

February 24, 2014

Ms Linda Tucker City of Isle of Palms PO Drawer 508 Isle of Palms SC 29451

RE: Breach Inlet Quarterly Survey — January 2014 (Amendment 2 – Task 8) [CSE 2386]

Dear Ms. Tucker:

Per Amendment #2 to the agreement between the City of Isle of Palms and Coastal Science & Engineering (CSE), CSE completed an assessment of the shoreline around Breach Inlet on 23 January 2014. The assessment was conducted in response to severe erosion occurring over the past two years along the southwestern end of the Isle of Palms (monitoring stations 0+00–80+00 encompassing monitoring Reach 1 and Reach 2) (Fig 1). The purpose of the assessment is to provide quarterly updates on the magnitude of erosion and potential threats to private property so that the City may inform property owners and plan remedial action if necessary.

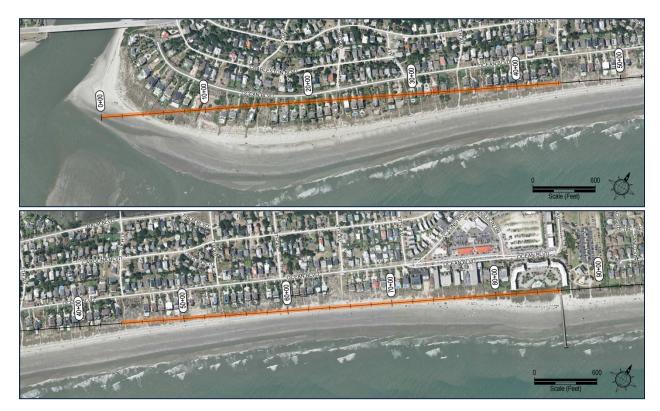


FIGURE 1. Monitoring baseline in Reach 1 (upper) and Reach 2 (lower). The highlighted areas show the reach limits.



The January 2014 survey included land-based and hydrographic survey work extending from landward of the frontal dune to $(\sim)1,500$ feet (ft) from the shore. The data allow for an analysis of dune recession or recovery, beach volume, and changes in the shoals and channels of Breach Inlet. Beach volumes were calculated to -6 ft NAVD, which is approximately low-tide wading depth, for comparison with the first quarterly survey (October 2013). Volume change was also computed to -10 ft to compare with the last comprehensive monitoring event in July 2013.

Beach profiles are provided in Attachment 1 and volume changes are shown in Table 1. The Breach Inlet area (Reaches 1 and 2) gained ~24,000 cubic yards (cy) of sand between July and October 2013. This led to moderate recovery of the dry beach following the erosion occurring between 2011 and July 2013 (details are provided in the letter report submitted in November 2013). Between October 2013 and January 2014, the area as a whole was stable, gaining only 116 cy (measured to -6 ft NAVD). Reach 1 (west of 6th Avenue) gained ~9,500 cy, while Reach 2 lost a similar volume.

There was not a distinct erosional trend within either reach. The tip of the spit (stations 0+00 thru 12+00) showed minor erosion (1.4 to 3.1 cy/ft) and stations 0+00 and 4+00 showed ~10 ft of dune recession. Stations OCRM 3105 thru OCRM 3110 (2nd and 3rd Ave) all gained sand and were responsible for the net accretion observed over the reach. Figure 2 shows unit volumes for monitoring stations useful for visualizing how beach volume has changed over the past 4.5 years. Profiles show that sand from a lowtide ridge (higher part of the beach seaward of a runnel) present in October 2013 migrated higher up the beach by January 2014. Erosion/accretion was more variable north of station 30+00, ranging from 9.0 cy/ft erosion to 4.4 cy/ft accretion. Station 30+00, 40+00, and OCRM 3115 all showed minor erosion of the frontal dune toe, though no significant loss of dune width or elevation was evident. Comparative ground photos are provided at the end of this letter.

In Reach 1, the October-January time period showed a similar accretion rate as the July-October time period (~45,000 cy/yr). The volume change rate for Reach 2 changed from +47,500 cy/yr (accretion) between July and October to -43,800 cy/yr (erosion) between October and January. For comparison, Reach 1 lost an average of ~85,000 cy/yr between July 2011 and July 2013 and Reach 2 was essentially stable.

