Oyster Restoration Pre-construction Site Assessment of the Manokin River Sanctuary

Prepared by Oyster Recovery Partnership

Updated January 2022

Oyster Recovery Partnership

Table of Contents

List of Tables and Figures

Introduction

As part of the 2014 Chesapeake Bay Watershed Agreement, Maryland committed to restoring oyster populations in five tributaries in Maryland's portion of the Chesapeake Bay by 2025. Progress to complete the 5 tributary restoration strategy is monitored by the Maryland Interagency Workgroup (hereafter Workgroup). The Manokin River is the fifth tributary selected for restoration under the 5 tributary strategy. This tributary is located on the lower eastern portion of Maryland's Chesapeake Bay and has been closed to wild commercial harvest since 2010. The mouth of the river empties into Tangier Sound and this area has historically exhibited strong oyster recruitment.

The Workgroup used data from the Maryland Department of Natural Resources (DNR) patent tong surveys conducted in 2012, 2015, 2017 and 2018 to determine the status of the oyster populations on habitat within the Manokin River sanctuary. National Oceanic and Atmospheric Administration (NOAA) completed additional GIS analysis, and this information was used to determine initial restoration construction areas: premet (defined as already meeting density and biomass targets), seed-only, and substrate and seed (Table 1). Premet reefs were estimated to be 20 acres, seed-only restoration reefs were estimated to be 305 acres, and substrate and seed restoration reefs were estimated to be 438 acres. A systematic patent tong survey was conducted to groundtruth and verify the accuracy of the restoration types determined for areas selected for restoration. This survey is ongoing and is expected to take several years to assess between 401 to 763 acres.

Table 1. The general guidelines for determining the most appropriate type of restoration.

	Premet Criteria	**Seed-Only Criteria**	**Substrate and Seed Restoration Criteria**
Depth	4-20 ft	4-20 ft	7-20 ft
Bottom Type	on shell dominant bottom, sand, sand & shell, muddy sand, muddy sand & shell, and sandy mud & shell (not on shell dominant bottom) also on hard subsurface sediments identified by sub-bottom profiling sonar	on shell dominant bottom	sand, sand & shell, muddy sand, muddy sand & shell, and sandy mud & shell (not on shell dominant bottom). also on hard subsurface sediments identified by sub-bottom profiling sonar

Oyster Density	> 50 per m^2 (also oyster biomass > 50 g per m^2)	<50 per m^2	< 5 per m^2
Lease Proximity	Not within 150 ft of leases	Not within 150 ft of leases	Not within 150 ft of leases
Navigation Aid Proximity	Not within 250 ft of navigation aids	Not within 250 ft of navigation aids	Not within 250 ft. of navigation aids
Dock Proximity	Not within 50 ft of private docks	Not within 50 ft of private docks	Not within 250 ft. of private docks
SAV Proximity	No intersection with SAV beds	No intersection with SAV beds	No intersection with SAV beds

Methods

The Spring 2021 round of Manokin River groundtruthing took place in July and August 2021. A total of 12 sites were sampled by the Oyster Recovery Partnership, in collaboration with local waterman, Bobby Walters (Table 2).

Table 2. Sites chosen for the Spring 2021 groundtruthing survey in Manokin River Sanctuary.

Restoration Type	Site ID	Area (acres)	Number of PT replicates	Report Reef ID
Substrate and seed	SS_08	5.71	39	MN_52
Substrate and seed	SS_20	18.22	124	MN_64
Substrate and seed	SS_21	12.38	82	MN_65
Substrate and seed	SS_22	11.85	80	MN_66
Substrate and seed	SS_23	18.02	124	MN_67
Substrate and seed	SS_24	10.10	69	MN_68
Substrate and seed	SS_25	7.83	58	MN_69
Substrate and seed	SS_26	4.32	30	MN_30
Substrate and seed	SS_27	2.29	16	MN_71
Substrate and seed	SS_37	18.27	125	MN_81

