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April 16, 2020

TO: Jeff Carlson (Natural Resources Director, Town of Nantucket)

CC: none

FROM: Greg Berman, Coastal Processes Specialist (WHSG & CCCE)

RE: Independent Review of the
2020 Annual Review – Sconset Geotextile Tube Project (SE48-2824) Project

Image date 2019 from MassGIS/USGS Orthos

Background: Since the inception of the coastal processes position established within WHSG & CCCE, on-site and remote technical assistance on coastal processes has been and continues to be an on-going, effective technical information communication and dissemination tool. Technical assistance relating to coastal processes, shoreline change, erosion control alternatives, coastal landform delineation, potential effects of various human activities on coastal landforms, coastal floodplains, coastal hazards and hazard mitigation analyses, and dune restoration techniques provided in the field and remotely will continue to be provided on an as-needed basis. Site visits generally address site-specific coastal processes or coastal hazards related issues. Follow-up unbiased, written technical analyses are generally provided.

Introduction:

After prolonged and severe erosion along Baxter Road on Nantucket the Sconset Beach Preservation Fund (SBPF) was permitted to install geotextile tubes (aka geotubes) at the base of the coastal bank. To reduce erosion an 852' geotube array was constructed into the coastal bank and within a couple of years was extended to 947'. The Order of Conditions for this array requires an annual report to review monitoring and mitigation to ensure negative effects are not occurring. The latest report is the *2020 Annual Review – Sconset Geotextile Tube Project (SE48-2824)* prepared by Epsilon Associates Inc. and dated 03/16/2021 (referred to in this document as the "2020 Epsilon Report"). Mr. Carlson (Natural Resources Director for the Town of Nantucket) got in touch with the Coastal Processes Specialist (working for both the CCCE and WHSG), requesting an evaluation of the 2020 Epsilon Report (and associated materials) to assess the impacts of the geotube array.

For brevity, this report does not replicate the extensive study on background coastal processes that has been performed on this area as well as the additional analysis on the climatologic setting was submitted in the previous independent reviews (by this office). The following comments are organized in the same format as the Epsilon Report section headings and **key points are in bold**.

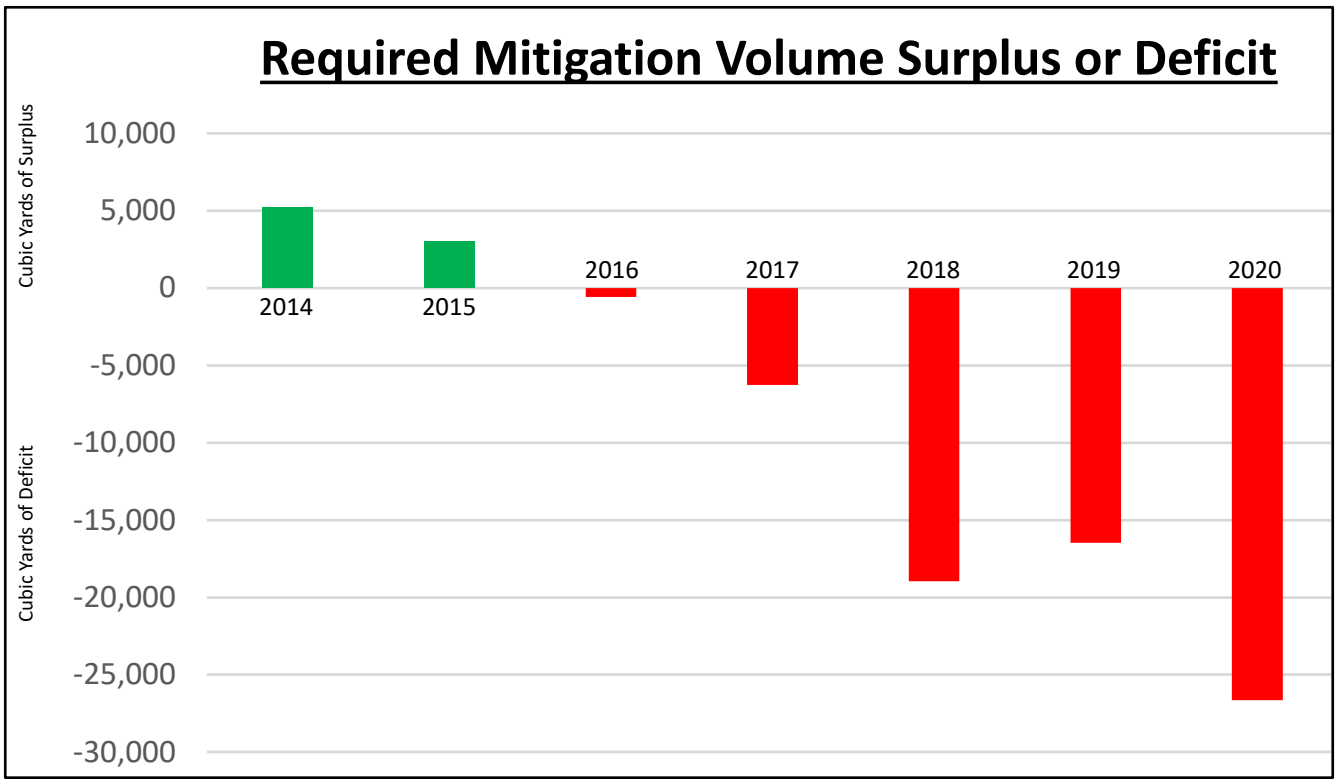
Comments on Section 4.1 Sand Delivery:

As presented in Attachment A the *January 2020 – January 2021 Sand Delivery and Contribution Report* , the Sconset Geotextile Tube Project is currently required to provide a substantial mitigation volume of compensatory sand nourishment 22 cy/lf/yr. Given the project's length of 947 feet, the currently required total annual mitigation volume is 20,834 cy.

The *January 2020 – January 2021 Sand Delivery and Contribution Report* (dated March 2021) indicates on Line 13 of Table 1 that there is **26,637 cy of sediment deficient** from the required volume as of 01/15/2021. Similar to last year, the report also indicates on Line 14 of Table 1 that if the applicant were only required to fill the template to 22 CY/LF then would currently be a surplus instead of a deficiency. However, this type of adaptive management has not been approved, and the surplus in the template combined with a deficit in nourishment volume may indicate that the template may not be providing sediment to the beach system during non-storm periods. The annual volume required was 18,744 CY (when the array was 852') for Sand Years 2014 and 2015 and has been 20,834 CY for Sand Years 2016-2020 (to account for the 947' array length). It should be noted that previous sand Years are actually time periods that range from as little as 3 months to as much as 22 months. The **2020 sand year is much closer to the calendar year** (1/1/2020 to 1/15/2020) and is a positive step towards a less confusing reporting system.

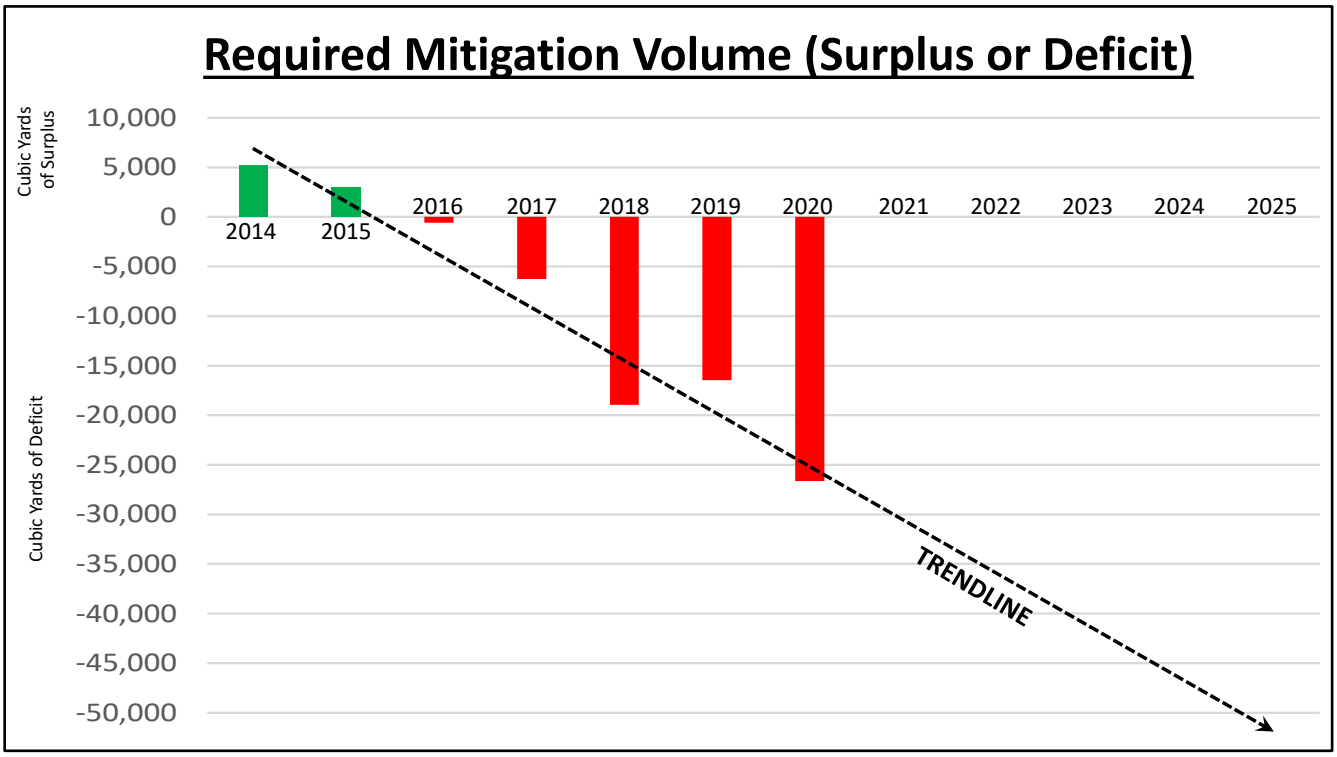
			From Table 1 Line 5	From Table 1 Line 12	From Table 1 Line 10	
		# Months	Required CY	# CY Provided	Additional	**Cumulative Delta**
Sand Year 2014	Dec 13 - Mar 14	5	18,744	23,951		**5,207**
Sand Year 2015	Apr 14 - Mar 15	12	18,744	14,429	2,138	**3,030**
Sand Year 2016	Apr 15 - Mar 16	12	20,834	15,085	2,138	**-581**
Sand Year 2017	Apr 16 - Jan 18	22	20,834	15,138		**-6,277**
Sand Year 2018	Feb 18 - Apr 18	3	20,834	8,152		**-18,959**
Sand Year 2019	May 18 - Dec 19	21	20,834	23,335		**-16,458**
Sand Year 2020	Jan 20 - Jan 21	12	20,834	10,656		**-26,636**

The volumes for the "#CY Provided" is from the *January 2020 – January 2021 Sand Delivery and Contribution Report* as shown at the top of the column for the table. The "Cumulative Delta" shows the surplus (in green) changing to a deficit (in red) for the past five Sand Years. It should be noted that there are very minor (+/- 1CY) differences between the Cumulative Delta when compared to the *January 2020 – January 2021 Sand Delivery and Contribution Report*, which are likely due to differences in rounding. Previous reviews have shown that despite irregular time periods used in defining the Sand Years, it does not appear to significantly impact the surplus or deficit for a given year.



