Upper Mississippi River Restoration

Habitat Rehabilitation and Enhancement Project (HREP) Planning and Design Workshop

Grand River Center - Dubuque, Iowa
May 6-8, 2019

Day 1

Opening Remarks/Setting the Stage

Marshall Plumley provided a welcome and introduction to UMRR's sixth HREP workshop. Plumley remarked that the workshop demonstrates the strength of the partnership by its willingness to convene, collaborate, share experience and knowledge, and learn together. Five webinars were held leading up to the workshop to provide participants with fundamental information about the program. Topics included a "101" on UMRR, the HREP element, and the LTRM element as well as the Habitat Needs Assessment II (HNA-II) and the hydrology and hydraulics modeling. Recordings of these webinars are available on UMRR's website on the "Key Initiatives" page (https://www.mvr.usace.army.mil/Missions/Environmental-Protection-and-Restoration/Upper-Mississippi-River-Restoration/Key-Initiatives/HREP-Workshops/HREP-2019/). Given very positive feedback received, Plumley said future webinars may be convened on various programmatic topics.

Plumley provided an overview of the workshop objectives and thematic areas, as follows:

<u>Objectives</u>

- Build relationships and facilitate dialogue among UMRR's restoration practitioners, planners, engineers, and scientists
- Discuss insights gained about project design, construction, monitoring, and OMRR&R
- Learn how ecological and specific habitat goals and objectives guide HREP planning and design
- Strengthen UMRR's restoration efforts by learning from insights gained as discussed above

<u>Thematic areas</u>

- Risk informed planning as a tool for project development
- Lessons learned (i.e., knowledge gained) since the 2016 UMRR HREP Workshop
- Modeling tools and continued integration of the HREP and LTRM components

Plumley provided an overview of the FY 2019 UMRR plan of work. The program was fully funded at $33.17 million for the third year in a row. The program puts more wetland restoration on the ground than any other Corps program in the nation. As of 2019, UMRR has constructed 56 projects affecting 106,000 acres. Currently, there are 17 projects in planning and design. Plumley also provided reflections on major lessons learned during his first-year tenure as UMRR Program Manager, grouping them by the following themes: listen, people first, execution, partnership, stewardship, and vision. UMRR is the first large riverine ecosystem restoration and scientific monitoring program. UMRR benefits from its multilayered and diverse regional partnership, which places a high value on the integration of science and rehabilitation activities.

Partner Remarks

Megan Moore (Minnesota DNR) expressed support for using HNA-II to inform HREP project selection. Moore recommended that water level management be considered in HREP selection and funding. The notion to review projects more regularly as new priorities emerge is important, and there may be opportunities to use channel maintenance in conjunction with UMRR funds to advance projects. Project partnership agreements (PPAs) remain an issue for Minnesota serving as a cost-share sponsor.

Jim Fischer (Wisconsin DNR) reflected on the considerable changes in both the river and UMRR over his career. UMRR is reaching maturity. It is a well-respected program nationally and internationally and has served as an exemplary program because of its cutting-edge science and restoration accomplishments. Fischer acknowledged that further work remains to integrate the HREP and LTRM elements. He said the HNA-II is a good example of integration that will move the program forward in a unified way. This workshop represents another opportunity for growth in the program. Fischer encouraged everyone to engage with those involved in different components. UMRR is fortunate to have received full funding now and in recent years. Fischer suggested that the next HREP selection process be flexible, to adjust to new priorities, and promote funding-dependent scalable projects as well as innovative projects – e.g., collaborating with the Corps' Channel and Harbor Program.

Randy Schultz (Iowa DNR) said the investment to develop HNA-II proved beneficial. Schultz underscored the importance of restoring, protecting, and enhancing off-channel areas and floodplain forest as well as monitoring functionality and longevity of HREPs. PPAs remain an issue for Iowa. He thanked Plumley for his commitment to collaboration, observing that internal communication is at its greatest during his tenure. Partnership communication is integral to the program's success.

Matt O'Hara (Illinois DNR) emphasized that Illinois DNR is committed to being a more engaged partner than in recent years following significant staff turnover. The agency will have hired all river staff in the next few months. Rivers are changing and require careful selection and evaluation of projects going forward. O'Hara is encouraged by his experience and involvement in the program to-date as well as the demonstrated commitment of partners.

Matt Vitello (Missouri DoC) said he is excited to see UMRR's use of the HNA-II to select and design habitat projects, especially as the projects relate to submerged aquatic vegetation. He expressed interest in developing innovative approaches to HREPs, implementing projects in the open river, and potentially, revisiting historic HREPs to see how they could be improved.

Jeff Houser (USGS) discussed USGS' role in providing high quality science, data, and information. USGS maintains long term datasets with staff at UMESC providing analysis expertise and the LTRM field station infrastructure allows for important data collection. Houser reiterated that the two reports from the HNA-II effort provide a great example of integration within the program by combining the long-term data with the expert opinion of river professionals. HREPs provide abundant learning opportunities as they alter fundamental drivers of river conditions. Houser suggested that more is learned from established and future HREPs.

Tim Yager (USFWS) explained that USFWS' mission is to protect fish and wildlife habitat. USFWS is involved in UMRR through its fisheries, ecological services, and Refuges. Ultimately, Refuge priorities will drive development of projects at those locations. Yager voiced support for the HNA-II and expressed particular interest in using HNA-II to help identify lost or missing habitat and inform how to recreate that habitat. USFWS staff assisted the river teams in the recent selection of new HREPs.

Plumley acknowledged the multiple nonprofits that support UMRR in various ways.

District HREP Highlights

Shahin Khazrajafari, Erica Stephens, and Brian Markert discussed UMRR's habitat projects recently constructed, under construction, in feasibility, and in the queue for future work. They discussed ecological objectives, restoration techniques and approaches, design considerations and challenges, insights gained from individual projects, and goals for future restoration.

Risk-Informed Planning

Rachel Perrine explained the major phases of the Corps iterative planning process for HREPs using Steamboat Island as a case study. The PDT meets for a kickoff meeting that includes a charette and site visit followed by a conceptual model workshop. A public open house will seek input regarding problems, goals, and objectives. The PDT will then meet to identify potential features, including an array of alternative combinations of those features. Condition forecasts are developed for those various combinations as well as for a "no action" condition. A cost-effectiveness and incremental cost analysis (CE/ICA) is conducted to assess the return on investment for the alternative plans and to help identify a tentatively selected plan (TSP). The draft feasibility report is submitted for review within the partner agencies, MVD, and the public.

Rachel Mesko described the directive from James Dalton, Director of Civil Works, to operationalize risk-informed decision-making, moving away from risk aversion tendencies to designing projects with innovation and risk acceptance. Mesko also discussed how risk-informed planning relates to past Corps planning processes – i.e., SMART planning and the Corps' six-step process. Risk management requirements and tools can be tailored to individual programs such as UMRR. The purpose of risk-informed planning is to reduce uncertainty. This happens by gathering information needed to make the next decisions and to manage the associated risks without having complete information.

Reducing uncertainty facilitates more deliberate decision-making that results in greater confidence in the final recommendations. "Instrumental uncertainty" refers to issues that could affect a decision and, therefore, should be the focus of risk reduction. "Relevant uncertainty" refers to issues that might be pertinent but would not affect a decision. Mesko explained the following three types of risk that should be considered:

- Study risk – e.g., analytical error, delays, costs
- Implementation risk – e.g., schedule and cost of implementation, re-design
- Outcome risk – e.g., project performance, safety

Risk registers are tools for the PDT to identify, document, and evaluate risks associated with planning decisions to help anticipate potential effects of uncertainty on the quality of the study and project outcomes. Risk registers evolve with the study and risks identified should continue to be evaluated, monitored, and managed throughout the life cycle of the project – i.e., planning, design, construction, and operation.

Rapid Iteration

Mesko said PDTs should employ their first rapid iteration within 30-days of the study's initiation with its second iteration finished within the first 100 days and the third iteration within three years or by the time the study is complete. Broadly, the first iteration establishes what is known and unknown. The second iteration involves evidence gathering and incorporates other available sources of information to reduce risk and uncertainty. The third iteration identifies remaining information needs and develops new data to support decision-making and to further reduce risk and uncertainty.

Participants formed breakout groups to engage in a rapid iteration exercise, using Yorkinut Slough to answer the questions listed below. Jasen Brown provided an overview of Yorkinut Slough to provide participants with a general understanding of the project.

1) Identify at least one problem, one opportunity, one objective, and one constraint
2) Generally describe the existing and future-without-project condition
3) Identify an array of measures and their associated function or related objective
4) Identify an initial array of alternatives and criteria that can be used to evaluate and screen alternatives
5) Develop a "best guess" alternative that could be the TSP
6) Identify key risks and uncertainties to be addressed in future iterations

Day 2

Rapid Iteration Debrief

Each group from the Day 1 facilitated exercise provided a report of its rapid iteration exercise. As a large group, participants offered their perspectives on the use of rapid iteration for HREP planning. Kara Mitvalsky observed that some people need to reflect on preparatory material in advance of meetings in order to weigh in and actively participate. Megan O'Brien said it would be helpful to include field-level staff who have familiarity with the project site. Marshall Plumley added that rapid iteration might facilitate programmatic integration efforts – i.e., project planning would benefit from the involvement of LTRM experts. In response to a question from Megan McGuire, Plumley said conversations about problems, opportunities, objectives, and constraints (POOCs) should happen early in the planning process. Erica Stephens cautioned against deciding on the TSP too quickly without adequate evaluation.

In response to a question from Gretchen Benjamin, Plumley said rapid iteration could be a tool that the river teams use to identify future HREPs. Steve Clark acknowledged that rapid iteration could be helpful at the first kickoff meeting to get an understanding of partners' opinions. Clark observed that rapid iteration may also serve as a good team building activity. Scott Gritters and Stephen Winter echoed the sentiment. Gritters said it appears that rapid iteration does not fundamentally change the planning process. Winter said the iteration exercise might be helpful in introducing new people to the UMRR planning process. Dave Herzog asked how this process could be used to inform HNA-II, LTRM, or resilience efforts. In response to a question from Matt Mangan, Mesko explained that rapid iteration could be used at various points in the planning process such as prior to a TSP decision or after the ATR is complete. Jim Fischer recommended that river teams use this at upcoming meetings to discuss HNA-II indicators.

Neal Jackson noted that rapid iteration seems to be related to structured decision-making. It will be important to clearly articulate next steps and desired end product. Chuck Theiling suggested that rapid iteration be paired with a conceptual model and that a standard process for using the technique be developed that aligns with the HREP fact sheet format. The HNA-II should inform rapid iteration exercises. Sharonne Baylor emphasized the importance of having a good project manager or planner to effectively use rapid iteration and document process and decisions. According to Jeff Janvrin, UMRR used a form of rapid iteration in the program's early years to make decisions with relatively little information. Janvrin emphasized the importance of integrating the process with HNA-II and managing stressors in the system, not just addressing drivers.

Mesko reiterated that UMRR is just beginning to test the rapid iteration technique and learning how to apply it to meet the program's habitat project planning needs.

Applying Risk-Informed Planning

Rachel Mesko explained that risk informed-planning is used to focus on the necessary information, balancing time, effort, expense, and risks of decision-making. Mesko provided the following four guiding questions for the process:

1) What is the planning decision?
2) What data are needed to make the decision within constraints?
3) What is the risk involved with the decision?
4) Is the data good enough to make the decisions with the risk identified?

Rachel Perrine explained that the use of risk-informed decision-making in planning the Bass Ponds HREP was critical to its success. The PDT recorded decisions and associated risks (using a decision log), communicated known risk to the vertical team, and conducted an abbreviated risk assessment exercise, ultimately resulting in increased cost contingency. If the project had started today, planning would likely have involved a rapid iteration exercise and the use of a risk register in conjunction with the decision log.

Marshall Plumley noted that Bass Ponds is uniquely located in an urban area, presenting different risks than typical UMRR habitat projects. Angela Dean said communication flyers were distributed to the Minnesota Department of Transportation, Cargill, and other companies. Low attendance at the public meeting may indicate general support among the local public. Mangan thanked presenters for demonstrating how these techniques are applied to actual habitat projects. Plumley noted that decision logs also are helpful for detailing the application of these tools. Mangan suggested that trained staff help facilitate the PDTs through the use of these new techniques.

Following initial small group discussions at individual tables, the full group reflected on the application of any of the concepts, tools, or strategies presented thus far as well as any general takeaways or other perspectives. Karen Hagerty noted that decision logs provide an outlined schedule that can be helpful to planning for when decisions will be asked of project sponsors and partners. Kirk Hansen suggested that a consensus log be developed to detail points of agreement and disagreement, including when that occurred throughout the planning process. Neal Jackson agreed, emphasizing the value of structural models. Jackson suggested that the consensus log note the key concept or strategy being used.

Megan Moore observed that, and Mangan voiced agreement, rapid iteration and HNA-II should help in developing projects more collaboratively. Marshall also agreed and noted that river teams had been tasked with identifying these needs going into the HREP selection process. In response to a question, Plumley said the process does not address future conditions, but the PDT must still evaluate a “future-without-project.” Plumley said more emphasis is needed on post-project monitoring.

Ed Britton said USFWS’s habitat management plan outlines issues of concern that need to be considered. Dave Potter added that project sponsors sometimes have agency-specific constraints that need to be addressed prior to them committing to a project and the associated OMRR&R obligations. Sharonne Baylor and Kirk Hansen observed that prolonged decision-making or over analysis may have negative unintended consequences – i.e., delayed work. Perrine agreed, pointing to the decision to use professional judgement to include timber stand improvement in Bass Ponds HREP rather than wait (and pay for) a forest inventory to be completed.

Erica Stephens stressed the importance of avoiding “false consensus” on decisions. Stephens emphasized the potential tradeoff with not adequately understanding the consequences of decisions made. Kara Mitvalsky said that additional vetting in the planning phase can be very valuable and result in efficiencies in feasibility. Mangan underscored the value of decision logs for facilitating PDT members in effectively providing comments as well as for the sake of transparency. The logs should be readily available to all PDT members. Plumley agreed, noting that decision logs are also helpful for new staff to quickly learn about a project and its planning status.

General Discussion

Plumley reflected on the results of a live polling exercise. Of all participants, there is a total of 829 years of experience with UMRR at the workshop. Twenty-five attendees have been involved with UMRR for less than three years, 40 attendees have been involved between three and 20 years, and 20 attendees have been involved for more than 20 years.

Megan McGuire used live polling to capture feedback from attendees on various concepts presented thus far. Images provided below show the most frequently used words in the responses.

Question: What key ideas have you heard?

Question: What new ideas have you learned?

Plumley said the results clearly show that the partnership is highly valued, including opportunities to have meetings and discussions. Other themes that are apparent in the responses include integration, flexibility, and innovation. Plumley acknowledged the partners' universal acceptance of HNA-II. Partners are interested in exploring opportunities for collaborating with channel maintenance. He recognized that UMRR's partnering agencies and organizations bring important missions, goals, and perspectives, making the program more powerful.

Lessons Learned

Habitat Criteria

<u>Bluegill Overwintering Model</u>

Dillan Laaker explained that bluegill not only offers valuable recreation opportunities but serves as an important indicator of the ecosystem. Two-thirds of the 30 HREPs located in Pools 4 to 11 include an objective to improve Centrarchids' overwintering habitat. The Corps uses a bluegill overwintering model to predict and evaluate potential restoration features. The model evaluates dissolved oxygen, temperature, water velocity, and depth. Potential changes to the model are being evaluated.

Laaker explained that the revisions to the bluegill overwintering model are as follows:

1) Creating a 0 mg/L input for dissolved oxygen
2) Modifying the backwater depth curve to indicate that having over 80 percent of backwaters deeper than four feet would decrease survival
3) Revising the desired backwater depth threshold from four feet to two meters
4) Adjusting the current velocity curve to show that velocities exceeding six cm/sec are detrimental
5) Revising winter water temperature peak to three degrees Celsius.

Additional parameters to consider include connectivity, cover, size of backwater, and residence time. The Corps will continue to draft potential updates to the model and then run sensitivity tests on completed HREPs.

Mussel Model

Michael Dougherty presented on the Corps' new spatially explicit model for mussels. The model was developed using machine learning (i.e., Maxent) with existing UMR mussel data. The predictor variables are derived from the adaptive hydraulics (ADH) two-dimensional modeling commonly used in HREP planning, including velocity, sheer stress, Reynolds number, Froude number, depth, and slope. The dependent variables include the mussel community assessment tool (MCAT) metrics – i.e., percent listed, percent tolerant, percent lampsilini, percent juveniles, percent greater than or equal to 15 years old, abundance, species evenness, tribe evenness, and species evenness.

Dougherty provided an overview of the how the mussel model can be applied to the Steamboat Island HREP. The model is useful for determining project impacts associated with various design concepts because it is able to measure fine grain changes across the study area. The model can be used to predict mussel suitability to compare alternatives and calculate habitat units.