Substrate and seed	SS_42	1.23	9	MN_86
Substrate and seed	SS_44	1.74	12	MN_88

Two analytical approaches were used to assess the accuracy of the restoration types and determine the appropriate treatment type of areas slated for restoration. The first approach determines whether a site needs restoration based on the abundance and biomass of oysters currently on the site, while the second approach used an index of habitat quality to determine whether a site is suitable for restoration and the type of restoration required. An index of habitat quality was developed to determine whether oyster habitat was suitable for seed-only restoration, substrate and seed restoration, or not suitable for either (e.g. an area consisting of all mud that cannot support restoration). Six benthic habitat components observed from samples were used to develop the index:

1. Exposed Shell
2. Primary Substrate and Secondary Substrate
3. Surface Sediment
4. Number of Live Oysters
5. Surface Shell, calculated as (Total shell volume x percent gray shell) – total shell volume
6. Oyster density and biomass data

The first five benthic components are given a binary score expressed as a 1 or 0, with a result of 1 suitable for restoration construction and 0 being unsuitable (Table 3).

Table 3. Five benthic habitat components used to develop the index of habitat quality and the criteria used to establish a binary score for each component.

Benthic Component	**Suitable for Oysters**
Exposed Shell	Shell 50% exposed or greater
Bottom Type	Oyster, loose shell, or shell hash
Surface Sediment	Less than 5 cm
Number of Live Oysters	Greater than 5 oysters per square meter
Surface Shell Volume	Greater than 10 liters per square meter

A final habitat suitability score for each grid cell is calculated as the sum of each benthic component score at the individual grid cell using the equation:

$$Habitat\ Suitability\ Score = S1 + S2 + S3 + S4 + S5$$

Where S1 = Exposed Shell Score, S2 = Bottom Type Score, S3 = Surface Sediment Score, S4 = Number of Live Oysters Score, and S5 = Surface Shell Volume Score. The result of habitat

suitability scores will determine whether a sampling grid cell is suitable for restoration construction based on a ranking between zero and five. Ranks of one or two are suitable for substrate and seed restoration, ranks of three require additional review, and ranks of four and five are suitable for seed-only restoration.

In the St. Mary's Sanctuary methods, a rank of zero is considered unsuitable for restoration (ORP, 2019b). However, the Manokin sanctuary is very different than the St. Mary's Sanctuary, with a large Yates oyster bar area classified as sand with little to no co-occurring shell. The original Little Choptank Sanctuary groundtruthing methodology is more appropriate to use on the Manokin River Sanctuary given range of bottom types in both rivers.

During the Winslow and Yates surveys, the survey indicated an oyster population was present and, in the past, some of these areas did receive shell plantings under the DNR's historic dredged shell program. However, due to the loss of oyster habitat over time and the transition to sand bottom, it is important to carefully consider the use of sand for oyster restoration. Historically sand has been avoided because oysters can subside and be lost. However, there are instances of successful restoration on primarily sandy bottom, in both Harris Creek and Little Choptank (ORP, 2019a).

Given that sand particles vary in size and compaction, sand bottom can range from soft, to moderate, to firm. This will affect the degree to which planted substrate might bury or be covered by shifting sand due to currents and wave action. Areas that have a layer of sand on top of clay or other hard bottom type may be appropriate areas to construct, as they can withstand the weight of the substrate material. Additional surveys and data analysis on sand bottom should be conducted to determine these impacts when considering constructing on sand bottom.

The amended groundtruthing methodology, similar to the one used in the Little Choptank Sanctuary, splits samples with ranks equal to zero into two subcategories:

- 0Mud – a ranking of zero with a predominate mud bottom type. If the majority of the site receives ranks of 0Mud, the sites are not suitable for restoration.
- 0Non-Mud – a ranking of zero with a predominant bottom type that is not mud. If the majority of the site receives ranks of 0Non-Mud, the sites require more information prior to determining if they are suitable for restoration.

Sites that have majority ranking of 0Non-Mud require further assessment to determine the suitability for restoration. Additional surveys using sounding poles, ponar sediment grabs, sediment cores, and an oyster dredge can be conducted on the site to collect more data on site suitability. Additional information can be gained from DNR's old Seed and Shell Program planting geodatabase: a site that is sand now but was once planted may have shells under the sand that add to its firmness and suitability.

