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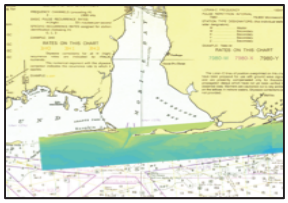
ENGINEERING WITH NATURE



USACE Regional Sediment Management and Engineering With Nature 2013 Workshop Summary

By Jennifer M. Gerhardt Smith and Cynthia J. Banks

PURPOSE: This document summarizes the major activities and findings of a U.S. Army Corps of Engineers (USACE) workshop entitled "Regional Sediment Management (RSM) and Engineering With Nature (EWN)." The workshop was held August 20-22, 2013, at the U.S. Army Engineer Research and Development Center (ERDC) in Vicksburg, Mississippi. Sponsored by the RSM and the Dredging Operations Environmental Research programs, the overall goals of the workshop were to:

1) identify RSM and EWN opportunities within the USACE missions;

2) introduce seven new EWN action projects;

3) provide RSM program updates and conduct the annual RSM In-Progress Review of district initiatives for fiscal year 2013;

4) share successes and lessons learned across the RSM and EWN communities;

5) establish future RSM and EWN directions and collaborations with districts.

Workshop participants included representatives from USACE Headquarters, ERDC, Institute for Water Resources-Hydrologic Engineering Center (IWR-HEC), and districts. The workshop included technical presentations and group breakout sessions on a broad range of topics associated with navigation, flood risk management, and environmental missions including innovative engineering and operational practices, modeling, data management, and strategic communications for the advancement of a joint RSM and EWN community. The coordinators of the workshop were Linda Lillycrop of ERDC Coastal and Hydraulics Laboratory (CHL) and Dr. Todd Bridges of ERDC Environmental Laboratory (EL).

OVERVIEW OF RSM AND EWN

Regional Sediment Management. RSM (*http://rsm.usace.army.mil/*) is a systems-based approach implemented collaboratively with other federal, state, and local agencies and organizations. The purpose of the program is to change our focus from managing projects and sediments on local scales to regional scales, therefore providing opportunities to implement adaptive management strategies across multiple projects which optimize the use of sediments while supporting sustainable solutions to the USACE navigation, flood risk management (FRM), and environmental missions.

Additional goals include increasing project benefits and reducing costs or collaborating with partners to share costs.

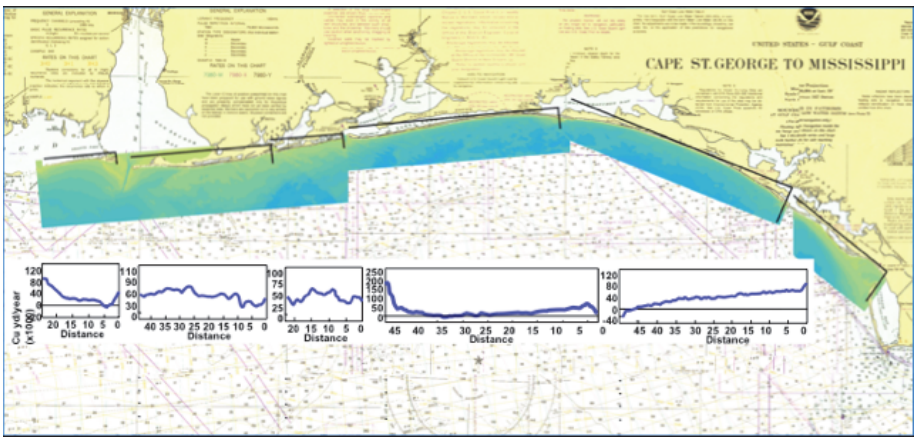


Figure 1. RSM analysis of potential sediment transport rates in the northern Gulf of Mexico. (Title page inset photo is a zoom of the Mobile Bay area.)

The RSM program provides opportunities to evaluate and implement various RSM actions throughout USACE districts as pilot projects with the objectives of improving sediment management practices and strategies in the short-term and providing lessons learned that will benefit districts and regions over the long-term. The pilot projects have resulted in advancing technologies and communications that have positioned the USACE to more efficiently and effectively implement regional approaches, share information and data, collaborate with stakeholders and partners, improve decision making, and implement strategies that improve the management of sediments and link multiple projects.

