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Kirk F. Bosma, M.C.E., B.S., P.E.

Senior Coastal Engineer

EXPERTISE

Kirk F. Bosma, PE, is a Senior Coastal Engineer and Team Leader of the Coastal Sciences, Engineering & Planning team at Woods Hole Group. He manages projects and develops engineering solutions related to coastal structure design, beach nourishment, beach management, inlet stabilization, water quality, environmental permitting, impacts of offshore dredging, marsh restoration, climate change planning, and wave, tide, and current data collection. He holds expertise in habitat restoration, shoreline protection, and climate change planning projects for a diverse client base and specializes in applying numerical models to optimize engineering designs and reduce overall project life cycle costs. Has developed and applied the latest data and numerical methods toward capturing current and future flooding risk for climate change vulnerability assessments. Development of comprehensive coastal flood risk assessments that incorporate storm surge risk coupled with increased precipitation and sea level rise. Developed gray, green, and hybrid coastal engineering adaptations for fostering urban and rural resiliency in a cost-effective approach. Has been the project manager for both large coastal restoration and marsh restoration projects that have included evaluation of a variety of restoration alternatives and included the implementation of a comprehensive data collection and physical processes modeling programs.

QUALIFICATION SUMMARY

- More than 20 years of diverse professional experience in the fields of coastal sciences and engineering, specializing in the areas of project management, numerical modeling, marsh restoration, sea level rise and extreme storms, climate change adaptations, sediment transport, and littoral processes
- Leader in coastal flooding risk under a changing climate, including development of storm climatology for probabilistic flooding risk
- Implemented technically advanced storm assessments under a changing climate; sea level rise and extreme storm numerical modeling techniques to assess climate change adaptations
- Managed multi-disciplinary coastal and marine projects requiring team management, scientific analysis, environmental sensitivity, diverse coordination, and cost-effective solutions
- Developed various hydrodynamic and hydraulic models for water quality assessment, marsh restoration projects, discharge and mixing design, bridge scour, dredging impacts, and contaminated sediment fate and transport
- Numerical model experience with FVCOM, REF/DIF S, SWAN, STWAVE, ACES, BOUSS2D, GENESIS, RMA-Series, MIKE 21, CMS-Flow/Wave, EFDC, SED-2D CGWAVE, , CORMIX, WAVAD, XBEACH, ADCIRC and EDUNE

Education

1996– M.C.E.
Civil Engineering
University of Delaware
1994 – B.S.
Civil Engineering
Calvin College

Licenses and Registrations

P.E., Professional Engineer, Massachusetts License #45849

Professional Affiliations

- Member, Association of Coastal Engineers (ACE)
- Member, Coasts, Oceans, Ports, and Rivers Institute (COPRI)
- Associate Member, American Society of Civil Engineers (ASCE)

Publications & Presentations

32

Work Experience

2001-Present Coastal Engineer/Team Leader, Woods Hole Group

1997-2001 Coastal Engineer, Woods Hole Group

1994-1996 University of Delaware (Teaching and Research Asst.)

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KEY PROJECTS

MassDOT – FHWA Pilot Project for Climate Change and Extreme Weather Vulnerability Assessments and Adaptation Options of the Central Artery, Massachusetts Department of Transportation – Project Manager/Coastal Engineer and Modeler

Was a key project member on a technically advanced, leading-edge pilot project for the Federal Highway Administration evaluating the vulnerability to sea level rise and extreme weather events for the Central Artery in Boston, MA. The project combines a vulnerability assessment by conducting a new systems-level assessment and evaluated adaptation options to reduce risk to specific assets. The project also is geared towards integrating climate change vulnerability into MassDOT and FHWA overall practices. A highly resolved, numerical processes model was developed to assess the combined impact of sea level rise, storm events (tropical and extra-tropical), winds, tides, and waves. Results from the model were used to assess risk for various assets throughout the City of Boston, and subsequently investigate adaption options to reduce the identified vulnerabilities and to establish an emergency response plan for tunnel protection and/or shutdown. The investigation also included a cost benefit analysis, which helped MassDOT select the most efficient method of protecting valuable existing assets against today's weather events and future climate impacts. Climate scenarios and combined storm surge and sea level rise were developed for current day, as well as 2070 and 2100.