The oyster density and biomass data assessment for each grid are over the entire reef and if both density and biomass are greater than 50 oysters per m^2 and 50 grams per m^2, the reef is considered premet.

Table 4. Restoration treatment designation based on habitat suitability composite score for the Manokin River Sanctuary.

Habitat Suitability Score		Restoration Treatment Suitability
5		Seed-Only restoration or Pre-met
4		Seed-Only restoration
3		Requiring further review of all variables at the site level to determine suitability for seed-only restoration or substrate and seed restoration
2		Substrate and Seed restoration
1		Substrate and Seed restoration
0	Mud	Not suitable for restoration (bottom type is mud)
	Non-Mud	Requiring further review to determine suitability at the site level for Substrate and Seed restoration (bottom type is sand)

The oyster density and biomass data assessment for each grid are over the entire reef and if both density and biomass are greater than 50 oysters per m^2 and 50 grams per m^2, the reef is considered premet.

Results

A total of 768 patent tong grabs were collected over 7 days during this phase of groundtruthing. The density of oysters was 0.67 individuals/m^2 but nearly 89% of the samples contained no live oysters (Table 4). Less than 5% of cells had a composite score of 4 or 5, meaning the majority of area surveyed in this round will require substrate addition.

Table 5. Summary results from the Spring 2021 groundtruthing survey.

Site ID	Dominant Substrate Type	Total Live Oysters Observed	Average Total Volume (L/m^2)	SD Volume	Depth Range (ft)
SS_08	Shell Hash	613	4.66	3.68	10.8–14.2
SS_20	Sand	0	0	0	7–12
SS_21	Sand	0	0	0	7–12
SS_22	Sand	115	0.41	1.72	9.5–16
SS_23	Sand	2	0.04	0.25	7.5–13.1
SS_24	Sand	0	0	0	7.5–12
SS_25	Sandy Mud	0	0	0	8–11.1
SS_26	Sand	40	1.00	1.67	9.4–11.7

SS_27	Sand	0	0	0	7.8–10.6
SS_37	Sand	185	1.44	2.59	8.5–12.4
SS_42	Sand	10	1.41	2.46	9.1–11
SS_44	Sand	0	0	0	8.4–9.3

The composite score for each cell was displayed in ArcGIS to allow visual review of the results for each site. As was expected during this phase of groundtruthing, most sites sampled revealed sandy bottom with little to no shell present (Figures 1-4). With the exception of one cell, SS_08 was mainly scores of 3 or 4, suggesting that is might be suitable for Seed Only restoration. The next step in determining treatment types for these polygons is a discussion at the Workgroup level.

