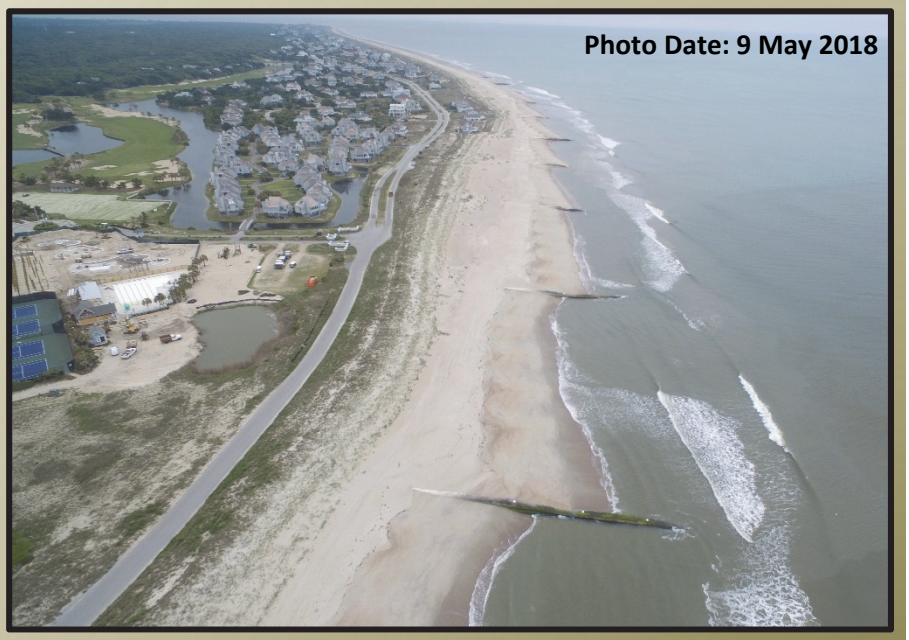
Bald Head Island, N.C.

Beach Monitoring Program

Monitoring Report No. 16 (May 2017 to May 2018)

Prepared for:
Village of Bald Head Island

Prepared by:
Olsen Associates, Inc.
2618 Herschel Street
Jacksonville, FL 32204
(904) 387-6114
(Fax) 384-7368
olsen-associates.com
C-1468



July 2018

olsen
associates, inc.

BALD HEAD ISLAND, N.C.
Beach Monitoring Program
Report No. 16
(May 2017 – May 2018)

EXECUTIVE SUMMARY

The most recent Wilmington Harbor Inner Ocean Bar maintenance dredging of Bald Head Shoal Channel Reach 2, and the Smith Island Channel segment is scheduled to be initiated in the summer months of May/June 2018. Approximately 1.15 Mcy of sand excavated during that operation will be placed at Oak Island pursuant to the terms of the Wilmington Harbor Sand Management Plan (WHSMP). The Contractor selected by the Wilmington District, USACOE is Weeks Marine, Inc. The Base Contract cost is $14.1 M.

Subsequent to federal beach disposal on Oak Island in the summer of 2018, Bald Head Island will be the recipient of the next two *future* beach disposal operations in accordance with the continued implementation of a present day WHSMP. Prior to that time (the next disposal is *estimated* to be spring of 2021) the need to offset annual erosional losses at South Beach on Bald Head Island, as well as to maintain the updrift fillet of the terminal groin constructed in 2015, have necessitated that the Village design and permit a 1 Mcy *interim* beach fill project. The latter will be constructed between November 1, 2018 and April 1, 2019. Bids are tentatively set to be received on 18 July 2018. The project borrow site will be Jay Bird Shoals.

By about 2013, the results of a comprehensive annual beach monitoring program initiated in 2000 by the Village of Bald Head Island yielded the conclusion that sand placement alone could *not* successfully offset navigation channel impacts to the west end of South Beach which have been typically manifest in chronic rates of erosion and a consistent northerly recession of the shorefront. Accordingly, the Village was ultimately forced to "change the existing dynamic" by constructing a single terminal groin designed to complement the placement of beach fill at the persistent South Beach erosional "hot spot". The project was permitted to be constructed in two phases – with Phase 2 being optional. Simplistically, the structure was designed to serve as a "template" for fill material placed eastward thereof on South Beach. The Phase 1 1,300 ft. long terminal groin (completed in Nov. 2015), was designed however as a "leaky" structure (*i.e.* semi-permeable) so as to provide for some level of continued sand transport to West Beach and portions of the Point (located both westward and northward of the groin stem). Through May 2018, terminal groin project performance – based upon monitoring – has been both as intended – and as predicted.