Coastal Climate Change Adaption and Engineering Alternatives East Boston, Massachusetts, The Boston Harbor Association – Project Manager/Coastal Engineer

Developed a range of engineering adaptation alternatives in response to potential sea level rise scenarios. The alternatives ranged from management approaches (e.g., evacuation, flood-proofing of structures, etc.), to soft-engineering options (e.g., beach nourishment, creation of wetlands, etc.). For each location, conceptual designs and associated cost estimates were developed and compared to the potential cost incurred by flooding and storm damages to the location without protective measures over a given time horizon.

Saco River and Camp Ellis Beach Section 111 Project, Saco, ME, U.S. Army Corps of Engineers – Project Manager/Coastal Engineer

Managed, coordinated, and conducted a comprehensive field data collection and numerical modeling scope of work for the Saco River and Saco Bay region. The field data collection effort consisted of a 2.5 month wave, current, and tidal observation deployment using two strategically located wave Acoustic Depth Current Profiler (ADCP) systems, a high resolution near shore bathymetric survey, and a ADCP current survey of the river hydrodynamics. The coastal monitoring data set is being utilized to calibrate and verify a series of state-of-the-art wave models ranging from generation scale (Atlantic Ocean), through transformation scale (regional), down to the local and near field scales. The advanced modeling effort includes spectrally based wind-generation (WAVAD), transformation (STWAVE and CGWAVE), and Boussinesq (MIKE 21BW) wave models. Model output is being used in sediment transport modeling on both a regional and local scale. The calibrated models are being used to assess a wide range of shore protection alternatives aimed at mitigating the erosion caused by federally maintained coastal structures. The project involves a high level of coordination between regulatory agencies, the federal government, State of Maine senators, US army Corps of Engineers, Town officials, and the local community.

KEY PROJECTS (CONTINUED)

Town of Palm Beach Technical Review of Proposed Coastal Management Program, Palm Beach, Florida - Coastal Engineer

Provided technical review of the proposed coastal management program assembled by the Town of Palm Beach. The primary purpose of the project was to provide Town Council objective technical recommendations regarding next steps for the Town's coastal program and specific projects. The scope of work focused on a truly unbiased analysis of the plan with a focus on the feasibility of potential recommendations while providing guidance on prioritizing funding for the recommended coastal projects. Relevant materials were reviewed, stakeholders were consulted, and supplemental technical analyses were performed to help assess the cost effectiveness of various recommendations. Throughout the review, considerations were given for both island wide approaches (e.g., inlet management, regional coastal processes, beach nourishment performance, sediment sources, coastal structures, hardbottom resources, dunes, and sea level rise planning), as well as project specific approaches. The technical evaluation also included preliminary engineering calculations of life cycle project performance for the various coastal projects within the Town. Ultimately, prioritized and phased recommendations were provided to the Town for consideration and that were intended to assist the Town in both the long- and shore-term planning of coastal management.

Hydrodynamic Characterization And Sediment Transport Potential at The Former Callahan Mine Property, Brooksville, ME, Maine Department of Transportation – Project Manager/Coastal Engineer

Managed and conducted a field data collection program, developed a numerical hydrodynamic model, and performed a sediment transport evaluation for a Superfund Site in Brooksville, ME. Goose Pond Estuary is a site of environmental concern and is classified as a Superfund site on the National Priorities List by the Environmental Protection Agency (EPA). The site is the former location of a zinc/copper open-pit mine where mining operations were conducted adjacent to and beneath the tidal estuary. When mining operations ceased, the property was flooded and it is now hydraulically influenced by the tides of Penobscot Bay, as well as a small upland stream. Phase I included the collection of field hydrodynamic data to help provide insight into the overall circulation within Goose Pond, and the exchange with Goose Cove and Penobscot Bay. Phase I also provided a basis for understanding potential transport processes between Goose Pond, Goose Cove, and Penobscot Bay. The field data collection program was also designed to provide input and calibration data for the subsequent numerical modeling tasks. Utilizing the data collected, a 3-D hydrodynamic model was implemented, calibrated, and verified to characterize the circulation within the Goose Pond Estuary system. The model was used to simulate a range of conditions, including spring and neap tidal conditions, high and low freshwater inflow conditions, as well as storm surge events within Goose Pond. Hydrodynamic model results were used to evaluate overall circulation patterns within Goose Pond under a range of environmental conditions in order to identify the water and volumetric exchange between Goose Pond and Penobscot Bay. Finally, a sediment transport model was developed to determine the fate and transport of contaminated material within the estuarine system and Penobscot Bay.

