The Impact on Great South Bay of the Breach at Old Inlet

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The Great South Bay project (http://po.msrc.sunysb.edu/GSB/) gathers data from a variety of methods to gain an understanding of the Bay dynamics and its ecology. Since superstorm Sandy, periodic reports to the National Park Service and NY Sea Grant have focused on the impact of the new Old Inlet breach utilizing data from sensors in Great South Bay, aerial overflights and bathymetric surveys of the inlet. The locations of the sensors deployed in Great South Bay are shown in Figure 1.

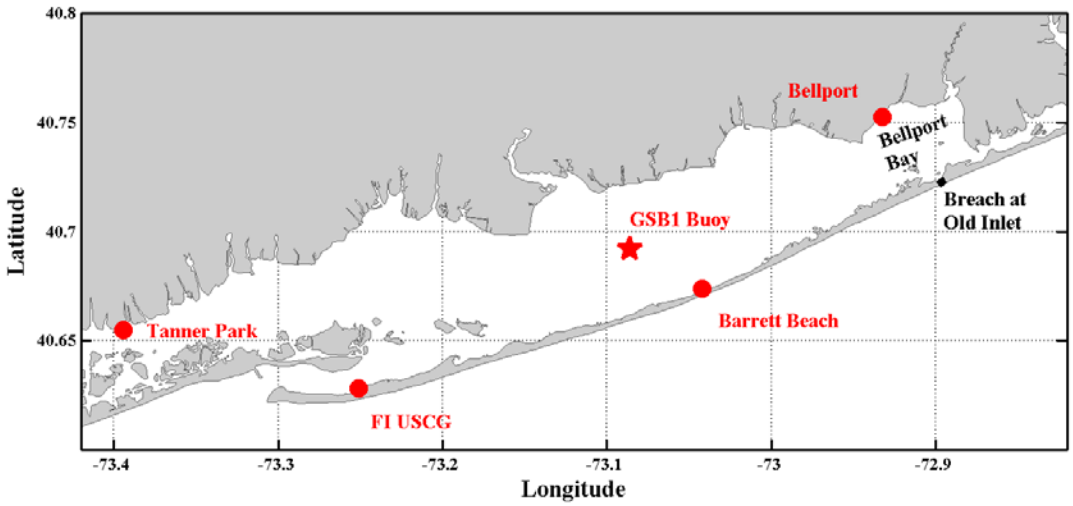

Figure 1, Chart showing the location of the Breach at Old Inlet and sensors deployed in Great South Bay.

There have been significant developments in the Old Inlet breach since the last report was released on February 27. February 27th is an interesting date as it was then that another of the nor'easters we have been getting was raging and the Pattersquash Gun Club house on Pelican Island was washed off its pilings to drift a couple hundred meters to the northeast. Also we have recently experienced very high waters causing more flooding in Great South Bay which have raised more questions as to the role of the breach. So this report seeks to address these issues using some new aerial photographs and a re-analysis of water level data from Great South Bay and along the coast.

The first photo, Figure 1, taken on February 14, 2013, is a blow-up of the mosaic shown in the Feb. 27 report. That photo was taken shortly after the February 9-10 blizzard. Over a period of three weeks in early February, the eastern tip of the inlet's western border showed about a 50 meter retreat to the west (#1 on photo) and a large sandbar was building up on the eastern shore (#2). At the same time, the main channels into Bellport Bay passed close along Fire Island to

west and south of the Old Inlet dock to the east (#3), with some flow passing on either side of Pelican Island. Although not shown in Figure 2, the channels all led to fan-shaped regions of shallow water often less than a foot deep at low tide. A bathymetric survey of the breach area on February 22, a week after the photo, indicated that there was a narrow channel about 7 m deep just off the tip of the western shore where the currents were the highest. At the northern and southern ends of the inlet, the water depths were between 2 and 3 m as the currents spread out and slowed down.