Engineering With Nature. The goal of the EWN (*www.EngineeringWithNature.org*) program is to enable more sustainable delivery of economic, environmental, and social benefits associated with water resources infrastructure and operations. EWN directly supports the USACE Civil Works Strategic Plan 2011–2015, Campaign Plan, and Environmental Operating Principles.

EWN is defined as the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental, and social benefits through collaborative processes. EWN seeks to create new ways of conducting business and expanding the benefits of USACE infrastructure projects through effective partner and stakeholder collaboration. The essential elements of EWN are to:

- use science and engineering to produce operational efficiencies supporting sustainable delivery of project benefits;
- use natural processes to maximum benefit; thereby, reducing demands on limited resources, minimizing the environmental footprint of projects, and enhancing the quality of project benefits;
- broaden and extend the base of benefits provided by projects to include substantiated economic, environmental, and social benefits;

- use science based collaborative processes to organize and focus interests, stakeholders, and partners to reduce social friction, resistance, and project delays while producing more broadly acceptable projects.

As a leading practice, EWN is holistic, utilizing a systems approach. It is sustainable, science-based, collaborative, efficient and cost effective, socially responsive, innovative, and adaptive.

Advancing the use of EWN within current and future practice is currently being pursued through innovative demonstrations, communicating about lessons learned, focused research and development, and active engagement and collaboration with partners and stakeholders.

WORKSHOP OVERVIEW: The 64 participants in the workshop included representatives from USACE HQ, IWR-HEC, USACE districts, and scientists and engineers from ERDC. The workshop included numerous technical presentations and group breakout sessions on a broad range of issues and topics including innovative engineering and operational practices, numerical modeling, and strategic communications for the advancement of a joint RSM and EWN community. The full agenda is available with weblinks to the RSM and EWN presentations given on the RSM website at *http://rsm.usace.army.mil/Meetings/RSM-EWN-workshop2013*.

Civil Works and Research and Development Leaders' Perspectives. The workshop opened with several briefings related to the research and development (R&D) perspectives from each business line including Navigation (Jeff Lillycrop), FRM (Dr. Cary Talbot) and Environmental (Dr. Al Cofrancesco). Presentations by Linda Lillycrop and Dr. Todd Bridges followed to help build a shared understanding of the context and opportunity for applying RSM and EWN within Civil Works missions. The second day of the workshop began with the USACE Navigation Business Line Manager, Jeff McKee, briefing on the USACE HQ perspective in moving forward with RSM and EWN across the USACE. Throughout this series of presentations, several common themes emerged. Those themes particularly relevant to RSM and EWN included:

- Sediments dredged for the Navigation business line must be increasingly recognized as a resource to the Nation in general and for the FRM and Environmental missions in particular. Improved coordination across business lines is needed to ensure that, when feasible, the sediments are beneficially used.

- Channel availability must be optimized. Keeping excess sediment out of the system and keeping sediment moving are two ways to increase channel availability while reducing dredging demand.

- The useful life of existing infrastructure needs to be extended. Sustainable means can be employed, such as RSM and EWN practices, to achieve that goal.

- In combination with increasingly stringent regulatory requirements, the momentum of the planning modernization movement could affect the expectations of customers. With more benefits and services, in less time, and for less cost being expected, RSM and EWN concepts could prove critical.

- Water and sediment resources should be managed regionally using a systems-approach and employ innovative financing methods (including public-private partnerships and strategic cross-business line project efforts).

- Projects, both those in the planning phase and those in an operations and maintenance status, should employ a forward-looking life-cycle analysis to evaluate alternatives including the utilization of RSM and EWN practices to improve the sustainability and resiliency of the project benefits and services.

- Multi-objective projects that leverage resources across business lines, programs, agencies, etc., through a high level of stakeholder engagement are one of the best means to attain triple-win benefits and realize operational and cost efficiencies for USACE and the Nation.

EWN Action Projects. The capabilities developed and demonstrated through EWN and RSM are broadly applicable and relevant across the USACE mission and business lines. Seven EWN Action Projects were presented to highlight ongoing projects with connections to RSM principles and practices (Table 1). Six of the seven projects connect ERDC scientists and engineers with USACE districts to foster strong collaborations.

Table 1. EWN Action Projects.