Coastal Climate Change Adaptation and Engineering Alternatives, Groton, Connecticut – Project Manager/Coastal Engineer

Worked with Battelle Ocean Sciences and the University of Southern Maine on assessing the impacts of Climate Change on coastal communities of Groton, Connecticut. Specifically, the regions of Groton Long Point and the

KEY PROJECTS (CONTINUED)

infrastructure surrounding the Mystic River were evaluated. The evaluation included the impacts of sea level rise and storm events on potential flooding. For each location, conceptual designs of engineering adaptation alternatives were developed. The alternatives ranged from management approaches (e.g., evacuation, flood-proofing of structures, etc.), to soft-engineering options (e.g., beach nourishment, creation of wetlands, etc.), to more significant hard engineering structures (e.g., modular seawalls, revetments, tide gates, hurricane barriers, etc.). The community recommended alternatives for which cost estimates were determined. Engineering adaptations and costs estimates were provided for high and low rates of projected sea level rise, coupled with various return period storm events (10-, 20-, 50-, and 100-year) projected to the year 2070.

Coastal Climate Change Adaptation and Engineering Alternatives East Boston, Massachusetts - – Project Manager/Coastal Engineer

Developed a range of engineering adaptation alternatives in response to potential sea level rise scenarios. The alternatives ranged from management approaches (e.g., evacuation, flood-proofing of structures, etc.), to soft-engineering options (e.g., beach nourishment, creation of wetlands, etc.), to more significant hard engineering structures (e.g., modular seawalls, revetments, etc.). For each location, conceptual designs and associated cost estimates were developed and compared to the potential cost incurred by flooding and storm damages to the location without protective measures over a given time horizon.

Nantasket Beach Seawall Repair and Reservation Master Plan Services, Hull, MA, Massachusetts DCR - Project Manager/Coastal Engineer

Led a project ream to assess the Nantasket Beach Reservation Property. The Reservation has been used as a recreational beach by Greater Boston residents since the 1800s and is currently owned and operated by the Massachusetts Department of Conservation and Recreation (DCR). Nantasket Beach serves as a valuable resource from both a commercial and recreational standpoint. The beach and the associated waterfront amenities serve as the defining feature for the Town of Hull and represent a significant draw for visitors and summer residents. Nantasket Beach has experienced ongoing erosion over the past 150 years, especially the public beach at the southern end of the system. Woods Hole Group conducted a detailed coastal processes study focused on determining potential alternatives to address the ongoing coastal erosion. The barrier beach system was simulated using state-of-the-art wave and sediment transport models to understand existing conditions, and assess potential alternatives. The project evaluated the performance of the existing seawall, as well as determined potential structural alternatives to enhance the beach and improve beach nourishment performance. The performance and lifetime of the beach nourishment were assessed in order to provide guidance on potential long-term solutions and future nourishment requirements.

Herring River Estuary Restoration Project, Wellfleet, MA, Town of Wellfleet – Project Manager

Currently managing a project to restore the Herring River Estuary System, which represents a significant floodplain (the largest estuary on outer Cape Cod). The restoration is geared towards developing a plan to restore up to 1,000 acres of wetland area. Coordinating and developing a complex hydrodynamic numerical model that will address numerous concerns associated with re-establishing increased tidal exchange, as well as provide the necessary information to design an appropriate system of dikes, culverts, and road crossings. The modeling program involves evaluation and selection of the best model for application to the Herring River Estuary, model set-up, calibration, and verification, and simulation of a range of alternatives and physical

KEY PROJECTS (CONTINUED)

conditions. The complex numerical modeling simulates both the hydraulics of the system and the salinity distribution throughout the estuary. The model results are used to design new engineering openings and water control structures.