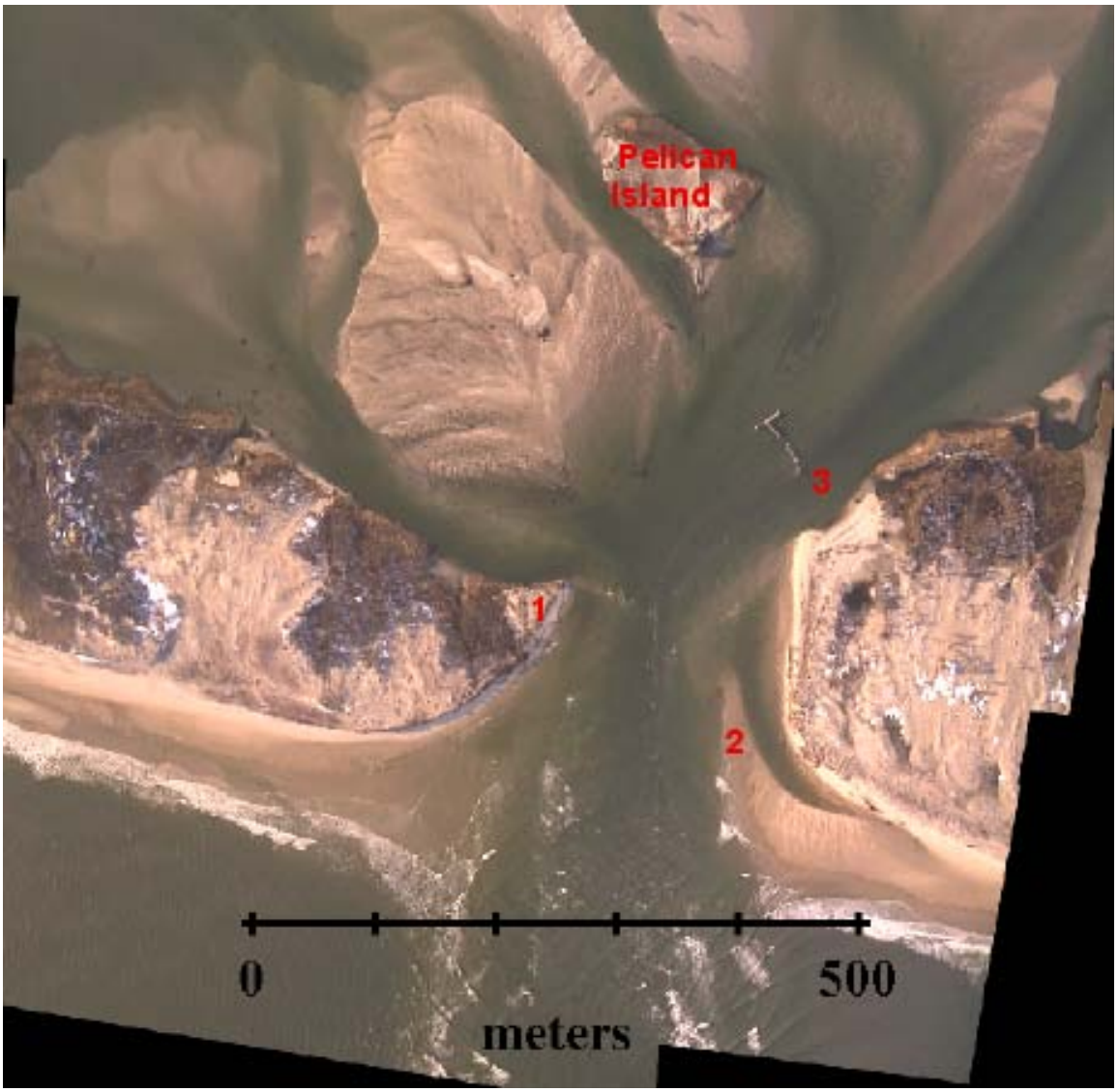

Figure 2, Photo mosaic from February 14 taken by C. Flagg and R.Giannotti.

Between the time that the photo in Figure 2 was taken and March 10 when we took another set of aerial photos, Figure 3, there was a 2 day period of strong northwest winds and two nor'easters,

Figure 4. It was during the nor'easter on the 27th that the Pelican Island house was carried from its pilings. The new position of the house is shown in Figure 3 just north of Pelican Island. The water levels at Bellport on the 27th do not seem to have been all that extraordinary compared to some of the high water periods we have had this winter. Examination of the recent photo in Figure 3 shows that a channel into the Bay now passes through the location where the house had been standing. So it appears that the water was sufficiently high to lift the house up during a flood tide which then carried it eastward against the winds.