The project site has received the required volume of sand in only one of the sand years since 2015. While there is some fluctuation, the net deficit has been increasing over time and the current deficient volume

is 26,636 CY (significantly more than one year's requirement). While the deficit was somewhat reduced from 2018-2019, it has increased even more in 2020.



The **trend of increasing deficit nourishment volumes is concerning and should be addressed**. As the trendline in the graph above shows, continuing this trend will lead to a potential deficit of >50,000 CY by 2025. Reexamining the appropriateness of the required mitigation volume is not part of this review. Assuming the required volume is appropriate, then there is a significant disruption in the supply of sediment to this region.

The 2020 Epsilon Report indicates that "*Continuing to place 22 cy/lf/yr on the sand template would cover up the vegetation on the bluff face and steepen the access ramps, making pedestrian or equipment access and template management activities (such as re-grading) more difficult or impossible*." The nourishment sand does not need to be placed on the template. Some of this material could be placed at the ends of the geotube array (an area of noted erosion) or immediately seaward of the array. This material would be transported away from the site more quickly than if placed on the template, but would serve its purpose as compensatory nourishment providing sediment to downdrift beaches and dunes.

Comments on Section 4.2 Bluff Monitoring:

The 2020 Epsilon report indicated that an UAV (aka drone) was again used to photograph and record topographic data across the site. The current report *Sconset Bluff June 2020 Aerial Survey Report* (February 2021) indicates a vertical accuracy was 2.3 cm (0.9 inches), and the **"mapping anomaly" from last year's survey does not appear**. This may be due to increased eroded volume overshadowing the uncertainty in the data. The uncertainty from last year was at least ±2.1 cy/lf and this year is reported as ±0.19 cy/lf. This report

also calculated the changes in the bluff volume above the geotextile tubes (9/2019 – 6/2020) as 267 CY (±181 CY). The uncertainty in the volume is now shown and is very helpful in putting the data in context. It would also be helpful if the Total Bluff Erosion for Adjacent Unprotected Areas, reported as 4,623 CY, also had the uncertainty provided (ex. 4,623 CY ±??? CY). Using the equation ((802'+138') * ±0.19 cy/lf) the Total Bluff Erosion for Adjacent Unprotected Areas is estimated as **4,623 CY ±179 CY**. For the next report I would still urge the Gain/Loss map to provide a different color for the range of uncertainty (for 2020 this was ±2.3 cm).

Comments on Section 4.3 Shoreline Monitoring:

The 2020 Epsilon Report included pages 19-28 of the Woods Hole Group, Inc. (WHG) "SOUTHEAST NANTUCKET BEACH MONITORING December 2020 84th SURVEY REPORT" (01/2021) which covers shoreline change trends from 1994. The natural changes in this **dynamic area continue to overshadow any signal** that might be from the geotube project. No additional shoreline change can be attributed to the project at this time with the available data provided. The Conservation Commission may want to request a different representation of the shoreline monitoring data. The excerpt of the WHG report represents the change in position of Mean Low Water (MLW) over time, however concerns about the geotube array are based on a **potential reduction in the volume of Longshore Sediment Transport** (LST). It is feasible to construct a sediment budget (example below) that illustrates the volume flowing past points along the shoreline. Then updrift, geotube, and downdrift rates can be compared over time. If there is a reduction in flow downdrift of the geotubes then negative impacts might be inferred regardless of the overshadowed signal. The data to perform this analysis is not readily available and this level of effort is outside the scope of this review.