USACE District	Project Title
San Francisco	San Francisco Bay Wetland Restoration Projects: Are Circular or Linear Berms More Effective?
Albuquerque	Realizing a Triple Win in the Desert: Systems-level Engineering With Nature on the Rio Grande
New Orleans	Atchafalaya River Island Creation Project
Buffalo	Ashtabula Breakwater Tern Nesting Habitat Demonstration Project
New England and New Orleans	Portfolio Framework to Quantify Beneficial Use of Dredged Material
Detroit	21st Avenue West Living Shoreline-Duluth/Superior Harbor
ERDC-EL	A Sustainable Design Manual for Engineering With Nature Using Native Plant Communities

RSM In-Progress Review. The workshop also included the annual RSM In-Progress Review to share progress, status, and lessons learned from ongoing RSM initiatives and identify opportunities to incorporate the concepts of EWN principles and practices.

Table 2, below, lists all of the projects reviewed during the workshop.

Table 2. RSM In-Progress Review – Presented Projects

USACE District	Project Title
Buffalo	Sediment Budget Analysis System for Lake Erie and Lake Ontario
Portland	Port Orford Sedimentation Reduction
San Francisco	SPN Regional Sediment Budget
Charleston	Myrtle Beach RSM GIS
Jacksonville	St. Johns, Duval, Nassau Counties RSM
Jacksonville	Sarasota and Tampa Bay RSM
Kansas City	Reservoir Sustainability/Sediment Continuity
Galveston	Gulf Intracoastal Waterway Sedimentation Reduction
Rock Island	Sedimentation Impacts Sangamon and Illinois Rivers
Baltimore	Atlantic Coast Regional Sediment Budget
Philadelphia	Post Sandy RSM and EWN O&M Opportunities
Omaha	Integration of Sediment Transport Tools into HEC-RAS
St. Louis	Kaskaskia River Navigation Channel
Mobile	Biodegradable Containment Structures for RSM
Honolulu	Hawaii RSM – Haleiwa Region
ERDC-CHL	Nearshore Berm Research, Guidance, Tool Development
ERDC-CHL	Regional Process and Analysis Tool

Breakout Group Discussions. Building on the presentations and discussions that followed, participants were divided into four facilitated breakout groups to consider four specific topics/questions (two per day) related to RSM and EWN opportunities and needs. Each group was asked to discuss the following breakout topics/questions:

1) Inland opportunities for RSM and EWN projects.

2) Opportunities for creating natural features to provide engineering function.

3) How best to substantiate, quantify, and calculate benefit streams from RSM and EWN projects?

4) Identification of opportunities to communicate with other organizations. How should we be building partnerships with others?

After eliciting responses, each group discussed and defined its top priorities and prepared to report back to the plenary. The groups briefly reported back to the plenary at the end of each breakout session. The information presented below summarizes participant input during breakout group discussions and plenary.

1) Inland opportunities for RSM and EWN projects.

- Utilize engineered, nature-based structures to increase and/or decrease the influx of sediment and shoaling, as needed to meet the project objectives and minimize the number of areas that need to be dredged.

- Capture eroding sediments and stock-pile dredged material for future use as a materials source for environmental restoration and/or FRM projects in batture, backwater, or other nearby areas.

- Utilize engineering to strategically mobilize dammed reservoir sediments.

- Consider life-cycle costs to a greater extent in determinations of whether to continue maintenance in perpetuity (e.g., repeated bank stabilization) versus creating a new circumstance (e.g., one-time river re-alignment or widening).

- Use a systems-approach to analyze the USACE portfolio for leveraging assets and opportunities across business lines and district boundaries.

- Utilize a RSM/EWN 'silver jackets' format to see if there are common goals with other Federal agencies or with State agencies. Seek innovative funding opportunities with those agencies as a joint-response to budget constraints.

- Expand stakeholder collaboration efforts within the watershed for improved opportunity identification.

- Increase awareness of commercial/industrial uses of dredged sediments and encourage policies that permit the transfer of sediment from USACE to private entities for use. Share successes and lessons learned.

- Increase the use of vegetation and other biodegradable materials (such as burlap geotubes) for the stabilization of banks and wetlands.

- Investigate the use of microbial remediation on materials at confined disposal facilities to enable beneficial use of the materials and regain capacity.

2) Opportunities for creating natural features to provide engineering function.

- Reconfigure channels to sinuosity to create more complex environments alongside of the navigation channel and divert some waters and sediments to the banks instead of predominantly the channel mid-line.

