



ERDC TN-DOER-R20  
August 2013

## Operationalizing Engineering With Nature – Regional Sediment Management Principles and Practices into Operations and Maintenance Dredging Beneficial Use Project Management

*by Cynthia J. Banks and Jennifer M. Gerhardt Smith*

---

**PURPOSE:** This document summarizes an effort to begin the process of operationalizing the application of Engineering With Nature (EWN) and Regional Sediment Management (RSM) principles and practices in Federal navigation channel Operations and Maintenance (O&M) dredging beneficial use project management. The ultimate goal of this effort was to develop a model that could be used to inform development of a Project Management Plan (PMP) and/or a Project Planning Management Information System (P2) Work Breakdown Structure (WBS) template(s), as appropriate, for use by Project Managers across the U.S. Army Corps of Engineers (USACE). This effort was sponsored by the USACE RSM and Dredging Operations and Environmental Research (DOER) Programs. The work was performed in support of the effort to attain benefit to the Nation via EWN and RSM practices.

**BACKGROUND:** In the last decade, the USACE Navigation Program has dredged at least 200 million cubic yards (MCY) of material each year from the Nation's ports, harbors, and waterways. Of those dredged amounts, an average of 75% of the material has been from projects in an O&M status (USACE Navigation Data Center (NDC) 2012). Therefore, on an average annual basis, over 150 MCY of dredged sediments are potentially available as a resource to the nation from O&M dredging activities for developing environmental, economic, and social value through beneficial use projects.

The term 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. Essential ingredients of EWN include: 1) use of science and engineering to produce operational efficiencies supporting sustainable delivery of project benefits, 2) use of natural processes to maximum benefit, thereby reducing demands on limited resources, minimizing the environmental footprint of projects, and enhancing the quality of project benefits, 3) broadening and extending the base of benefits provided by projects to include substantiated economic, social, and environmental benefits, and 4) use of 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 (USACE 2012a).

The EWN principles directly support USACE's "Sustainable Solutions to America's Water Resources Needs-Civil Works Strategic Plan 2011–2015" and contributes to the achievement of its Civil Works Mission and Goals (USACE 2011). In addition, the USACE Environmental Operating Principles (EOPs), which were originally established in 2002, were "reinvigorated" in August 2012. The EOPs continue to encourage USACE employees to consider the environment by

creating synergy between sustainability and the execution of its projects and programs. Two EOPs that directly relate to EWN are: 1) create mutually supporting economic and environmentally sustainable solutions, and 2) leverage scientific, economic, and social knowledge to understand the environmental context and effect of USACE actions in a collaborative manner (USACE 2012b).

RSM also supports USACE's "Sustainable Solutions to America's Water Resources Needs-Civil Works Strategic Plan 2011-2015," and the EOPs, by addressing sediment-related issues on a systems basis and supporting sustainable solutions to meet needs across the USACE Navigation and Dredging, Flood Risk Management, and Environmental Restoration missions (USACE 2011). The goal of RSM is to use regional approaches and best management practices to improve the management of sediments and projects, increase economic (short- and long-term cost savings) and environmental benefits, and improve collaboration with stakeholders and sponsors (USACE 2012c). As a management method, RSM:

- includes the coastal, estuarine, riverine, and watershed environments.
- recognizes sediments as a regional resource.
- seeks balanced, economically viable, and environmentally sustainable solutions.
- improves economic performance by linking multiple projects.
- considers local and regional impacts of human/engineering activities on sediment.
- protects and enhances the Nation's natural sediment resources while optimizing the natural exchange of sediments.

USACE engineers and scientists develop new technologies through research to improve management decisions regarding sediment management (USACE RSM). Benefits of the RSM approach are improved partnerships with stakeholders and partners, improved regional and project sediment management, improved environmental stewardship, and reduced lifecycle costs (USACE 2012c). Further integration of EWN and RSM principles into practice will facilitate sustainability of USACE's joint economic and environmental mandates.

**APPROACH:** To begin the process of developing tools such as a PMP model and a P2 WBS template, the investigators sought means by which to gain information as to how successful EWN and RSM projects were being achieved. Information reconnaissance was performed via attending a workshop, constructing and deploying a survey, and conducting targeted interviews. The information gathered was used to develop a pathway model for integrating RSM and EWN principles and practices into O&M dredged material management.