Figure 3 of March 10 shows important changes in the back bay area. The western shore has retreated another 50m or so west (#1) while the large sand bar (#2) along the eastern shore visible in the February 14 image, has grown larger. If the bar remains in the inlet and attaches to the eastern shore, it would significantly narrow the channel. The bar and runnel that is visible along the eastern edge of the inlet (#3) extended almost all the way to Smith Point while a similar feature extended along the shore to the west. Between March 7 and 10, Great South Bay and the area of the inlet experienced a ~3.5 day period of unusually high water that averaged nearly 2 ft above normal. (Reasons why are discussed below.) During this high water period, a photo taken on March 9 by Newsday showed that all the back bay islands visible in Figures 2 and 3 were covered by water. The high water makes it possible for a large redistribution of the sands throughout the area. As a result, while the western channel is still visible, its entrance is nearly blocked by a new sand bar (#4). This area has cleared itself before so the longevity of that bar is uncertain. The prominent sand island between the west channel and Pelican Island in Figure 2 has been cut in two (#5), while the channel to the west of Pelican Island has widened (#6). The main eastern channel which had run through and to the south of the Old Inlet dock (#7) appears to have shrunk with a sand island under and northeast of the dock. The main channel to the east now appears to be the one through the old site of the Pelican Island house.

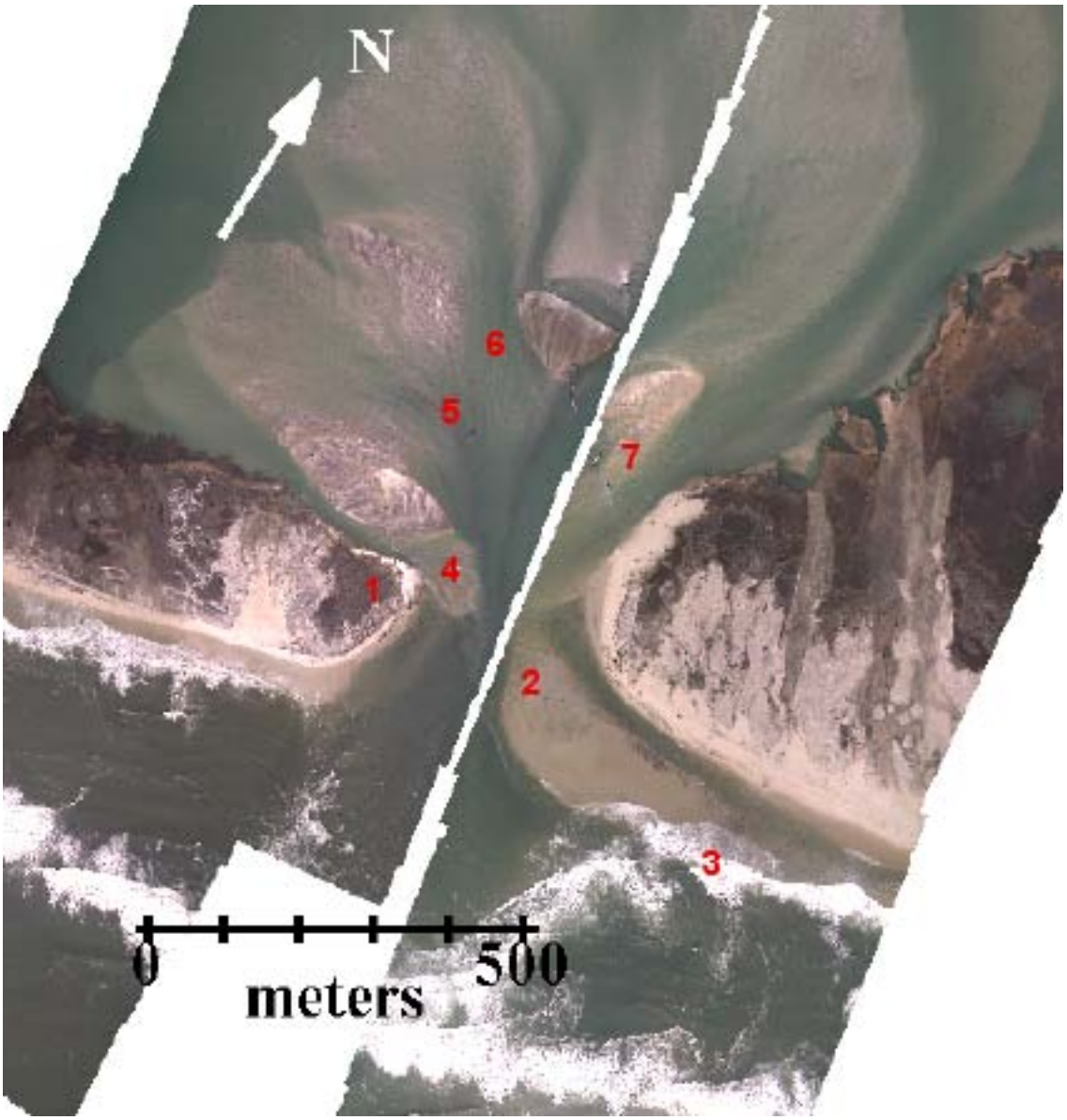

Figure 3, Photo mosaic of the inlet taken on March 10, 2013 by C. Flagg and R. Giannotti. Two photo moasics were joined to make this picture so there might be small spatial discrepancies.