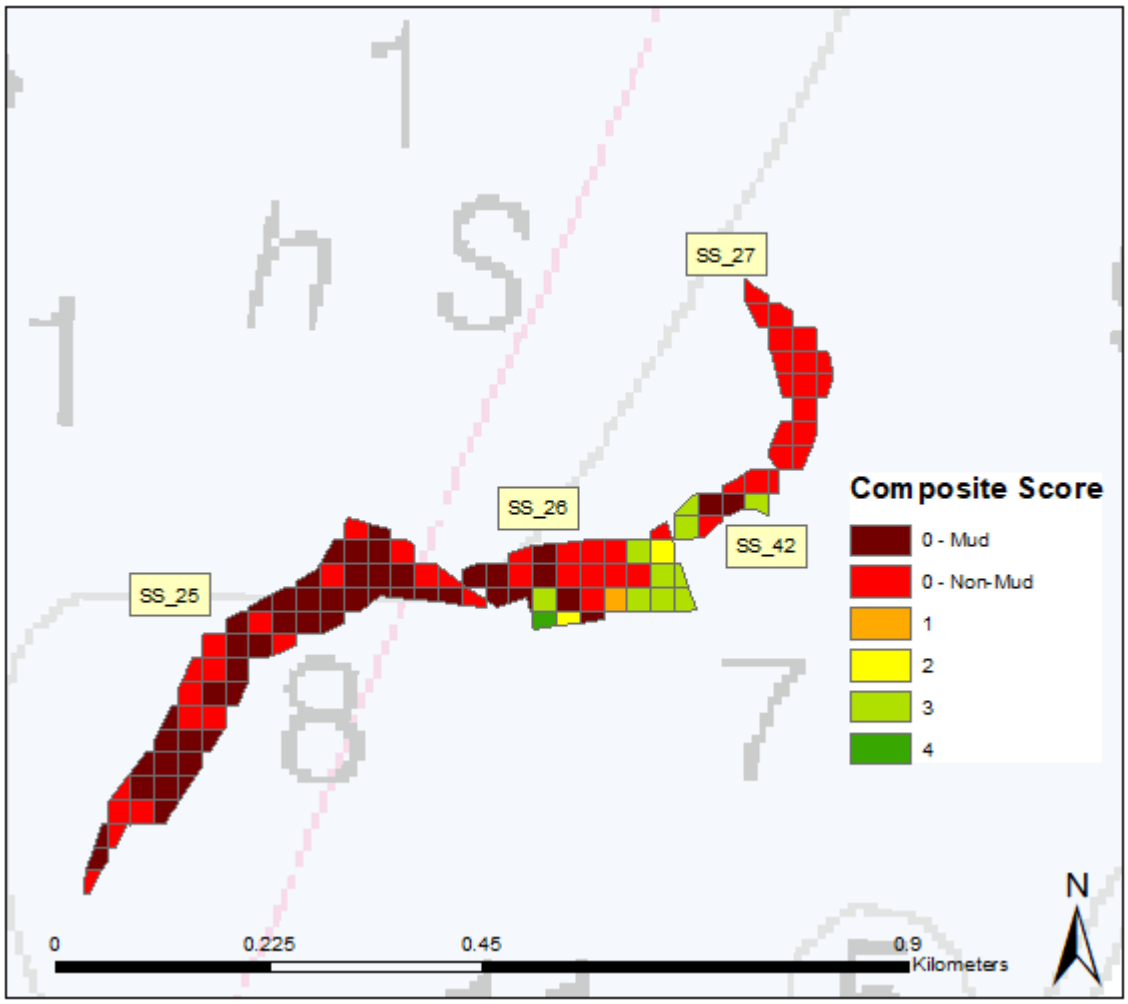

Figure 1. Results for four sites sampled during the spring 2021 phase of groundtruthing. Aside from SS_26, these sites likely need substrate added before deploying spat on shell.