**Workshop.** A "Regional Sediment Management and Engineering With Nature" workshop was held 28-30 August 2012, at the USACE Portland District, in Portland, Oregon. One of the goals of the workshop was to identify RSM and EWN opportunities to advance science, engineering, and operational practice leading to expanded benefits from navigation infrastructure and operations within USACE. The workshop was also intended to serve as a conduit to share technical presentations, to network, to participate in valuable discussions of experiences, and to generate outcomes (such as those related to this effort) that will support the USACE Navigation Program.

The workshop included three breakout sessions to address questions related to RSM and EWN implementation as a practice. Questions included:

- 1) What actions can O&M Project Delivery Teams (PDTs) take to incorporate RSM and EWN approaches within their projects?
- 2) What gaps in science, technology, engineering, or organizational practice should be addressed to advance RSM and EWN across USACE mission areas? Navigation O&M in particular?
- 3) How should USACE be communicating and collaborating with others on RSM and EWN opportunities?

**Survey.** A commercial, internet-based software tool (SurveyMonkey®) was used to conduct a survey assessing project management strategies, typical project outcomes, and lessons learned. The survey was distributed to USACE Division and District Operations Chiefs and Navigation points of contact via email and embedded weblink along with an invitation for participation and a brief description of the goal of the survey. USACE Division and District Operations Chiefs and Navigation Program points of contact were asked to forward the survey and invitation to Project Managers in their offices. The survey was made available for a seven-day period. The 10 questions posed and the available survey response choices are shown in Appendix A.

**Interviews.** Due to a low number of responses to the aforementioned survey, targeted phone interviews with three USACE Navigation Project Managers, one Navigation Operations Chief, and one Civil Engineer were conducted during this investigation to follow up on workshop comments and supplement the survey responses.

**Model development.** Based upon the information received from the RSM and EWN workshop, surveys, and interviews, a model was developed to 1) reflect how beneficial use O&M dredging projects are currently being accomplished, 2) identify features and practices conducive to RSM and EWN achievement, and 3) highlight components that could contribute to increasing application of RSM and EWN principles and practices.

## **RESULTS AND DISCUSSION**

**Workshop findings.** The 60 participants in the workshop included representatives from USACE Headquarters, scientists and engineers from the US Army Engineer Research and Development Center (ERDC), personnel from 21 USACE Districts, as well as representatives from academia and industry. The workshop included numerous technical presentations and group breakout sessions on a broad range of issues related to science, technology, and engineering associated with navigation projects, including innovative engineering and operational practices, modeling, and strategic communications for the advancement of a joint RSM and EWN community.

The workshop began with a series of presentations to build a shared understanding of the context and the opportunity for applying RSM and EWN to the various Civil Works missions. Representatives from the ERDC Coastal and Hydraulics Laboratory and Environmental

Laboratory; USACE Districts including Mobile, St. Louis, and Galveston; and academia discussed past and ongoing projects and potential future opportunities related to RSM and EWN.

Building on the presentations and discussions, participants were divided into six facilitated breakout groups and asked to answer several questions. After eliciting responses from group participants, along with their response rationale and priority, each group discussed and refined its top priorities and prepared to share the consolidated findings. At the end of each day, the groups briefly reported back to the plenary session. The information presented below highlights participant input that is relevant to the purpose of this investigation.

- 1) What actions can O&M PDTs take to incorporate RSM and EWN approaches within their projects?
  - Perform more comprehensive cost-to-benefit calculations. Be sure to include long-term, down-drift, secondary and tertiary benefits and to consider without-project condition comparisons.
  - Consider RSM and EWN in dredged material management plan (DMMP) formulations and annual reviews.
  - Bring special attention to RSM and EWN efforts by highlighting them in environmental documentation in order to ingrain their consideration in project planning.
  - Revamp the “standard” PDT; fully utilize interdisciplinary knowledge and include Regulatory Branch and ERDC personnel.
  - Take a regional and systems approach to possibly combine projects to achieve a broader base of benefits.
  - Add design time to the project milestone schedule for EWN and RSM considerations.
  - Develop a standard procedure to transfer data and knowledge to resource agencies to maximize their exposure/understanding, build trust, and get buy-in.
  - Create a robust and consistent strategy for communications internally and externally.
  - Hold “no-decision” information-only meetings to identify assumptions and needed information.
  - Hold charrette-style meetings for collaboration well in advance of the current project iteration advanced-planning stages; brainstorm; think outside of the norm for achieving greater and/or broader benefits.
  - Be proactive; approach stakeholders for partnering or in-kind services for accomplishing project goals such as plantings and monitoring.
  - Use decision-making tools (such as the Dredged Material Disposal Management tool) for increasing understanding and fostering a collaborative environment between the USACE, resource agencies, and stakeholders.
  - Participate in opportunities to learn more about RSM and EWN practices, especially any formalized training that may arise on RSM and EWN topics in particular and those of communication and outreach in general.
  
