



Philadelphia District: Cape May Inlet, New Jersey and Vicinity

INTRODUCTION/ISSUE: The coastal boundaries of the U.S. Army Corps of Engineers (USACE), Philadelphia District, extend from Manasquan Inlet, NJ, southward to the southern tip of Delaware (Figure 1). Within the district boundaries, there are 11 tidal inlets, five of which have federally-authorized projects (Manasquan, Barnegat, Absecon, and Cape May Inlets within New Jersey and Indian River Inlet, Delaware). Net longshore transport is generally northward north of Barnegat Inlet and southward south of Barnegat Inlet, with localized reversals adjacent to the inlets. Presently, there are seven existing federally-authorized beach-fill projects constructed within the Philadelphia District. An additional four projects are scheduled for construction within the next 2 years. Borrow area locations for these beach nourishment projects range from adjacent inlet channels and ebb shoals to nearshore and offshore features.



Figure 1. Atlantic Coast of New Jersey

Beach nourishment is a significant investment for the Philadelphia District and monitoring on an individual project and regional scale is required to insure that these beach nourishment projects are being constructed and renourished efficiently. There is a critical need to develop and implement a regional, systematic approach for monitoring, management and analysis of the numerous projects located along the District's coastline.

The Cape May, NJ, region has a wide range of projects with corresponding sand resource issues. Federal projects in the vicinity include a constructed beach-fill project from Cape May Inlet to Lower Township initiated in 1991, a constructed beach-fill project in Lower Cape May Meadows and Cape May Point initiated in February 2005, a National Shoreline Erosion Control Development and



Figure 2. Cape May Inlet and vicinity

Demonstration Program (Section 227) project at Cape May Point completed in September 2002 and a feasibility-level investigation of hurricane and storm damage reduction from Hereford Inlet to Cape May Inlet (Figure 2). Communities included in the feasibility study include North Wildwood, Wildwood, Wildwood Crest and a portion of Lower Township also known as Diamond Beach. Sediment management on a regional scale would benefit not only the Cape May beach-fill project, but all communities and agencies involved in the vicinity. Coordination with stakeholders and project partners is a major goal and key component of this demonstration project and the potential for future sand bypassing efforts.

RSM DEMONSTRATION PROJECT GOALS: As part of the National Regional Sediment Management Demonstration Program and the Cape May Inlet to Lower Township Federal Beach Nourishment Project, the Philadelphia District has investigated coastal processes and sand bypassing alternatives in the vicinity of Cape May Inlet, NJ. The primary goal of this demonstration project is the identification and documentation of an environmentally, economically, and technically feasible method of borrowing sand from updrift of the Cape May Inlet jetties and/or Wildwood beaches for use in future nourishment cycles of the Cape May Inlet to Lower Township project. The borrow area has been depleted of adequate material, and a critical need exists to find a new source of sediment. The RSM demonstration project was initiated to evaluate the region and identify a range of alternate sources and bypassing options for the approximate 150,000 cu yd/year needed to renourish the Cape May project.

Additionally, the concepts of utilizing the small amount of maintenance material dredged annually from Cape May Inlet and dredging Cape May Inlet deeper than the authorized depth were investigated as potential sources of beach-fill material.

SUMMARY

Cape May Inlet to Lower Township, NJ Beach Nourishment Project.

Beaches immediately east and west of Cape May Inlet experience problems related to an excess and a deficit of sediment supply, respectively. Since the jetties were completed in 1911, much of the net southwestward littoral drift has been impounded upcoast of the northeast jetty or diverted offshore. The result of this interruption of the natural flow of sediment has been accretion updrift and



Figure 3. Cape May Inlet

erosion downcoast of the inlet (Figure 3). Long-term erosion left the downdrift communities with little or no protective beach, and thus endangered many hotels, small businesses, prominent homes, and the U. S. Coast Guard Training Center. Subsequently, the Cape May Inlet to Lower Township, NJ Federal beach nourishment project was authorized and initially constructed in 1991. The cost-share partners for this project are the U.S. Coast Guard, the New Jersey Department of Environmental Protection, and the city of Cape May. The beach-fill project extends from the west jetty of Cape May Inlet through the U.S. Coast Guard Training Center to the Third Ave groin in the city of Cape May. The majority of the beach nourishment material has been placed in the USCG Training Center area. This area is intended to act as a feeder beach where sand is stored and then transported over time to Cape May City by natural littoral processes. To date, the project has successfully restored the beaches of Cape May City and greatly reduced the potential for future storm damages and maintenance of the seawall.

