



May 5, 2021

Nantucket Conservation Commission  
2 Bathing Beach Rd.  
Nantucket, MA 02554

Re: Siasconset Beach Preservation Fund (SBPF) 2020 Annual Review (SE48-2824)

Dear Commissioners:

On behalf of Mr. Robert Greenhill, I offer several comments on both the SBPF 2020 Annual Review as well as on the Independent review of Mr. Greg Berman. Most of my comments are updates to my earlier letter of March 11, 2021.

### **Shortfall in Mitigation**

Overall, my observations agree qualitatively with those of Mr. Berman that there is a large and growing shortfall in mitigation sand volume since project construction. But I believe that the volumetric shortfall is actually much larger than shown by Mr. Berman.

New data on sand placement volume from the 2020 Annual Report (January 2020-January 2021 Sand Delivery and Contribution Report) indicates that the sand placement in the past year, was 10,656 cy. While this is about average for the annual placement rate being achieved by SBPF, it is only about half the annual requirement of 20,834 cy (based on 22 cy/lf/yr).

As a result, as shown in Figure 1 and in Table 1, this annual shortfall also means that the cumulative shortfall in mitigation placement has continued to grow. According to my estimate, the total cumulative shortfall in sand mitigation is about 47,405 cy through January 2021.

To arrive at my numbers, the upper black curve in Figure 1 shows the mitigation requirements, accumulated at a rate of 18,744 cy/yr for the first two years, and 20,834 cy/yr since 2015. By the middle of January 2021 (the end date of the 2020 Sand Delivery report but 2.5 months shy of the full sand year ending in March), a total cumulative mitigation volume of 158,152 cy should have been placed<sup>1</sup>.

The lower red curve and symbols then give the cumulative placement volume listed in the 2020 Annual Report. The red symbols give the cumulative volume obtained by summing the mitigation volumes listed in Table 1 (Line 2) of the Annual Report. Note that these are given at irregular time periods and not necessarily at the end of the sand year in March. The red curve is then obtained

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<sup>1</sup> Total required mitigation of 158,152 cy through Jan 2021 is calculated as 2 years at 18,744 cy/yr plus 5 years and 9.5 months at 20,834 cy/yr.

by summing the various monthly sand delivery values given in Tables 4-10 of the 2020 Annual Report. Both methods give a cumulative total of 110,746 cy placed as of January 2021<sup>2</sup>.

As of January 2021, my estimate is that the cumulative shortfall, based on the difference of the cumulative requirement minus the cumulative placement, has reached 47,405 cy. As a result, SBPF is now more than two years behind on sand mitigation.

Further, while Mr. Berman concludes that the cumulative shortfall will reach more than 50,000 cy by 2025, I believe that a 50,000 cy shortfall will likely be reached this year, in 2021, unless SBPF substantially increases sand placement rates. For example, by this time next year in March 2022, the cumulative mitigation requirement would increase to 186,326 cy. The “catch up” requirement for SBPF to achieve the required mitigation within the next year is therefore  $186,326 - 110,747 = 72,579$  cy.