To that end, the most recent beach monitoring surveys performed in 2017/18, indicate that the terminal groin's updrift fillet contains approximately 250,000 cy. Without the structure, the significantly improved shoreline at this location resulting from federal beach disposal completed in April 2015 would have normally eroded back to the dune line with the residual sand fillet volume lost to the Cape Fear River channel. Interestingly, federal channel condition surveys performed by the USACOE in the spring prior to the summer of 2018 maintenance project indicated that no maintenance dredging was required this year in Bald Head Reach 1 – the section of channel immediately adjacent to the terminal groin. Until recently, this section of navigation channel had experienced chronic shoaling resulting from littoral material derived from South Beach – and in particular beach fill material episodically placed by the Wilmington District, USACOE since 2000, or by the Village itself.

Between November 2000 and April 2015, Bald Head Island had received about 7.0 Mcy, mol of sand from the initial widening/deepening and four (4) subsequent maintenance dredging operations for the Wilmington Harbor Navigation Project entrance channel. In addition, the Village has placed another 2.1Mcy along the West Beach and South Beach shorelines. Accordingly, in the net Bald Head Island has experienced a total estimated sand placement volume of approximately 9.1Mcy since 2000 at those two locations – with South Beach receiving some 75-80% of the total.

Conversely, the *gross* volumetric sediment *loss* over the November 2000 to May 2018 monitoring timeframe is conservatively computed at – 6,781,500 cy, or approximately – 387,500 cy per year – on "average". This "loss" addresses the continuous section of Bald Head Island shorefront extending from the marina entrance to the Cape Fear spit. The assignment of an *average annual* long-term rate of sand loss at Bald Head Island however, has *not* necessarily been a meaningful indicator of navigation project impact. Such an average rate is often temporally biased by periods of beach fill equilibration, groinfield "effectiveness," major storm events (such as Hurricane Matthew), the occurrence of episodic destabilization dredging events in close proximity to the island, as well as other physiographic phenomena temporally affecting annualized quantities of alongshore sediment transport – from Bald Head Island. In addition, the island's littoral system is now adjusting to the quasi-stabilizing effect of the terminal groin in existence only since 2015. Along South Beach per se, there has been historically a "nodal point" some 7,000 ft. eastward of the terminal groin (approx. STA 116+00). At or close to the nodal point, the directionality of *net littoral transport* on an annual basis changes from West (toward the groin) to East (toward Cape Fear). *Note* – depending on wave climatology, the condition and exposure of the sand tube groinfield, as well as other factors, the effective location of the nodal point can vary slightly along South Beach from year to year. Currently, within the 22,755 shoreline influenced by sand placed since 2000, some 2,301,300 cy remain in the littoral system (measured above elevation -16 ft. NGVD 29).

From the May 2017 to May 2018 monitoring data, it is clear that sediment losses along the various defined sections of shorefront – this year – are substantially less on average than last year. Most noteworthy was the 2017-2018 South Beach one year loss volume (above -16 ft NGVD) of -270,500 cy compared to the 2016-2017 volumetric loss of -619,000 cy. South Beach in this instance is defined as the shorefront between STA 56+00 and STA 210+00.

Similarly, measured sand losses above the MHWL (i.e. from the beach berm only) for the same two periods were reduced from -161,900 cy (2016-17) to -46,000 cy (2017-18). Conversely, losses or gains above -16 ft. NGVD for West Beach, the Point shorefront northward of terminal groin and the Point shoreline southward of the terminal groin were very self-similar for each of the last two monitoring periods analyzed. The 2016-17 losses were to some degree indicative of a shoreline reconfiguration in response to the completion of the terminal groin in late 2015 as well as the equilibration of the 2015 federal beach disposal project.

Although not directly impacted by long-term navigation channel improvements and maintenance of the Cape Fear River entrance, the Village Council elected to initiate monitoring of the East Beach shorefront at Bald Head Island in November 2008. Since that time, it is observed that East Beach undergoes strong seasonal variations of beach width and profile volume to a large degree dependent upon storm frequency and intensity, as well as the ever-changing configuration of the Cape Fear spit. The most recent May 2018 survey data show a net shoreline accretion of approximately 56,400 cy (above elevation -16 ft NGVD) throughout the 6,000 ft East Beach shoreline lying northward of Cape Fear over the last 12 months. Between November 2008 and May 2018, the total change has been +289,000 cy.

Unfortunately, recent configurations of the Cape Fear spit deemed beneficial to East Beach have resulted in a high rate of erosion and duneline recession along the easternmost section of South Beach – directly seaward of the Shoals Club facility. For example, between 2000 and 2018, the average MHWL erosion rate at this general location has been about -13 ft/yr.