Rhode Island Regional Sediment Management Study (RIRSM), U.S. Army Corps of Engineers – Project Manager/Coastal Engineer

Managed a project in support of the Regional Sediment Management (RSM) Study for the State of Rhode Island. The overall purpose of the study is to develop both local and regional sediment budgets along the coast of Rhode Island and to develop a management plan for the south coast of Rhode Island, incorporating ecosystem concerns, sediment management, and sea level rise considerations. The physical data collected as part of this program will be used to develop, calibrate, and validate a comprehensive set of hydrodynamic, wave, sediment transport, and water quality models that are intended to help guide the Rhode Island (RI) RSM Study. The field measurement program for the Rhode Island RSM Study consists of long-term (yearlong) observations of a wide variety of physical processes, including:

- Twelve real-time tide stations deployed throughout numerous coastal inlets and ponds along the RI shoreline
- three real-time wave and current profile (ADCP) stations located offshore of the RI coastline in approximately 30-35 feet of water
- meteorological station
- four in-situ horizontal current profilers observing current/sediment flux at coastal inlets
- optical backscatter observations and acoustic Doppler current profile (ADCP) surveys

Data were provided via real-time webcasting and available through a website. Data were analyzed and provided to the Corps to assist in the description of the annual conditions along the coastline and within the coastal inlets/ponds

Reverse Osmosis Concentrate Dilution Analysis and Ambient Water Characterization, Melbourne, FL, Reiss Environmental, Inc. - Project Manager and Coastal Engineer

Led a team of engineers and scientists in an evaluation of an existing Reverse Osmosis (RO) discharge. The scope of work included the collection of field data and application of a model to characterize the dilution of the existing RO discharge. The purpose of the evaluation was to assess whether a mixing zone could be permitted within the existing water quality regulations at the State and Federal level. Observations included bathymetry, a full suite of water quality constituents, and long-term, tide, current, and salinity observations. These data were used to develop a mixing zone model for constituents of concern.

Engineering Services and Environmental Impact Evaluation – Hammonasset State Park, Madison, CT, Connecticut DEP - Project Manager/Coastal Engineer

Managed and performed an engineering assessment and environmental impact study/report for Hammonasset Beach in Madison, Connecticut. Hammonasset Beach State Park contains Connecticut's largest public swimming beach and campground and is one of the region's most valued recreational and natural resources. During the winter of 2004-2005, severe storms resulted in the loss of a ¼-mile section of the beach on the western end of

KEY PROJECTS (CONTINUED)

the park and significant damage to the boardwalk. Despite ongoing stop-gap measures to address the erosion problem, the beach continues to experience significant erosion and the boardwalk and beach remain at risk. Consequently, the Connecticut Department of Environmental Protection (DEP) was concerned about the viability of the western portion of the beach and park for recreational use and was seeking to identify the most cost-effective and long-term course of action to remedy this urgent situation. Therefore, an Environmental Assessment and Impact Evaluation was conducted to study the shoreline erosion problem, identify and evaluate the feasibility of alternative solutions, evaluate the potential impacts on Hammonasset Beach and the surrounding environment, and make recommendations as to the preferred solution. The proposed project consists of three distinct, but related elements: (1) Compilation and review of existing data and studies, as well as collection of new baseline topographic, bathymetric, sediment, and wave data; (2) an engineering feasibility study to identify and analyze beach management alternatives; and (3) an Environmental Impact Evaluation (EIE) pursuant to the Connecticut Environmental Policy Act (CEPA) to further analyze alternatives, identify potential adverse impacts and any necessary mitigation, and ultimately to support the selection of a recommended course of action.

Mixing Zone Evaluation, Whiting, IN, BP Products North America - Project Manager
Performed a third party peer review of an existing mixing zone submittal, including engineering design, confirmation of the mixing zone analysis (with specific evaluation of the implementation of the modeling), determination of the physical processes, and assessment of the diffuser design. The evaluation also included site-specific ambient water current measurements at the proposed discharge location to more accurately characterize the receiving waters. The water current observations were then used to develop more representative conditions and appropriate scenarios for modeling the dispersion and mixing zone. The distribution of water current observations and the percent occurrence of each mixing ratio were used to develop a probability density function of the dispersion ratios and provide design guidance/recommendations for diffuser orientation, design, and layout.

Peer Review of the Florida Bay Hydrodynamic and Salinity Model, Florida, South Florida Water Management District – Coastal Engineer
Served as an expert peer reviewer of the hydrodynamic modeling effort for the Florida Bay and Florida Keys Feasibility Study. The model is required to simulate circulation, salinity stratification and distribution, and water quality behavior in the Florida Bay and Reef Tract utilizing a standardized set of field data. Offered expert opinions based on knowledge, expertise, and practical experience in conducting, analyzing, and applying similar hydrodynamic modeling strategies. The peer review included assessment of the grid methods and optimization techniques to determine spatial density, scale, and distribution, the adequacy of calibration and verification, and the quality and extent of the input data and model parameters.