CSE updated a contour map showing the position of the +7 ft NAVD elevation contour (approximate base of the dune or escarpment line) in Reach 1 (Fig 3). The map shows little change between the October 2013 and January 2014 position, indicating little dune recession occurred during that time. The stability of the contour is a positive sign for the beach condition as portions of the area lost over 100 ft of dunes between 2011 and 2013.



TABLE 1. Volume calculations for recent surveys at Breach Inlet. Volumes were calculated to -6 ft NAVD within the boundaries shown in the profile plots (Attachment 1). Reach 1

436,038

445,387

433,406

442,771

432,496

434,976

Reach 2

Init Volumes (γ/ft) to -6 ft NAVD Sep -09 Jun-11 Jun-13 Oct-13 Jan-14 Sep -09 Jun-11 Jul-12 Jul-13 Oct-13 Jan-14 129.1 68.3 175.9 110.4 112.7 110.9 179.2 188.6 135.8 59.1 83.1 83.0 179.2 188.6 135.8 155.4 131.7 130.3 205.5 134.9 132.4 132.4 130.3 205.5 134.9 135.4 132.6 134.4 205.5 134.9 152.4 132.6 134.3 205.5 134.4 187.8 131.7 130.3 205.5 134.4 101.9 101.4 120.3 124.5 124.7 124.4 133.9 121.2 111.6 112.7 125.9 137.4 113.4 124.6 124.1 121.4 113.4 121.2 124.6 124.1	-						
Jun-11 Jul-12 Jul-13 Oct-13 68.3 175.9 110.4 112.7 138.6 135.8 59.1 83.1 138.6 135.8 59.1 83.1 138.6 135.8 130.4 112.7 185.3 167.1 129.7 131.7 202.2 186.8 146.1 131.4 214.9 174.4 187.6 132.6 194.9 131.4 101.9 107.8 155.7 132.4 131.4 117.4 155.7 128.4 131.4 117.4 155.7 128.4 131.4 117.4 155.7 129.1 115.9 117.4 113.4 115.9 117.4 117.4 113.4 115.9 117.4 117.4 113.4 115.9 117.5 117.4 113.4 115.9 117.4 117.4 113.4 113.9 117.4 117.4 113.4 113	Station	D	Unit Volume Change Since Previous (cy/ft) to -6 ft NAVD	e Since Previous	(cy/ft) to -6 ft N	AVD	Unit Volume Change to -10 ft NAVD
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185.3 167.1 129.7 131.7 131.7 202.2 168.8 146.1 131.4 131.4 211.4 177.4 187.8 131.6 144.1 231.4 177.4 187.8 131.6 131.6 231.4 197.5 185.4 155.6 155.6 155.6 155.7 128.4 103.4 111.4 117.8 155.7 128.4 103.4 111.4 117.8 155.7 128.4 103.4 111.4 117.4 155.7 128.1 120.1 88.3 88.3 155.7 129.9 121.4 117.4 117.4 113.4 129.9 121.4 117.4 117.4 113.4 128.9 121.4 117.4 117.4 113.4 128.9 121.4 118.9 117.4 113.4 128.9 121.4 118.9 117.4 113.4 128.9 121.4 118.9 117.4	00+0	83.9	-2.8	-76.7	24.0	-3.1	-1.6
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121.4 123.3 127.7 135.9 112.8 117.7 121.4 135.9 112.8 117.7 121.4 138.9 Immediate Next Station (cy) to -6 ft NAVD Jun-11 Jul-12 Jul-13 Oct-13 Jun-11 S5,164 S5,164 S5,164 S1,260 S9,82 S0,31 S5,164 J1,059 S7,10 S5,164 S5,164 J10,091 S3,5067 S0,852 S1,64 J10,091 S3,5067 S0,852 S1,64 S1,64	90+00	1.3	3.3	-4.7	7.8	-4.1	3.7