Floodplain Forest Modeling

Lucie Sawyer presented on design criteria for floodplain forest restoration, such as using inundation characteristics to support forest management actions. Flood inundation is a fundamental driver of successional patterns in floodplains. Frequency, duration, depth, and timing are the fundamental ecologically-relevant attributes of flooding. Sawyer explained the three types of silvicultural prescriptions from MVR's forest management plan – i.e., timber harvest, thinning treatment, and tree planting with topographic diversity. Better understanding flood inundation is particularly important for placement of tree planting. Sawyer explained that the HEC-Ecosystems Function Model (HEC-EFM) is a tool that combines forester expertise with hydrologic analysis allowing time series analyses to determine ecosystem responses to changes in flow regime. HEC-EFM can help answer two questions:

1) How long can tree species be wet during the growing season until mortality is likely?
2) How frequently can this inundation duration be exceeded without increasing likelihood of mortality?

Required inputs for HEC-EFM are growing season, inundations duration (conservative assumption), exceedance probability, and period of analysis – e.g., most recent 30 years. The output can determine minimally-tolerant species for a given project area as well as whether and how wetland soils relate to a project's objectives. One limitation is that professional judgement has not yet been validated (with systemic inundation datasets or forest inventory data) regarding the classification of certain tree species as flood tolerant.

In response to a question from Megan McGuire, Sawyer said Nate De Jager has developed a regression curve using DBH to serve as a proxy for tree age. Ben Vandermyde said the regional forestry group is working with Molly Van Appledorn and De Jager to capture the threshold for flooding duration with regards to the relative age of forest.

Ben McGuire asked whether the floodplain forest models are applicable across the UMRR and/or could be tailored to the three UMR Corps districts. Sawyer said inundation modeling can be used to identify the landscape variables having the strongest influence. Dougherty said systemic datasets can be used to create system-wide models.

In response to a question from Tim Yager, Laaker said the bluegill model does not account for variable ice cover due to climate change but suggested that it be addressed in future iterations of model development. Scott Gritters expressed concern that the bluegill model double counts for dissolved oxygen when at high temperatures.

Gritters asked if some mussel populations are suppressed in deeper waters dominated by zebra mussels. Dougherty explained that areas having high zebra mussel presence are not used to "train" the model. The more normal mussel sites are used for model development.

Kirk Hansen noted that fish move into areas independent of ice. Neal Jackson pointed out that the model includes parameters affected by ice, thereby indirectly accounting for climate change. Dougherty suggested that "depth below ice" serves as the variable to estimate bluegill habitat.

In response to a question from Rachel Perrine, Dougherty acknowledged that any model used for project planning must be certified by a Corps review process. UMRR will need to identify which models to seek certification. Multiple PDTs have expressed interest in using the mussel model, if approved. Matt Mangan agreed that model certification is important. Mangan questioned UMRR's long term intentions given that the program has transitioned a few times just over the last ten years.

In response to a question from Dave Herzog, Dougherty said that models cannot address all life cycle factors but can show correlations to other considerations. The model review process should address the models' strengths and weaknesses. Laaker said young-of-the-year fish utilize the same the habitat as older fish. Gritters added that young-of-the year fish could use even shallower habitat.

Evaluating HREPs

Ben McGuire provided a brief overview of the policy and guidance for monitoring HREP success. WRDA 2016 resulted in some changes in the required monitoring. Monitoring plans can be relatively simple, but the scope and duration need to include the minimum monitoring necessary to evaluate success – i.e., to demonstrate the functionality of each project feature and how to address any inadequacies as identified. Monitoring must connect directly to the project objectives. Monitoring is employed either until success criteria is met or ten years has passed since project construction is complete.

Dave Potter presented on several recent UMRR project performance evaluation reports (PERs). Potter outlined the associated milestones and activities, including the responsibilities of the Corps and of the sponsor during pre-construction, construction, and post-construction. Ideally, the Corps develops an initial PER five years post-construction and the final PER 10 years post-construction. The PER template includes an executive summary, introduction, project purpose, project description, project performance monitoring, project evaluation, public support, and lessons learned.

The St. Louis District has constructed ten HREPs. All of the projects have initial PERs and one project has a final PER. The Rock Island District has 60 completed PERs for 15 of 19 constructed HREPs. This includes 53 initial PERs and seven final PERs. Site inspections were done for all the District's constructed HREPs between 2016 and 2018. The St. Paul District has constructed 27 HREPs, 14 of which have PERs completed and inspections were completed on 17 HREPs in 2018. St. Paul District has taken 14 years on average to complete a PER. PERs represent an important milestone for projects though they are challenging to complete and there are differences in how performance is assessed and implemented across districts. Some challenges to completing PERs include staff turnover, perception as a low priority, no central repository for data/reports, a long response time when requesting information, and mother nature delaying monitoring.

Construction During an Era of Increased Flows

Scott Baker described a significant upward trend in annual discharge according to gages between the Twin Cities and Guttenberg since 1940. Moreover, there has been a transition to wetter conditions with greater variability from the early 1980s to present day. Baker presented a case study of Capoli Slough Stage 2, which included building two islands. To accommodate high water, the contractor first built up the middle of the islands so work could continue and was then able to push out stockpiled material to toe stakes to complete the island when water receded. The contractor also built bump outs for survey equipment to allow accurate and consistent monitoring while minimizing impact on construction activities. Baker credited the contractor's attention to NWS forecasts, experience, and good surveys for allowing the work to finish to final grade with a minimum of double handling and additional costs.

Mark Pratt said high water cannot be defined by flood stage as many project features are located below flood stage. High water should not be a static number, but rather task dependent. High water conditions occur any time of year and are hard to predict. Pratt explained some of the recent impacts on HREPs due to high water, including for Pool 12 Stage 2-Stone Lake, Pool 12 Stage 3-Kehough Slough, Beaver Island, and Huron Island. High water can result in delays in scheduled seeding, planting, material placement, and rock work, among other construction tasks as well as damages such as erosion, wash out, inundation of trees. Damages to constructed features include bankline erosion, scour holes, and deposition of debris. Costs due to any delays are absorbed by the contractor. As a result of more frequent high water events, Pratt said the Corps is adding flexibility to construction schedules, and said it may be wise for the Corps to anticipate needing to accept some of the financial burden when circumstances out of contractor control.

Mark Games provided a contractor perspective regarding the implications of constructing HREPs under frequent high water conditions. Games said HREPs are high-risk projects due to the frequency of flood events that can impact project schedules. Contractors experience difficulty accessing project sites that is further challenged by the uniqueness of each project. Opportunities to reduce risk include repeating feature designs across projects and determining how projects could be accessed during high water, including via local roadways.

Games suggested the use of best available bathymetry data in planning as well as the involvement of hydrologists with experience in high water events. Project designs should evaluate how various features can withstand erosion from high water and how rock can be used to lessen high water impacts. Games recommended developing a high water action plan. During construction in high water, access dredging can be reduced or eliminated for some features, most rock structures can be placed if adequate rock sizes are used, and some islands can be placed if greater than four feet above the low control or flat pool level. Lessons learned should be documented to inform future projects. Additionally, adaptive management should be considered for upgrades or repairs.

Sharonne Baylor mentioned that tree planting is occurring after construction in order to realize the final topography. In response to a question from Jesse Ray, Pratt and Baker said Lowest Price Technically Acceptable or low-cost bids are used. In response to a question from Matt Vitello, McGuire said the project success determination is delegated to the MVD Commander. The District Commander and project sponsor inform that decision as well as a completed PER.

In response to a question from Matt Mangan, Ben McGuire said projects may be started before an adaptive management approach is developed. Marshall Plumley responded to a follow-up question from Mangan, saying the Corps needs to consider how or whether UMRR can provide improvements to completed habitat projects. Jon Hendrickson said UMRR was able to fix the Peterson Lake habitat project, which was not providing sufficient water levels to provide habitat for the desired fish response. In response to a question from Tim Miller, Steve Clark noted that a pool scale drawdown was considered in the North and Sturgeon Lakes HREP in Pool 3, but was not accepted due to its high cost and 50 percent chance of success. Clark suggested that UMRR focus on resolving the long-term issues associated with implementing drawdowns rather than focusing on the issues specific to an individual HREP. Dan Dieterman suggested maintaining low water conditions during construction to alleviate high water concerns.

UMRR HREP Knowledge Sharing and Breakout Session

Kara Mitvalsky presented on the history of UMRR's knowledge sharing. Mitvalsky said LTRM's database provides access to monitoring data on fish, water quality, macroinvertebrates, and vegetation. The site allows for filtering searches by a range of criteria. A program-wide HREP database provides information on project costs, goals and objectives, project characteristics, boundaries, and restoration features, but is currently accessibly only by USACE staff. UMRR's website provides programmatic information to the public. Seven workshops held in 1996, 1999, 2002, 2005, 2008, 2016, and 2019 have brought together individuals who help plan, design, build, operate, maintain, and monitor HREPs. UMRR has submitted four reports to Congress and is now preparing the third revision of the Design Handbook. Mitvalsky emphasized the importance of documenting and incorporating the latest information into a central location to ensure that UMRR continues to develop a high standard of restoration projects.

Participants formed break out groups based on HREP techniques – i.e., localized water level management, dredging, river training structures and secondary channel modifications, floodplain restoration/floodplain forest, islands, and shoreline and riverbank protection. The groups were tasked with discussing new design elements, performance monitoring, and changes to operation and maintenance as well as other lessons learned. Facilitation questions are listed below as well as general statements form the group's discussions.

<u>Facilitation questions</u>:

1) What habitat types can be restored or enhanced with this technique?
2) What new design elements have occurred – i.e., different dredging methods, planting survivability improvements?
3) What are some constructability lessons learned?
4) If site inspections or performance monitoring has been conducted, what have we learned?
5) What operation and maintenance lessons or changes have been made?
6) What studies, reports, or projects have been completed since 2012 that should be included or referenced in upcoming HREP feasibility reports and/or the next version of the Environmental Design Handbook?
7) How can we better incorporate HNA-II into the planning and design of new HREPs?
8) What are some methods or tools that can help us identify the best HREP features for different habitat types?
9) How can we better share lessons learned at all project stages with planning and designing HREPs, including planning, design, construction, O&M, and monitoring?

Group discussions:

Localized Water Level Management

Localized water level management (WLM) can improve habitat for waterfowl and fish in currently unproductive areas as well as trigger SAV growth and create moist soils. This technique can be useful for adapting existing projects to changing conditions and restoring areas behind abandoned agricultural levees. It can also be used to trap invasive fish species for eradication such as Asian carp. UMRR has improved the cost-effectiveness of pumps (i.e., learned that expensive pumps are not required), reduced required maintenance, designed techniques to work with the river's natural tendencies, and is taking the watershed into account in designs. Past projects have shown that older techniques to facilitate localized WLM were not always effective. For example, levee height was not factored into the design as well as the price of fuel needed to operate the pumps. The group suggested revisiting constructed HREPs to update objectives and to consider replacement or repairs to features. Changes made to this technique include the cost justification as well as the design of the pump structures. The HNA-II can help focus where to use the technique to restore lost habitat. Localized WLM might be helpful were forests are degraded from excess sedimentation. Improving localized WLM could result from focused workshops as well as efforts to reduce staff turnover. It will also be important to clearly communicate estimated O&M costs with the sponsor as soon as possible.

Dredging

Dredging is used to restore habitat in backwaters, floodplain forests, flowing channels, islands, mudflats, and isolated wetlands as well as turtle and turn nesting sites. The group recommended using dredge cuts to improve summer habitat conditions for fish in addition to overwintering sites; both for objectives relating to the availability of dissolved oxygen. New design features related to matching depth of dredge cuts to the photic zones, providing the appropriate flow for refugia, and creating more natural channel cross sections to promote depth diversity. The group recommends that future documents include graphics illustrating a more natural channel slope and for "sill" used in dredge cuts to prevent backflow of cold water. Additionally, that sections be added to the Design Handbook regarding phosphorus release rates and thresholds for depth and duckweed. Beaver Island's dredge cut was designed to match the forestry needs rather than vice versa. The Bertrom & McCartney habitat project found that the site was overburdened with fine-grained sands. Access dredging consumes the placement capacity and reduces what is available for habitat dredging. Using geotubes may help deal with highly flocculant material.

Additional recommendations and findings for future documents and projects are as follows:

- Include an illustration regarding the use of a raised berm to deflect sand (e.g., Huron Island)
- Examine access considerations when project planning to address the volume of dredging required to reach desired location – e.g., locate a better site for dredged material that is easily accessible
- Pre-dredge scour hole (e.g., Sunfish 11)
- Improve dewatering capacity to increase production rates
- Use larger buckets when mechanically dredging as it provides a cleaner method
- Include measurements of depth of fines/particle size required for growing trees on placement sites
- Include a monitoring plan for dredge cut longevity to learn about the longevity of various sites
- Identify target pools that lack deep backwater habitat – e.g., Pools 5a, 6, 11, and so forth
- Include HNA-II criteria and terminology to more effectively define objectives and measure success

- Include additional important variables not discussed in the HNA-II – e.g., fetch and velocity
- Place a higher priority on post-project monitoring
- Provide and manage a central repository for agency reports and data that is accessible on the public domain (not all agencies can access certain sites such as Dr. Checks)
- Use cloud-based document sharing forums for reports and other relevant information

River Training Structures and Secondary Channel Modifications

Modifications to river training structures and secondary channels can improve lentic and lotic habitats, depending on location and feature. The group suggested referencing the project rankings in the NESP/UMRR reach planning documents and inventory the location of existing habitat types. The group acknowledged that these structures may result in unintentional sedimentation and other impacts to habitat. The use of wood would help to direct flow and provide habitat whereas sheet piles would provide for flow but not habitat. A series of seed islands might simultaneously redirect flows while promoting natural island building. Gravel liners could be used for mussel habitat. The height of structures is an important consideration – e.g., structures along the bank line could facilitate habitat development down river. Additionally, these structures may influence connectivity whether desired or not.

The group discussed various insights gained since 2012. This includes that similarly constructed structures have differing results in various locations. Deflection structures may cause scouring, which could be designed to be helpful in achieving objectives. Rock size is an important consideration; if correct, the structure will work as intended. Associated sedimentation from the structure could create new problems.

The group suggests continuing hydraulics and hydrology modeling as well as hydrogeomorphic analyses. Constructed projects could provide useful information sources as well as the backwater sedimentation research and mussel modeling.

Floodplain Restoration/Floodplain Forest

USGS recently published floodplain inundation modeling to analyze the lower inundation thresholds for hard mast planting. Recent design improvements include the use of mats, tree tubes, rice berms, mounding, cover crops, tillage brassicas, and planting turnips and radishes. The use of turnips and radishes over dredge material reduces compaction, increases organic material, “shades out” noxious weeds, and regulates soil moisture. Design improvements include temporal-based and staggered planting across multiple years, collecting and storing seeds on the project site, using mounding techniques to create favorable elevations, and directly seeding on mid- to higher-elevations, which achieved variable success across sites with wet conditions. Delayed planting also allows for the soil to establish and build. Separate contracts for construction of project features and plantings have been important. Other recommendations include the use of rice berms in low lying areas as well as planting cottonwoods over oak plantings so the deer consume the cottonwood trees rather than oak trees. Weed control mats can receive excess silt and do not photodegrade, girdling the trees and unintentionally creating vole habitat. The group noted some failures with the mounding technique that need to be improved. New O&M techniques include applying three weed management entries per growing season, or possibly four entries depending on the zone. Information gained since 2012 include the use of cover crop treatments prior to planning, decoy plantings to lessen impacts from beavers, and bamboo stalks on either side of the contour. USGS’s 1950 woody seed manual also serves as a helpful reference.

Islands and Shoreline/Bank Stabilization

Islands are a sustainable feature and can be built as rock berms, seed islands, Geotech-style container islands, rock sills, sand traps, chevrons, and woody bundles. Channel management techniques (i.e., disposal of dredged material and other hard structures) can be implemented in ways that facilitate island building and restoration. Islands are particularly important for their ability to reduce wind fetch and wave action, facilitate vegetation growth, create self-scouring channels, restoring lost habitat diversity, and other multipurpose features.

Insights gained in designing islands since 2012 relate to the normal water line being greater than four feet, the use of rock armoring, veins/groins, and full rock berm as well as wood for armoring purposes and shoreline stabilization and on-site materials – e.g., existing rock, wood. The Harper's Slough habitat project provided important information regarding the efficacy of various gap sizes. UMRR has gained more knowledge of how to design islands that provide habitat while not triggering FEMA's flood height no-rise requirements. This includes maximizing wetted perimeter, channeling the flow to avoid flood impacts, and orienting the islands to use the historic footprint or adding additional shoreline complexity. The group warned against adding "ledge" as it causes erosion, and suggested planning for a larger footprint noting the large variance in alignment over time. Sub-base conditions have proven to be an important consideration as island settling differs based on where it is located within the channel. Additional lessons learned center around the profile variation of the islands. UMRR has also learned how to use bedload as seed islands to create deposition/scour zones.