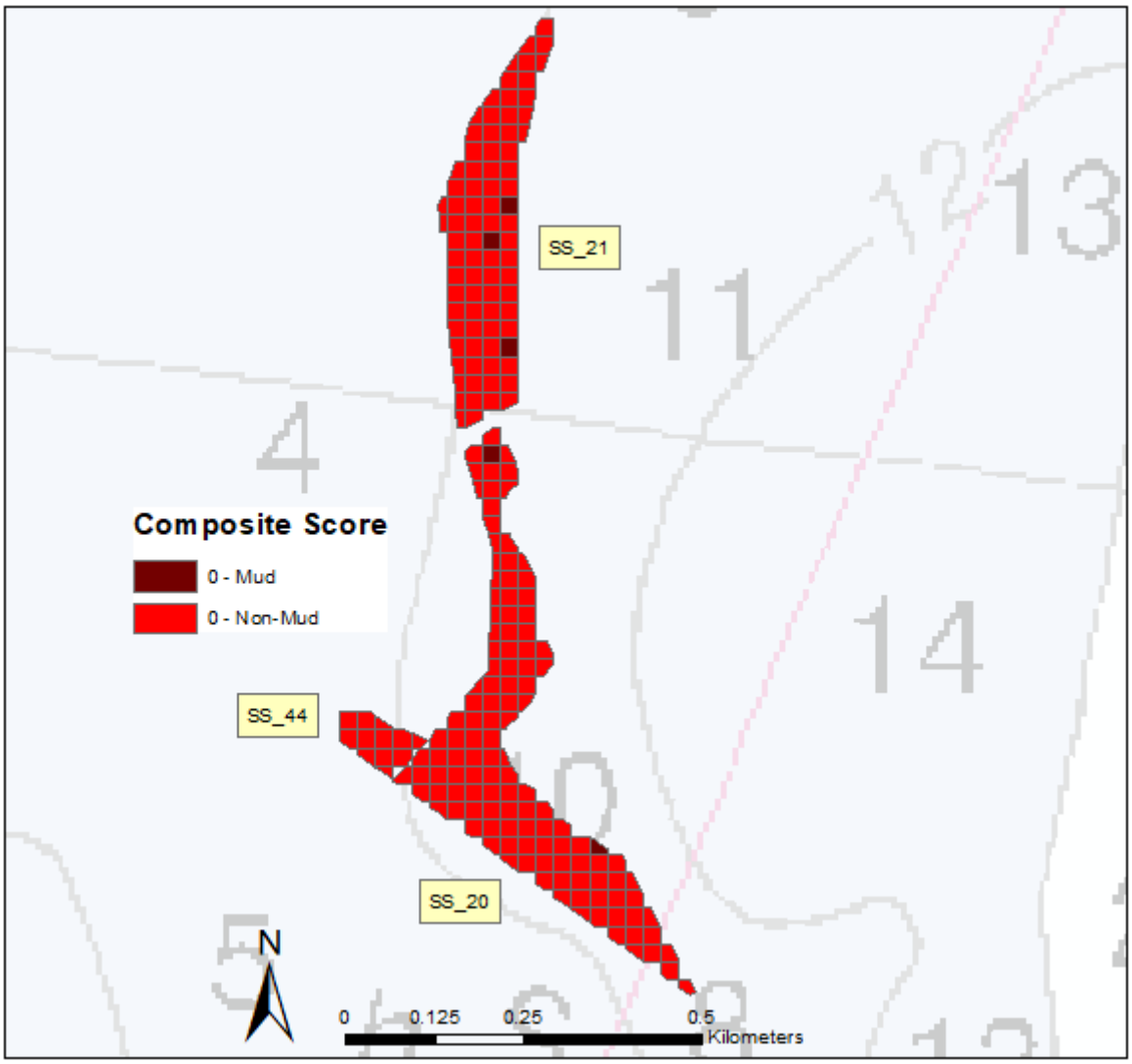

Figure 2. SS_21, SS_44, and SS_20 were characterized by mostly sandy substrate. No live oysters were found on these sites, suggesting that substrate addition is appropriate.