Sediment for initial construction and subsequent nourishments of this project has been obtained every 2 years from an offshore borrow site, but that site has an insufficient reserve of material for future nourishment needs. The District is investigating alternative sources for the approximate 150,000 cu yd/year demand at Cape May City and the U.S. Coast Guard beach.

Sand Surplus Updrift of Inlet.

Properties immediately updrift of the Cape May Inlet jetties are occupied by the U.S. Coast Guard and the U.S. Fish and Wildlife Service's (USFWS) Cape May National Wildlife Refuge (Figure 4). Further to the northeast of the Wildlife Refuge are the communities of Lower Township and the Wildwoods. Contrasting the erosion on the downdrift (southwest) side of Cape May Inlet is the



Figure 4. Cape May Inlet looking north

accumulation of sediment in the fillet updrift of the jetties and accretion of the beaches in Wildwood Crest and the city of Wildwood. The sand surplus in the Wildwoods is clogging the storm-water outfall pipe system creating an unhealthy and unproductive beach habitat as well as costly maintenance responsibility for the municipalities. In addition to the water quality issues faced by these communities, beach widths and access to the ocean are often viewed as excessive by recreational beach users (Figure 5).



Figure 5. Photograph showing an example of the wide Wildwood beaches

STATUS

Cape May Inlet Sand Bypassing. A coordination meeting between environmental agencies and project partners took place in April 2002 to present the initial concepts of RSM and sand bypassing in the Cape May vicinity. This meeting was important to determine potential borrow configurations and designs as well as to identify concerns and interests of the project stakeholders.

The Philadelphia District evaluated a range of options to remove sediment from the updrift beaches for use in nourishing the beaches downdrift of Cape May Inlet. Approximately six initial alternatives were evaluated and reviewed with Project Delivery Team members, project stakeholders, dredging contractors and technical experts from the U.S. Army Engineer Research and Development Center's Coastal and Hydraulics Laboratory. Additionally, the USACE, Jacksonville District, was consulted and plans and specifications obtained for the Cape Canaveral Harbor, FL, Sand Bypassing Project which had similar goals for removing sediment from the beach face. Initial options included mechanical scraping of the Wildwood beach, transport and stockpiling of the sand in the fillet area, permanent installation of infrastructure such as a pipeline to hydraulically transport sediment from Wildwood to the updrift fillet, removal and trucking of sand to the Coast Guard feeder beach area or the updrift fillet and varied options to transport the sand from the fillet across the inlet without using a bypass plant. Due to environmental, economic and political constraints on a number of these options evaluated, the following three alternatives were selected for further development:

Alternative 1 – Fixed Sand Bypass Plant. This alternative develops and updates the concept of sand bypassing presented in USAED, Philadelphia (1987) and involves a low level of sand bypassing across Cape May Inlet on a daily basis from September through April. Since the preparation of the initial report, the Philadelphia District constructed and helps to maintain a sand bypass plant at Indian River Inlet, DE. The Cape May design is similar to the Indian River Inlet plant in size and operation since the demand for bypassing is on the same order of magnitude, but discharge lines would be buried beneath Cape May Inlet instead of crossing over a bridge. Pipelines would be emplaced under Cape May Inlet from the vicinity of the east jetty fillet (the bypassing sand source and bypassing pump location) to a discharge point at the USCG base on the west side of the inlet. This plan includes the construction of a new sand bypass plant including a 60-ft-long x 28-ft-wide pump house building, suction line, PVC water line, drain line, eductor supply water line and an eductor slurry discharge line. Other work includes constructing an access road, furnishing and installing pumps, diesel generators, sensor metering devices in the pump house, and installation of an eductor assembly and extension, including providing a crawler crane for the movement of the eductor. The plant and bypass operation would be located on property occupied by the U.S. Coast Guard.