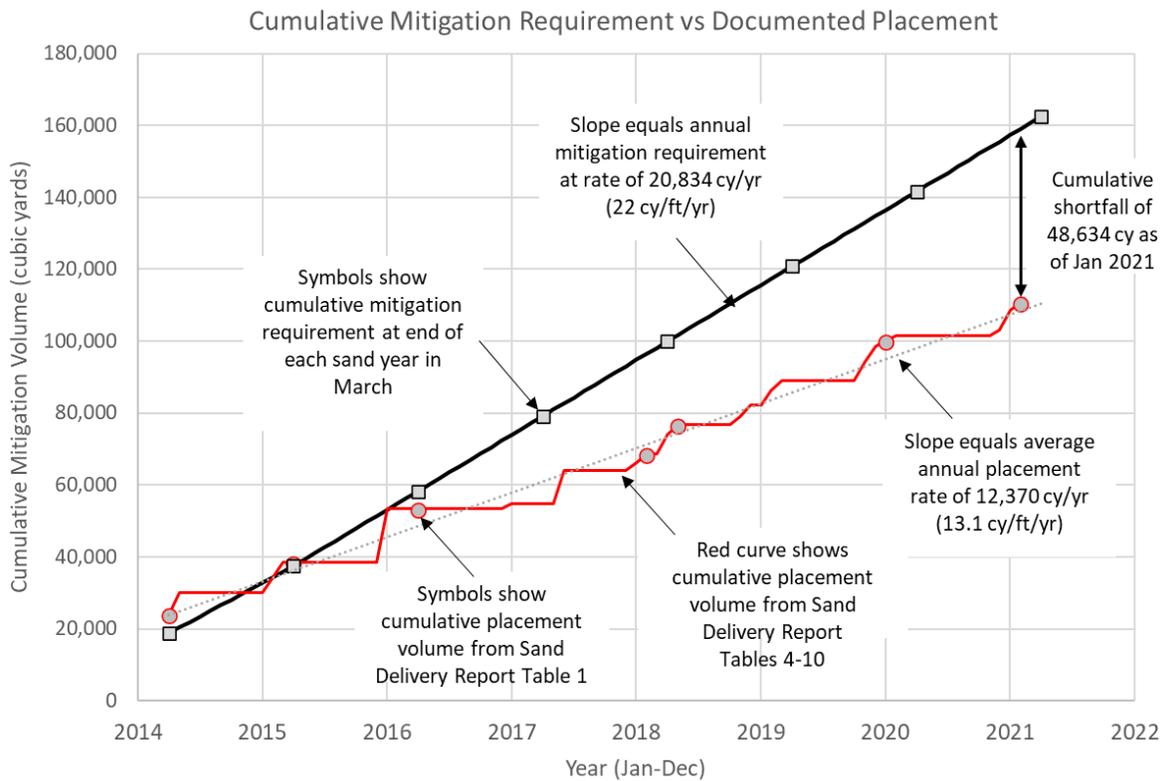


Figure 1. Cumulative sand mitigation requirements and placements

<sup>2</sup> This value for total mitigation differs from the 133,398 cy that SBPF states was delivered to the template, as their value also includes sand within the geotubes and sand placed on the bluff face during construction, values that are not considered part of the mitigation sand.

In my opinion, and in agreement with Mr. Berman, the data tables used by SBPF are unnecessarily confusing. Part of the confusion comes from the methods used by SBPF to carry over values from previous years, part from the SBPF tabulation of sand volume on the template (which in my opinion is irrelevant to the placement requirement), and part from the different and irregular time periods used which do not follow the standard sand year definition.

In Table 1, I have tried to simplify the data. The table adopts standard and uniform sand years as outlined by the Commission, extending from April of one year to the end of March the following year. Note that in red italics, I show results for January 15, 2021 aligning with the 2020 Annual Report but not quite at the end of the 2021 sand year.