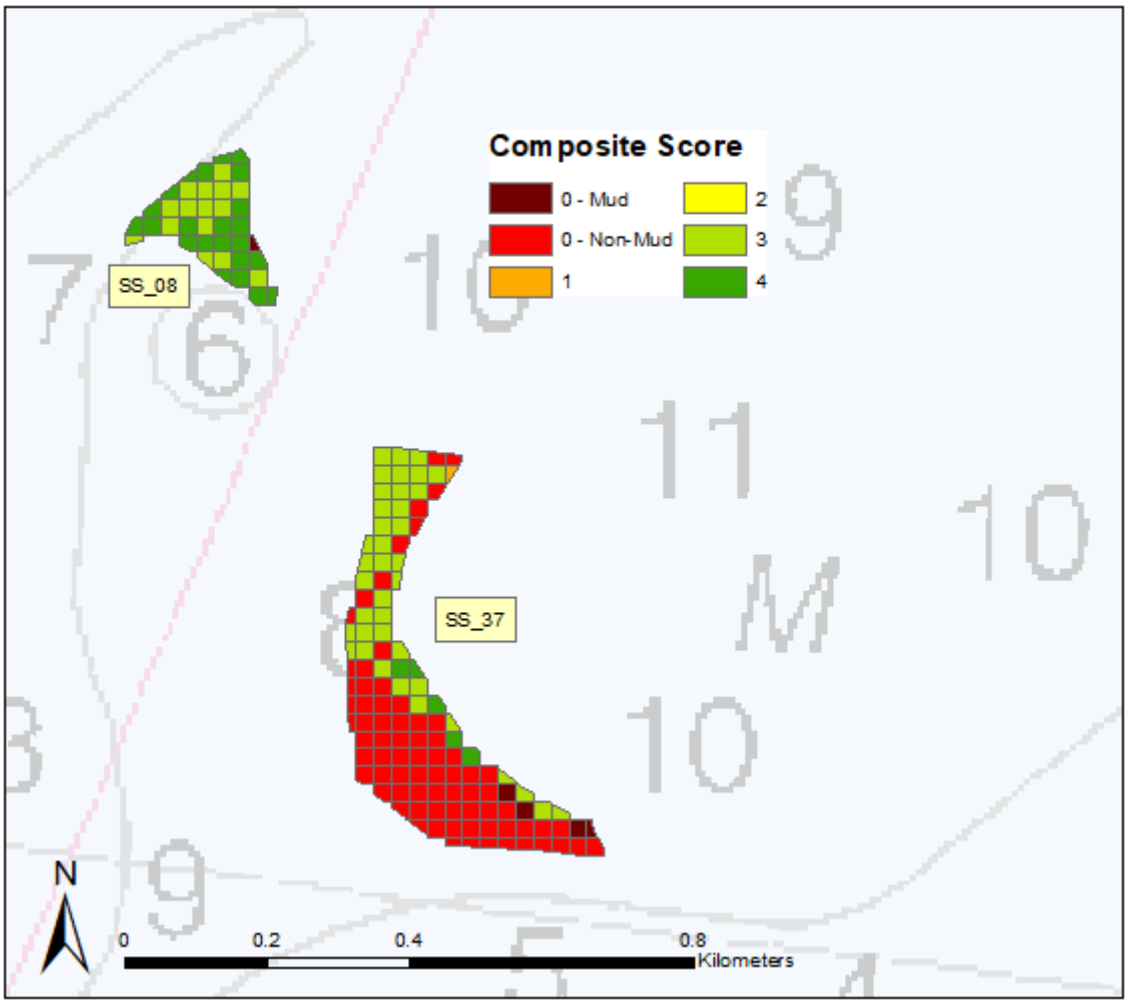

Figure 3. The cells sampled in SS_08 mostly scored 3 and 4, suggesting that further review is required but this site could potentially be changed to Seed Only. SS_37 contains both cells suitable for Seed only treatment as well as some poorly scoring cells, suggesting that modifying the boundaries of this site is appropriate.