- Develop bypass channel systems at inlets to permit the sand to drift through jetty thus reducing unwanted shoaling up-current and erosion down-current.

- In response to sea-level rise, dredged material from projects in a maintenance status could be used as a reliable source of material for adding lifts over marshes and wetlands to maintain the desired emergent elevations.

- Utilize consolidated dredged materials to construct effective soft-structure breakwaters or berms around marsh that needs to be protected.

- Focus on encouraging living shorelines/banks (in lieu of bulkheads and/or in combination with riprap) to stabilize banks and shorelines and to reduce sediment flow into channels, lakes, and bays.

- Strategically locate and orient restored islands and marshes/wetlands to keep sediment moving and promote deposition in desired locations.

- Employ natural and nature-based infrastructure (e.g., berms, dunes, beaches, and submerged mounds) and construction materials (e.g., reef balls, combination of rock sills and oyster bags, native plants, and biodegradable containment systems) for reducing storm damage, protecting compromised infrastructure, and increasing aquatic habitat diversity.

3) How best to substantiate, quantify, calculate benefit streams from RSM and EWN projects?

- Although often costly, it was acknowledged that more long-term monitoring is needed to capture benefit streams for RSM and EWN projects. Monitoring has proven to be one of the purest means used to substantiate, quantify and calculate multiple benefits. EWN promotes partnerships and collaborations which may open the door for monitoring plan funds via cost sharing.

- Utilizing existing literature, pre- and post-project surveys, and personal feedback instruments can provide valuable data on habitat, economics and overall performance.

- RSM and EWN projects should solicit the expertise of an economist and ecologist to provide benefit stream assessments. Each USACE district has staff economists; collaboration between ERDC and a USACE district is directly aligned to the EWN guiding principles.

- There is a need to develop guidance and to provide training opportunities (perhaps through the Planning Community of Practice or Center of Expertise) on benefit analysis for the field as RSM and EWN projects are initiated.

- Decision support tools are useful to projects by providing sensitivity and trade-off analyses. The advantage of such tools allows the project delivery team to utilize “what-if” scenarios in an effort to multiply benefits and consider uncertainties encountered throughout the project.

4) Identification of opportunities to communicate with other organizations. How should we be building partnerships with others?

- A fundamental understanding of memorandums of agreement (MOAs) should be investigated. The MOA is a viable mechanism to utilize as RSM and EWN embraces external partnerships (academia, federal agencies, etc).

- Successful RSM and EWN projects should allow site visits which are open to the public. This is an ideal opportunity to communicate with local, state and regional entities and spread the word of how multiple benefits projects are impacting the community.

- Local universities and colleges can prove to be an invaluable resource to a RSM and EWN project. Student interns are often available at no or minimal cost to support volunteer efforts, modeling, communications, etc.

- Technical experts should be involved with RSM and EWN project communications with project partners to guarantee the engineering and science aspects of the project are well articulated.

- The RSM and EWN community is growing at a rapid pace. To ensure we are promoting the right messages to the right audiences, a professionally developed communications and public relations strategy (internal and external) should be pursued.

Tours and Demonstrations. In response to feedback received during past workshops, a series of ERDC research facility tours and technology demonstrations were incorporated into the workshop. The tours and technology demonstrations included:

- The effects of marsh plants on waves and sediment processes

- Sediment transport in rivers, ports, and offshore berms

- Navigation Data Integration Framework and Navigation Program Portals

- Joint Airborne Lidar Bathymetry Technical Center of Expertise and National Coastal Mapping Program: Post Hurricane Sandy Surveys, Channel Condition Indices, On-line Map Products

Figure 2. Dr. Dave Perkey demonstrates equipment used to assess sediment transport.

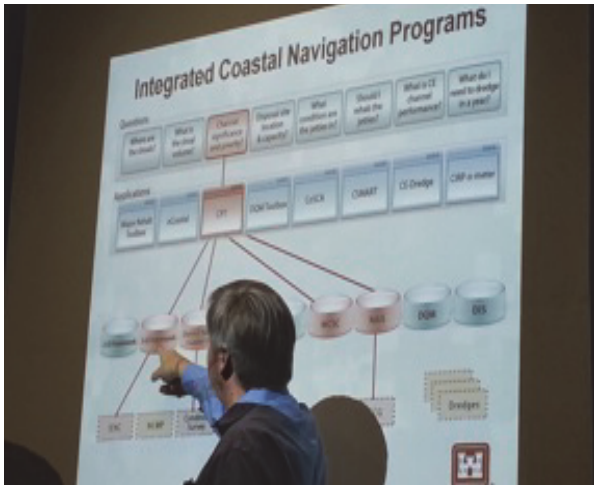


Figure 3. Jeff Lillycrop describes the Navigation Data Integration Framework.