Site inspections and performance monitoring showed that the islands constructed as part of the Peterson Lake habitat projects were not effectively sized. Island orientation is important for ensuring that deposition occurs as desired, including by considering flow and current changes relative to the historic footprint. Risk management is important to assess and communicate with the sponsor. The project manager's creativity to work with the nature of the river can create efficiencies in maintenance. Degradation to islands (or other damages) typically happen over different time scales.

The group noted the importance of the Corps and sponsor continuing to communicate through the O&M phase. In addition, exchange information among Districts and with other programs. Given frequent high water conditions, it is important to design islands that overtop more frequently. Other insights gained regarding O&M of islands include the use of vegetation on rock structures, how to minimize material mobilization, and the fact that dredging outside of islands tend to fill quickly.

Shoreline Protection

Shoreline protection also can improve mussel and fish spawning habitat. This measure can involve moving appropriate substrate in ways that are advantageous for mussels – e.g., gradual slope revetment, different size of rock for interstitial spaces. New features include alluvial-friendly features – e.g., modify stone size and flatter slopes to achieve desired velocity. That includes current breaks, interstitial spaces, and heterogeneity in velocity. MVS conducted a study regarding the use of locked logs to create dikes.

Lessons learned since 2012 include effective undercutting, placement of riprap/revetment to provide heterogeneity, successional stages of islands, and willow staking built into revetment.

Day 3

General Discussion

Marshall Plumley reflected on the topics and conversations covered in Day 2 of the workshop, including issues related to construction during high water, access, and challenges with seeding. Attendees identified a need for better access to data and improved sharing among partners. Plumley said he is committed to hosting workshops on a more regular basis as was done in the early years of the program. Plumley invited participants to use the live polling to identify new ideas they had heard and out of the box ideas they wanted to share. A word cloud of new ideas and a list of the top five out of the box ideas are included below.

<u>What new ideas have you learned?</u>

<u>Any out of the box ideas you would like to share?</u>

— Coordinate with channel maintenance to utilize dredged sand

— Work within constraints of the river today rather than recreating a historical version of the river

— To mitigate for staff turnover, PDTs should include more experienced individuals along with newer people to more effectively transition knowledge.

— Identify new partners – e.g., USFS, NPS, Trout/Ducks Unlimited, federal and state DOTs

— HREPs of larger-scale and with longer-duration implementation, like ongoing forest management or WLM

HREP – LTRM Integration

Jeff Houser presented on how LTRM and research support inform habitat rehabilitation and river management. Houser described the LTRM's conclusions about the river's current conditions and long-term trends. He discussed the findings of the HNA-II and the ecological resilience assessment. The 2018 UMRR Science Meeting integrated LTRM and HREP staff to determine science priorities in three thematic areas, as follows:

1) Changes in hydrogeomorphology and the implications for the future condition of the UMRS
2) Relationships between hydrogeomorphic conditions and the distribution/abundance of biota
3) The physical, chemical, and biological processes causing the observed spatial and temporal patterns in biota and water quality as described by the LTRM data.

Houser observed that UMRR is well-equipped to address these themes in part due to LTRM's systemic datasets, detailed biotic and biogeochemical data, analytical and ecological expertise, and infrastructure to efficiently collect additional data. Houser summarized the efforts of the current six working groups focusing on:

1) Changes in geomorphology
2) Vegetation, wildlife and water quality
3) Native freshwater mussels
4) Relationships among floodplain hydrogeomorphic patterns, vegetation, and soil processes
5) Woody debris
6) Vital rate drivers of UMRS fishes to support management and restoration

The next UMRR Science Meeting is scheduled for winter 2020. Houser invited UMRR partners to contact him with any suggestions for that meeting.

Dave Bierman explained that land cover/land use, bathymetry, and LiDAR are frequently used for HREPs. The long-term biological data are used less frequently. Bierman used Peterson Lake HREP as an example of successful LTRM and HREP integration. LTRM water quality staff assisted in a three-year monitoring effort at the project site prior to a proposed modification. Wisconsin demonstrated early integration with condition monitoring through winter water quality monitoring at various projects in Pools 5-9 from 1991 to 2001. Bierman highlighted additional examples of programmatic integration for habitat projects involving aquatic vegetation, backwater sedimentation rates, and overwintering habitat. He noted that the Lake Chautauqua HREP found that LTRM's spatial and temporal sampling frequencies may be insufficient to detect the effects of individual HREPs at the pool scale or greater. LTRM datasets trend information can help tease out natural or annual variations, but it is critical to establish a scientifically rigorous and explicit monitoring design for HREPs to ensure future HREP contributions can be measured. Bierman recommended consistent and standardized HREP monitoring using LTRM's sampling design and protocols when possible. In addition, a centralized data repository to store HREP monitoring data would be helpful. Monitoring designs for HREPs with similar project types and objectives should be consistent.

Break Out Group Discussion

Break out groups were formed to discuss two main questions:

1) How do you envision HREP and LTRM working together in the future?
2) How can LTRM datasets be used in new ways to inform HREP planning and design?

Generally, there was consensus that methods should be standardized when possible, including across districts, agencies, and states. There should be a central repository for information and data collected and LTRM staff should be incorporated into the HREP planning process early or be included on the PDT. The group report outs are as follows.

How do you envision HREP and LTRM working together in the future?

- Continue to utilize field station staff for sampling needs
- Convene webinars to share information and facilitate communication about LTRM data and tools, HREP lessons learned, and data collection strategies
- Provide a centralized database or repository, including for historic imagery (potentially hosted by LTRM)
- Determine the appropriate level of scientific detail needed for HREP monitoring and analysis
- Incorporate project monitoring within LTRM sampling
- Identify and address data gaps – e.g., systemic forestry and waterfowl datasets, ecological function/drivers
- Develop ways to focus simultaneously on habitats as well as specific species
- Develop standardized monitoring protocols (i.e., methodology for data collection) among five states and across Corps districts – e.g., longevity of dredging, floodplain forest survival, other feature-specific monitoring
- Promote ongoing and topic-specific communications and collaboration – e.g., LTRM research products
- Utilize the Corps' forestry dataset, which will be made available on a public database
- Commit to monitoring as a priority

- Integrate environmental stewardship staff and provide long-term labor to plan HREPs
  - This occurs in MVP. MVR and MVS should consider replicating this approach
- Leverage resources among UMRR's partnering agencies and organizations
- Secure necessary equipment – e.g., telemetry, buoys for monitoring
- Offer LTRM visits to various HREP sites

How can LTRM datasets be used in new ways to inform HREP planning and design?

- System-wide, process-based models to provide context for HREPs and predict responses to them
- Spatially-explicit response models of various ecological drivers/processes – velocity and hydraulic parameters, and understanding links between hydraulic drivers and other variables that could be used as proxies
  - Scenario analysis tied into these models to validate with post-project monitoring and using the monitoring data to report out
  - Pool 8 SAV model is a good example
- Reconciling broad-scale models with local HREPs; perhaps by creating a sampling scheme that allows for comparison at various spatial scales
  - Questions include what data is needed to evaluate HREPs and to validate systemic models, how can data be collected in non-LTRM monitoring reaches, and where should the data be stored
- Complete forest inventory, and expand to include Forest Service (same as is done for the Corps)
  - Add long term monitoring of various floodplain forest locations
- Bird (neotropical and waterfowl) and invertebrate monitoring
- Involve LTRM staff in project selection, on PDTs, and river teams
  - Involvement in charettes to help determine what data/monitoring will be helpful and other pre-project needs
  - Provide UMRR funding to ensure this occurs
- LTRM's "soils" database
- Large topobathy and flow maps/database to see how pools are affected by one another
- Floodplain inundation maps, including integrating elevation data to tree diversity
- Various conceptual models
- Indicators of ecological resilience
- Utilize LTRM data from other pools to fill data gaps
- Provide context around habitat objectives when communicating to others, including project engineers
- Inform project designs that work with nature
- Provide innovative ways to analyze the data
- Add a trend pool in an area with greater HREP monitoring – e.g., Pool 12
- Create a baseline for examining trends and success of individual and cumulative HREP implementation
- Provide expertise regarding the appropriate baseline and monitoring timeframes given that the construction timeframe is not flexible

— Integrating HNA-II results into habitat planning and projects

— Develop hypothesis testing associated with new projects, including determining how information is collected and where it is stored

Habitat Modeling

Nate Richards provided an overview of ecosystem restoration planning and modeling including an explanation of environmental benefits assessments (EBA). Ecological models are used to distinguish between different proposed actions or alternatives, characterize expected return on investment, evaluate the efficiency of different actions, and prioritize restoration given finite resources. Both quantitative and qualitative benefits are considered in project alternative comparisons, but average annual habitat units (AAHUs) are the most popular form and are calculated by multiplying the quality rating of the habitat by the quantity of acres affected. Models are selected and applied to future without project condition as well as each alternative. Benefits are annualized over a 50-year planning horizon. A cost-effectiveness and incremental cost analysis (CE/ICA) is used to compare monetary costs and non-monetary outputs (AAHUs) to identify the least-cost solution with the greatest return. Ecological models only provide a portion of the information needed to make a decision. Before recommending an alternative, other decision-making criteria are considered – e.g., risk and uncertainty, reasonableness of cost. This type of modeling is designed to differentiate between potential alternatives and is not designed to capture all of the benefits that could occur.

Break out groups were formed and instructed to discuss problems/gaps with the environmental benefit analysis and current suite of models available in UMRR, how to better capture additional benefits, and areas of uncertainty that may override the ability to demonstrate an HREP's value. The groups acknowledged that models are species-specific and not community-based and, therefore, do not allow for multiple benefits. Common issues shared among the groups were the limited number of certified models and the lack of an aquatic invasive model. The groups also discussed challenges when the modeling is informed by the project rather than its purpose to inform the project. In response to the following discussions, Plumley committed to facilitating follow-up discussions regarding modeling needs.

Problems/Gaps

— Policy against valuing habitat units – e.g., habitat benefitting T&E species

— Lack of assessing whether and how constructed HREPs improve surrounding habitat – e.g., "shadow benefits" from wind fetch and wave action beyond the project boundary

— The use of two-dimensional models that do not allow for overlap whereas three-dimensional models could capture these benefits

— The use of models to estimate project benefits in ways that do not make sense

— Acres are the only quantitative measure of habitat projects

— Monitoring and modeling focuses on species-specific impacts rather than community-based impacts

— Lack of modeling of forests (to predict or measure recruitment and regeneration), hydrogeomorphology, invasive species, and mussels

  - Existing models are not sensitive to management measures in established forests, making it difficult to justify projects there particularly in comparison to aquatic features

— Inability of layering benefits in project-related modeling (or overlapping models) – e.g., "stacking" waterfowl benefits on top of fisheries benefits or vice versa

— Inability to quantitatively measure connectivity (or synergy) among HREPs

— Difficult to capture complexity of the river ecosystem in more simplified modeling
  - Models are not well suited to show change in larger spatial scales
— Use of outdated models/risk is sometimes based on old information – e.g., changes in hydrology, sedimentation, physical-biological connectivity value, proximate areas
  - This affects certain project types more particularly such as water level management
— Limits to models' ability to estimate project benefits; features are sometimes dropped because they do not fit well with the model
— Modeling can be subjective pending inputs – i.e., there is misalignment regarding the use of various models; modeling can be manipulated to obtain a desired outcome
— Challenge in assigning monetary values
— The 50-year planning horizon is not helpful to floodplain forest restoration (it takes about 50 years to build a floodplain forest)
— Lack of certified models for UMRR's uses

Opportunities for Improvement

— Engage the Corps' vertical team to tell UMRR's story and gain appreciation for the program's values as well as potential innovative approaches that would improve project development
— Seek river users' feedback on projects (to gain a public perspective)
— Integrate ecological services (OSE) into modeling
— When modeling habitat benefits and overcome the "stacking issue" (e.g., use volume for fish and surface area for waterfowl) and allow a single feature to reflect multiple benefits/model output
  - Consider weighing factors
— Add flexibility in selecting and justifying the TSP
— Add benefits that are not included in the CE/ICA (this is sometimes referred to as "Incidental Benefits" in Feasibility Reports)
— Team members can describe all anticipated benefits, including direct and indirect, within the project boundary and beyond
— Enhance communication efforts about the projects – i.e., tell a concise and compelling story about how projects are working to achieve larger ecological goals
— Improve communications within the PDTs
— Create guidance related to Asian carp impacts and benefits as well as other invasive species; incorporate invasive species models into project ranking and selection
— Use the best available data/information, including existing models that include numerous species and features
— Develop new models (e.g., mussels) and certify existing models
  - Create community-based floodplain models
  - Certify the Aquatic Habitat Appraisal Guide (AHAG) and Wildlife Habitat Appraisal Guide (WHAG) models
— Examine model outputs with post-project modeling

- Increase collaboration and transparency among project partners and related experts
- Spend more time deliberating among project alternatives during the planning phase
- Consider using a pool-based cost-benefit analysis
- Scale up models to show value at larger spatial scales
- Identify other potential models and how they might be useful
- Share information/insights gained, including among UMRR partners, across Corps districts, and with other large river ecosystem programs
- Develop a forest growth model; connect forest condition to a desired habitat
- Use only conceptual modeling during the planning process rather than quantifying habitat benefits
- Analyze a project's cumulative benefits
- Consider more complex modeling for feature selection and project design, including alternative selection
- Utilize the HNA-II drivers in modeling

Areas of Uncertainty

- Sedimentation
- Hydrology
- Linking biological features to output
- UMRR's future appropriations

FY 21-25 UMRR HREP Next Generation Project Selection

Plumley said the UMRR Coordinating Committee, district-based river team chairs, and District HREP managers convened a face-to-face meeting on March 27-28, 2019 to discuss the FY 21-25 HREP selection process. River teams will have until December 2019 to develop and select fact sheets. The goal is to facilitate a collaborative process among program partners and to create project ideas that would address the HNA-II indicators. The top four indicators from HNA-II were aquatic functional classes, floodplain functional class, floodplain vegetation, and aquatic vegetation. River teams will determine their own process for collaboration and document their process to share with the program manager. Plumley explained that the creation and purpose of the science support team (SST) is to help river teams think through indicators and available data sources.

In response to a question from Dave Potter, Jeff Janvrin said environmental pool plans (EPP) need to be updated. Janvrin explained that the EPP was a GIS exercise prior to the availability of a bathymetry dataset. EPPs also had a lot of public engagement through mapping exercises. HREPs used to have more public engagement as well. Plumley said NGOs are increasing their engagement and, if interested in being sponsors, they will be matched up with a river team member to assist them through the HREP process.

In closing, Plumley reflected on the tremendous energy among participants and the productive conversations and collaboration throughout the workshop. He reiterated his commitment to hosting another workshop in three years and said information sharing will continue through a future webinar series to follow-up on the many topics addressed at the workshop.