March 15,2013

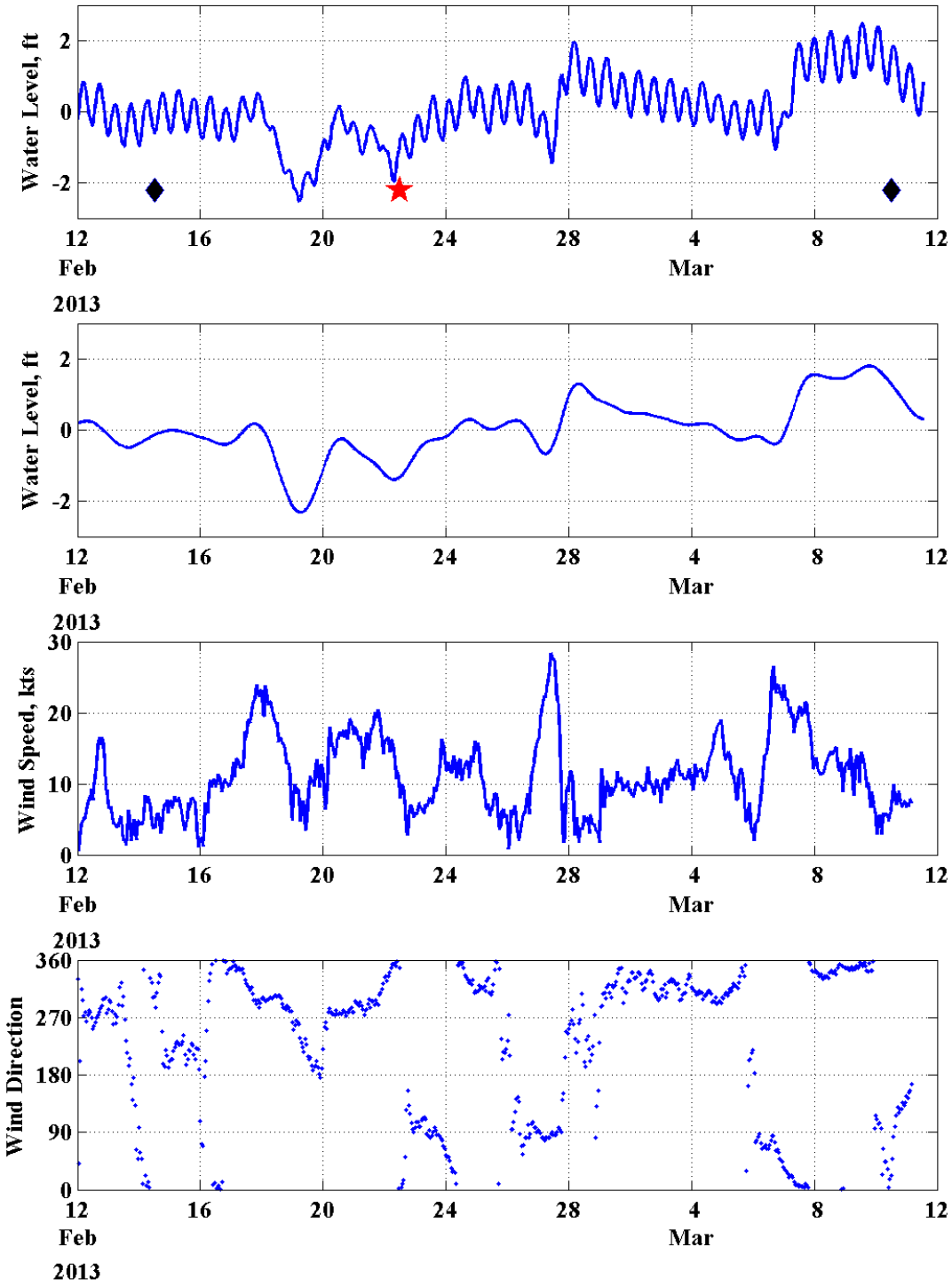

Figure 4, Time series plot of Bellport water levels and winds from the GSB1 buoy south of Sayville. The second panel shows the water levels with the tides removed. The red star indicates the time of a bathymetric survey and the black diamonds show the times of the aerial photos.

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One feature of this winter has been the unusually large water level fluctuations which have gone up and down more than 2 ft in some instances. Two of these periods are evident in the Bellport record in Figure 4, one on February 18th when water levels were more than 2 ft below normal and then March 7 - 10 when the water levels were nearly 2 ft above normal. Both of these events were tied to strong winds, the first during a two day period of strong west winds while the second occurred after a moderately strong nor'easter. The changes in water level that we have seen agree with what we know about the coastal ocean's response to wind events. When the winds blow along the coast toward the east, the ocean waters are transported offshore causing a drop in sea level along the coast. Conversely, when the winds blow toward the west, the ocean waters are transported shoreward and sea levels along the coast rise. To diagnose this further, we have looked at the sea level record from Bellport over the past four years for which we have data, Figure 5. The record from the eastern bay at Bellport – directly across from the breach - suggests that water fluctuations this year are about the same order as those seen in the winter of 2009-2010 but much greater than those seen in the past two years.

So the inevitable question is: Are the unusual water level fluctuations that we have seen this year the result of the breach in Fire Island? To answer that question, we looked at the water level records from the eastern and western ends of Great South Bay and also along a large part of the open coast. One result is shown in Figure 6 that shows the de-tided water level records from Bellport, Lindenhurst and Woods Hole, MA. Woods Hole represents a completely different coastal region from that of our locale. The first thing to note is that the records from all three sites are very similar. Atlantic City and Chesapeake Bay Bridge records look similar but would clutter the plot. Sometimes Bellport gets more water than Lindenhurst and sometimes the opposite happens as a result of local winds. When ocean levels go up or down and stay there for 12 to 24 hours, the inlets regardless of their number, size or condition raise or lower the Bay waters to match the ocean. And that is what happened during the March 7 – 10 period when flooding occurred in the eastern and western ends of the Bay. Thus, these large water level excursions we have been seeing span a distance of nearly 1000 km along the east coast and clearly are not a result of the new inlet.