Hydraulic Analysis of Flow Control Structures for Wetlands Restoration, Town Creek, Salisbury, MA - Project Manager and Coastal Engineer
Assessed and designed a modification to an existing embankment that served to restore marsh habitat and more efficiently alleviate flooding concerns in Salisbuty, MA. Approximately 350 acres of tidal and formerly-tidal wetlands existed upstream of an abandoned railroad embankment. Tidal exchange was prevented from entering/exiting the marsh by a wooden flap gate on the downstream side of the railroad culvert. Hired by the

KEY PROJECTS (CONTINUED)

MCZM Wetlands Restoration Program and US Fish and Wildlife, a hydraulic study and model of the Town Creek system was completed to assess potential restoration options. The hydraulic study evaluated a range of potential alternatives. The preferred culvert and tide control alternative: 1) increased the capacity of the marsh to drain during flood events; 2) provided the Town with a greater ability to preserve flood storage capacity by closing off the system prior to predicted storm events; and 3) provided the means for small, incremental increases in tidal range over an extended time period as part of a well-monitored, risk-adverse, adaptive management approach to tidal restoration.

Hydrodynamic Analysis and Engineering Design for the Restoration of the Bride Brook Estuary, Rocky Neck State Park, East Lyme, CT, Connecticut Fund for the Environment - Coastal Engineer

Evaluated and designed a restoration project for the Bride Brook Estuary system in East Lyme Connecticut. The project investigated the hydrodynamic characteristics of the Bride Brook estuarine system and evaluated potential alternatives to restore more natural conditions to a system that has been structured since the early 20th century.). Historically, Bride Brook was one of the largest anadromous fish runs the state of Connecticut. However, since the construction of twin elliptical culverts at the mouth of the estuary in 1934, alewife numbers declined. This decrease has been attributed to the reduced tidal flow and water column light caused by the 200-foot long structure, which obscures the fish passage upstream. Therefore, the primary objective of this project was to determine an engineered alternative to the existing structure that could effectively restore the tidal regime and fish passage of the Bride Brook estuary. This project is composed of three separate tasks: 1) Data Observations, 2) Analysis and Conceptual Design, and 3) Final Design and Engineering. The design to restore the system removed the existing, undersized twin culverts and replaced them with an open channel and box culvert through the dune system. The design was successfully constructed and opened in the spring of 2010.

Beach Nourishment and Inlet Stabilization at Sandwich Town Beaches and Dredging the East End of the Cape Cod Canal, Sandwich, MA, Town of Sandwich - Project Manager/Coastal Engineer

Managed and performed comprehensive beach management plan for all Town of Sandwich beaches, including evaluation of the physical processes governing sediment transport, alternatives analysis for shore protection measures and inlet stabilization, and appropriate beach maintenance and usage. The project consisted of numerical modeling of alternatives and final design for establishing a long-term beach/dune restoration plan, as well as relocation and design of a jettied tidal inlet. Required excellent communication and close coordination with numerous agencies, local officials, sub-contractors, and multiple clients. The regulatory process is currently underway.

Waquoit Bay Yacht Club Revetment Repair, Waquoit, MA, Waquoit Bay Yacht Club - Project Manager and Coastal Engineer

Assessed and designed a repair to an existing revetment protecting the Waquoit Bay Yacht Club. Significant gaps in the toe of the structure had developed allowing for removal of the finer grain sediments from the core. In this region of revetment, which is most critical, there is significant washout of the backfill of the revetment. At Waquoit Bay Yacht Club, continued cavity formation and subsequent collapse of the existing revetment would present an immediate threat to the structural stability of the clubhouse. A wide range of alternatives were assessed and the preferred alternative was selected and designed that consisted of the installation of filter fabric

KEY PROJECTS (CONTINUED)

behind the existing structure, the addition of a bedding and drainage stone layer behind the structure, the addition of a stormwater runoff trench at the crest of the existing structure, the addition of clean backfill material behind the structure as needed, and addition of compatible beach material in front of the structure planted with marsh species and encouraged to develop into salt marsh. Also provided construction oversight and permit compliance inspections.

