.22534370 -95.92838550	N/A
Boring 1, Block 550 Brazos Area	Walter Oil and Gas	0201-0375-3	28.25684890 -95.87593732	N/A
Boring 1, Block 319 Galveston Area	Walter Oil and Gas	0201-0853	28.82704866 -94.79592720	N/A
OCS-G-14152, Well No. 1, Block A-218 Galveston Area	Walter Oil and Gas	0201-2353	27.968622828 -94.58970805	N/A
Boring 2, Block 350 Galveston Area	Walter Oil and Gas	1188-1040-1	28.74757723 -94.9026740	N/A
Generalized seafloor conditions Block 326 Galveston Area	Walter Oil and Gas	1188-1040-2	N/A	N/A
Boring 1, Block 351 Galveston Area	Walter Oil and Gas	1188-1083	28.74849787 -94.88627377	N/A
Boring 1, Block 507 Brazos Area	W&T Offshore	93-001341	28.35972275 -95.51966452	N/A
Seafloor Conditions Block 181 Galveston Area	W&T Offshore	93-001355	29.2134474 -94.5796897	N/A
OCS-04565, Well No. 7 Block 303 Galveston Area	W&T Offshore	0201-6148	28.87972307 -95.06455527	N/A

Note: Borings with large bodies of sand within the upper 40', based on the stratigraphic logs and descriptions presented in the reports. Facies described as "sandy silt," "sandy clay," or anything with sand interbedded with something else are not included.

5 Conclusions and Recommendations for Future Work

Within the area of interest defined by BOEM, Fugro was able to identify over 760 geotechnical reports. Other geotechnical engineering firms likely have similar magnitudes of data. There is thus an extensive dataset of seafloor and subseafloor sedimentology in federal (and likely state) waters on the Gulf of Mexico continental shelf currently locked away in proprietary geotechnical reports. These data represents decades of survey work carried out for a variety of offshore infrastructure projects. It could be an invaluable resource for sand exploration on the continental shelf and digitizing it would vastly expand the data available in MMIS.

Of the 19 borings examined for this pilot project, six contained sand at or near the seafloor, while the others were characterized by muddy substrates. This is extremely useful data for the search for sand because it shows where sand exists on the continental shelf. This data could be used to evaluate the presence or absence of sand at or near the seafloor on a broad, first-order basis. Areas with sand can then be more extensively surveyed and cored to develop detailed, quantitative analysis of the extent, thickness, and quality of these sands. A first-order dataset of sand presence/absence would allow for a more efficient use of limited exploration resources by prioritizing areas where we know sand occurs.

The key to unlocking these data sets is the effort required by the geotechnical companies that hold these data to find it, receive permission from the original operator to share it, and then translate the original paper (or pdf) report into a MMIS compatible database. The most time consuming of those steps is working to receive permission, but synthesizing the remaining 743 Fugro reports from just the area of interest evaluated here would be a substantial time commitment as well. Hiring the relevant geotechnical companies to find their own data, synthesize it, and create a product that can be integrated into the MMIS would be the most straightforward path to utilizing this data. This would involve some investment, but it would be substantially cheaper than paying for new surveys covering the same regions. There are many possibilities for how such a study could be carried out (i.e., a desktop study with a report and derivative products without the original data – perhaps useful if permission from the operators is difficult to obtain – or a digital geotechnical dataset incorporated into the MMIS data schema) and a deep dive into these legacy datasets would provide a huge benefit in the search for sand.