Alternative 2 – Floating Dredge Plant Using Cape May Fillet Beach Borrow Area. This approach for bypassing sediment to Cape May involves periodic (i.e., once every 2 years) dredging from the east jetty fillet by means of a conventional floating hydraulic pipeline dredge. In this plan, sediment would be bypassed to Cape May less frequently and with larger quantities as compared to the continuous or low-volume transport rate associated with Alternative 1. This conceptual design recommends the use of a floating dredge plant, similar to the one used at Cape

Canaveral Harbor, to remove approximately 300,000 cu yd every 2 years from the borrow area located at the fillet beach on U.S. Coast Guard property updrift of Cape May Inlet.

Alternative 3 – Floating Dredged Plant Using Wildwood Beach Borrow Area. This alternative will also use a floating dredge plant, similar to the one used at Cape Canaveral Harbor to remove approximately 300,000 cu yd every 2 years. The difference from Alternative 2 is that the borrow area is located just offshore of the Wildwood and/or Wildwood Crest beaches and sand transport to Cape May is required over a much greater distance. This alternative is the least intrusive option relative to the fillet area near the Cape May National Wildlife Refuge. The exact location and dimensions of the Wildwood borrow area is still to be determined, but an estimate of the borrow area size needed for the quantity required is shown. Additionally, a supplemental plan may be developed that would use nonstandard dredging operations to mine sand from the beach and allow for prioritized and localized removal of sediment at approximately 20 to 25 storm water outfalls that presently cross the approximately 5 miles of beach east of Cape May Inlet. This mechanical and localized removal of sand at the outfalls has not yet been coordinated with local stakeholders and is not included in the overall costs for this alternative. This alternative would also allow for the design to be further developed to backpass material to the beaches of North Wildwood.

An initial economic analysis was completed for the proposed operations. Initial construction cost estimates as well as Operation and Maintenance and monitoring costs incurred over the remaining 35-year life of the Cape May City beach-fill project were developed for the three alternatives described. A summary paper entitled “Three Conceptual Designs and Cost Estimates for Bypassing Alternatives at Cape May Inlet, New Jersey” was prepared and is available through the Philadelphia District.

Investigation of Cape May Inlet as a Borrow Source and Improved RSM Practice.

Vibracore data were collected in Cape May Inlet to determine the quality of material available and the potential to dredge the inlet channel deeper than authorized depth for purposes of obtaining borrow material. The vibracore data showed that the material is of poor quality and subsequently the inlet has been eliminated as a significant sand source for the adjacent beach-fill project. This decision point was considered to be critical prior to further investigating the more costly alternative of sand bypassing.

At least annually, a small amount of beach quality sand accumulates in a shoal within Cape May Inlet, impeding navigation. The Philadelphia District’s Operations Division has typically removed the shoal by sidecast dredging within the inlet. In April 2005, maintenance dredging was accomplished using the Currituck to remove the inlet shoal. The material was then taken out of Cape May Inlet and placed as close to shore as possible in the Coast Guard feeder beach area. Although the amount of sand is very small and an alternate source is still needed for the beach fill, this is an improved RSM practice over sidecasting the material back into the inlet.

Stakeholder Coordination. This RSM initiative involved a significant number of instrumental project stakeholders including the: U.S. Coast Guard, U.S. Fish and Wildlife, U.S. Department of Agriculture, New Jersey Department of Environmental Protection (Engineering and Construction, Fish and Wildlife, and Land Use Regulation and Policy Divisions), New

Jersey Geological Survey and the communities of North Wildwood, Wildwood, Wildwood Crest, Lower Township, and Cape May. An initial meeting was held with the stakeholders to discuss the general concepts and potential options for borrow sources and bypassing operations. Subsequent meetings and field trips were held with individual stakeholders to address concerns and promote ideas that would potentially lead to acceptable sediment management alternatives (Figure 6). This was and will continue to be a significant challenge from an RSM perspective in that the alternative sources and methods must be acceptable to all project stakeholders and satisfy a large number of economic, environmental and technical requirements.