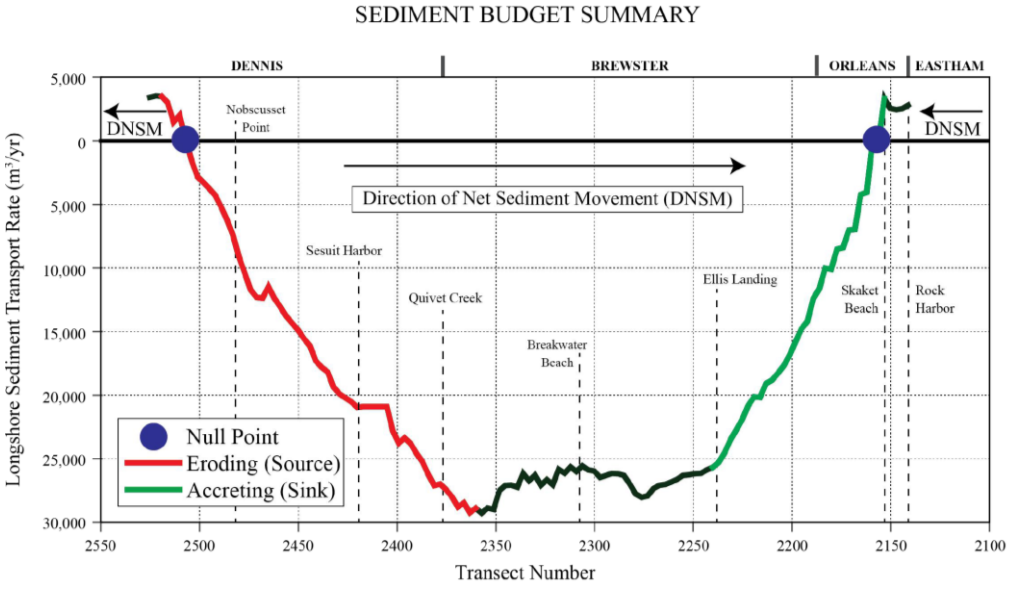
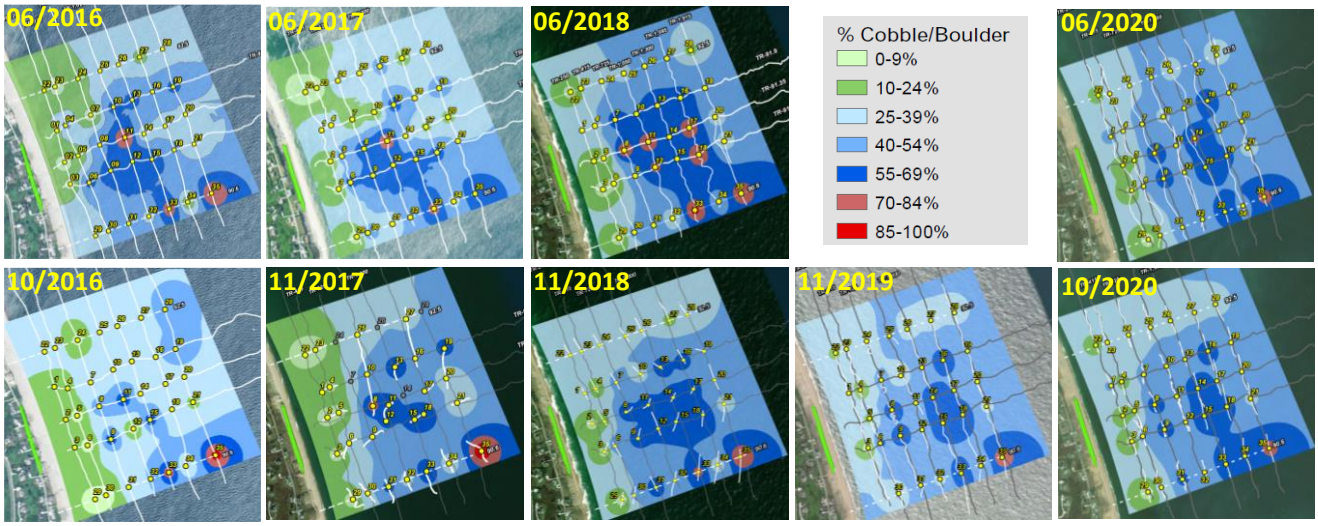


Figure 8 from Giese et al. (2015) that shows an example of how varying LST along a shoreline can be depicted.