Upper Mississippi River Restoration
Habitat Rehabilitation and Enhancement Project
Planning and Design Workshop

May 6-8, 2019
Attendance List

Julie Millhollin	U.S. Army Corps of Engineers
Erica Stephens	U.S. Army Corps of Engineers
Kara Mitvalsky	U.S. Army Corps of Engineers
Nicole Manasco	U.S. Army Corps of Engineers
Karla Sparks	U.S. Army Corps of Engineers
Rachel Perrine	U.S. Army Corps of Engineers
Bre Popkin	U.S. Army Corps of Engineers
Michael Dougherty	U.S. Army Corps of Engineers
Rachel Mesko	U.S. Army Corps of Engineers
Joe Jordan	U.S. Army Corps of Engineers
Mark Pratt	U.S. Army Corps of Engineers
Karen Hagerty	U.S. Army Corps of Engineers
Marshall Plumley	U.S. Army Corps of Engineers
Anthony Heddlesten	U.S. Army Corps of Engineers
Jesse Ray	U.S. Army Corps of Engineers
Lucie Sawyer	U.S. Army Corps of Engineers
Kyle Nerad	U.S. Army Corps of Engineers
Jason Appel	U.S. Army Corps of Engineers
Megan Cackley	U.S. Army Corps of Engineers
Ben Vandermyde	U.S. Army Corps of Engineers
Nate Richards	U.S. Army Corps of Engineers
Kaileigh Scott	U.S. Army Corps of Engineers
Jasen Brown	U.S. Army Corps of Engineers
Mark Games	U.S. Army Corps of Engineers
Brad Krischel	U.S. Army Corps of Engineers
Ben McGuire	U.S. Army Corps of Engineers
James Wallace	U.S. Army Corps of Engineers
Brandon Schneider	U.S. Army Corps of Engineers
Shahin Khazrajafari	U.S. Army Corps of Engineers
Scott Baker	U.S. Army Corps of Engineers
Anthony Horacek	U.S. Army Corps of Engineers
Randy Urich	U.S. Army Corps of Engineers
Paul Morken	U.S. Army Corps of Engineers
Jon Hendrickson	U.S. Army Corps of Engineers
Kacie Opat	U.S. Army Corps of Engineers
Steve Clark	U.S. Army Corps of Engineers
David Potter	U.S. Army Corps of Engineers

Megan McGuire	U.S. Army Corps of Engineers
Angela Deen	U.S. Army Corps of Engineers
Dillan Laaker	U.S. Army Corps of Engineers
Nick Dunham	U.S. Army Corps of Engineers
Abby Moore	U.S. Army Corps of Engineers
Elliott Stefanik	U.S. Army Corps of Engineers
Alex Le	U.S. Army Corps of Engineers
Will Wolkerstorfer	U.S. Army Corps of Engineers
Kelli Phillips	U.S. Army Corps of Engineers
Alisa Behrens	U.S. Army Corps of Engineers
Chuck Theiling	U.S. Army Corps of Engineers
Brian Markert	U.S. Army Corps of Engineers
Charlie Deutsch	U.S. Army Corps of Engineers
Angeline Rodgers	U.S. Fish and Wildlife Service
Neal Jackson	U.S. Fish and Wildlife Service
Sara Schmuecker	U.S. Fish and Wildlife Service
Tyler Porter	U.S. Fish and Wildlife Service
Matt Mangan	U.S. Fish and Wildlife Service
Heidi Keuler	U.S. Fish and Wildlife Service
Louise Mauldin	U.S. Fish and Wildlife Service
Tim Yager	U.S. Fish and Wildlife Service
Stephen Winter	U.S. Fish and Wildlife Service
Sharonne Baylor	U.S. Fish and Wildlife Service
Brandon Jones	U.S. Fish and Wildlife Service
Wendy Woyczik	U.S. Fish and Wildlife Service
Ed Britton	U.S. Fish and Wildlife Service
Nate Williams	U.S. Fish and Wildlife Service
Justin Sexton	U.S. Fish and Wildlife Service
Ken Dalrymple	U.S. Fish and Wildlife Service
Meta Griffin	U.S. Fish and Wildlife Service
Erin Adams	U.S. Fish and Wildlife Service
Tim Miller	U.S. Fish and Wildlife Service
Jeff Houser	U.S. Geological Survey
Kathi Jo Jankowski	U.S. Geological Survey
Kristen Bouska	U.S. Geological Survey
Molly Van Appledorn	U.S. Geological Survey
Jason Rohweder	U.S. Geological Survey
Matt O'Hara	Illinois Department of Natural Resources
Randy Schultz	Iowa Department of Natural Resources
Kirk Hansen	Iowa Department of Natural Resources
Scott Gritters	Iowa Department of Natural Resources
Dave Bierman	Iowa Department of Natural Resources
Kyle Bales	Iowa Department of Natural Resources
Megan Moore	Minnesota Department of Natural Resources
Dan Dieterman	Minnesota Department of Natural Resources

Matt Vitello	Missouri Department of Conservation
Molly Sobotka	Missouri Department of Conservation
Dave Herzog	Missouri Department of Conservation
Joe McMullen	Missouri Department of Conservation
Jim Fischer	Wisconsin Department of Natural Resources
Jeff Janvrin	Wisconsin Department of Natural Resources
Kurt Rasmussen	Wisconsin Department of Natural Resources
Deanne Drake	Wisconsin Department of Natural Resources
Madeline Magee	Wisconsin Department of Natural Resources
Cale Severson	Wisconsin Department of Natural Resources
Brenda Kelly	Wisconsin Department of Natural Resources
Keith Weaver	Wisconsin Department of Natural Resources
Luis Ramirez	Audubon
Gretchen Benjamin	The Nature Conservancy
Doug Blodgett	The Nature Conservancy
Reema Abi-Akar	Tri-County Regional Planning Commission
Michael Bruner	Tri-County Regional Planning Commission
Kirsten Wallace	Upper Mississippi River Basin Association
Andrew Stephenson	Upper Mississippi River Basin Association
Lauren Salvato	Upper Mississippi River Basin Association

Day 1 Presentations
May 6, 2019

- **UMRR Program Overview**
  - ***Presenter Marshall Plumley (MVR)***

- **District HREP Highlights**
  - ***Presenters Shahin Khazrajafari (MVP), Erica Stephens (MVR), and Brian Markert (MVS)***

- **Risk Informed Planning Overview**
  - ***Presenters Rachel Mesko (RPEDN) and Rachel Perrine (RPEDN)***

- **Rapid Iteration Overview**
  - ***Presenter Rachel Mesko (RPEDN)***

- **Rapid Iteration Exercise - Yorkinut Slough HREP**
  - ***Presenter Jasen Brown (MVS)***

UPPER MISSISSIPPI RIVER RESTORATION HREP WORKSHOP

Marshall Plumley
Regional Program Manager
St. Paul District
Rock Island District
St. Louis District

6 May 2019

US Army Corps of Engineers

UMRR PARTNERS

WELCOME TO THE 6TH UMRR HREP WORKSHOP

HREP WORKSHOP WEBINARS

Date	Topic	Presenter
April 17	Habitat Needs Assessment II	*Nate DeJager, USGS, Sara Schmuecker, USFWS, Kat McCain, MVS*
April 18	Upper Mississippi River Restoration Program (UMRR) 101	*Marshall Plumley, MVR*
April 23	Habitat Rehabilitation and Enhancement Project (HREP) 101	*Marshall Plumley, MVR*
April 30	Long Term Resource Monitoring (LTRM) 101	*Jeff Houser, USGS*
May 1	Hydrology and Hydraulics Modeling	*Jon Hendrickson, MVP*

HREP WORKSHOP THEMES

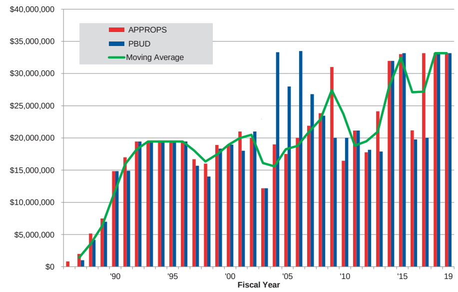
- Risk Informed Planning
  - Overview
  - Rapid Iteration Exercise
  - HREP Application
- HREP Lesson Learned
  - Habitat Criteria
  - HREP Evaluation
  - Knowledge Sharing
- The Future
  - HREP& LTRM Integration
  - HREP Habitat Modeling
  - Next Generation Projects

UMRR PROGRAM OVERVIEW

FY19 PLAN OF WORK

	Budget	Obligations (2nd Q
TOTAL FY19 Program	$33,170,000	$7,556,524
Regional Administration and Program Efforts	$ 1,100,000	$ 512,337
Regional Management	$ 850,000	
Program Database	$ 100,000	
Program Support Contract (UMRBA)	$ 100,000	
Public Outreach	$ 50,000	
Regional Science and Monitoring	$10,295,000	$3,658,752
LTRM (Base Monitoring)	$ 4,920,000	
UMRR Regional Science In Support Rehabilitation/Mgmt. (MIPR's, Contracts, and Labor)	$ 3,750,000	
UMRR Regional (Integration, Adapt. Mgmt.)	$ 200,000	
Habitat Evaluation (split between MVS,MVR,MVP)	$ 975,000	
HNA II/Regional Project Sequencing	$ 450,000	
District Habitat Rehabilitation Efforts (Planning and Construction)	$21,775,000	$3,385,435
Rock Island District	$ 7,695,000	
St. Louis District	$ 6,310,000	
St. Paul District	$ 7,670,000	
Model Cert.	$ 100,000	

UMRR PROGRAM APPROPRIATION/BUDGET HISTORY



FY1985 to FY2019

UMRR FIVE YEAR PLAN

ACHIEVEMENTS OF UMRR LONG TERM RESOURCE MONITORING AND SCIENCE

30+ years of data
- 6 study reaches spanning the broad range of conditions within the UMRS
- Standardized study design and methods
- Centrally stored, and made publicly accessible in raw, summarized, and graphical formats

Extensive analysis of the long-term data, and associated research projects have improved our understanding of the UMRS, and substantially informed its management.

Interagency partnership provides a network of infrastructure, expertise, and collaboration.

UMRR PROGRAM - HABITAT REHABILITATION & ENHANCEMENT PROJECTS

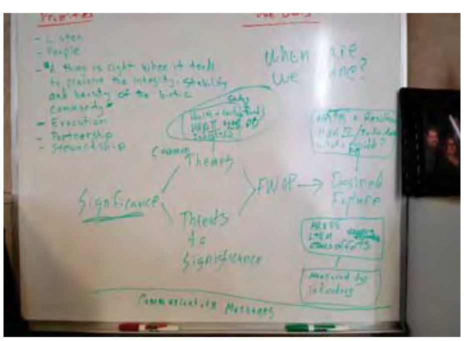
AS OF 2019:

56 PROJECTS COMPLETED (106,000 ACRES)

17 PROJECTS IN PLANNING & DESIGN

REFLECTIONS

- **Listen**
- **People First**
- **Execution**
- **Partnership**
- **Stewardship**
- **Vision**



REFLECTIONS

- ***Listen***

REFLECTIONS

- Listen
- ***People First***

REFLECTIONS

- Listen
- People First
- ***Execution***

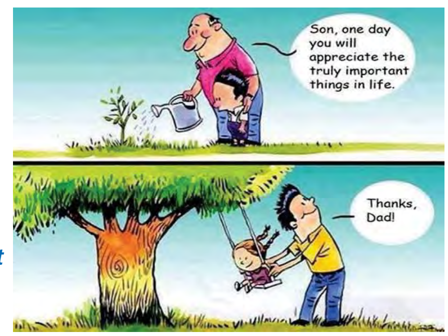
REFLECTIONS

- Listen
- People First
- Execution
- ***Partnership***

REFLECTIONS

- Listen
- People First
- Execution
- Partnership
- ***Stewardship***

"A society grows great when old men plant trees whose shade they know they shall never sit in." – Greek Proverb



REFLECTIONS

- Listen
- People First
- Execution
- Partnership
- Stewardship
- ***Vision***

"A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community." – Aldo Leapold

PARTNER AGENCY & ORGANIZATION HREP PRIORITIES AND PERSPECTIVES

- State of Minnesota
- State of Wisconsin
- State of Iowa
- State of Illinois
- State of Missouri
- Upper Mississippi River Basin Association
- USDA – Natural Resources Conservation Service
- U.S. Geological Survey
- U.S. Fish & Wildlife Service

ST. PAUL DISTRICT (MVP) HREP HIGHLIGHTS

Shahin Khazrajafari
Project Manager
MVD/MVP/PM
Date: 06 May 2019

US Army Corps of Engineers

CONWAY LAKE, POOL 9, IA

Habitat Benefits
- ~321 acres of floodplain forest and aquatic habitat
- ~133 Average Annual Habitat Units

Cost
- $7.1M to construct project

Status
- Feasibility Report approved in FY 17
- Contract awarded to Kaiyuh Services, LLC in FY 18
- Construction to begin in FY 20

MCGREGOR LAKE, POOL 10, WI

Habitat Benefits
- ~380 acres of floodplain forest and aquatic habitat
- ~125 Average Annual Habitat Units

Cost
- $17.7M to construct project

Status
- Feasibility Report pending MVD approval
- Design to be completed in FY 20
- Award 1st contract in FY 20

BASS PONDS LAKE, MN RIVER

Habitat Benefits
- ~2,000 acres of aquatic and waterfowl habitat
- ~255 Average Annual Habitat Units

Cost
- $5.9M to construct project

Status
- Feasibility Report pending MVD approval
- Design to be completed in FY 19
- Award contract in FY 19

OTHER PROJECTS IN THE WORKS

Feasibility Studies
- Lower Pool 10, Pool 10, IA - Initiated feasibility study late FY 18
- Reno Bottom, Pool 9, MN/IA - Initiated feasibility study in FY 19

Monitoring & Adaptive Management
- Pool 4 Peterson Lake Adaptive Mgmt
- Pool 8 C8 Rock Sill Repair
- Pool 9 Cold Springs – Inspect for possible adaptive management

HREP HIGHLIGHTS-MVR

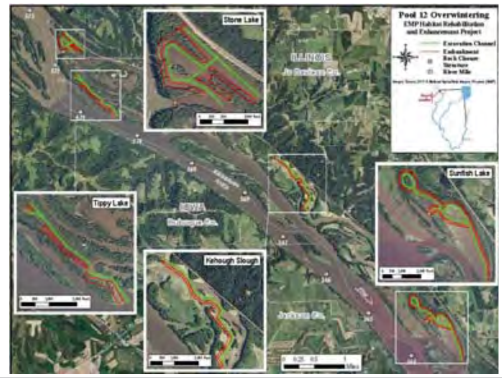
Erica Stephens
Project Manager
USACE-MVR
Date: 06 May 2019

US Army Corps of Engineers

POOL 12

Project Objectives from DPR:
1) Increase deep water habitat
2) Increase depth diversity
3) Decrease sedimentation
4) Increase coverage of forest stands with mast-producing trees

Project Measures:
1) Excavate backwater channels
2) Construct land and aquatic deflection berms
3) Establish trees on berms



POOL 12-CONSTRUCTION

Stage 1-Sunfish Lake
- $4 mil contract
- Construction complete was Fall 2015

Stage 2-Stone Lake and Tippy Lake
- $4.5 mil contract
- Construction complete Fall 2019

Stage 3-Kehough Slough
- $1.5 mil contract
- Construction complete Fall 2019

Stage 4-Tree planting (BPA)
- Solicitation summer 2019

Stage 3-Kehough Slough-Upper Channel Placement and Site Shaping

HURON ISLAND

Project Objectives from DPR:
1) Increase acres of emergent and submersed aquatic vegetation in backwater areas
2) Increase diversity of floodplain forest and scrub-shrub habitat
3) Increase aquatic habitat diversity
4) Maintain sediment transport and geomorphic processes in Huron Chute

Project Measures:
1) Construct bathymetric and topographic diversity features
2) Establish native aquatic and floodplain forest vegetation and trees
3) Construct a closure structure at Garner Chute
4) Protect side channel islands in Huron Chute from erosion

HURON ISLAND-CONSTRUCTION

Stage 1-Dredging, Garner Chute Closure Structure, Erosion Protection on Huron Chute Islands
- $2.6 mil contract
- Construction complete was Spring 2017

Stage 2-Berm Shaping, Bank Stabilization, Locked Logs, Anchored Logs, Tree Planting
- $3.7 mil contract
- Construction complete Fall 2019

Stage 3-Native Plant Propagation (ERDC)
- ERDC collected plants in June and September 2018
- Containerized aquatic plants are being propagated at ERDC's plant nursery in Lewisville, TX
- Site plantings Summer 2019

Stage 1-Huron Chute Island Erosion Protection

BEAVER ISLAND

Project Objectives from Feasibility Report:
1) Increase year-round aquatic habitat diversity
2) Diversify floodplain forest habitat on Beaver Island
3) Increase structure and function of side channel habitat, as measured by native freshwater mussel use

Project Measures:
1) Excavate channels in backwater areas
2) Construct elevated berms using excavated channel material
3) Plant mast producing trees on the elevated berms
4) Use timber stand improvement techniques
5) Place a rock closure structure on the island's upstream end
6) Construct a chevron, place bank protection and provide mussel substrate on Albany Island.

BEAVER ISLAND-CONSTRUCTION

Stage 1B-Dredging, Topographic Diversity Site Placement, Closure Structure, Chevron, Bank Protection and Mussel Substrate at Albany Island, Anchored Logs
- $10 mil contract
- Construction complete is January 2021

Stage 2&3-Tree planting and timber stand improvement measures
- To be done following completion of Stage 1B

Stage 1B-Clearing for Topographic Diversity Site Placement

RICE LAKE

Project Objectives from Feasibility Report:
1) Increase emergent and moist soil vegetation in Big Lake and Goose Lake
2) Decrease summer water levels to below 440 in Big Lake, Goose Lake, and Rice Lake
3) Increase connectivity between Big Lake, Rice Lake, and the Illinois River during summer draw downs
4) Increase year-round flowing side channel habitat areas

Project Measures:
1) Construct perimeter water control spillway
2) Construct pump station
3) Plant mast-producing trees

RICE LAKE-CONSTRUCTION

Stage 1-Pump Station, Water Control Spillway
- $9.3 mil contract
- Construction complete was Spring 2017
- Pumps currently down. Service contract for repairs awarded April 2019.