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Total Volume to Next Station (cy) to -6 ft NAVD Jun-11 Jul-13 Oct-13 Jun-11 Jul-12 Jul-13 Oct-13 Jun-11 Jul-12 Jul-13 Oct-13 64,787 60,569 37,764 42,958 Oct-13 82,728 65,412 55,161 55,164 Oct-13 82,728 65,437 66,771 65,142 66,433 Oct-13 81,260 63,802 68,031 66,433 66,433 Oct-13 81,260 63,802 68,031 66,433 Oct-13 81,260 63,771 65,433 66,433 Oct-13 81,260 55,200 59,822 77,100 25,583 Oli 10,091 91,103,18 85,346 93,774 41,145 Oli 11,368 113,411 113,827 113,626 113,526 III,01,091 111,411 113,627 123,827 123,826	80+00	1.3	4.9	3.7	-2.5	4.4	-6.2
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82,728 68,647 66,771 65,142 81,260 63,802 66,031 66,433 81,260 63,802 68,031 66,433 72,054 55,200 50,852 51,684 72,054 55,207 27,110 29,583 101,091 85,346 69,842 72,859 113,689 103,739 88,010 90,901 45,012 45,068 39,774 41,145 77,141 78,992 72,376 71,617 120,797 123,571 118,558 113,536 117,411 130,966 119,827 127,826 117,411 150,570 124,552 117,741	Reach 2 (cy)	-2,480	10,275	-9,365	11,980	-9,349	-9,778
81,260 63,802 68,031 66,453 72,054 55,200 50,852 51,664 72,054 55,200 50,852 51,664 101,091 85,346 69,842 72,953 113,689 103,739 88,010 90,901 113,689 103,739 88,010 90,901 77,141 78,992 72,376 71,617 120,797 113,526 113,558 113,536 117,111 119,996 119,827 127,826 117,141 105,797 124,545 113,738	Total (cy)	22,904	-86,584	-90,071	23,954	116	6,357
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101,091 85,346 69,842 72,859 113,689 103,739 88,010 90,901 45,012 45,068 39,774 41,445 77,141 78,992 72,376 71,617 120,797 123,271 116,668 118,558 117,411 119,986 119,827 127,326 117,411 110,998 119,827 127,326 117,411 10,057 124,542 127,326	Reach 2 (cy/ft)	-0.7	2.8	-2.6	3.3	-2.6	-2.7
113,689 103,739 88,010 90,901 45,012 45,068 39,774 41,145 77,141 78,992 72,376 71,617 120,797 123,271 116,668 118,558 117,411 119,986 119,827 127,826 117,411 130,597 134,558 117,356	Total (cy/ft)	2.9	-10.8	-11.3	3.0	0.0	0.8
45,012 45,068 39,774 41,145 77,141 78,992 72,376 71,617 120,797 123,271 116,668 118,558 117,411 119,986 119,827 127,826 117,417 130,679 131,538 137,345							
77,141 78,992 72,376 71,617 120,797 113,271 116,668 118,558 117,411 119,986 119,827 127,826 117,417 130,575 131,736 734,568		Annual C	Annual Change Bate (cv/ft ner vr) to -6 ft NAVD	t ner vr) to -6 ft	NAVD		Change to -10 ft
120,797 123,271 116,668 118,558 117,411 119,986 119,827 127,826 117,147 100,575 124,555 177,385			יומוופר וימיר (ראו	י הרי או אים מור			NAVD
117,411 119,986 119,827 127,826 117,147 120,523 124,535 127,385			Jun 11 - Jul 12	Jul 12 - Jul 13	Jul 13 - Oct 13	Jul 13 - Oct 13 Oct 13 - Jan 14	Jul 13 to Jan 14
117 147 120 522 124 535 127 385	L Reach 1		-89,276	-80,706	47,506	44,289	32,007
	5 Reach 2		9,471	-9,365	47,531	-43,747	-19,396
0	Total		-79,806	-90,071	95,037	542	12,611
656,095 681,479 584,620 503,914 515,888 525,353	~	÷			÷		