In 2017, the Village was required by Permit to perform the 7th year of monitoring for the Jay Bird Shoals borrow site utilized to construct the non-federal 1.85 Mcy beach fill sponsored by the Village in 09/10. The computed change within the monitored survey area (excavated and unexcavated) was a *net* gain of approximately 611,600 cy over the 86 month monitoring period following project construction. As noted above, the Village intends to build a 1 Mcy fill project in 2018/19 again utilizing the Jay Bird Shoal borrow site.

After the extension of the two marina entrance channel jetties in 2015, reduced shoaling within the navigation channel resulted in a corresponding reduced volume of disposal sand being place along the Row Boat Row shoreline. Although the Village had planned to continue to proactively bypass sand from the south jetty fillet (at the distal end of West Beach) to the Row Boat Row shorefront, it became clear that the existing four (4) low level groins would not be capable of providing an acceptable level of shoreline stabilization at that location – with a significant reduction in episodic sand placement.

Hence, during the last monitoring period, the Village initiated construction of two (2) detached rock breakwaters located north of the marina entrance seaward of the Row Boat Row shoreline. The original project proposed four (4) structures. To receive permission to construct during the months of the "moratorium", the Village was required to reduce the project scope. Final acceptance of the project occurred in July 2017.

The placement of breakwaters between existing groins northward of the marina entrance was intended to combine the attributes of each of the two types of stabilization structure so as to reduce the rate of sediment transport from the eroding shoreline caused principally by ferry/barge generated waves. The subject expanded shore stabilization project (detached breakwaters *and* existing groinfield) was designed to have a sand fill prior to construction. The source of the fill was the exiting Bald Head Creek borrow area. A previously permitted Bald Head Creek borrow area was dredged in early 2017 by Marcol Dredging. Some 26,000 cy were placed at Row Boat Row prior to breakwater implementation. Another 24,000 cy were placed along a portion of West Beach as beach fill.

In the spring of 2017, the Village submitted permit applications accompanied by indepth geotechnical studies and environmental analyses necessary to develop a long term (and large scale) borrow site located within Frying Pan Shoals. The purpose of such a borrow site would be to both ensure compliance with Permit conditions necessitating the maintenance of the updrift fillet associated with the 2015 terminal groin project and to provide a long-term source of beach quality material sufficient to meet future South Beach renourishment requirements. It was originally anticipated that the borrow site would be needed for limited sand placement along South Beach in 2018/19 between the terminal groin and Sta. 134+00. That conclusion resulted from the scheduled hiatus in the disposal of channel maintenance sand on Bald Head Island by the Wilmington District, USACOE. Pursuant to the existing tenets of the Wilmington Harbor Sand Management Plan, all beach quality channel maintenance material excavated in the summer of 2018 was to be placed at Oak Island.

In June 2017, the National Marine Fisheries Service (NMFS) issued concerns related to the near term use of the Frying Pan Shoals (FPS) borrow site *without first exploring and*

exhausting other viable sand-source alternatives. Realistically, the only alternate borrow area available for near term sand placement at Bald Head Island (BHI) was sand remaining in the previously permitted JBS borrow site. Accordingly, in consideration of the NMFS request the Village agreed to withdraw their application and to prioritize the use of the previously authorized borrow site permitted at Jay Bird Shoals (JBS) (including both the partially recovered area dredged in 2009/10 and the remaining undredged portion of the borrow site. For purposes of doing so, the Village was instructed to seek modifications to the existing terminal groin permits which had included proposals for renourishment of the shoreline bordering the terminal groin via the use of alternate sand sources – one of which included Jay Bird Shoals. With the anticipated depletion of the Jay Bird Shoals borrow site resulting from the 2018/19 renourishment project, the Village will need to consider reinitiating the permitting of a long term borrow site located within Frying Pan Shoals.

An important secondary precept of the upcoming (2018/19) beach fill project by the Village is to allow for the replacement of 6 or more sand tube groins which have become damaged over time. During renourishment, the groin field in its entirety will be covered by beach fill. This will allow a second contractor to excavate and replace various sand tube groins "in the dry". Typically, permits necessitate that all such work must be performed in non-turtle nesting months of the year. Existing permits allow for "maintenance" of the sand tube groins as long as their locations and lengths are not modified.

The Permits for construction of the terminal groin at Bald Head Island stipulate that if the permittee elects to dredge more than 250,000 cy from the Jay Bird Shoals borrow site, limited additional monitoring of the eastern end of Oak Island must be performed. At the scheduled time of the next routine island wide survey at Bald Head Island (*i.e.* November 2018), the Village will initiate the requisite monitoring at Oak Island (Caswell Beach).