- 2) What gaps in science, technology, engineering, or organizational practice should be addressed to advance RSM and EWN across USACE mission areas? Navigation O&M in

particular? (The workshop inputs highlighted below are only those relevant to operationalizing RSM and EWN principles for O&M beneficial use projects.)

- Identify up front the data types and criteria that would be accepted by resource agencies and stakeholders as relevant and credible.
- Monitor project effects/outcomes more often and for a longer duration to provide data that are needed to broaden knowledge and understanding and to support future project cost-to-benefit calculations and alternatives formulations.
- Consider synergy, functionality, resiliency, and sustainability in project planning.
- Develop a mechanism to provide a “one-stop-shop” for tools and data that are available for supporting the application of RSM and EWN principles to projects.
- Consider modifying P2 to encourage the use of RSM and EWN by adding resource and tool/technology/methodology recommendations.
- Increase the focus on utilizing natural processes and features in combination with structures to reduce channel in-filling and, thereby, the need to dredge.
- Provide broader socialization and support for RSM and, particularly, EWN as a “business strategy” across the USACE in order to affect a broad shift to these practices through both project management techniques and project funding.
- Consistently involve individual PDTs in discussions regarding broader regional or systems-based ongoing and potential efforts. Provide functional improvement of internal USACE communication across PDTs, Districts, and Divisions.
- Provide, as standard, more early-stage collaborative efforts in project planning to identify/discuss new opportunities or constraints and have a diverse roster of participants.

3) How should we be communicating and collaborating with others on RSM and EWN opportunities?

- Develop a joint RSM and EWN Community of Practice.
- Utilize workshops to promote the exchange of ideas and lessons learned. Invite a diverse group of attendees including resource agency personnel. Attendees should be able to return to Districts or agencies with a baseline presentation to share with peers and thus continue the spread of knowledge gained at the workshop.
- The USACE needs a proactive and diversified outreach strategy to keep in better and more frequent contact with resource agencies and common stakeholders on programmatic information and strategic efforts (not just project-by-project contact).
- When conveying project information, be prepared to communicate with non-scientists and non-engineers via non-technical presentations.
- PDTs should hold both general and targeted meetings with a focus on being inclusive when selecting invitees.
- Hold annual or semi-annual multi-disciplinary discussions within Districts to encourage system-wide and cross-mission information sharing.
- As part of project management responsibilities, increase focus on communicating successes as well as lessons learned in a manner similar to the idea of “technology transfer.”

**Survey results.** The survey was constructed to elicit information regarding the planning methods/activities for, and outcomes of, O&M dredging beneficial use projects with RSM and EWN features. Several of the survey questions combined multiple choice responses with open responses in order to 1) accommodate participants with both more and less time to spend on the survey, and 2) provide an opportunity for participants to provide information particular to their experiences. There was no personal or organizational information to link participants to their responses, lending to an anonymous collection of information.

The survey invitation was sent within two weeks of the RSM and EWN workshop in an attempt to capitalize on momentum from the workshop. However, the survey received far fewer responses than were sought or expected. Seven persons completed the full survey, and several participants did utilize the “open response” opportunities to provide additional information. Responses and additional comments are summarized below.

- 1) At what stage of a typical project do you identify the beneficial use opportunity or innovative design or method?
  - a) It is already part of the DMMP and project plan
  - b) During consideration of the larger RSM plan
  - c) During resource agency and/or stakeholder meetings
  - d) Identified from other USACE project experience/lessons learned

Responses to this question revealed that all of the above scenarios are prevalent in the participants’ experience. It was noted through open responses that identifying opportunities is not particularly problematic; the difficulty lies in implementing a beneficial use option within the tethered constraints of limited funding and the timing of funding availability with respect to Congressional budget and O&M project cycles. Until these constraints can be overcome, RSM and EWN opportunities may sit “on the shelf.”