Analysis of Shoreline Change for Western Beach, Scarborough, ME, U.S. Army Corps of Engineers - Project Manager

Led the project that used a computer-based shoreline mapping methodology, within a Geographic Information System (GIS) framework, was used to compile and analyze changes in historical shoreline position between 1864 and 2003 for Western Beach, Saco Bay, Maine. The purpose of this task was to quantify changes in shoreline position for three (3) specific periods, (1864-1944, 1962-1977, and 1986-2003) using the most accurate data sources and compilation procedures available, and to characterize areas of erosion and accretion. This project's overall goal was to evaluate changes in the coastline of Western Beach due to significant modifications to the Scarborough River Inlet and entrance region. In addition to evaluating the shoreline change data, a projected shoreline was produced using the shoreline movement rates of the pre-1962 or pre-Scarborough River jetty construction time from 1864-1944. Using the rates prior to project construction, a projected shoreline position was estimated assuming no project had taken place and the rates continued to exist over the entire 139-year time span. The results indicated had the shoreline continued to erode at the same rates as seen from 1864-1944, the shoreline would have retreated significantly on either end of Western each, while experiencing a slight advance in the center.

Numerical Modeling of Storm Surge Induced Hydrodynamics and Pollutant Transport, New Bedford, MA, Confidential Client - Project Manager/Coastal Engineer

Simulated the hydrodynamics and resulting pollutant transport due to the effects of a historical hurricane in the New Bedford Harbor Region, including the immense flooding of the upland due to the accompanying storm surge, and the release and transport of chemicals from a confidential entity. Through numerical modeling of this complex phenomena, hydrodynamic results, coupled with pollutant input data, pollutant mass rate, duration of release, and time of release, pollutants were released from a single specific area to quantify the transport pathways and concentrations due to the storm surge caused by the hurricane. This project also requires expert testimony and technical analysis of wave energy, breaking, set-up, diffusivity, and mixing.

Thermal Modeling Analysis for Proposed Cooling Plant on Lake Waban, Wellesley College, Wellesley, MA, Vanasse Hangen Brustlin, Inc. - Project Manager

Performed thermal and analytical modeling of design alternatives for a proposed cooling water discharge plant on Lake Waban in Wellesley, MA. Two methods of analysis (analytical and computer model) were used to determine the mixing of temperature concentration, and the ability of the Lake to receive the discharged waters under peak demand (representing a worst-case scenario under August conditions). The purpose of this analysis was to simulate the mixing and dilution of the discharge waters with the ambient water of Lake Waban under worst-case conditions, discuss the results of the modeling effort, and provide recommendations related to potential design modifications.

KEY PROJECTS (CONTINUED)

Characterization Study of Delaware River Detritus, Hancock's Bridge, N.J., PSE&G, - Project Manager
Conducted an assessment of the ability of hydroacoustic technology to detect detrital material throughout the water column. Never utilized for this specific application, use of the innovative technology saved the client from other costly alternatives. Phase I of the study consisted of controlled laboratory testing in an enclosed basin and was performed with samples taken from the Delaware Bay Estuary. The results indicated that hydroacoustic technology could be utilized for identifying detritus within the Delaware Bay Estuary. Phase II of the study consisted of implementation of the hydroacoustic technology in the Delaware Bay Estuary. Field sampling also included Acoustic Doppler Current Profiler (ADCP) measurements, net captures, Conductivity Temperature Depth (CTD) casts, and Optical Backscatter Sensor (OBS) profiles. Responsible for project management, analysis and interpretation of the acoustic return signals, and reporting. Biomass estimates were determined from the measured currents and captured detrital material and compared to the integrated hydroacoustic signal. Future phases consist of detailed field measurements, 3-dimensional detrital transport modeling, and evaluation of mitigation oriented engineered solutions and management strategies.

Observations of Ocean Wave, Tide, and Current Processes Offshore of Little Bay, Montserrat, Montserrat, U.K., Mouchel Consulting, Ltd. - Project Manager/Coastal Engineer/Field Data Collection
Installation and monitoring of a real-time data acquisition system connected via a cable link to the shoreline in Little Bay, Island of Montserrat. Ocean wave, tide, and current data were collected and analyzed. Responsible for QA/QC of collected data. Observations from the one-year deployment will be utilized to develop and design a new harbor on the Island.