Rice Lake Pumps

KEITHSBURG

Project Objectives from Feasibility Report:
1) Restore mudflat and shallow water habitat for shorebirds
2) Restore submergent and emergent vegetation for migratory waterfowl
3) Increase acres of hard mast-producing trees
4) Improve existing scrub-shrub community
5) Improve bottomland hardwood habitat

Project Measures:
1) Excavate channels in backwater areas
2) Construct water control structures, spillways, and pump station
3) Plant floodplain forest trees
4) Construct elevated berms/embankments
5) Use timber stand improvement techniques

KEITHSBURG-CONSTRUCTION

Stage 1-Spillway Construction
- Currently in final design review
- Anticipate award late FY19

Stage 2-Berm Construction
- Real Estate Needed before Solicitation
- Anticipate design in FY20
- Anticipate award in FY20

Stage 3-Pump Station and Water Control Structure Construction
- Anticipate design following completion of Stage 2

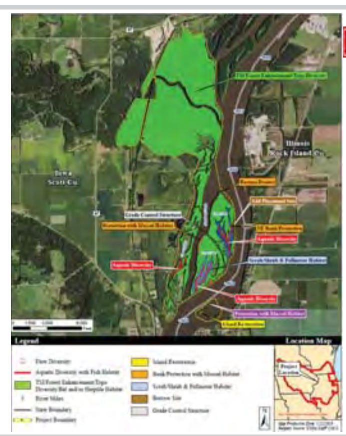
Stage 4-Tree Planting and Timber Stand Improvements
- Anticipate design following completion of Stage 3

Keithsburg-Looking northwest from the boat ramp

STEAMBOAT

Project Objectives from Feasibility Report:
1) Enhance and restore forestry diversity and function
2) Increase aquatic habitat diversity and overwintering habitat
3) Restore and protect island acreage and function
4) Protect and enhance backwater and interior wetland areas

TSP Measures:
1) Upper Steamboat Island restoration/protection
2) Steamboat Island Aquatic Diversity
   - Dredging
   - NE bank restoration/protection
   - Grade control structure
3) Southeast Island restoration/protection
4) Grant Slough Aquatic Diversity
5) Timber Stand Improvement



LOWER POOL 13

Factsheet Approved-June 2018

Kickoff Charette scheduled for 5/14/2019-5/15/2019

Proposed Features
- Island Stabilization/Restoration
- Closure Structure
- Backwater Dredging
- Elevation of floodplain habitat
- Pool-wide water level management

GREEN ISLAND

Factsheet Approved-February 2019

Kickoff Charette anticipated late Summer/Fall 2019

Proposed Features
- Update existing pump station
- New pump station
- Dredging
- Island creation with dredged material
- Water level control structures
- Berm improvements

FACTSHEETS

Upcoming Factsheets
- Pool 12 Forestry
  - Anticipate factsheet going to MVD for approval Summer 2019
- Working with partnership to identify new projects

Upper Mississippi River Restoration

Brian Markert

Program Manager

St. Louis District

2019 Overview

US Army Corps of Engineers
BUILDING STRONG®

Upper Mississippi River Restoration

Program Vision Statement

"A healthier and more resilient Upper Mississippi River ecosystem that sustains the river's multiple uses"

Ecological resilience is the ability of an ecosystem to maintain its normal patterns of nutrient cycling and biomass production after being subjected to damage caused by an ecological disturbance.

UMRR Goals

- **Enhance habitat** for restoring and maintaining a healthier and more resilient Upper Mississippi River ecosystem
- **Advance knowledge** for restoring and maintaining a healthier and more resilient Upper Mississippi River ecosystem
- Engage and **collaborate** with other organizations and individuals to help accomplish the UMRR vision
- Utilize a strong, integrated **partnership** to accomplish the UMRR vision

---

UMRR is…. PARTNERSHIP

USGS science for a changing world

US Army Corps of Engineers

Habitat Restoration

Research and Monitoring

PUBLIC

NGO's

FY 19 District Program

$6.635M Budget

- Feasibility Studies *$1.6M*
  - Harlow Island – Feasibility Report Approved February 2019
  - Rip Rap Landing – Complete Draft Feasibility Report
  - Oakwood Bottoms – Complete Draft Feasibility Report
- Projects in Plans & Specs Development *$1.5M*
  - Clarence Cannon National Wildlife Refuge- Complete construction package for Levee Setback
  - Crains Island – Complete design 1st phase of construction package
  - Piasa and Eagles Nest Islands – Initiate development of P&S package
  - Harlow Island – Initiate development of P&S package
- Projects in Construction *$3.5M*
  - Ted Shanks – Pump Station Closeout, Reforestation, & OMRR manual
  - Clarence Cannon National Wildlife Refuge
    - Full Funding of Pump Station Contract
    - Levee Setback Initial Contract Award
  - Crains Island – Initial Contract Award – deferred pending funding availability
- Project Evaluation Reports, Baseline Monitoring, Habitat Evaluation *$150K*

Feasibility Studies

Oakwood Bottoms

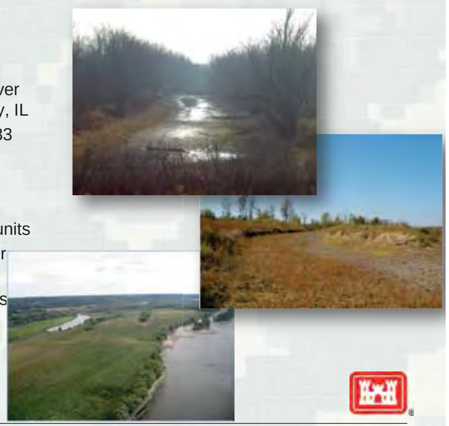
About the Site
- Sponsor: USFS
- Location: 13,500 Acres in the Middle Mississippi River Floodplain, River Miles 73-84, Jackson County, IL
- Important stopover, wintering, and breeding habitat for migratory wildlife
- One of the largest contiguous bottomland hardwood tracts with the MMR
- Wetland habitat
- 34 Management units
- Topographically consist of sloughs, oxbows, and berms and water delivery channels

Oakwood Bottoms

- **Issues**
  - Fragmented landscape (~34 units)
  - Modified Hydrology
  - Degraded forest community and habitat
  - Disconnected floodplain
  - Flood Protection Management Impacts
  - Inadequate water management capabilities
- **Proposed Solutions ($21m)**
  - Replace undersized water control structures
  - Installation of pumps
  - Manipulation and optimization of existing berms and water delivery channels
  - Restoration of ridge and swale topography
  - Reforestation
- **FY19**
  - **Complete Draft Feasibility Report**

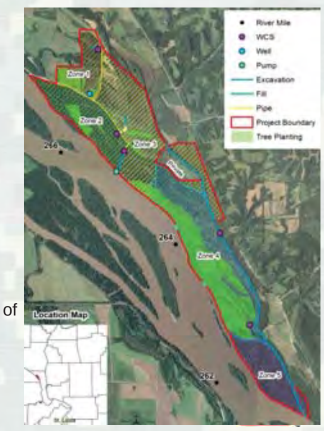
Rip Rap Landing

About the Site
- Sponsor: ILDNR
- Location: Pool 25, Mississippi River Miles 260.5-267, Calhoun County, IL
- 2,338 Acres (790 Acres WRP, 283 Acres GP Lands)
- Degrading hardmast forest
- Sny Creek runs through property
- Several moist soil management units
- Undersized and inadequate water control structures and pump
- Inefficient water delivery channels



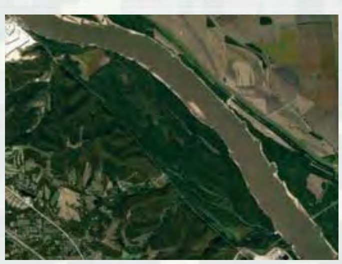
Rip Rap Landing

- **Issues:**
  - Degraded Habitats
  - Sedimentation and nutrients
  - Altered Hydrology
  - Major Flooding
  - Floodplain connectivity and Levees
  - Invasive species
  - Lack of forest diversity and hard mast
  - Limited Infrastructure & sized too small for site needs
- **Proposed Solutions: ($9m)**
  - Installation of water control structures
  - Installation of pump
  - Increase depth, diversity, and UMRS connection of Sny Creek
  - Reforestation
- **FY19**
  - ► **Update Feasibility Report to Exclude WRP Lands**



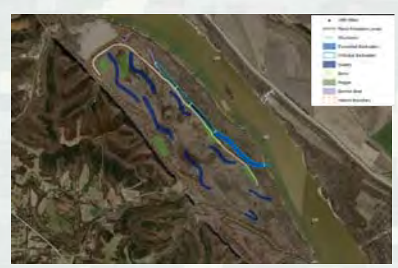
Harlow Island

- **About the Site:**
  - Sponsor: USFWS
  - Location: Middle Mississippi River Miles 144.5 – 140.5, Jefferson County, MO.
  - 1,224 Acres
  - Acquired by USFWS in 1995
  - Aquatic backwater, floodplain forests, and Wetland habitats
  - Interior agricultural berms
  - Internal drainage ditches



Harlow Island

- Issues:
  - Lack of diversity in forest community and structure
  - Lack of topographical diversity
  - Disconnected backwater habitat
- Proposed Solutions: ($36M)
  - Restore ridge and swale topography
  - Reforest
  - Remove restrictive ag. Levees
  - Reconnect backwater habitat
  - Build sedimentation deflection berm
- **FY19**
  - ► **Complete Feasibility Report**



Plans and Specifications

Piasa & Eagle's Nest Islands

About the Site
- Sponsor: ILDNR
- Location: Mel Price Pool, Mississippi River Miles 208-211, Madison & Jersey Counties, IL
- 1350 Acres
- Side Channel, two islands, and one backwater
- Pooled riverine habitat
- Piasa Creek confluence
- Managed for migratory waterfowl hunting
- Prominent recreation area: boating, fishing, hunting

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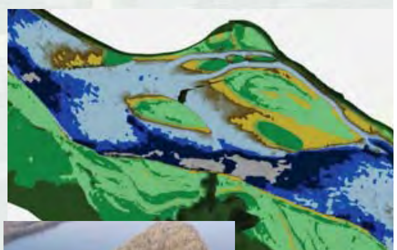
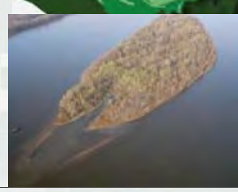
Piasa & Eagle's Nest Islands

- Issues:
  - Sedimentation accretion in side channel
  - Lack of depth and flow in side channel
  - Loss of island habitat
  - Loss of connection between backwater habitat and side channel
- Proposed Solutions: ($29M)
  - Dredge side channel and backwater
  - Install river training structures
  - Build islands
- **FY19 Tasks**
  - **Develop P&S for Project Phases**





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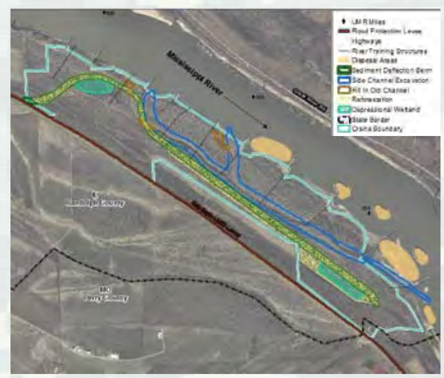
Crains Island

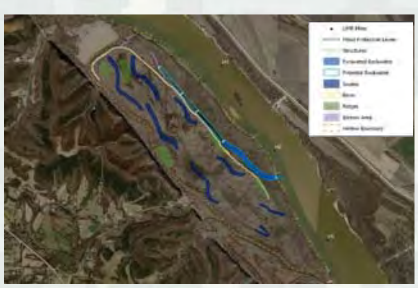
- Issues:
  - Disconnected Side Channel
  - Lack of Depth and Flow
  - Low diversity forest community and structure
- Proposed Solutions: ($36M)
  - Dredging of side channel – widen and deepen
  - Beneficial use of dredge material – Sedimentation Deflection Berm
  - Reforestation
  - Build Depressional Wetlands
- FY19
  - Complete P&S for Phase 1



BUILDING STRONG®

Harlow Island

- Issues:
  - Lack of diversity in forest community and structure
  - Lack of topographical diversity
  - Disconnected backwater habitat
- Proposed Solutions: ($36M)
  - Restore ridge and swale topography
  - Reforest
  - Remove restrictive ag. Levees
  - Reconnect backwater habitat
  - Build sedimentation deflection berm
- **FY19**
  - **Initiate Development of P&S**



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CCNWR Levee Setback

FY19 Design Efforts:
- Setback Levee
  - Roadway on top of Levee
- Degrades of existing river levee and interior Berms
- Restoration of historic meanders

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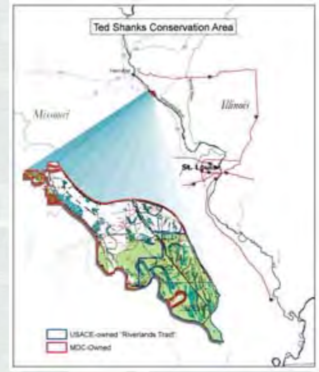
Projects in Construction

Ted Shanks CA

About the Site
- Sponsor: MDC
- Location: 2900 Acres in Pool 24, Mississippi River RM 284.5-288.5, Pike County, MO

FY19
- Reforestation
- Completion of O&M Manual
- Initiate Project Closeout for 2020



Clarence Cannon Pump Station

FY19
- Pump Station Contract
  - Fully Funded
  - Construction Complete in 3rd Qtr FY21
- Complete North and South Unit Water Control Structures

CCNWR Levee Setback

Solutions:
- Setback Levee
  - Roadway on top of Levee
  - Pull off ramps
- Degrades of existing river levee and interior Berms
- Restoration of historic meanders
- $5M-$10M
- Partial Award in 4th Qtr of FY19

Points of Contact

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District Program Manager
(314) 331.8455

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(314) 331.8540

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Project Manager
(314) 331.8368

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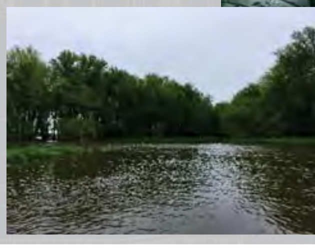
Budget Analyst, Project Assistant
(314) 331.8241

Kat McCain
LTRM Coordinator/Ecologist
(314) 331.8047

RISK INFORMED PLANNING

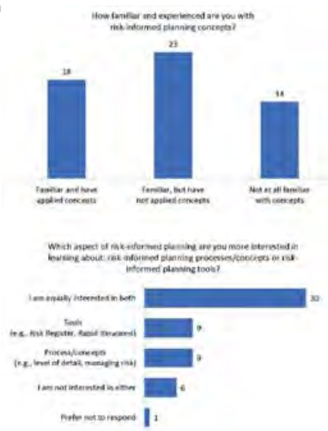
Rachel Perrine and Rachel Mesko
Regional Planning & Environmental Division North
6 May 2019



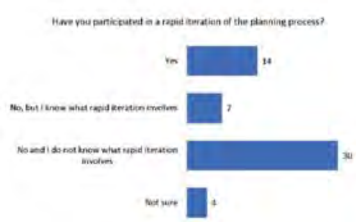
US Army Corps of Engineers

AGENDA

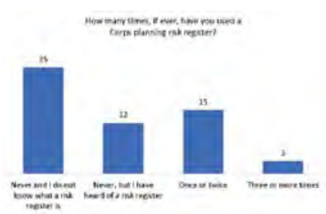
- **Survey Results**
- **HREP Planning 101**
- **Risk 101: The Big Picture**
  - USACE Enterprise Risk Management
  - Risk Informed Planning & SMART Planning
- **Risk Informed Planning: Key Concepts**
  - Planning Manual, Part II
  - Defining Risk & Uncertainty
  - Rapid Iterations
  - Risk Management Tools

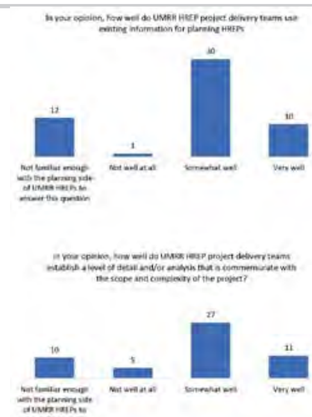


RISK INFORMED PLANNING SURVEY RESULTS

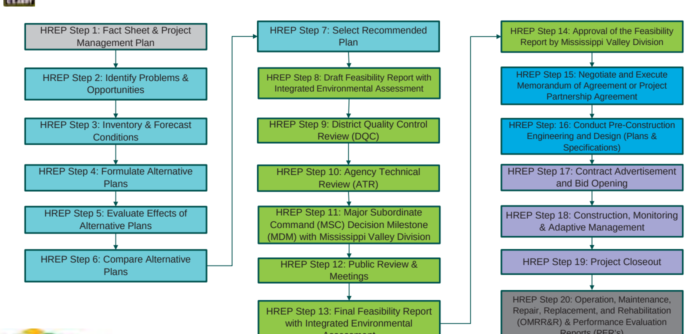


RISK INFORMED PLANNING SURVEY RESULTS





HREP PLANNING 101



HREP PLANNING 101

- *Project Initiation*
- *Feasibility Phase*
- *Feasibility Report Review and Approval*
- Pre-Construction Engineering and Design (Plans & Specifications)
- Project Implementation and Construction
- Operations and Maintenance (OMRR&R)