- 2) For a typical project iteration, did you meet with resource agencies or local stakeholders first?
  - a) Resource agencies
  - b) Local stakeholders
  - c) Met with them at the same time
  - d) Did not meet with resource agencies or local stakeholders
  - e) Other [Open Response]

One of the practices stated as being fundamental to achieving RSM and EWN is highly collaborative communication. Comments during the workshop illuminated a variety of attitudes regarding collaborative communication with resource agencies and local stakeholders. This survey question was put forth in an attempt to discern if a pattern existed in the order in which collaboration was pursued by District personnel. Responses to this question were equally mixed, yielding no new insight.

- 3) What specific tools, technologies, or methodologies have you used that contribute to EWN project features? [Open Response]

This question was included in the survey to see if a common response element would show as appropriate for inclusion in a model PMP or P2 WBS template. Responses were highly varied and included mentions of particular models, collection of certain types of data, and examples of structural project features used to achieve benefits. Of particular note in the responses (with respect to the recommendations in this report) was the mention of “Project Management processes.”

- 4) The P2 input for a typical project Work Breakdown Structure (WBS) is:
- a) Simple, only one to three major tasks identified in the P2 WBS
  - b) Moderate, several major tasks and subtasks are identified in the P2 WBS
  - c) Complex, the P2 WBS shows multiple tasks, subtasks, and activities
  - d) Very complex, the WBS is detailed to show multiple tasks, subtasks, and activities and identifies individual persons, work units, and branches
  - e) P2? Someone else does that.

While one participant did not offer a response to this question, the responses by the other participants were overwhelmingly indicative that typical project WBSs in P2 are usually simple in design. One participant wrote, “P2 [has the capability to be] more detailed, but Project Managers typically keep the WBS as simple as possible.” The results of this survey question could imply that creating a P2 WBS template would not yield significant benefit to operationalizing RSM and EWN principles since, in practice, P2 is utilized minimally for identifying and managing the complex tasks involved in project planning and execution.

- 5) To accomplish projects, do you actively team with Subject Matter Specialists at: [Check all that apply]
- a) Another District
  - b) Another Division
  - c) An ERDC Laboratory
  - d) A resource agency
  - e) A University
  - f) With Industry/Contractors
  - g) A Professional Facilitator
  - h) None of the Above – Other
  - i) None of the Above – All work was accomplished using ‘home’ District personnel

All except one respondent cited teaming with at least three of the above subject matter specialist groups. In order of popular response, the participants selected: five responses for a resource agency; four responses each for an ERDC Laboratory, a university, another District; three responses for Professional Facilitators; and two responses each for another Division and Industry personnel/Contractors. The outlying response stated that all work was accomplished using ‘home’ District personnel. The results of this survey question support the assertion that communication, collaboration, and cooperation are essential components for accomplishing RSM and EWN projects.

- 6) Are costs typically in excess of the Federal Standard? [Yes/No]

This question was asked in order to determine if efforts for cost-sharing agreements and the concomitant additional collaboration and planning should be part of a model PMP or P2 WBS template. All participants responded that costs were not typically in excess of the Federal Standard. A conclusion from these results may be that a model PMP or P2 WBS template would not need to include items related to cost-sharing agreements.

- 7) What are the effects of using EWN concepts on a typical project?

- a) Reduced overall cost
- b) Reduced schedule length
- c) Reduced overall cost and schedule length
- d) Increased overall cost
- e) Increased schedule length
- f) Increased overall cost and schedule length
- g) No effect to cost or schedule

Participant responses to this question ranged from both ‘reduced overall cost and schedule length’ and ‘increased overall cost and schedule length’ to ‘had no effect to cost or schedule,’ revealing that these effects are either variable depending on the project or that the assessment of these effects may be subjective. In either case, the survey results do not indicate that a model or template would need to address these particular issues.

- 8) Do assumptions or concerns typically delay project progress for collaborations with resource agencies and stakeholders? If yes, what assumptions/concerns do you feel delayed progress the most? [Check all that apply.]

- a) Dredged material character concerns (believed “dirty”)
- b) Dredged material active placement concerns
- c) Dredging process concerns (e.g. underwater noise)
- d) Negative view towards USACE intent
- e) Expectations regarding what the USACE could pursue through policy and budget
- f) Assumptions and concerns were not a problem
- g) Other [Open Response]

The majority of participants marked three or more of the response options as responsible for delays in project progress collaborations. The responses “dredged material character concerns (believed “dirty”)” and “negative view towards USACE intent” were selected most frequently as the assumptions or concerns that typically delay project progress (five of seven respondents selected one or both of these choices). Concerns regarding “active placement” and the “dredging process” and “expectations regarding what the USACE could pursue through policy and budget” were selected by three persons each. No participants responded that “assumptions and concerns were not a problem.” One participant further noted that “there is a lack of understanding of the dredging process” and that assumptions and concerns can be mitigated by “collaboration, before, during, and after the dredging work to facilitate active communication.” The results of this

survey question indicate that proactively building trust between the USACE, resource agencies and stakeholders, and fostering better understanding of the science and technology related to dredging and beneficial use placements could reduce project progress delays.