Comments on Section 4.4 Underwater Video Monitoring:

The Sconset Beach June 2020 and October 2020 Underwater Video Survey Reports again mentions that "*…cobble/boulder coverage at video locations within just a few feet of one another could vary by up to 20-30%…*". While this type of video survallance is adequate for ground truthing, **Sidescan** (backscatter) sonar images would provide a much more complete picture of the bottom. This has been mentioned in previous reviews, but is not a requirement of the Order of Conditions. The migration of the large (several feet high) underwater sand forms in the area overshadow any potential impact from the geotube sand contribution. One survey (06/2018) shows more cobble/boulder than any of the other surveys. There does not appear to be a significant difference between any of the remaining surveys. It is possible that the **bottom type varies too abruptly to allow for fine scale parsing** using this method. If the areas were more simply classified (>50% or <50%) there would likely be little to no significant change between the maps. An expert in fisheries could be consulted to determine the minimum acceptable percentage of Cobble/Boulder. It should also be noted that no June 2019 survey was provided.



Comments on Section Annual Drainage System Report:

Previous Epsilon Reports have included professional determinations regarding accumulated sediment in the drainage system. In the past the system has been likely performing as designed, however there is **no mention of the drainage system** in the 2020 Epsilon Report.

Comments on Section 5.0 Recommended Changes to Monitoring and Mitigation Program

The 2020 Epsilon Report indicates that "The recommended changes are the **same** as presented in the December 2016 Annual Report…". These recommended changes have also been addressed in previous reviews of the Epsilon Reports and are not repeated in this document.

Key finding for this independent review of the 2020 Epsilon Report:

In the 2020 Sand Year less than the required amount of sediment was provided to the project area resulting in a current net deficiency of 26,637 cy. This continues a disturbing trend of increasing deficits which may lead to negative impacts, although the current reporting requirements have not shown such an impact. A more direct look at potentially changing volumes in longshore sediment transport may of use in determining downdrift impacts. The annual volume of sediment eroded from a coastal bank can vary greatly along this section of shoreline, therefore there might be some leeway in providing the exact volume each year (at least from a coastal processes point of view, if not the Order of Conditions). However, over the long-term more sediment will need to be provided to average out these years of deficit.

Works cited

03/16/2020. 2020 Annual Review – Sconset Geotextile Tube Project (SE48-2824). Submitted to Nantucket Conservation Commission, Submitted by Siasconset Beach Preservation Fund, Prepared by Epsilon Associates, Inc.

11/2020. Sconset Beach June 2020 and October 2020 Underwater Video Survey Reports. Submitted to Nantucket Conservation Commission, Submitted by Siasconset Beach Preservation Fund, Prepared by Epsilon Associates, Inc. & CR Environmental, Inc.

02/2021. Sconset Bluff September 2020 Aerial Survey Report. Submitted to Nantucket Conservation Commission, Submitted by Siasconset Beach Preservation Fund, Prepared by Epsilon Associates, Inc.

03/2021. January 2020 – January 2021 Sand Delivery and Contribution Report Baxter Road and Sconset Bluff Stabilization Project Nantucket, MA. Submitted to Nantucket Conservation Commission, Submitted by Siasconset Beach Preservation Fund, Prepared by Epsilon Associates, In Association with Cottage + Castle, Inc.

01/2021. Excerpt from Southeast Nantucket Beach Monitoring, December 2020 84th SURVEY REPORT. Prepared by Woods Hole Group.

06/2015. Giese, Graham, Mark Borrelli, Stephen Mague, Theresa Smith, and Patrick Barger. Assessment of the Century Scale Sediment Budget of the Brewster Coast. A Report Submitted to the Town of Brewster By Center for Coastal Studies June 2015.