HREP PLANNING 101 – STEP 1

- HREP Step 1: Fact Sheet & Project Management Plan
- HREP Step 2: Identify Problems & Opportunities
- HREP Step 3: Inventory & Forecast Conditions
- HREP Step 4: Formulate Alternative Plans
- HREP Step 5: Evaluate Effects of Alternative Plans
- HREP Step 6: Compare Alternative Plans
- HREP Step 7: Select Recommended Plan
- HREP Step 8: Draft Feasibility Report with Integrated Environmental Assessment
- HREP Step 9: District Quality Control Review (DQC)
- HREP Step 10: Agency Technical Review (ATR)
- HREP Step 11: Major Subordinate Command (MSC) Decision Milestone (MDM) with Mississippi Valley Division
- HREP Step 12: Public Review & Meetings
- HREP Step 13: Final Feasibility Report with Integrated Environmental Assessment
- HREP Step 14: Approval of the Feasibility Report by Mississippi Valley Division
- HREP Step 15: Negotiate and Execute Memorandum of Agreement or Project Partnership Agreement
- HREP Step: 16: Conduct Pre-Construction Engineering and Design (Plans & Specifications)
- HREP Step 17: Contract Advertisement and Bid Opening
- HREP Step 18: Construction, Monitoring & Adaptive Management
- HREP Step 19: Project Closeout
- HREP Step 20: Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) & Performance Evaluation Reports (PER's)

HREP PLANNING 101 – STEP 1

- Fact Sheet Development
- Project Delivery Team (PDT)
- Project Management Plan (PMP)
  - » Agreement by all parties on how to conduct the feasibility study- the scope of work for the study and its review
- Review Plan

HREP PLANNING 101: STEPS 2-7

- HREP Step 1: Fact Sheet & Project Management Plan
- HREP Step 2: Identify Problems & Opportunities
- HREP Step 3: Inventory & Forecast Conditions
- HREP Step 4: Formulate Alternative Plans
- HREP Step 5: Evaluate Effects of Alternative Plans
- HREP Step 6: Compare Alternative Plans
- HREP Step 7: Select Recommended Plan
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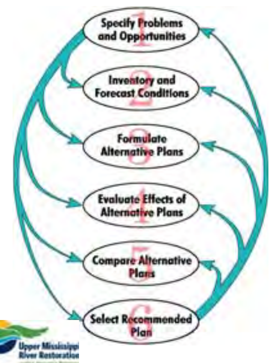
HREP PLANNING 101: STEPS 2-7



HREP PLANNING 101: STEPS 2-7

Feasibility Study & Report

- Formulate and evaluate an array of alternative plans and make a recommendation for action/No-Action
- Documents analyses (H&H, HEP, design, etc) and findings
- Accompanied by a National Environmental Policy Act (NEPA) document
- Describe the Recommended Plan

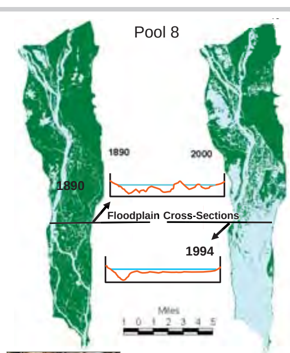
COMMON HREP STRESSORS & GOALS/OBJECTIVES

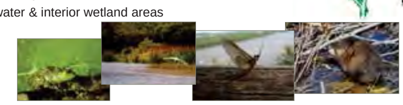
Problem: Changes to ecosystem structure and function over time.

Objective: Address stressors on the system and make changes on the landscape to create a more resilient environment

Goals/Objectives:

- Increase & maintain quality waterfowl habitat
- Create habitat for neotropical migrants & shorebirds
- Create backwater fish overwintering habitat
- Enhance backwater fish spawning & summer habitat
- Enhance channel habitat for riverine fish & mussels
- Increase emergent, submersed & floating leaved aquatic vegetation
- Enhance & restore forest diversity & function
- Restore & protect island acreage & function
- Protect & enhance backwater & interior wetland areas





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STEAMBOAT ISLAND HREP

US Army Corps of Engineers

- Scott County, IA, & Rock Island County, IL; Pool 14,
- All Project lands are in Federal ownership; most managed by Upper Mississippi River NWFR
- 2,630 acres of interconnected backwaters, secondary channels, wetlands, islands, floodplain, and aquatic habitat
- Cordova Power Plant and Cordova Essential Habitat Area (both along Illinois shoreline across the River from Project area)

Upper Mississippi River Restoration

STEAMBOAT ISLAND HREP

Planning Steps 1 & 2

- PDT Kickoff – Site Visit & Charette
- PDT Conceptual Model Workshop
- Public Open House

Upper Mississippi River Restoration

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STEAMBOAT ISLAND HREP

Problems:

- Silt deposition
- Impoundment of the UMRS and higher water elevations
- Island loss & impacts

Goals & Objectives:

- Enhance and restore forest diversity & function
- Increase year-round aquatic habitat diversity
- & overwintering habitat
- Restore and protect island acreage & function
- Protect and enhance backwater & interior wetland areas

Upper Mississippi River Restoration

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STEAMBOAT ISLAND HREP

Planning Step 3

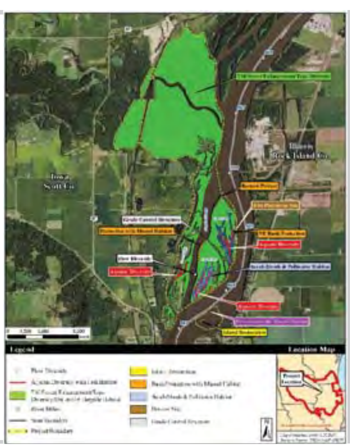
- PDT Features Workshop & subsequent meetings
- PDT Alternatives Workshop & subsequent meetings

Upper Mississippi River Restoration

STEAMBOAT ISLAND HREP

Potential Features

- Diversifying flow within Steamboat Slough (1 location)
- Dredging in backwater channels (3 locations)
- Topographic diversity, including forest, scrub-shrub, and pollinator habitat (8 locations)
- Timber stand improvement (prescription in development, ~1,200 acres)
- Island restoration and protection (3 locations)
- Fish and mussel habitat incorporation (7 locations, will be refined in Plans and Specifications)



Upper Mississippi River Restoration

18

STEAMBOAT ISLAND HREP

31 alternative combinations *(Initial array)* →

Final Array of 8 action alternatives + No Action

Alt ID	Final Array of Alternatives – 2 Jan 2019
18	USI (Head) restoration and protection, SI aquatic diversity
19	USI (Head) restoration and protection, SI aquatic diversity, Grant Slough Complex
22	USI (Head) restoration and protection, SI aquatic diversity, Flow Diversity
23	USI (Head) restoration and protection, SI aquatic diversity, Flow Diversity, Grant Slough Complex
26	USI (Head) restoration and protection, SI aquatic diversity, SE Island
27	USI (Head) restoration and protection, SI aquatic diversity, SE Island, Grant Slough Complex
30	USI (Head) restoration and protection, SI aquatic diversity, SE Island, Flow Diversity
31	USI (Head) restoration and protection, SI aquatic diversity, SE Island, Flow Diversity, Grant Slough Complex

Upper Mississippi River Restoration

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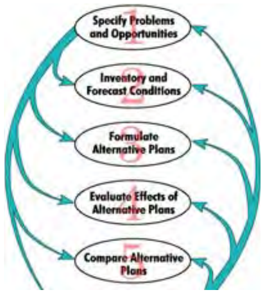
STEAMBOAT ISLAND HREP

Planning Steps 4 & 5

- PDT meetings – refine measures & alternatives
- PDT CEICA Workshops



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STEAMBOAT ISLAND HREP

4 Best Buy Plans, including No Action and Cadillac Plans
–No Action, Alternative 19, Alternative 27, Alternative 31

(These columns reflect annualized costs and annualized benefits)

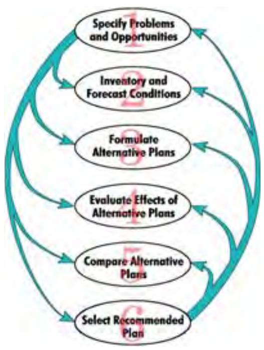
Plan ID	Plan Description	Cost	Output	Non-Cost Effective, Cost Effective, or Best Buy
No Action	Default No Action Plan	0	0	Best Buy
18	USI (Head) restoration and protection, SI aquatic diversity	$907,143	43.59	Cost Effective
19	USI (Head) restoration and protection, SI aquatic diversity, Grant Slough Complex	$1,174,112	71.53	Best Buy
22	USI (Head) restoration and protection, SI aquatic diversity, Flow Diversity	$922,270	43.69	Cost Effective
23	USI (Head) restoration and protection, SI aquatic diversity, Flow Diversity, Grant Slough Complex	$1,191,538	71.63	Cost Effective
26	USI (Head) restoration and protection, SI aquatic diversity, SE Islands	$1,086,210	47.13	Cost Effective
27 ★	USI (Head) restoration and protection, SI aquatic diversity, SE Islands, Grant Slough Complex	$1,355,285	75.07	Best Buy
30	USI (Head) restoration and protection, SI aquatic diversity, SE Islands, Flow Diversity	$1,124,066	47.23	Cost Effective
31	USI (Head) restoration and protection, SI aquatic diversity, SE Islands, Flow Diversity, Grant Slough Complex	$1,403,156	75.17	Best Buy

21

STEAMBOAT ISLAND HREP

Planning Step 6

- TSP Selection; In Progress Review (IPR) with MVD



STEAMBOAT ISLAND HREP

TSP

- Upper Steamboat Island (USI) restoration/protection
- Steamboat Island (SI) Aquatic Diversity:
  - Upper Lake aquatic diversity + NE Bank restoration/protection
  - Steamboat Island Grade Control Structure
  - Lower Lake aquatic diversity (possible deflection structure)
- SE Island restoration/protection
- Grant Slough aquatic diversity
- Timber stand improvement (in development)

All features categories include

- Topographic diversity (forest, scrub shrub, and/or pollinator habitat)
- Mussel/fish habitat incorporated, where appropriate

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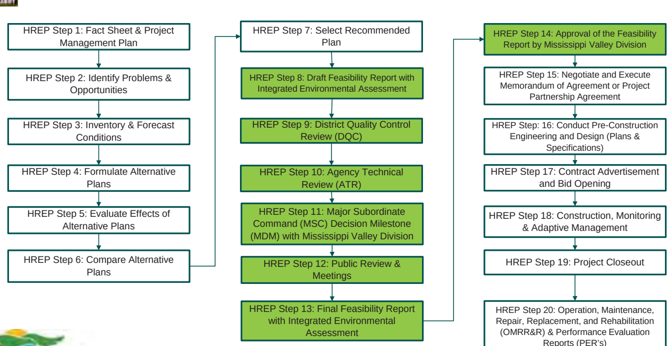
HREP PLANNING 101: STEPS 8-14



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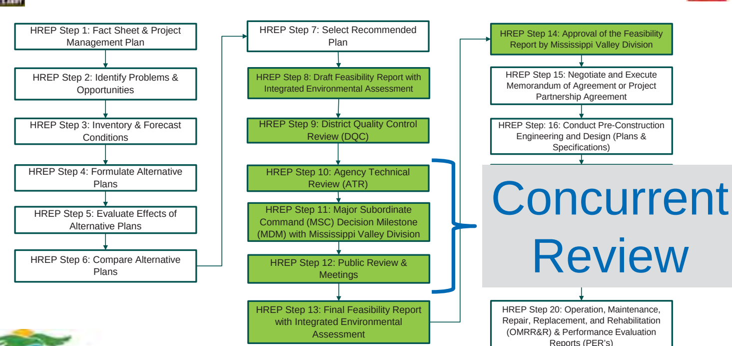
HREP PLANNING 101: STEPS 8-14



"OPERATIONALIZING RISK INFORMED DECISION MAKING"

ENTERPRISE RISK MANAGEMENT

- *"As part of the Civil Works strategy, I intend to operationalize risk-informed decision making at all levels of the organization, and then I expect discipline in documenting the decisions at the appropriate level… We must change our behavior regarding risk management across Civil Works and in our policies, analytical approaches and models, priorities, and dialogue with sponsors and communities."*
- *We must move from a culture and convention of risk aversion to one of innovation and risk acceptance or our partners will go elsewhere for services.*

  - Mr. James Dalton, PE, SES
  Director of Civil Works

USACE CIVIL WORKS RISK MANAGEMENT

Some caveats (or opportunities)…

- "New" risk management initiatives are primarily focused on the largest Civil Works studies (General Investigation Feasibility Studies).
- Risk management requirements and tools can be tailored to regional programs like UMRR/HREP.
- What risk management strategies, tools, etc. can be effectively used to make UMRR/HREP more efficient?

WE'VE BEEN TALKING ABOUT RISK FOR A WHILE*

- Process and outputs are **decision focused**
- Risk and uncertainty is **acknowledged and managed**
  - ✓ Only collect data needed to make the decision
  - ✓ Make decision and move on to next decision
  - ✓ Level of detail (of data / decision) grows over time
  - ✓ Vertical Team agreement on "acceptable" level of uncertainty
- Report developed from the beginning of the study

**Content on this slide is from a 2012 USACE Planning Community of Practice webinar*

IN 2012 WE STATED THAT THE SMART PLANNING PROCESS WOULD RESULT IN…

- Studies completed in a more reasonable amount of time
- Studies cost significantly less
- High quality and concise decision documents
- Decisions informed by managing risk and acknowledging uncertainty
- Strong, viable Civil Works Project portfolio developed

We're doing this…but how do we continue to improve?

RISK INFORMED PLANNING VS. SMART PLANNING

The "R" in SMART Planning has always been about risk

- » **S** pecific
- » **M** easurable
- » **A** ttainable
- » **R** isk-Informed
- » **T** imely

RISK INFORMED PLANNING: KEY CONCEPTS

31

- Planning Manual, Part II
- Defining risk and uncertainty
- Rapid iterations
- Using the risk register as a risk management tool

Reminder…

Risk management concepts and tools can be tailored to regional programs like UMRR/HREP.

What risk management strategies, tools, etc. can be effectively used to make UMRR/HREP more efficient?

Upper Mississippi River Restoration

PLANNING MANUAL PART II

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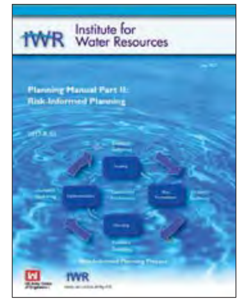
- Risk-informed planning is the combination of the USACE planning process and the USACE risk management orientation.
- Risk-informed planning is completely faithful to the USACE six-step planning process.
- We try to reduce uncertainty by gathering the information that's needed to make the next planning decision and to manage the risks that result from doing so without having complete information.
- As uncertainty is reduced, the decisions are more deliberative and allow a greater confidence in our final recommendation.



Upper Mississippi River Restoration

"TRADITIONAL" SIX STEP PLANNING PROCESS

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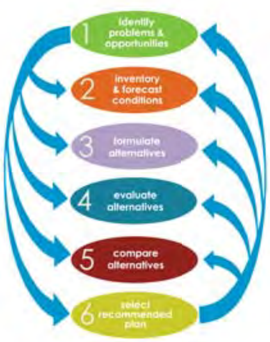
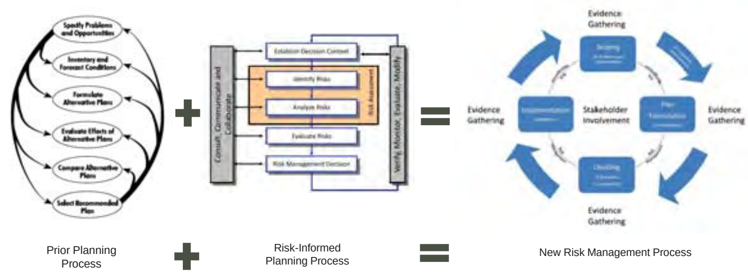


Upper Mississippi River Restoration

FROM RISK INFORMED PLANNING MANUAL: "EVOLUTION, NOT REVOLUTION"

34



Upper Mississippi River Restoration

RISK INFORMED PLANNING PROCESS

35

Upper Mississippi River Restoration

RELEVANT VS. INSTRUMENTAL UNCERTAINTY

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- **Instrumental uncertainty** refers to things that could affect the decision
  - ✓ Focus on instrumental uncertainty
- **Relevant uncertainty** refers to things people may care about but things that will not change the decision
  - ✓ Reducing relevant uncertainty can feel essential

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INSTRUMENTAL UNCERTAINTY

Instrumental uncertainty gives rise to instrumental risk

- What is uncertain?
- Why is it uncertain?
- How uncertain is it?
- Why is the uncertainty important?