- 9) Does a typical project include a monitoring plan? If yes, who is responsible for the monitoring?
- a) Yes, the USACE performs monitoring as a project requirement
  - b) Yes, the USACE performs monitoring for its own data-gathering purposes
  - c) Yes, the resource agencies/stakeholders perform monitoring
  - d) Yes, Other [Open Response]
  - e) There is typically not a monitoring plan

During the RSM and EWN workshop, several comments were made regarding a lack of monitoring data to show the effects of projects and to “tell a good story.” This question was included in the survey to determine if and how a model PMP or P2 WBS template should include planning for project monitoring. The majority of participants responded that there typically is a monitoring plan (two participants responded that there typically was not a specific monitoring plan). The responses were distributed equally amongst who does the monitoring and for what purpose. One participant noted that resource agencies and stakeholders are taking a more prominent role in monitoring activities. In light of the responses to this question, it may be advisable to incorporate monitoring plan-related activities into a proposed model or template.

- 10) What are some of the “lessons learned” that you have encountered during project execution? [Open Response]

Three of seven participants provided information on lessons learned through the survey. Their responses were as follows:

- “Be flexible and keep resource agencies updated.”
- “Include the resource agencies and stakeholders early and continue to communicate throughout. In the past the thought of a single meeting was sufficient. This was a bad assumption.”
- “Involvement of all resource agencies and stakeholders is a long and tedious (sometimes contentious) process, but in our case... it looks like it will pay huge dividends.”

The comments provided by participants further support the assertion that “early and often” communication, collaboration, and cooperation are essential components for accomplishing RSM and EWN projects.

**Interviews.** This portion of the investigation was a more concentrated effort that provided a number of insights to consider when planning, implementing, and executing O&M dredging beneficial use projects with EWN and RSM features. Five 1-hour interviews were conducted. The respondents included one Navigation Operations Chief, three Project Managers, and one

Civil Engineer. Some of the overarching themes expressed by the interviewees were: 1) the urgent need for buy-in from upper management to show value in applying EWN-RSM principles to projects, 2) the observation that EWN and RSM would be more implementable with more time to consider opportunities and alternatives and additional funding, 3) the utilization of charrettes (highly focused and inclusive planning meetings) early on would help to better shape the project's scope, 4) the need to coordinate with ERDC for support with appropriate models, tools, etc., 5) the need to share lessons learned and successes broadly, and 6) interaction with stakeholders should be proactive, occur early in the planning process, and continue throughout the course of the project.

**Model development.** Based upon the information received from the RSM and EWN workshop, surveys, and interviews, an idealized pathway model (Figure 1) was created to 1) reflect how projects are currently being accomplished, 2) highlight the importance of communication and collaboration, and 3) identify components of RSM and EWN project planning where targeted research and the development of planning process guidance could contribute to increasing application of RSM and EWN practices.

Participants shared that the processes for assessing the need to dredge and dredged material management (DMM) are often ingrained in the O&M dredging project's plan, such that the word "traditional" is apropos. O&M Project Managers receive a finite amount of funds to execute the project and often have significant time constraints that preclude them from proactively seeking out deviations from pre-established plans. New DMM options are discovered through communication and collaboration opportunities. Executing a new option, whether it relates to equipment, placement site, or placement methodology, requires various time- and cost-consumptive actions related to seeking new environmental consistency determinations and other permitting approvals.

The information gained through this effort confirmed the purported great importance of communication and collaboration in achieving RSM and EWN projects. As presented in Figure 1, communication and collaboration (symbolized throughout in the color orange) lead to the identification of RSM and EWN opportunities, the formulation of project options that could include RSM and EWN aspects, and the overall quality of project planning that leads to the execution of a successful beneficial use project.