Future Opportunities for RSM and EWN Discussion. The workshop participants were asked which future opportunities (such as specific actions, broad approaches, next steps, etc.) they felt were important for furthering implementation of RSM and EWN principles and practices across USACE. Several common themes emerged in the responses that identified needs. The participant's input provided valuable information for future initiative planning by RSM and EWN leadership teams, and is summarized below.

- Innovative ways to account for additional "secondary" project benefits are needed by the field to build the internal case for projects and methods and communicate with stakeholders and regulatory agencies.

- Development of guidance on how to effectively establish RSM and EWN partnerships is needed.

- A new methodological approach to monitoring is needed that focuses on recording benefit achievement in addition to accounting for adverse effects.

- In the spirit of collaboration, each USACE participant at subsequent RSM-EWN workshops, should nominate for (non-funded) invitation someone from a resource agency to participate.

- RSM and EWN practitioners could be informed earlier than is current practice about what projects are being funded in the out-year, so that lessons learned related to project planning and execution can be shared among the community before the new-starts are underway.

- A quarterly RSM and EWN information bulletin may be helpful in communicating practices with USACE districts and external potential partners.

- Fostering multi-district integrated initiatives could increase dispersal of learning and practices amongst USACE and resource agencies within the broader system.

- The RSM and EWN practitioners could get more involved with universities as both a public relations and a collaboration/partnering strategy.

- For maximum exposure, a session dedicated to RSM and EWN at the 2014 World Association for Waterborne Transport Infrastructure (PIANC) World Congress could be organized.

- As an organizational practice, we need to fully document lessons learned to include not only what did not work, but also what did work and how obstacles were overcome. This reporting could also lead to the development of guidance documents and/or training for the field on how to overcome pervasive challenges.

- The Dredging Operations Technical Support program may be able to provide support to the districts for project publication for the purpose of communicating innovative methods and transferable practices across USACE and with stakeholders.

WORKSHOP FEEDBACK: Prior to adjournment, participants were asked to provide feedback as to how the workshop could be improved for the future. The feedback included:

- Workshop and conference approval and attendance processes have tremendously hindered the ability to meet and network with each other. Even so, most participants are in favor of more face-to face interaction as an effective mode of RSM and EWN communication.

- Due to the effort and cost to get to Vicksburg, Mississippi, consider including a brief (perhaps one day) meeting prior to the workshop, lengthening the agenda, scheduling the workshop adjacent to another significant opportunity, and/or moving the location to an air travel hub.

- Building in additional informal time to discuss specific projects with researchers could assist in justification for attendance and allow broader collaboration.

- Although the tours and demonstrations were well received, some participants felt that more time was needed to fully take in the content presented.

- Some participants would have liked additional demonstrations of other ERDC capabilities and the ability to select from several options based on their area of interest.

- Incorporation of an interactive poster session for participants to socialize during breaks, lunch, etc. was suggested.

- Holding the workshop before RSM proposals are due would increase brainstorming of opportunities, collaboration across districts, and improve project plans and outcomes.

- The RSM and EWN workshop is a great opportunity for participants, particularly professional engineers, to earn professional development hours.

ADDITIONAL INFORMATION: This technical note was prepared by Jennifer M. Gerhardt Smith, research biologist and Cynthia J. Banks, research biologist, Environmental Laboratory, U.S. Army Engineer Research and Development Center. The summary was prepared as an activity of the USACE EWN program. For more information on EWN, please consult *www.engineeringwithnature.org* or *http://el.erdc.usace.army.mil/ewn*. You may also contact the USACE EWN Program Manager, Dr. Todd Bridges, at *Todd.S.Bridges@usace.army.mil*. For more information on RSM, please consult *http://rsm.usace.army.mil/* or contact the RSM Program Manager, Linda Lillycrop, at *Linda.S.Lillycrop@usace.army.mil*. This technical note should be cited as follows:

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