Instrumental Risk: A risk that could change the decision you make or a risk that could change the outcome of the decision you make

- What can go wrong?
- How can it happen?
- What are the consequences?
- How likely are these consequences?

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TYPES OF RISK

- **Study Risk**
  - Analytical error
  - Study delays
  - Study costs
- **Implementation Risk**
  - Schedule and cost of implementation
  - Re-design
- **Outcome Risk**
  - Project Performance
  - Safety

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RAPID ITERATIONS

- The Project Delivery Team should complete its first iteration of the planning process within the **first 30-days** of the study's initiation.
- The second complete iteration of the planning process should be finished within the **first 100 days**.
- Complete the third iteration **within three years** (or by the time the study is complete).

Rapid Iteration exercise is on the agenda for later today!

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RISK REGISTER

- One of the tools we use to document study risks.
- Completed by the Project Delivery Team to identify and document risks, and communicate them with the Vertical Team.
- Used as a guide for decision making and accepting decisions based on information available to the Project Delivery Team at that time.
- Documents and evaluates risks associated with planning decisions to help the Project Delivery Team anticipate the potential effects of uncertainty on the quality of the study and project outcomes.
- Evolves with the study and risks identified should continue to be evaluated, monitored, and managed throughout the life cycle of the project (planning, design, construction, and operations).

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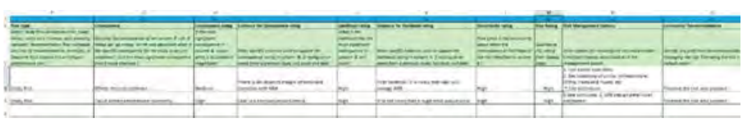
RISK REGISTER TEMPLATE



Check out https://planning.erdc.dren.mil/toolbox/smart.cfm?Section=8&Part=4 for more risk register information, examples, and a template

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RISK REGISTER

- Completing the risk register is less important than **using it**
- You identify risks so you can manage them, not to build a case for a waiver or to check off a requirement
- Every risk has a manager
- Actively manage every H and M risk to keep undesirable consequences from developing
- Monitor L risks to make sure they do not progress
- Risk communication: Decision makers would like a summary of key risks at each In Progress Review or Milestone Meeting.

WRAPPING UP

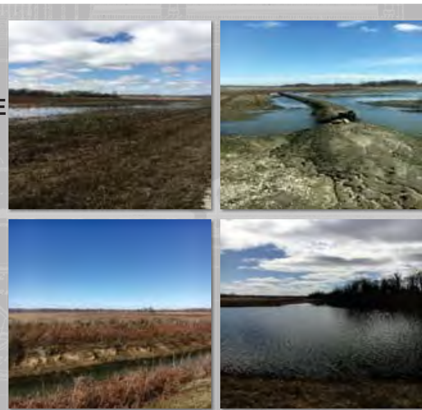
- Risk Informed Planning is an opportunity to continue to improve our processes and more efficiently execute the Civil Works mission, including UMRR/HREP.
- Key Concepts
  - ✓ Planning Manual, Part II
  - ✓ Defining risk and uncertainty
  - ✓ Rapid iterations
  - ✓ Using the risk register as a risk management tool
- Risk management requirements and tools can be tailored to regional programs like UMRR/HREP.

QUESTIONS / DISCUSSION

RISK INFORMED PLANNING

RAPID ITERATION EXERCISE

Rachel Mesko
Water Resources Certified Planner
Regional Planning & Environmental Division North
6 May 2019



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WHAT IS AN ITERATION?

What is an iterative process?
- An iterative process is one that is repeated, at times, over and over.

What is iterated?
- The entire planning process, a single step in the process, or any portion of the process can be iterated.

What do planners do in an iteration?
- They attempt to reduce uncertainty with each iteration of the planning process.
- Iterations repeat, elaborate, refine, correct, or complete a part of the planning process.

RISK INFORMED PLANNING: RAPID ITERATIONS

- The Project Delivery Team should complete its first iteration of the planning process within the **first 30-days** of the study's initiation.
- The second complete iteration of the planning process should be finished within the **first 100 days**.
- Complete the third iteration **within three years** (or by the time the study is complete).

1ST ITERATION: KNOWLEDGE ON THE TEAM

Within the first 30 days…

Use of Project Delivery Team knowledge to inform scoping

- What do we know now?
- Reveals available information and illustrates what the Project Delivery Team does not know
- Identify key uncertainties: where do we need more information?
- Ask for information that would help to reduce uncertainties

2ND ITERATION: WHAT DO OTHERS KNOW

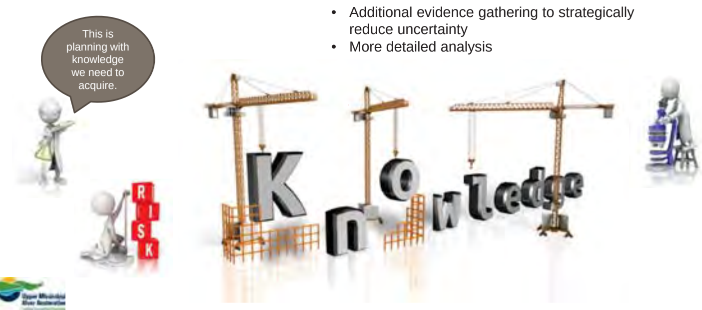
Use of existing information to inform scoping

- What do other people know?
- Bring in other people's knowledge
- Reduce the most significant uncertainties
- Preliminary evidence gathering
- Data collected by others
- Analysis of existing data

3RD ITERATION: WHAT MUST WE LEARN?

Develop new data to support decision-making and reduce risk and uncertainty

- What do we need to know to make a decision?
- Additional evidence gathering to strategically reduce uncertainty
- More detailed analysis



ITERATE THE SIX-STEP PLANNING PROCESS

Gather evidence to reduce uncertainty and manage study and project risk

Rapid iterations for a traditional Corps Feasibility Study may look like this.

Rapid iterations for a HREP project may follow a different process.

There is no "right" number of iterations.

RAPID ITERATION EXERCISE: YORKINUT SLOUGH

Task: Complete a rapid iteration to inform scoping of a new HREP project (Yorkinut Slough).

Objective: Develop a "best guess" TSP to restore ecosystem functions at Yorkinut Slough

PROJECT LOCATION

– Mississippi and Illinois River floodplain
– Right Descending Bank of Illinois River
– Illinois River Mile 5
– Calhoun County, Illinois
– 5 Miles southwest of Grafton, Illinois
– 22 miles upstream of Mel Price Lock and Dam (Pool 26)

BACKGROUND: PROBLEMS & GOALS

Main underlying ecological issues
- Altered hydrology
- Sedimentation
- Uniform Topography

Site-specific problems
- Limited water level management capability
- Loss of ridge and swale topography
- Channelization of existing tributary through wetlands
- Sedimentation from Illinois River and adjacent watersheds degrading wetland and slough habitats
- Loss of forest diversity (including hard mast trees)

Project goals
- Improve water management capabilities to increase diversity and quantity of native wetland vegetation needed for migratory wildlife
- Enhance natural topographic gradient and restore wetland functions
- Improve quality (diversity of age, structure, and species) and quantity (total acres) of bottomland forest
- Improve quality (depth, connectivity) of existing water bodies for enhance spring fish spawning habitat

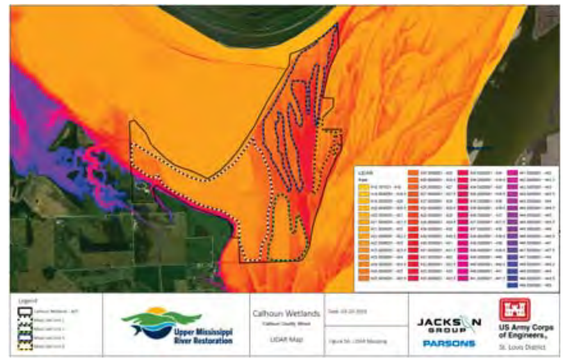
EXISTING RESOURCES

– Former agricultural area located near confluence of Illinois and Mississippi rivers
– 1,182 acres of floodplain habitat
– Owned by U.S. Fish and Wildlife Service as part of Two Rivers National Wildlife Refuge, Calhoun Division
– Specific habitat types in the area consist of the following:
  - Open Water Pools
  - Backwater Sloughs
  - Small Impoundments
  - Wetland Management Units
  - Bottomland Hardwood Forest
– Managed primarily for the production of moist soil vegetation through water level manipulation and a cooperative farming program
– Management activities seek to provide resources and habitat for wildlife including:
  - Migratory Waterfowl
  - Shorebirds
  - Wading Birds
  - Forest Resources

EXISTING RESOURCES

EXISTING RESOURCES

EXISTING RESOURCES



EXERCISE: 45 MINUTE RAPID ITERATION

TASK: Complete a rapid iteration to inform scoping of a new HREP project (Yorkinut Slough) using the information that was just provided to you and your own knowledge.

6-part exercise:

1. Identify at least one problem, one opportunity, one objective, and one constraint.
2. Generally describe the existing and future-without-project condition.
3. Identify an array of measures and their function or related objective.
4. Identify an initial array of alternatives and criteria that can be used to evaluate and screen alternatives.
5. Develop a “Best Guess” alternative that could be the Tentatively Selected Plan.
6. Identify key risks and uncertainties to be addressed in future iterations.

RAPID ITERATION CASE STUDY DEBRIEF

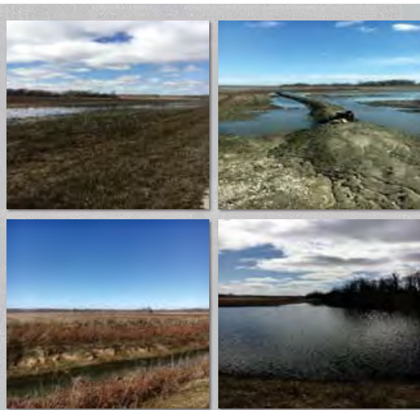
Group Debrief:

1. Identify at least one problem, one opportunity, one objective, and one constraint.
2. Generally describe the existing and future-without-project condition.
3. Identify an array of measures and their function or related objective.
4. Identify an initial array of alternatives and criteria that can be used to evaluate and screen alternatives.
5. Develop a “Best Guess” alternative that could be the Tentatively Selected Plan.
6. Identify key risks and uncertainties to be addressed in future iterations.

Discussion: How can we use rapid iterations for UMRR/HREP projects?

YORKINUT SLOUGH HREP

Brandon Schneider
Date: 06 May 2019



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PROJECT OVERVIEW

3

PROJECT LOCATION

– Mississippi and Illinois River floodplain
– Right Descending Bank of Illinois River
– Illinois River Mile 5
– Calhoun County, Illinois
– 5 Miles southwest of Grafton, Illinois
– 22 miles upstream of Mel Price Lock and Dam (Pool 26)

4

PROJECT PROBLEMS/NEED FOR ACTION

5

PROBLEM IDENTIFICATION

– Main underlying ecological issues
  - Altered hydrology
  - Sedimentation
  - Uniform Topography
– Site specific problems
  - Limited water level management capability
  - Loss of ridge and swale topography
  - Channelization of existing tributary through wetlands
  - Sedimentation from Illinois River and adjacent watersheds degrading wetland and slough habitats
  - Loss of forest diversity (including hard mast trees)

6

PROJECT GOALS

7

PROJECT GOALS

– Improve water management capabilities to increase diversity and quantity of native wetland vegetation needed for migratory wildlife
– Enhance natural topographic gradient and restore wetland functions
– Improve quality (diversity of age, structure, and species) and quantity (total acres) of bottomland forest
– Improve quality (depth, connectivity) of existing water bodies for enhance spring fish spawning habitat

8

EXISTING CONDITIONS

9

EXISTING RESOURCES

– Former agricultural area located near confluence of Illinois and Mississippi rivers
– 1182 acres of floodplain habitat
– Owned by U.S. Fish and Wildlife Service as part of Two Rivers National Wildlife Refuge, Calhoun Division
– Specific habitat types in the area consist of the following:
  • Open Water Pools
  • Backwater Sloughs
  • Small Impoundments
  • Wetland Management Units
  • Bottomland Hardwood Forest
– Managed primarily for the production of moist soil vegetation through water level manipulation and a cooperative farming program
– Management activities seek to provide resources and habitat for wildlife including:
  • Migratory Waterfowl
  • Shorebirds
  • Wading Birds
  • Forest Resources

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EXISTING RESOURCES

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EXISTING RESOURCES

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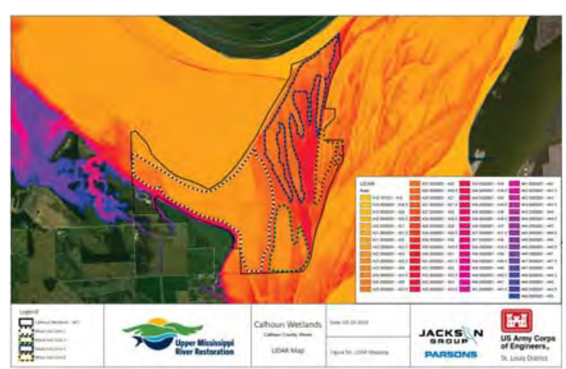
EXISTING RESOURCES



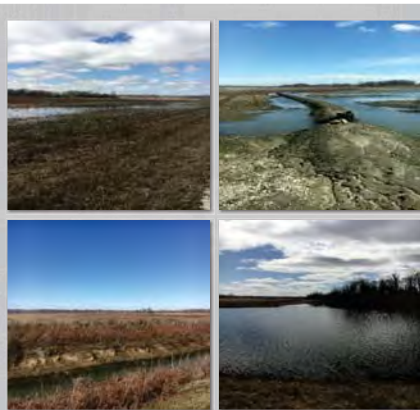
Day 2 Presentations
May 7, 2019

- **Risk Informed Planning Rapid Iteration Debrief**
  - ***Presenter Rachel Mesko (RPEDN)***
- **Applying Risk Informed Planning to HREPs: Lessons Learned and Tips for Success**
  - ***Presenter Rachel Mesko (RPEDN)***
- **Bluegill Overwintering Model Update: Utilizing Current Data to Improve HREP Planning**
  - ***Presenter Dillan Laaker (RPEDN)***
- **HREP Mussel Modeling: Habitat Suitability Modeling for Upper Mississippi River Restoration Projects**
  - ***Presenter Michael Dougherty (MVR)***
- **Design Criteria for Floodplain Forest Restoration: Using Inundation Characteristics to Support Forest Management Actions**
  - ***Presenter Lucie Sawyer (MVR)***
- **Evaluating HREPs**
  - ***Presenters Ben McGuire (RPEDN) David and Potter (RPEDN)***
- **Construction During an Era of Increased Flows: Dealing with high water events, designing for contractor access, and minimizing construction risks**
  - ***Presenters Scott Baker (MVP), Mark Pratt (MVR), and Mark Games (MVS)***
- **UMRR HREP Knowledge Sharing**
  - ***Presenter Kara Mitvalsky (MVR)***

RISK INFORMED PLANNING

RAPID ITERATION DEBRIEF

Rachel Mesko
Water Resources Certified Planner
Regional Planning & Environmental Division North
7 May 2019



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RAPID ITERATION CASE STUDY DEBRIEF

TASK: Complete a rapid iteration to inform scoping of a new HREP project (Yorkinut Slough) using the information that was just provided to you and your own knowledge.

Group Debrief:

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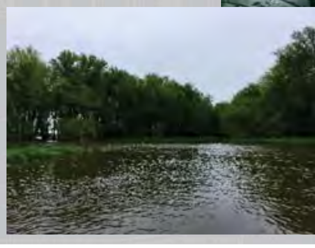
5. Develop a “Best Guess” alternative that could be the Tentatively Selected Plan.
6. Identify key risks and uncertainties to be addressed in future iterations.

DISCUSSION

How can we use rapid iterations for UMRR/HREP projects?

APPLYING RISK INFORMED PLANNING TO HREPS: LEVEL OF DETAIL & LESSONS LEARNED/TIPS FOR SUCCESS

Rachel Mesko
Water Resources Certified Planner
Regional Planning & Environmental Division North
7 May 2019



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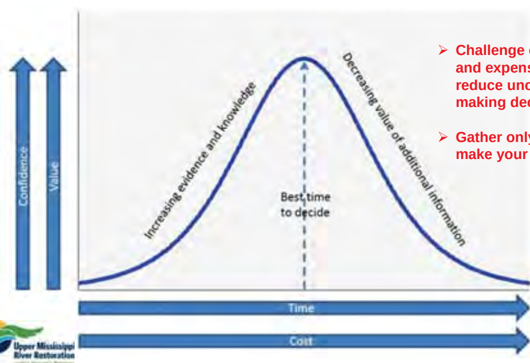
PLANNING: DECISION FOCUSED & RISK INFORMED USING CRITICAL THINKING

- What is the decision we are trying to make?
  - *Identify an initial array of alternatives? Select a recommended plan? Determine the optimized scale of a feature included in the recommended plan?*
- Can we make a decision with what we know now?
- What risks would we face if we make decisions with what we know now?
- Do we need to address that risk now? Later?