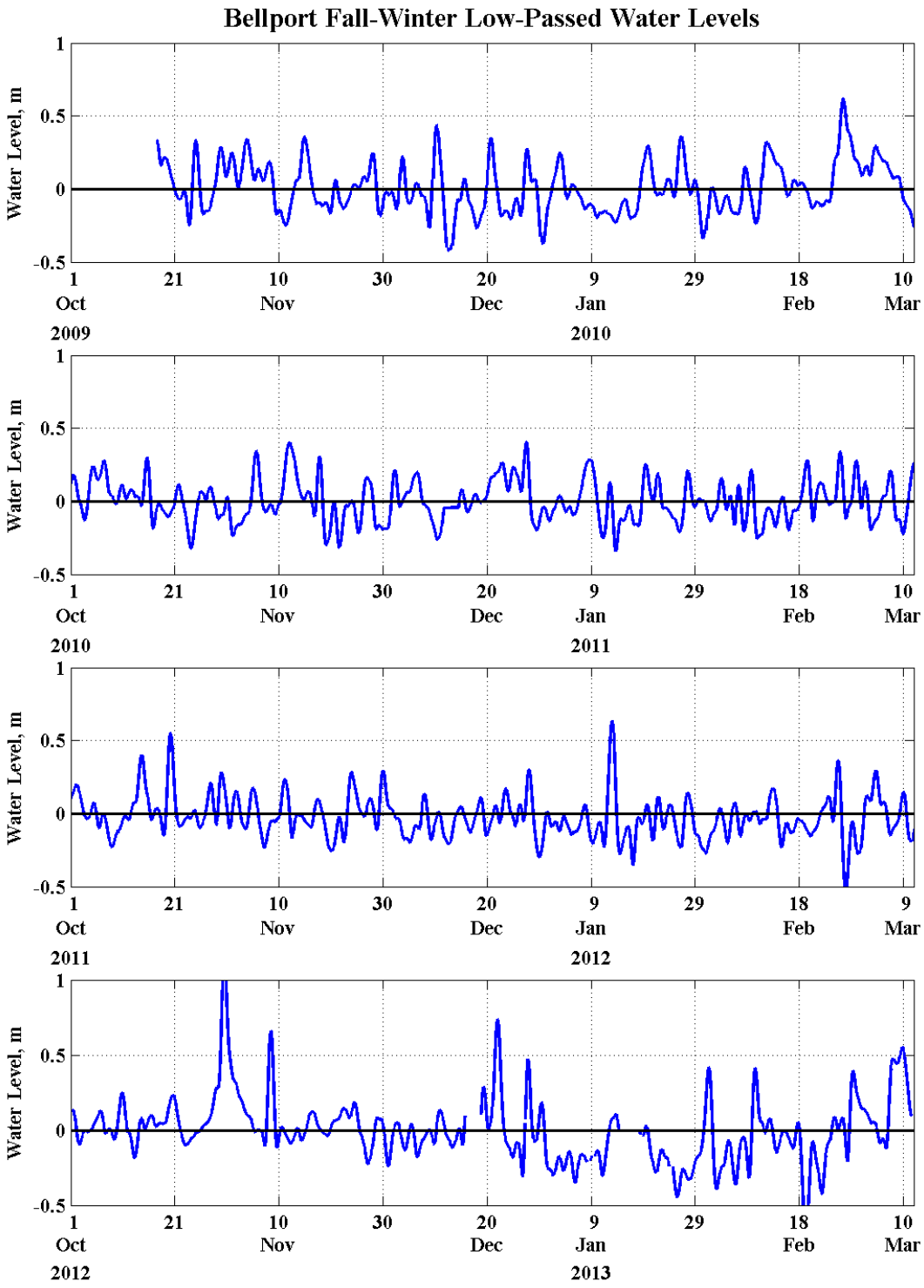

Figure 5, Fall-winter de-tided water levels for the past 4 years at Bellport.