Table 1 Mitigation requirements and placement organized by sand year

			Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
MITIGATION SAND			Required Annual (cy)	Required Cumulative (cy)	Tables 4 - 10 Placed by Month (cy)	Placed in Sand Year (cy)	Placed Cumulative (cy)	Surplus (+) or Deficit (-) Annual (cy)	Surplus (+) or Deficit (-) Cumulative (cy)
<b>Sand Year 2014</b>	<b>mar</b>	<b>2014</b>	<b>18,744</b>	<b>18,744</b>	<b>23,952</b>	<b>23,952</b>	<b>23,952</b>	<b>5,208</b>	<b>5,208</b>
	apr	2014			6,015				
	jan	2015			4,477				
	feb	2015			3,936				
<b>Sand Year 2015</b>	<b>mar</b>	<b>2015</b>	<b>18,744</b>	<b>37,488</b>		<b>14,428</b>	<b>38,380</b>	<b>-4,316</b>	<b>892</b>
	dec	2015			15,085				
<b>Sand Year 2016</b>	<b>mar</b>	<b>2016</b>	<b>20,834</b>	<b>58,322</b>		<b>15,085</b>	<b>53,465</b>	<b>-5,749</b>	<b>-4,857</b>
	dec	2016			1,230				
<b>Sand Year 2017</b>	<b>mar</b>	<b>2017</b>	<b>20,834</b>	<b>79,156</b>		<b>1,230</b>	<b>54,695</b>	<b>-19,604</b>	<b>-24,461</b>
	may	2017			9,320				
	dec	2017			2,090				
	jan	2018			2,499				
	feb	2018			40				
<b>Sand Year 2018</b>	<b>mar</b>	<b>2018</b>	<b>20,834</b>	<b>99,990</b>	<b>5,506</b>	<b>19,455</b>	<b>74,150</b>	<b>-1,379</b>	<b>-25,840</b>
	apr	2018			2,606				
	oct	2018			2,204				
	nov	2018			3,156				
	jan	2019			4,120				
	feb	2019			2,683				
<b>Sand Year 2019</b>	<b>mar</b>	<b>2019</b>	<b>20,834</b>	<b>120,824</b>		<b>14,769</b>	<b>88,919</b>	<b>-6,065</b>	<b>-31,905</b>
	oct	2019			5,400				
	nov	2019			4,266				
	dec	2019			1,506				
	jan	2020			1,350				
<b>Sand Year 2020</b>	<b>mar</b>	<b>2020</b>	<b>20,834</b>	<b>141,658</b>		<b>12,522</b>	<b>101,441</b>	<b>-8,312</b>	<b>-40,217</b>
	nov	2020			1,800				
	dec	2020			5,454				
<i>End Annual Report</i>	jan	2021		<i>158,152</i>	2,052		<i>110,747</i>		<i>-47,405</i>
<b>Sand Year 2021</b>	<b>mar</b>	<b>2021</b>	<b>20,834</b>	<b>162,492</b>		<b>9,306</b>	<b>110,747</b>	<b>-11,528</b>	<b>-51,745</b>
<b>TOTALS FOR MITIGATION</b>			<b>162,492</b>		<b>110,747</b>	<b>110,747</b>		<b>-51,745</b>	

With this organization by uniform sand years, the annual mitigation requirement can be reflected at the end of each sand year (Col 1) It is then a simple matter to sum these to also show the cumulative mitigation requirement (Col 2). SBPF tabulates sand placement by month in their Tables 4-10, and these values are listed in Column 4 directly from their report. These can be summed annually to reflect sand placed within each sand year (Col 5) and accumulated over the time since initial construction (Col 5). The final two columns then give the annual surplus or deficit (Col 6) and the cumulative surplus or deficit (Col 7).

The monthly tabulation helps (in my opinion) to see some of the reasons for my cumulative shortfall being larger than that of Mr. Berman or SBPF. For example, in the 2017 sand year, just 1,230 cy was placed resulting in a large jump in the cumulative shortfall equal to about one year of mitigation requirements. Sand year 2018 almost reached the sand placement goal, but repeated annual shortfalls in 2019, 2020, and 2021 then have caused the overall shortfall to continue to double, reaching 47,405 cy in January 2021<sup>3</sup>.

My estimated shortfall (47,405 cy) is then larger than the value listed by SBPF and Mr. Berman (26,637 cy) for two reasons. First, three annual reports from April 2016 through December 2019 cover a time period of 45 months or almost 4 years. But the Annual Report only lists a mitigation requirements for 3 years or 36 months rather than for the full 45 months. As a result, the mitigation requirements used by SBPF (in their Table 1) and by Mr. Berman are underestimated. Further, both Mr. Berman and SBPF include material placed on the bluff face during construction; I do not include this per Tables 4 and 6 which state that this should not be counted as mitigation.

One question that should be addressed with SBPF is how the more than 47,000 cy cumulative shortfall in mitigation will be made up? Since the initial construction, SBPF has never placed more than 19,455 cy in a single sand year. Each year the shortfall grows, it will become harder to get back on schedule. At some point, it must be asked whether SBPF will ever make up the deficit to eliminate the mitigation shortfall.

### **Sand Placement and Template**

The Annual Report discusses sand volumes (or cross sectional areas) in the “sand template” but how the template is defined is not clear. In the Commission files from the Tier 4 construction, I found a proposed template shown in Figure 2 (note that I cut off the bluff portion to the left to enlarge the portion with the geotubes).

In the future, it would be useful if a detailed drawing of the template appeared in Annual Reports, with beach and template survey data plotted so that it would be clear what the actual in-place template looks like compared to the drawings.

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<sup>3</sup> The shortfall shown in Table 1 of 51,745 by the end of March will likely not be that large, however I do not have record of sand placements that may have occurred in February or March of this year.