San Francisco Airport Expansion Project, San Francisco, CA, URS Corp. - Coastal Engineer
Served as a Team Engineer working on the preparation of an Environmental Impact Report/Environmental Statement (EIR/EIS) for the San Francisco Airport Expansion Project. WHG has deployed a suite of Sediment Transport Monitoring Systems (STMS) to collect seasonal current, wave, and suspended sediment concentration measurements in each of the Bay's characteristic environments. Responsible for analysis and interpretation of hydrodynamic and sediment dynamic measurements, estimation of sediment flux, modeling of sediment transport, and report generation.

Physical Sampling and Sediment Transport Analysis at Weymouth Neck, Weymouth, MA, Massachusetts DEP - Project Manager/Coastal Engineer
In this region, concerns have been raised that the metals (arsenic, copper, lead, and zinc) found in upland areas may have migrated into the sub-tidal area surrounding the peninsula. As a precursor to the chemical sampling, developed an analytical sediment transport model that was geared towards assisting in defining appropriate areas to perform sub-tidal chemical sampling. The model required a field investigation in order to determine the physical characteristics of the sub-tidal sediment within the Weymouth Neck region (including Upper Neck Cove, Lower Neck Cove, and Weymouth Back River), as well as generation of local physical processes (winds, waves, tides, and currents) in the vicinity of Weymouth Neck Peninsula. The analytical model was used to identify areas of erosion and deposition in the sub-tidal regions surrounding the peninsula. The results of the model are used as a tool to assess, justify, and bound the chemical sampling locations around the peninsula.

KEY PROJECTS (CONTINUED)

Evaluation of the Great Creek Outlet Structure, Milford, CT., Fuss & O'Neill, Inc. - Project Manager/Coastal Engineer
In an ongoing project, provided coastal processes analysis, analytical modeling, outlet structure assessment, and design support services for evaluating the impact of an outlet structure on downdrift erosion. Engineering alternatives are being evaluated through sediment transport analytical modeling to determine potential mitigation measures. Wave transformation modeling and sediment transport modeling are focused to assess the parameters of the outlet structure (e.g., height, length, culvert depth, etc.) and provide design guidance for corrective action and potential nourishment.

Analysis and Design of Revetment Structures at Hingham Shipyard, Hingham, MA, Sea Chain, L.L.C. - Coastal Engineer
Completed a fast-track study and design of revetment structures at Hingham Shipyard on Weymouth Back River. The study focused on analyzing the relevant coastal processes, and optimizing the design to gain the most upland area, while minimizing adverse impacts to the nearby salt marsh and other nearshore wetland resource areas. Analysis for the design included wave modeling, storm surge analysis, extremal analysis, wave reflection analysis, wave runup and overtopping analysis, revetment design and stone sizing, and sediment transport analysis.

Particle Tracking Analysis and Improvements to the Near-Field Boundary Condition, Hancock's Bridge, NJ, Public Service Electric and Gas Company - Coastal Engineer
Completed a numerically driven particle tracking study for the Delaware Bay and estuary system to identify detrimental sources of detritus within the system. The particle tracking model, utilized in concert with a validated hydrodynamic model, was utilized to statistically evaluate near- and far-field impacts to a cooling water intake. Recommendations were provided to improve management and recycling practices, as well as provide future steps for numerical modeling of appropriate engineered solutions, which would result in safer and more cost-effective operations.

Ocean Currents Offshore Eastern Trinidad, Trinidad, Amoco Production Company - Coastal Engineer
Developed and performed in-depth data analysis of ocean conditions off the eastern coast of Trinidad based on data collected during recent measurement programs in the area. Observations were utilized to investigate coastal ocean processes active at the site and extrapolate the observations to predict future extremal and operational conditions. Conducted a detailed literature review, assessed the structure and variability of the observed currents, separated the current into specific process components using advanced numerical analysis techniques, formulated an extremal value analysis, and completed technical writing of a final report. Results of the study provided recommendations for design criteria and operational procedures.