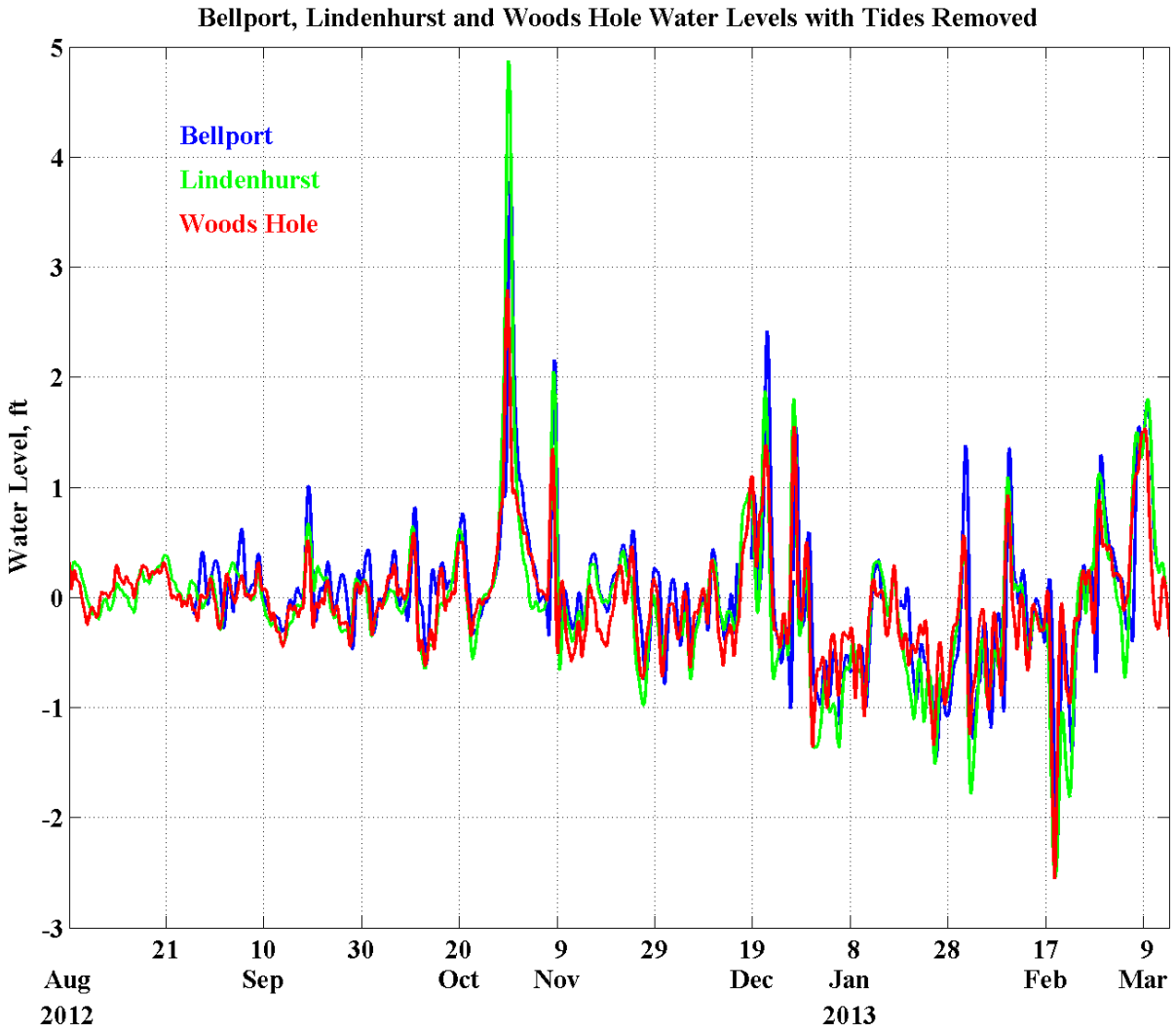

Figure 6, Times series of water levels from Bellport, Lindenhurst and Woods Hole, MA with the tides removed showing the high degree of similarity along ~300 km of coastline and within Great South Bay.

The last issue we need to address is whether the new inlet is impacting the tides in the Bay. Tides are the rise and fall of water levels due to the combined effects of the sun and moon, modified by local topography. They are largely independent of the wind-forced changes in sea level. We have already documented in previous reports that there have not been major alterations since Sandy in the main tidal constituents at Bellport, Tanner Park, Fire Island Coast Guard base or Barrett Beach. As one more demonstration of that, Figure 7 shows pieces of the tidal records from Bellport and Lindenhurst from before and after the breach was formed. These plots have had the low frequency water level variations from Figure 6 removed so as to focus on the tides alone. As one can see, there has not been an appreciable change in the Lindenhurst record as

compared to the Bellport record from before and after Sandy. So despite fears to the contrary, the breach at Old Inlet is not responsible for the increased frequency of flooding in the western or eastern Great South Bay.