Figure 6. Field trip to Indian River Inlet, DE, sand bypass plant with project stakeholders

Future Work. The three conceptual designs described will be further coordinated with the U.S. Coast Guard and other project stakeholders and developed as necessary by leveraging funds with the Cape May Inlet to Lower Township beach-fill project and the Hereford to Cape May Inlet Feasibility Study. The technical and environmental feasibility of Alternative 2, Use of a Hydraulic Dredge in the Cape May Fillet Beach Borrow Area, will be further developed in FY05. The goal is to use Alternative 2 as the borrow method for the FY06 Cape May Inlet to Lower Township renourishment, monitor the infilling rate of the fillet and then based on those results, evaluate the use of a more permanent sand bypass plant for future renourishments. Additionally, the Hereford Inlet to Cape May Inlet Feasibility Study will further investigate excess sediment concerns in the Wildwood communities and potential future RSM actions.

LESSONS LEARNED: Benefits of the three alternatives include providing cost-effective nourishment for Cape May City and the USCG training area with an ample quantity for the remaining life of the project, providing high quality beach sand as an alternative to depleted and finite offshore borrow areas, minimizing environmental impacts to offshore sites, obtaining multiple uses of sediment already in littoral system, and reduced sediment surplus at Wildwood alleviating clogged outfalls, safety issues from ponding of water, and lengthy ocean access by beach users. Additionally, the management of sand resources on a regional scale has developed important stakeholder relationships and will benefit the USACE, Cape May and Wildwood communities, and other resource agencies involved with this study area. This demonstration project will also benefit others involved with RSM by providing a model for other communities to develop sediment management plans, developing the innovative technology of sand bypassing, providing sample procedures for other communities to contract for similar dredging services and to identify local equipment needs and methods of purchase, and providing a framework for intercommunity loan of sediment moving equipment.

From the initial cost estimates for the three alternatives, it appears that the fixed sand bypass plant (Alternative 1) has the lowest total cost over the approximately 35 years of project life remaining for the Cape May Inlet to Lower Township beach-fill project. Although the lowest cost might be the preferred selection criteria, other issues such as the long-term effect on the environment must also be taken into account. Findings from this study and these conceptual designs will be presented and coordinated with District management, project stakeholders, and resource agencies to develop improvements and determine any impediments to the further pursuit of these sand-bypassing alternatives. Coordination and partnership with state, local, and other Federal agencies are imperative for accomplishment of this RSM effort and are continuing.

OTHER RSM ACTIVITIES: The Philadelphia District has been able to accomplish numerous RSM activities and start to bring RSM into standard business practice by leveraging several activities and funding sources. Efforts coordinated include the National RSM Demonstration Program, the New Jersey Alternative Long-Term Nourishment Feasibility Study, the Philadelphia District Coastal Project Monitoring Program, and development of the North Atlantic Division and Philadelphia District RSM Team.

Other Philadelphia District investigations and products included in the RSM demonstration program include the following:

Tech Note: Rapidly Deployed Survey Vehicle Shoreline Data Collection and Analysis. The Rapidly Deployed Survey Vehicle was developed by the Philadelphia District to conduct regional shoreline surveys along the Atlantic coasts of New Jersey and Delaware. The system also provides the District with the capability of conducting rapid pre- and poststorm shoreline and profile surveys of multiple Federal beach nourishment projects, within hours of a storm. Data from the system can be processed by the survey crew and fed back to engineers in the office within a day to allow quick assessment and provide accurate information for project design, operations, and management. This system has generated interest from other survey groups within industry and Corps-wide. A technical note entitled “A Rapidly Deployed System for Use Regional Shoreline Surveys” by R.A. Wise and J. V. Scolari is available through the Philadelphia District.

Incorporating Regional Sediment Management into Beach-Fill Construction Practices. The Philadelphia District coordinated and implemented more efficient sand management practices during FY04 construction of the fourth renourishment project at Ocean City, NJ, and initial construction of the Absecon Island project. These efforts included coordination and communication with project stakeholders for more efficient sand placement, modification of dredging locations that better met the needs of local mariners, modification of dune locations to accommodate local businesses and walkovers, tapering of the project relative to corporate boundaries, dredging concerns within the borrow area, adjustment of the placed sand relative to outfall construction, and accommodation of manholes, utilities and other infrastructure relative to an active boardwalk environment.