Hydrodynamic Modeling and Sediment Transport Analysis During Temporary Tunnel Storage in Fort Point Channel, Boston, MA, Gannett Fleming, Inc. - Coastal Engineer/Project Manager
Conducted a hydrodynamic and sediment transport modeling study of Fort Point Channel, MA to determine the impact caused by temporary storage of floating tunnel sections on existing conditions and industrial water

KEY PROJECTS (CONTINUED)

usage. Completed technical report presenting the hydrodynamic and potential sediment transport results, which was utilized to assist in engineering methodology and design.

Historical Shoreline Change Analysis: Western Town Line to Horton Point, Southold, NY, Town of Southold - Coastal Engineer

Conducted an assessment of the history of storm activity in Long Island Sound. Wind and tide records were analyzed and Generalized Extremal Value (GEV) calculations were completed to determine the historical behavior and return periods of major storm events. Results of the analysis were correlated to historical shoreline change and incorporated to determine the rate and extent of erosion and accretion along the Southold coastline.

Tidal Current Characteristics of St. Lucie Inlet, St. Lucie, FL, Coastal Technologies Corporation - Coastal Engineer

Performed data analysis of observations of tidal currents in the St. Lucie Inlet to map the temporal variation in the spatial structure of flow through several Inlet cross-sections. These high-resolution measurements of tidal current velocities were obtained using a vessel-mounted Acoustic Doppler Current Profiler (ADCP) coupled with a GPS-based integrated navigation (IN) system. Results of the surveys show current energy focused in the deeper southern and center channels of the Inlet. The south channel was characterized as 'flood dominant', with stronger flood currents than ebb currents, which tend to transport sediments into the Inlet interior. The center channel was characterized as 'ebb dominant', with stronger ebb currents than flood currents, tending to move sediments out of the Inlet to form an ebb tide shoal. The geometry of the waterway, hard structures, and the alongshore coastal currents appeared to modify the spatial structure of the tidal currents through the Inlet cross section.

PUBLICATIONS & PRESENTATIONS

Bosma, K. and B. Caufield, “Integration of Multiple Wave Models from Generation Scale to Nearshore Scale. A Practical Application in Maine, USA,” 8th International Wave Hindcasting and Forecasting Workshop, Oahu, Hawaii, 2004. Keynote Speaker.

Caufield, B.A., and K.F. Bosma, Use of a Large Scale Spectral Wave Generation Model to Define Input into a Nearshore Wave Transformation Model. 8th International Wave Hindcasting and Forecasting Workshop, Oahu, Hawaii, 2004.

Bosma, K.F. 2002. “Coastal Processes Evaluation in Development of a Long-Term Beach Management Plan, Sandwich, Massachusetts.” Proc. of Northeast Shore and Beach Preservation Association, Northeast Beaches: A Balancing Act, Woods Hole, MA.

Jachec, S.M. and Kirk F. Bosma. 2001. “Sediment Transport Related to Potential Sand Mining Offshore New Jersey.” Proc. of Waves 2001 Conference, San Francisco, CA.

DiMassa, D. and K.F. Bosma. 2000. “Hydroacoustic Measurement of Detritus from the Delaware Bay Estuary.” Proc. of Oceans 2000 Conference, Providence, RI.

PUBLICATIONS & PRESENTATIONS (CONTINUED)

Wood, J.D., K.F. Bosma, and J.S.Ramsey. 1998. "Tidal Current Characteristics of St. Lucie Inlet." Proc. 11th Annual National Conference on Beach Preservation Technology, Tallahassee, FL.

Bosma, K.F. 1997. "Beach Profile Analysis Along the Delaware Atlantic Coastline." Master's Thesis, University of Delaware, Newark, DE.

Bosma, K.F. and R. A. Dalrymple. 1996. "Beach Profile Analysis Around Indian River Inlet, Delaware, U.S.A." Proc. 25th Intl. Coastal Engineering Conf., ASCE, Orlando, FL.

Chawla, A., Bosma, K.F., Gobbi, M., and M.N. Herrman. 1995. "Gravity Waves on a Gently Sloping Beach." CACR, University of Delaware, Newark, DE.

Bosma, K.F. 1995. "Investigation of Delaware State Profiles." CACR, University of Delaware, Newark, DE.

21 other presentations and papers.

OTHER

NOAA Planning for Sea Level Rise in the Northeast: Considerations for the Implementation of

Tidal Wetland Habitat Restoration Projects – Steering Committee Member.