The model also identifies components of RSM and EWN project planning where targeted research and the development of technologies and planning process guidance could contribute to increasing application of RSM and EWN practices, including:

- 1) Innovative dredging and placement methods and designs
- 2) Utilization of research, development, and technology tools, models, etc.
- 3) Consideration of functionality, resiliency, and sustainability in plan designs
- 4) Evaluation of all benefits (including economic, social, and environmental) on both a project and system level
- 5) Monitoring of completed projects

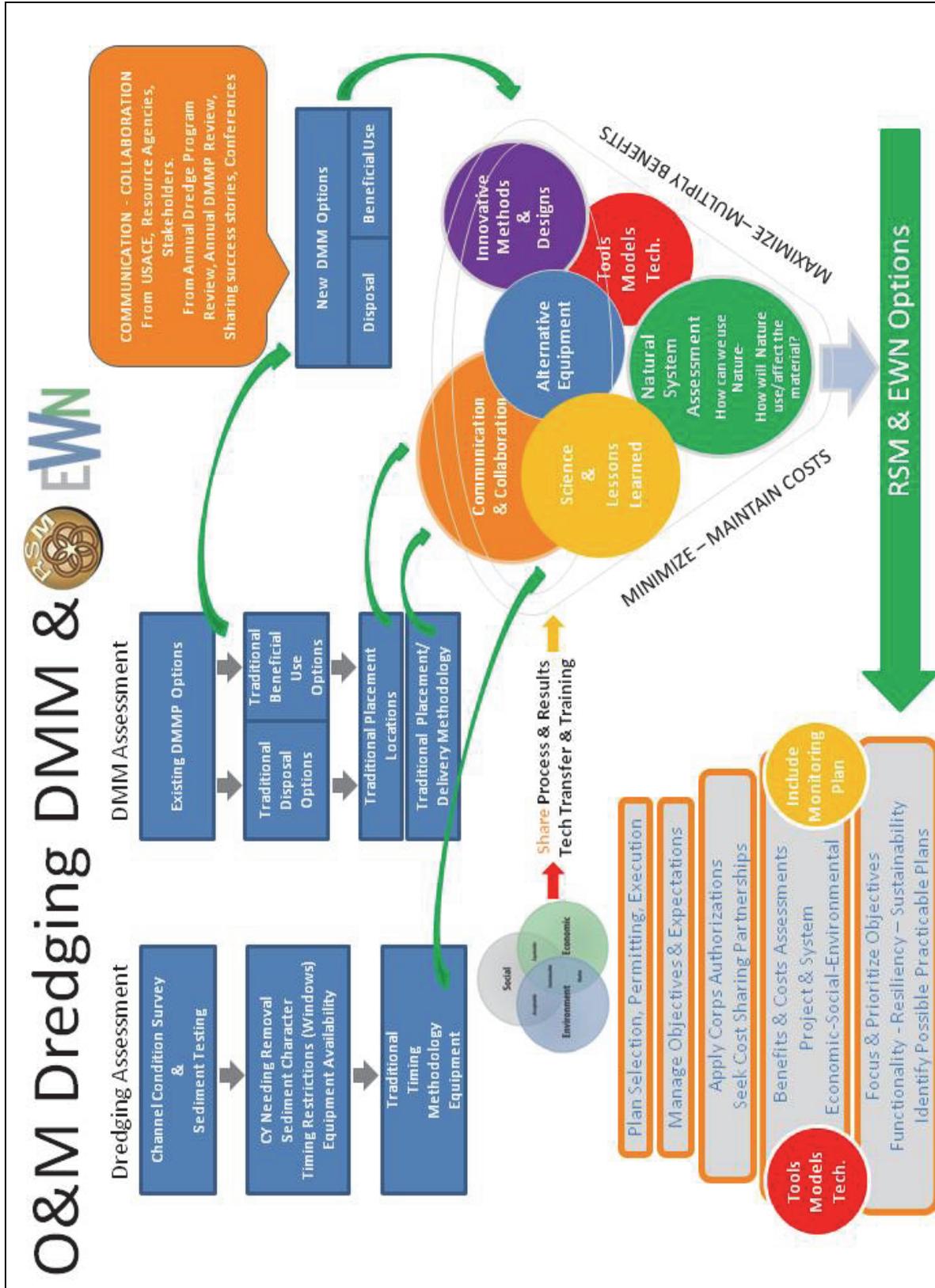


Figure 1. Idealized pathway model.