In my opinion, the template also requires clarification with regard to how mitigation sand is placed, and it would be useful to separate out portions of the template that serve different functions. First, in Figure 2, I note that the notation of template volume appears to include the volume of the geotubes themselves. I would suggest that sand in the geotubes is not available to the littoral system and should not be included in any assessment of template volumes. Second, sand used as protective cover for the geotubes should be indicated separately from sand intended primarily as mitigation. Third, the template drawing should indicate how mitigation sand is to be placed.

I fully concur with Mr. Berman that mitigation sand does not need to be placed on the template (as shown in Figure 2) and should be placed both seaward of the geotubes as well as at the ends of the geotube system.

In the cross section, sand placed on top of the geotubes to elevations of 30 ft or more, will not naturally be mobilized by waves and can only enter the active system if pushed over the geotubes artificially. A more effective method of placement for mitigation would be to place sand in front of the geotubes in the form of a berm, at elevations of 10 to 15 ft or so, and then sloping down to MHW. This berm would hold maybe half the mitigation sand and would serve to protect the base of the geotubes while also feeding the littoral system. Additional sand volume could be placed at the ends of the geotube system where it would be more readily available to downdrift beaches.

Note that these recommendations are consistent with the Conservation Commission Additional Conditions specified at the time of the Tier 4 construction, which indicated that mitigation sand should be placed in a berm from the toe of the bank out to MHW and also 300 ft from ends of the geotube installation.

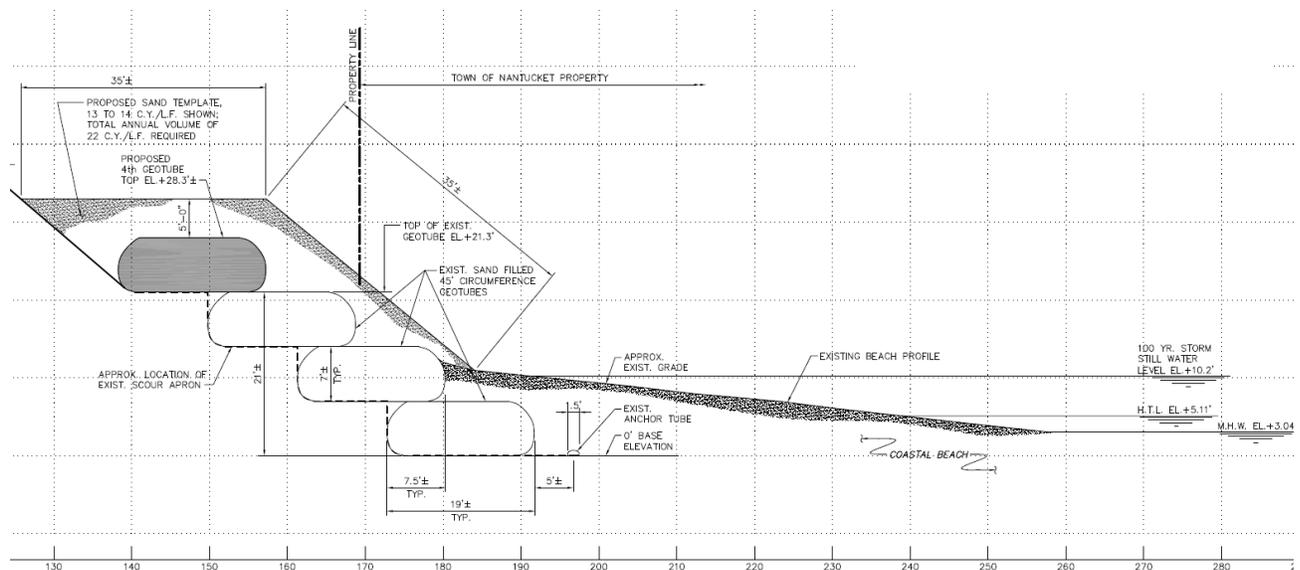
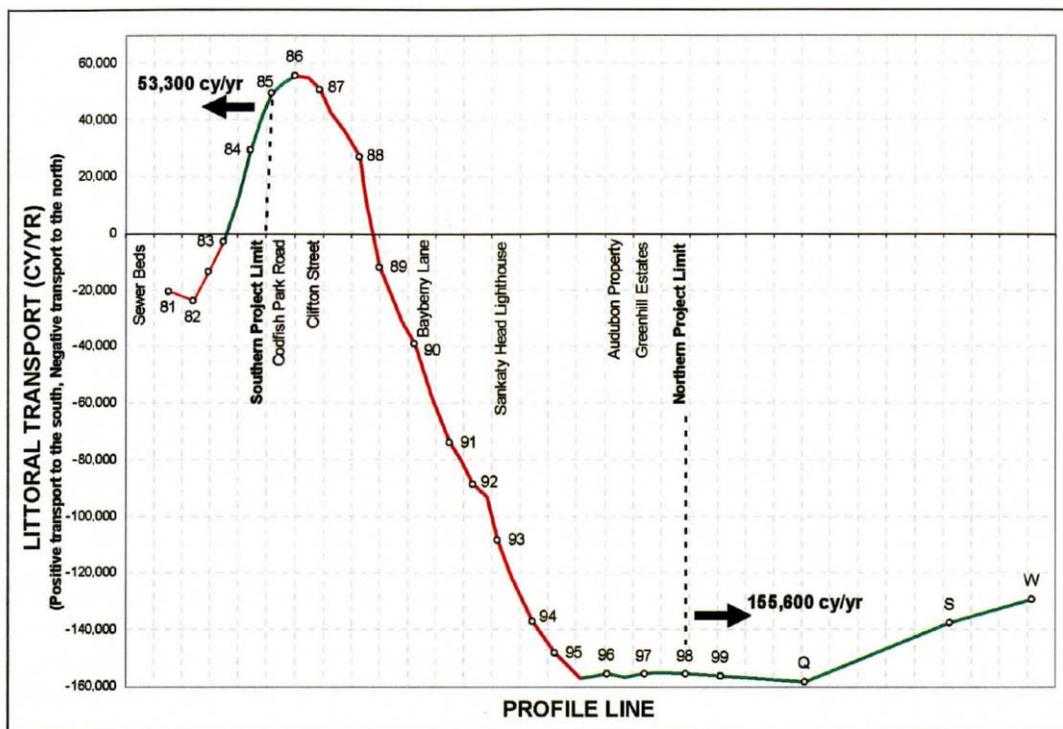