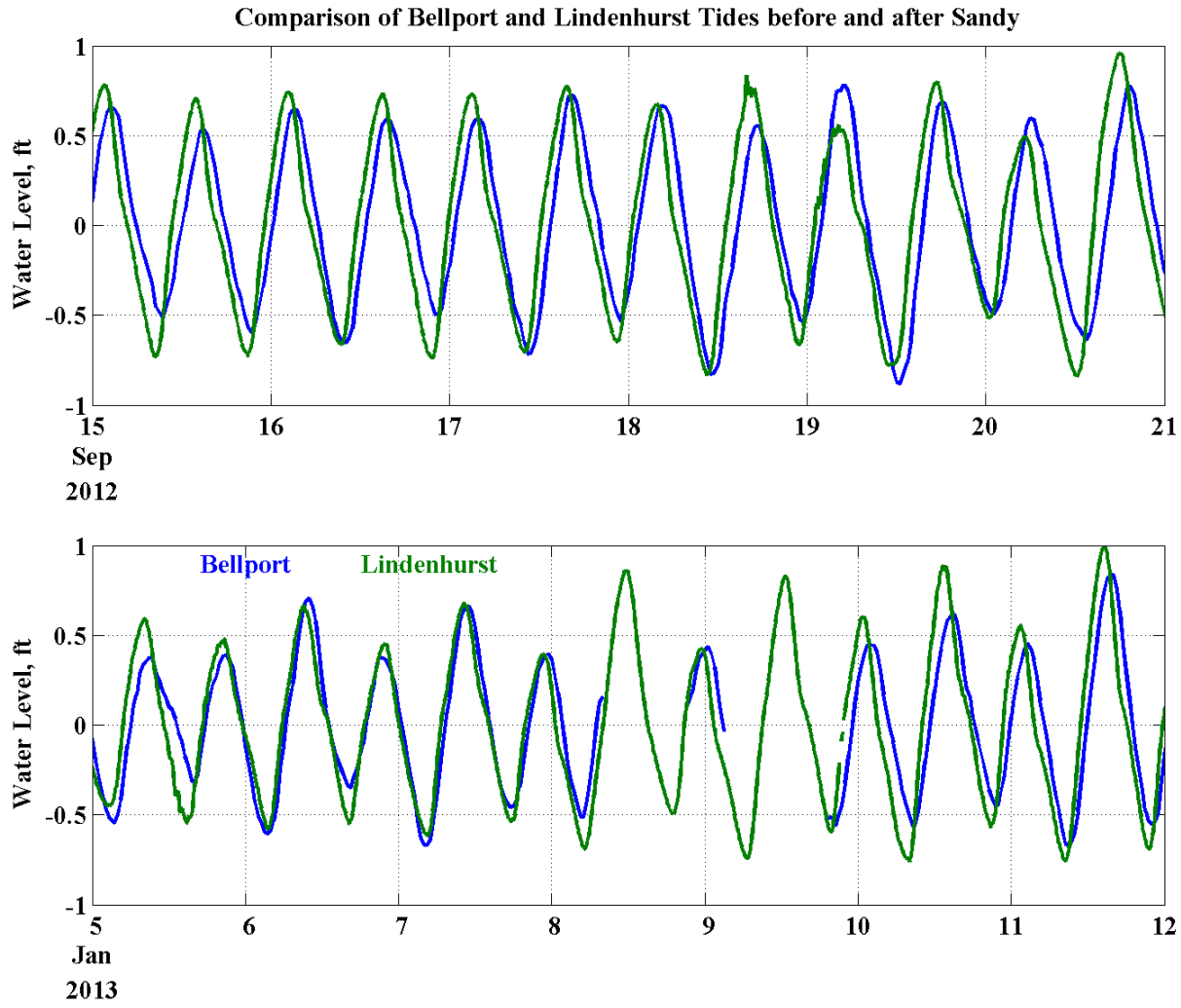

Figure 7, Comparison plot of the tides at Bellport and Lindenhurst before and after hurricane Sandy. The low frequency variability from Figure 6 has been removed.

To summarize, the aerial photo record shows that the inlet and back bay continue to evolve with the inlet migrating westward in fits and starts, while the sensors deployed in Great South Bay show that the breach at Old Inlet has not made any appreciable alteration in either the tides or water levels.