Importantly, the model presents two critical pathways related to operationalizing RSM and EWN practices: 1) sharing processes used and results achieved through information and technology transfer and training is a necessary component to support the future development and growth of RSM and EWN practices and projects, and 2) in order to affect a significant increase in RSM and EWN practices and projects, a culture shift is needed to ensure that Project Managers consistently move beyond traditional ways and means and proactively consider RSM and EWN principles and practices for the projects and systems under their management.

**RECOMMENDATIONS:** As a result of utilizing multiple forms of outreach including a workshop, a survey, and targeted interviews, insights emerged that would inform the development of a PMP and/or P2 WBS template. The following recommendations should be considered to further develop guidance or methodologies for the application of EWN and RSM principles and practices in navigation channel O&M dredging beneficial use activities.

**Maximize use of communication and coordination mechanisms.** The study results indicate that EWN and RSM projects will require coordination among multiple stakeholders. Charrettes, for example, are available as coordination mechanisms that can maximize communication with stakeholders. As stated a number of times throughout this study, it is very important to communicate with the stakeholders “early and often.”

**Research new funding mechanisms.** Incorporating EWN and RSM practices into projects is not intended to inflate project costs. Nevertheless, the potential for additional project costs will continue to be a challenge. In many cases, implementing a new strategy may initially increase costs; however, the long-term costs will decrease. Cost-sharing ideas and other funding mechanisms should be investigated thoroughly.

**Promote the EWN and RSM approach.** Continued promotion of the EWN and RSM approaches should be pursued through workshops, webinars, the internet, and conferences. For some USACE planners, project managers, etc., this is a cultural change. Synergy and innovation can be established by considering a project from an EWN and RSM perspective.

**Seek new EWN and RSM research ideas.** Workshops such as that described above garner numerous ideas for EWN and RSM research. Once ideas are gathered from such forums, the input should serve as a resource to develop future research efforts.

**Revisit the Project Management Business Process (PBMP).** USACE policy for PMBP remains a viable resource for project development and should be utilized to the extent possible. The PMBP is the doctrine by which the USACE executes and delivers projects in a consistent manner. PMBP enables: 1) consistent program and project execution, 2) focus on meeting commitments, 3) parameters to measure progress across the entire organization, 4) focus on project inclusiveness, and 5) culture change (USACE 2012d).

**POINTS OF CONTACT:** For additional information, contact Cynthia J. Banks (601-634-3820, [Cynthia.J.Banks@usace.army.mil](mailto:Cynthia.J.Banks@usace.army.mil)) or Jennifer M. Gerhardt-Smith (601-634-3702, [Jennifer.M.Gerhardt-Smith@usace.army.mil](mailto:Jennifer.M.Gerhardt-Smith@usace.army.mil)). This technical note should be cited as follows:

Banks, C. J., and J. M. Gerhardt Smith. 2013. *Operationalizing Engineering With Nature - Regional Sediment Management Principles and Practices into Operations & Maintenance Dredging Beneficial Use Project Management*. DOER Technical Notes Collection. ERDC TN-DOER-R20. Vicksburg, MS: U.S. Army Engineer Research and Development Center. <http://el.ercd.usace.army.mil/>.

## REFERENCES

- U.S. Army Corps of Engineers (USACE). 2011. *Sustainable Solutions to America's Water Resources Needs-Civil Works Strategic Plan 2011-2015*. [http://planning.usace.army.mil/toolbox/library/Misc/Sustainable\\_Solutions-2011-15.pdf](http://planning.usace.army.mil/toolbox/library/Misc/Sustainable_Solutions-2011-15.pdf) (accessed 10 September 2012).
- U.S. Army Corps of Engineers (USACE). 2012a. Engineering With Nature Fact Sheet. Website: <http://EngineeringWithNature.org> (accessed 7 August 2012).
- U.S. Army Corps of Engineers (USACE). 2012b. USACE “reinvigorates” Environmental Operating Principles. Website: <http://www.usace.army.mil/Media/NewsArchive/tabid/204/Article/3592/usacereinigorates-environmental-operating-principles.aspx> (accessed 13 September 2012).
- U.S. Army Corps of Engineers (USACE). 2012c. Regional Sediment Management Program FY12 Fact Sheet. Website: [http://rsm.usace.army.mil/pubs/facts/RSM\\_FY12\\_FactSheet.pdf](http://rsm.usace.army.mil/pubs/facts/RSM_FY12_FactSheet.pdf) (accessed 11 December 2012).
- U.S. Army Corps of Engineers. (USACE). 2012d. PMBP Portal Document Library. Website: <https://pmbp.usace.army.mil/portal/page/portal/DocLib/PMBPManual/> (accessed 13 December 2012).
- U.S. Army Corps of Engineers - Navigation Data Center (USACE NDC). 2012. The U.S. Waterway System Facts. Website: <http://www.ndc.iwr.usace.army.mil/factcard/factcard.htm> (accessed 13 November 2012).
- U.S. Army Corps of Engineers - Regional Sediment Management Program (USACE RSM). Website: <http://rsm.usace.army.mil/> (accessed 7 August 2012).