Figure 2 Sand template from Tier 4 construction document

## Sediment Budget

Following up from the last Conservation Commission meeting, and in support of Mr. Berman, I would strongly encourage the Commission to sanction the development of an updated sediment budget for the area.

The only sediment budget that I have located is from a 2006 study by Coastal Planning and Engineering (CPE), shown in Figure 3. To develop this, CPE analyzed beach profile changes over a 10 year period from 1995 to 2005. In Figure 3, regions in red were identified as erosional with more longshore sediment transport leaving an area than entering, thus producing a volumetric sediment deficit. Areas in green were accretional or stable. It would be useful to update this to see what change have occurred since 2005.



Annual Littoral Transport (Dec 1995 to June 2005)

Figure 3 Sediment budget developed by Coastal Planning and Engineering in 2006

One advantage of a sediment budget, is that it focusses on beach and bluff volume change, so it is closely linked to the way mitigation is quantified. I note that while the Annual Report includes bluff volume change, the Woods Hole Group attachment only shows the change in shoreline position. Shoreline position is a simple measure of beach conditions but it does not indicate volumetric change. A sediment budget would look at the entire beach and bluff profile (cross sectional area) from top of bluff offshore to the depth of closure about 3000 ft offshore, and would then account for the longshore spacing of profiles to estimate volume change.

In this regard, I have some concerns over the SBPF proposals to decrease the monitoring frequency and to change monitoring methods. Most of these proposed changes appear to be based on an attempt to make surveys easier and cheaper, while one proposal to reduce wading surveys may be based on safety concerns. Either way, the proposals are not aimed at improving the data available for evaluating project impacts.

While I have not yet reviewed the survey data, I would say from experience that reducing survey coverage will generally produce greater unknowns and less certainty. In sediment budgets I have developed, more survey data with greater spatial resolution and extending farther offshore and farther downdrift is always helpful. So I would not recommend changes to the monitoring plan until after a sediment budget is developed.

I thank the Commission for the opportunity to comment on the 2020 Annual Review.

Sincerely,



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