Due to the high visibility of these projects, good opportunities existed to demonstrate the benefits of RSM within the Philadelphia District and to our project sponsors and stakeholders including the local public. During past beach-fill construction efforts, problems were dealt with as they

arose on a case-by-case basis. In a relatively short period of time, an RSM approach was communicated and embraced during these efforts. Evaluating construction practices, contractual issues and stakeholder requests on a regional basis was essential during the construction of both the Ocean City and Absecon Island projects. Decisive actions by the project managers and project engineer were usually required in a short time frame as construction was ongoing. Technical practices, communication skills, and teamwork fostered through the RSM Demonstration program were critical to the ultimate success of these projects and lessons learned for future beach-fill construction projects.

A technical note will be developed by the Project Engineer (from Construction Branch) and Project Managers responsible for the construction of the fourth renourishment cycle of the Ocean City project and initial construction of the Absecon Island beach nourishment project. This document will focus on incorporating regional sediment management into beach-fill construction practices and will provide lessons learned on technical issues, accommodating stakeholders and dealing with short-term issues from a construction perspective while considering project management and contractual requirements. The technical note will provide information valuable to other USACE Districts involved with the construction of beach nourishment projects.

Innovative Creation of Plover Habitat at the Cape May Wildlife Refuge: Phase I. This Phase I effort is the first of three to construct an overwash area and develop plover habitat in advance of sand bypass efforts in the Cape May Inlet updrift fillet. Property immediately updrift of the jetties is owned by the U.S. Coast Guard and is used primarily for recreation by Coast Guard personnel. The property to the north of the Coast Guard is managed by the U.S. Fish and Wildlife Service (USFWS) as a National Wildlife Refuge with strict regulations on use and public access. The area of the fillet that will be most impacted by the proposed sand bypass operation is within the Coast Guard property. Ironically, endangered piping plovers have historically nested on the Coast Guard property, but plover nesting has had only limited success within the Wildlife Refuge.

In FY04, the Philadelphia District held several meetings and conducted site visits with project stakeholders including the USFWS and the New Jersey Department of Environmental Protection (NJDEP) to discuss sand bypassing alternatives. Subsequent discussions led to the concept of providing early mitigation by creating new, high-quality plover habitat at the National Wildlife Refuge to offset potential impacts on beach nesting bird habitat and food resources related to sand bypassing operations in the vicinity of Cape May Inlet. Early construction of the habitat area would have the benefit of making the habitat available to plovers at the Wildlife Refuge prior to any construction activities at Cape May Inlet, thereby ensuring that there will be no net loss of plover habitat at the sand bypass site. In addition, if success is not immediate, time remains to modify the bypass project design and make it more environmentally acceptable relative to impacts on bird habitat adjacent to the inlet. By constructing the habitat area prior to project implementation and attempting to minimize impacts to the natural environment, the Philadelphia District would be best managing the resources available and addressing the requirements and concerns of all stakeholders and environmental resource agencies involved early on in the process.

The Ocean City, MD, and Fenwick Island, DE, Beach Nourishment Projects: An Opportunity for Regional Sediment Management Across District Boundaries. A unique opportunity exists to begin regional business practices and collaborate on two adjoining beach nourishment projects: Fenwick, Island, DE, located at the southernmost boundary of the Philadelphia District and Ocean City, MD, located at the northernmost boundary of the adjacent Baltimore District .

There has been some coordination between the Philadelphia and Baltimore Districts; however, additional efforts are necessary to bring together the two Project Delivery Teams and implement a regional approach for analyzing the performance and operating the two projects. In FY05, a 1-day workshop for all those involved with the Fenwick and Ocean City projects will be held to kickoff the partnership efforts. The workshop will focus on improving communication, strategizing ways to leverage efforts on both a project management and technical basis, and brainstorming RSM opportunities relative to the two projects and districts. Primary issues to be addressed will include monitoring data collection programs, borrow area concerns, sediment budget analyses, environmental resources coordination, nourishment cycles and leveraging contracts and funds.

Following the workshop, a technical note will be developed summarizing coordination efforts and providing recommendations on how to make both projects more efficient in a regional context. This document will discuss experiences to date and the potential for partnering relative to technical issues, regional monitoring opportunities, possibilities for leveraging project efforts from funding and contractual perspectives, and future action items to continue project coordination. The technical note will also provide information valuable to other USACE Districts involved with the construction of beach nourishment projects and regional sediment management.

KEY WORDS: Beach fill, jetties, erosion, sand bypassing, innovative

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