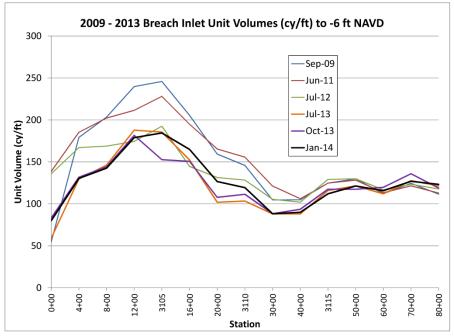


FIGURE 2. Beach unit volumes (in cy/ft to -6 ft NAVD) for monitoring stations in the Breach Inlet area.





The most recent assessment included a comprehensive survey of the Breach Inlet delta to evaluate potential changes in channel positions, channel depths, and shoal positions. Figure 4 shows digital terrain models (DTMs) of the inlet delta in July 2013 and January 2014. Note that the data coverage is variable between the two, so the limits of the colored area are not the same. Overall, the main channel of the inlet (green hues) has been fairly stable, although it continues to slowly migrate toward Sullivan's Island. As the channel shifts west, the linear shoal on the eastern side of the channel also migrates west, drawing sand away from Isle of Palms.

Of particular importance to the Isle of Palms shoreline directly adjacent to Breach Inlet is the position and extent of the marginal flood channel. The channel is marked by "M" (Fig4) and was generally stable between October and January. The only location showing any notable change was at station 8+00, where the channel edge moved closer to the beach, although this was likely in response to a low-tide bar merging with the wet beach (sand moved higher up in the profile, allowing the channel boundary to migrate closer to the shore). Other than the minor changes in the marginal flood channel, no significant changes were observed in the DTMs that directly impacted the beach condition between October and January. The next quarterly monitoring event (scheduled for April 2014) is planned to survey only the beach to low-tide wading depth (excluding the channels and shoals of the inlet). The next comprehensive survey is scheduled for summer of 2014.

The January 2014 survey revealed that the Breach Inlet area was less accretional between October and January than from July to October 2013. The most critically eroded area, near the tip of Breach Inlet, showed minor volume loss (though the dune line was stable), while the area near 2nd Avenue and 3rd Avenue accreted. The area remains more stable than the 2011 to July 2013 period, where certain areas lost over 100 ft of dunes. This is a positive trend, especially since the stability is occurring over the typically erosive winter season. CSE continues to anticipate the area recovering naturally over time, although the area should continued to be monitored at least semi-annually until significant recovery can be documented.

Under the present agreement, CSE will complete a land-based assessment of the Breach Inlet area in April 2014. A similar letter report will follow updating the condition of the beach and providing volume-change analysis to -6 ft NAVD.

Sincerely,

Coastal Science & Engineering (CSE)

Steven Traynum Coastal Scientist

Enclosures: Photos and Attachment 1 - October 2013 Profiles



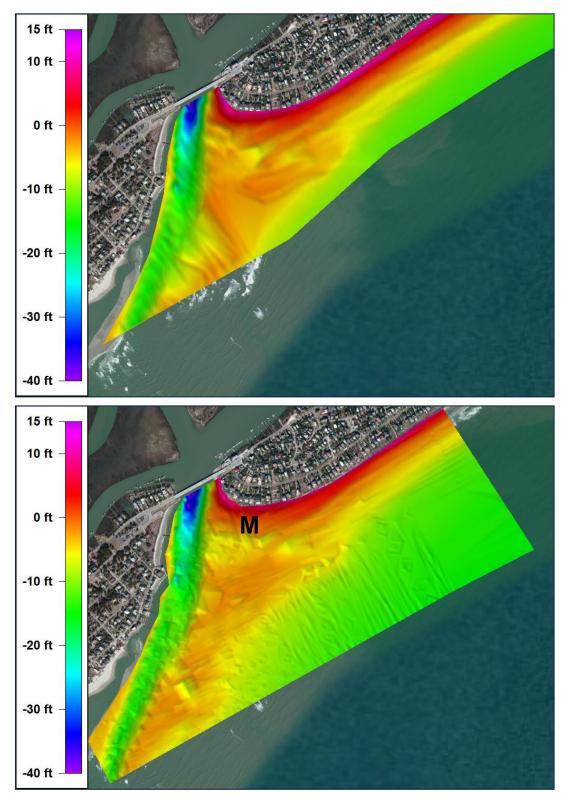


FIGURE 4. Digital terrain models (DTMs) of the Breach Inlet area in July 2013 (upper) and January 2014 (lower). The marginal flood channel is denoted by "M" and was mostly stable between October and January.





October 2013 (left) and January 2014 (right) images from station 8+00, looking toward the dune. The escarpment in this area moved a few feet landward between the image dates.



October 2013 (left) and January 2014 (right) images from station 16+00, looking west. This area gained sand between the image dates.



October 2013 (left) and January 2014 (right) images of station 16+00, looking east.





October 2013 (left) and January 2014 (right) images of station 50+00, looking west. This station gained 4.0 cy/ft between October and January, and the escarpment appears to be healing (note small buildup of sand at the base of the escarpment in the right image).



January 2014 image from station 4+00, looking landward. This area continues to rebuild following extensive erosion between 2011 and 2013. Note the older escarpment behind a more recent one, all fronted by a dry beach.