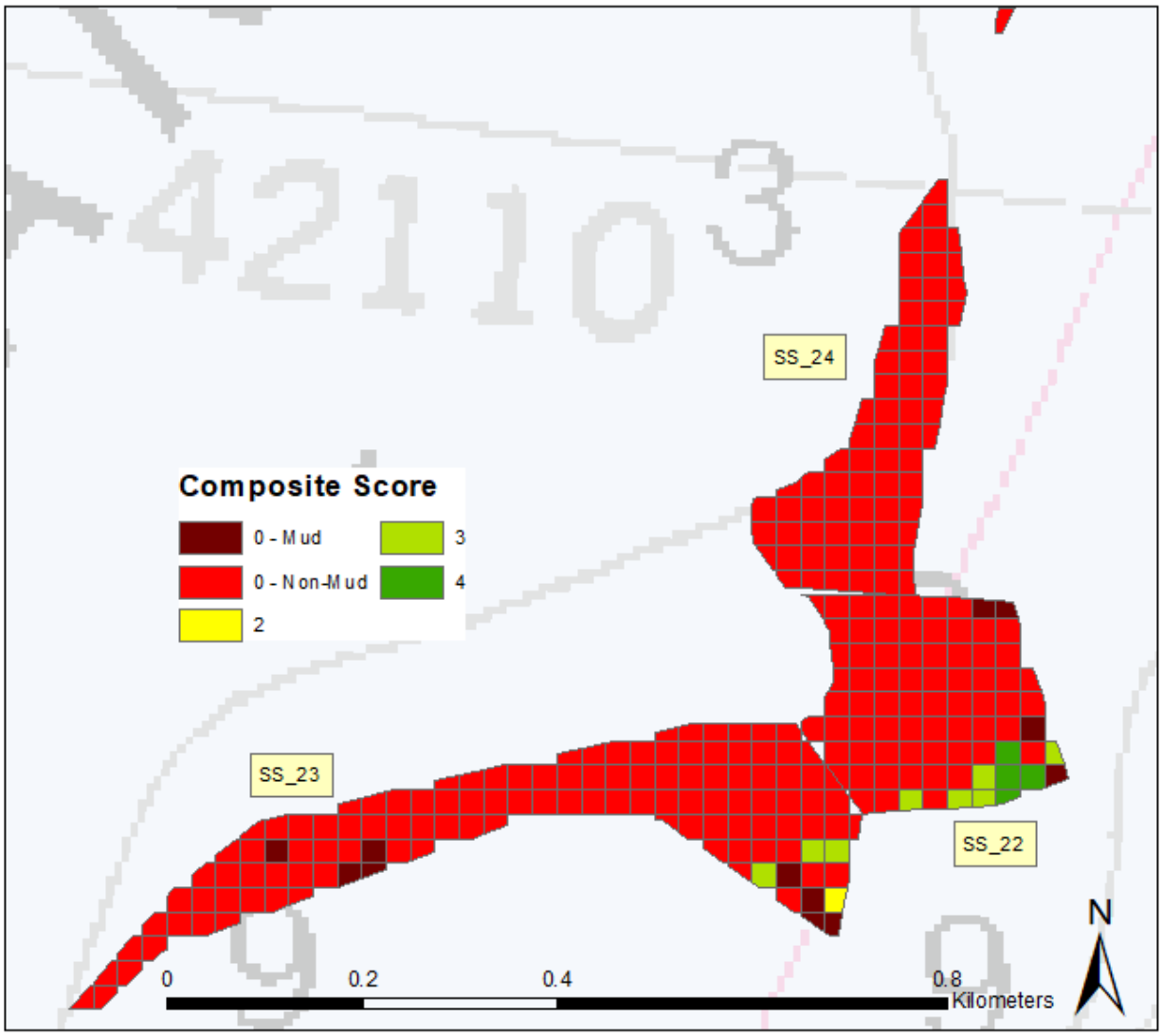

Figure 4. The results of groundtruthing on SS_24, SS_22, and SS_23 show many cells with a composite score of 0. These areas may require further surveys.

Conclusions

In this round of groundtruthing, a great deal of sandy bottom was observed. Approximately 76% of cells surveyed received a score of 0Non-Mud, meaning additional data need to be collected to determine the most appropriate treatment type. Seventy-one cells received a score of 0Mud, meaning these areas are not restorable. Five cells with a score of 0 were predominantly clay substrate.

After discussions at the IAWG, it was determined that sites SS_08, SS_26, SS_37, and SS_42 would be modified. SS_08, given the number of cells with a composite score of 4, was changed to seed only restoration. The new site is SO_42 (5.67 acres). SS_37 was divided into two sites; the northern portion is now SO_44 (7.61 acres), and the southern portion is SS_37 (10.66

acres). SS_42 was reduced in area and combined with a portion of SS_26 to create a new seed only site, SO_43.

References

Oyster Recovery Partnership (ORP). 2019a. Oyster Restoration Pre-Construction Site Assessment of Oyster Shell Dominated Benthic Habitats in Little Choptank River, Chesapeake Bay. Submitted in partial fulfillment of MOU #605P7400192

Oyster Recovery Partnership (ORP). 2019b. Oyster Restoration Pre-Construction Site Assessment of Oyster Shell Dominated Benthic Habitats in St. Mary's River Sanctuary, Maryland. Submitted in partial fulfillment of MOU #605P7400192