**APPENDIX A**

Question #	Question Posed to Survey Participants
1	<p>At what stage of a typical project do you identify the beneficial use opportunity or innovative design or method?</p> <ul style="list-style-type: none"> <li>a) It is already part of the Dredged Material Management Plan (DMMP) and project plan</li> <li>b) During consideration of the larger RSM plan</li> <li>c) During resource agency and/or stakeholder meetings</li> <li>d) Identified from other USACE project experience/lessons learned</li> </ul>
2	<p>For a typical project iteration, do you meet with resource agencies or local stakeholders first?</p> <ul style="list-style-type: none"> <li>a) Resource agencies</li> <li>b) Local stakeholders</li> <li>c) Met with them at the same time</li> <li>d) Did not meet with resource agencies of Local Stakeholders</li> <li>e) Other [Open Response]</li> </ul>
3	<p>What specific tools, technologies, or methodologies have you used that contribute to EWN project features? [Open Response]</p>
4	<p>The P2 input for a typical project Work Breakdown Structure (WBS) is:</p> <ul style="list-style-type: none"> <li>a) Simple, only 1-3 major task identified in the P2 WBS</li> <li>b) Moderate, several major tasks and subtasks are identified in the P2 WBS</li> <li>c) Complex, the P2 WBS shows multiple tasks, subtasks and activities</li> <li>d) Very Complex, the WBS is detailed to show multiple tasks, subtasks and activities and identifies individual persons, work units, branches</li> <li>e) P2? Someone else does that.</li> </ul>
5	<p>To accomplish projects, do you actively team with Subject Matter Specialists</p>

	<p>at: [Check all that apply.]</p> <ul style="list-style-type: none"> <li>a) Another District,</li> <li>b) Another Division,</li> <li>c) A U.S. Army Engineer Research and Development Center (ERDC) Laboratory, or at</li> <li>d) A Resource Agency,</li> <li>e) A University,</li> <li>f) With Industry/Contractors</li> <li>g) A Professional Facilitator</li> <li>h) None of the Above – Other</li> <li>i) None of the Above – All work was accomplished using ‘home’ District personnel</li> </ul>
6	Are costs typically in excess of the Federal Standard? [Yes/No]
7	<p>What are the effects of using EWN concepts on a typical project?</p> <ul style="list-style-type: none"> <li>a) Reduced overall cost</li> <li>b) Reduced schedule length</li> <li>c) Reduced overall cost and schedule length</li> <li>d) Increased overall cost</li> <li>e) Increased schedule length</li> <li>f) Increased overall cost and schedule length</li> <li>g) No effect to cost or schedule</li> </ul>
8	<p>Do assumptions or concerns typically delay project progress for collaborations with Resource Agencies and Stakeholders? If yes, what assumptions/concerns do you feel delayed progress the most? [Check all that apply.]</p> <ul style="list-style-type: none"> <li>a) Dredged material character concerns (believed “dirty”)</li> <li>b) Dredged material active placement concerns</li> </ul>

	<ul style="list-style-type: none"><li>c) Dredging process concerns (e.g. underwater noise)</li><li>d) Negative view towards USACE's intent</li><li>e) Expectations regarding what the USACE could pursue through policy and budget</li><li>f) Assumptions and concerns were not a problem</li><li>g) Other [Open Response]</li></ul>
9	<p>Does a typical project include a monitoring plan? If yes, who is responsible for the monitoring?</p> <ul style="list-style-type: none"><li>a) Yes, the USACE performs monitoring as a project requirement</li><li>b) Yes, the USACE performs monitoring for its own data gathering purposes</li><li>c) Yes, the resource agencies/stakeholders perform monitoring</li><li>d) Yes, Other [Open Response]</li><li>e) There is typically not a monitoring plan</li></ul>
10	<p>What are some of the lessons learned you have encountered during project execution? [Open Response]</p>

**NOTE:** The contents of this technical note are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such products.