REDUCING UNCERTAINTY STRATEGICALLY



- **Challenge of balancing time, effort, and expense of more evidence to reduce uncertainty vs. risks of making decisions**
- **Gather only enough evidence to make your next decision**

APPROPRIATE LEVEL OF DETAIL?

YORKINUT HREP CASE STUDY LEVEL OF DETAIL

How do data gaps impact decision making?

Level of Detail Decision: Do we need to gather more detailed LIDAR data?

Planning Phase/Decision: Initial identification of future without-project condition and formulation of an initial array of alternatives.

Relevant Existing Information: Some LIDAR data is available, but it may not be of the quality needed to design interior impoundments.

Do we have enough information to make this planning decision now?

YES | NO

YORKINUT HREP CASE STUDY

Other potential data gaps:
- Limited information on timeframes it takes to get water on and off the units
- Water quality: Existing information from FWS and potentially LTRM
- Sensitive species (bat habitat): Existing data for nearby areas

Other risk/uncertainty examples from the rapid iteration exercise?

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BASS PONDS HREP CASE STUDY

POCs: Angela Deen
Kacie Opat
Jon Hendrickson

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BASS PONDS HREP CASE STUDY - OVERVIEW

Water Level Management Study Focus
- Urban Location
- Along Minnesota River
  - Sponsor and Partners
- MVD approved expedited "SMART Schedule"
  - January 2018 – Kicked-off
  - April 2019 – Completed Report

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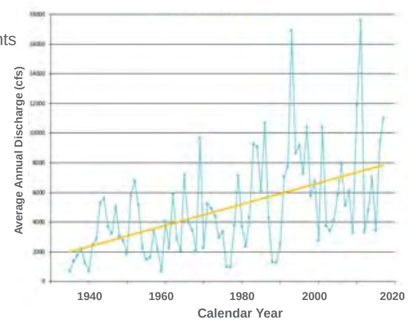
BASS PONDS HREP CASE STUDY - PROBLEMS

Changes in Hydrology
- Increased number of overbank flood events
- Prolonged full pool conditions
- Lack of seasonal variability

Condition of Existing Structures
- 7 of 8 non-functional or projected to fail

→ High O&M – rusting, clogged, or collapsed



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BASS PONDS HREP CASE STUDY - OBJECTIVES

Habitat Objectives

1 Increase diversity and quantity of emergent plants

2 Increase diversity and quantity of submergent plants

3 Create quality feeding and resting habitat for waterfowl

Improved Stoplog Structure Design →

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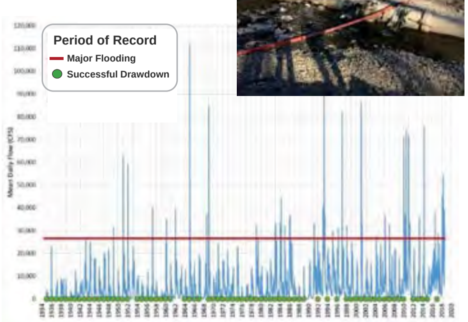
BASS PONDS HREP CASE STUDY- KEY PROJECT RISKS

Unexpected Utilities
- Exposed Fiber Optic Cable
- Natural Gas Pipeline
  - Identified Utility Risks Early
  - Modified Alternatives

Unknowns with Flow Conditions
- No groundwater data
- Climate change assessment
- Drawdown analysis (HEC-RAS)
  - Successful drawdown would have been possible 80% of past years if project had been in place
  - Designed structures to provide capability for successful drawdown into future



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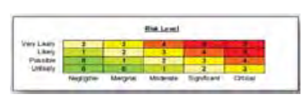
BASS PONDS HREP CASE STUDY - HOW TEAM USED RISK TOOLS

Decision Log
- Documented key decisions and risks
- Shared tracking with PDT and sponsors

Vertical Team Communication
- Risk slides included in meeting discussions

Abbreviated Risk Assessment
- Team exercise to assess risks
- Adjusted cost contingency



RISK INFORMED PLANNING: SUMMARY AND NEXT STEPS

Rachel Mesko
Water Resources Certified Planner
Regional Planning & Environmental Division North
7 May 2019

US Army Corps of Engineers

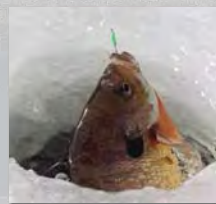
RISK INFORMED PLANNING: SUMMARY AND NEXT STEPS

Table Discussion

- After learning about risk informed planning, identify one concept, tool, or strategy that you can apply to make HREPs more successful.
- For non-Corps attendees: Is there a key takeaway or perspective unique to your agency that you would like to share?

BLUEGILL OVERWINTERING MODEL UPDATE: UTILIZING CURRENT DATA TO IMPROVE HREP PLANNING

Dillan Laaker
Biologist
MVD/RPEDN/Rock Island District
Date: 07 May 2019



US Army Corps of Engineers

BLUEGILL SUNFISH (*LEPOMIS MACROCHIRUS*)

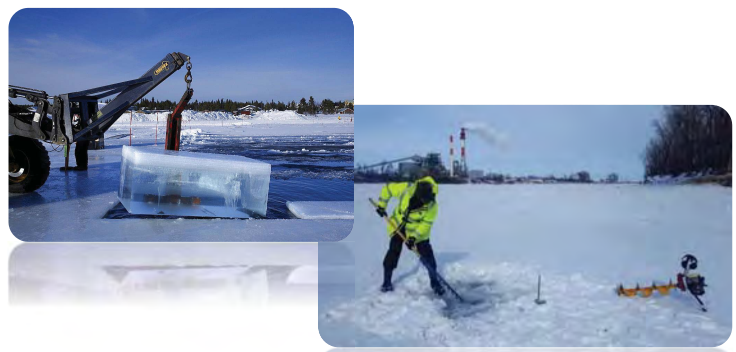
Represents an important resource for native wildlife and fisherman

- Most-caught fish on the Mississippi River (IA DNR)
- Major food source

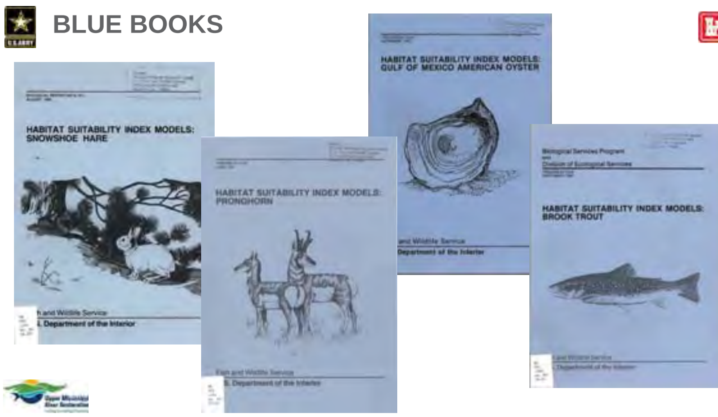
HREP'S

- ~ 30 HREP's in Pools 4-11
- 2/3 have included an objective to improve or restore centrarchid habitat, ***primarily through providing overwintering habitat***

OVERWINTERING HABITAT



BLUE BOOKS



HABITAT SUITABILITY INDEX

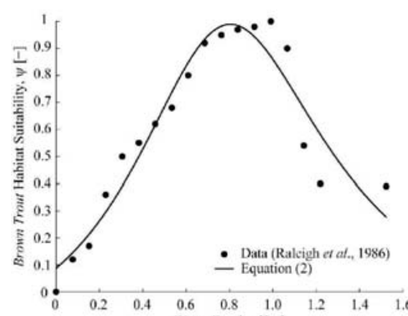
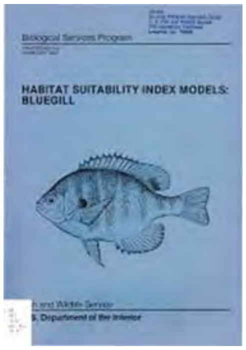


Fig. 2 Habitat suitability curve for brown trout: comparisor

BLUEGILL HSI MODEL

7



BLUEGILL OVERWINTERING HSI MODEL

8

Modification of the Habitat Suitability Index Model for the Bluegill (Lepomis macrochirus) for Winter Conditions for Upper Mississippi River Backwater Habitats

by
Gary Palesh and Dennis Anderson

January 1990

St. Paul District
Corps of Engineers

UTILIZING CURRENT DATA

9

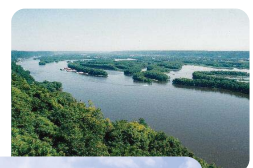
SUMMARY

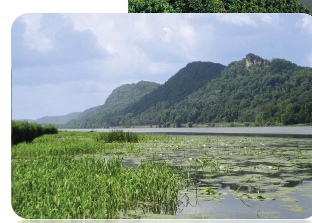
This modification of the existing FWS habitat suitability index model for the bluegill was undertaken to incorporate variables that allow for the consideration of winter habitat conditions. Currently, there is limited research-generated information concerning the winter habitat requirements for the bluegill in Upper Mississippi River backwaters. We expect that, as this information becomes available, the model will continue to be modified to take advantage of new information.

SURVEY SAYS…

10

- “What additional scientific information is needed to help design better/more diverse HREP’s in the future?”
- “More discussion on updating species models and improving models that quantify existing” but at-risk habitat
- “Finding best conditions for backwater overwintering that will self-maintain without maintenance dredging”
- “Fish use of HREP features”



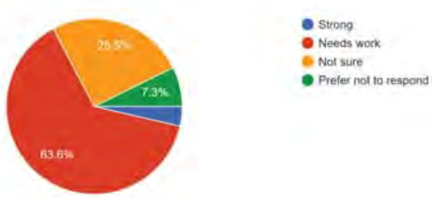


SURVEY SAYS…

11

In your opinion, how strong is the current suite of available habitat models used for HREP planning?

55 responses

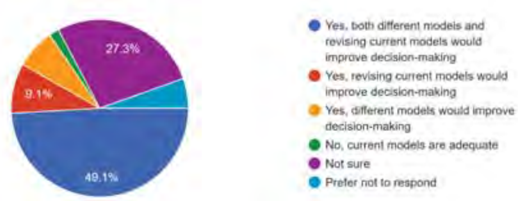


SURVEY SAYS…

12

Do you feel different models or revising current models would improve decision-making?

55 responses



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BLUEGILL OVERWINTERING HSI MODEL

Modification of the Habitat Suitability Index Model for the Bluegill (*Lepomis macrochirus*) for Winter Conditions for Upper Mississippi River Backwater Habitats

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Gary Palesh and Dennis Anderson

January 1990

St. Paul District
Corps of Engineers

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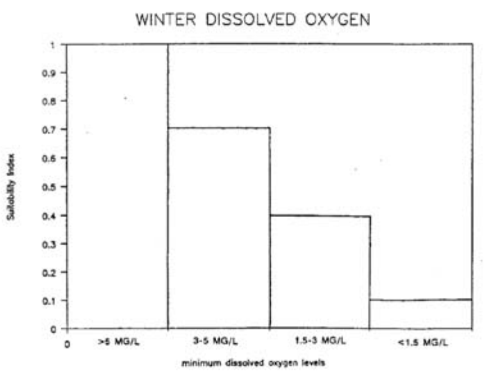
BLUEGILL OVERWINTERING MODEL WORKSHOP

1. Dissolved Oxygen (DO)
2. Temperature
3. Water velocity
4. Depth

15



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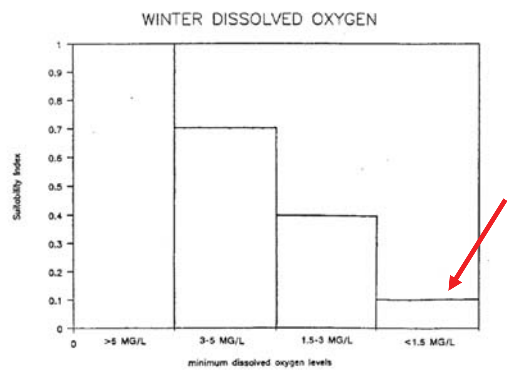

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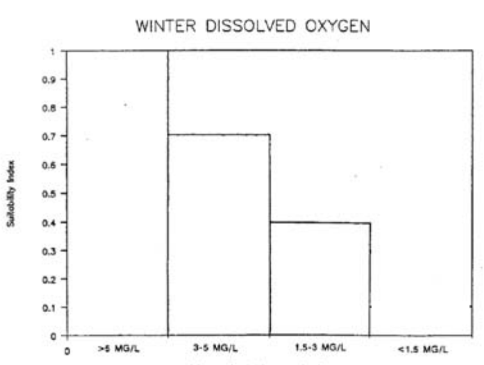

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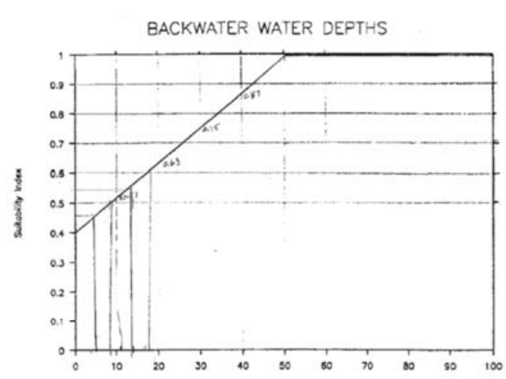
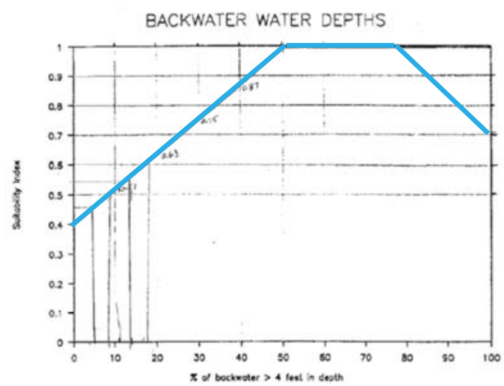
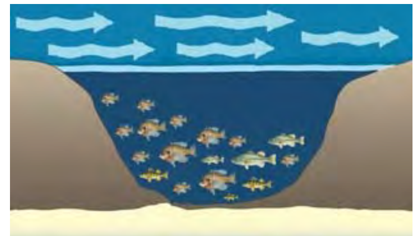
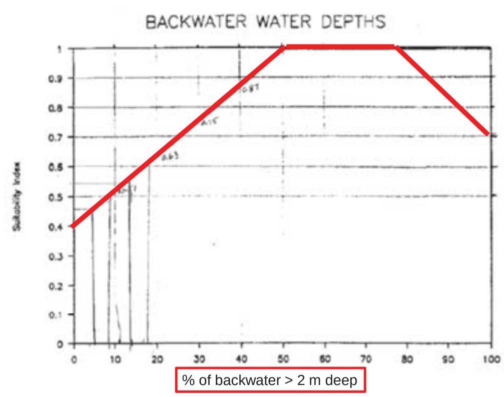


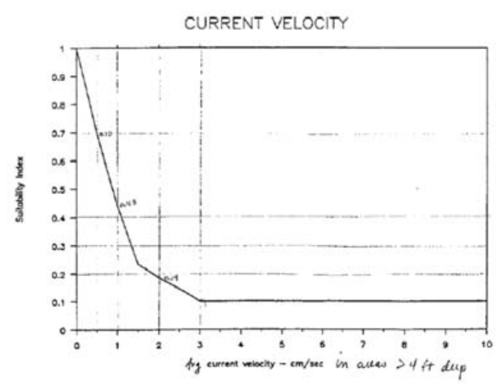


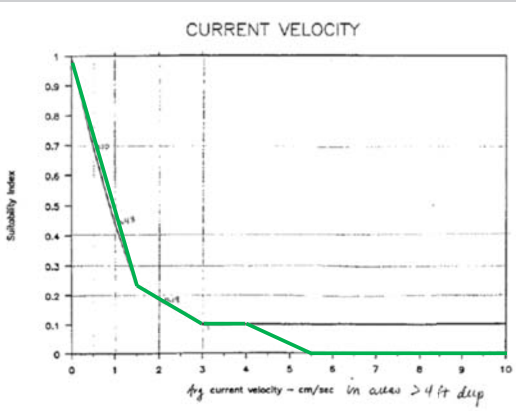
BACKWATER DEPTH

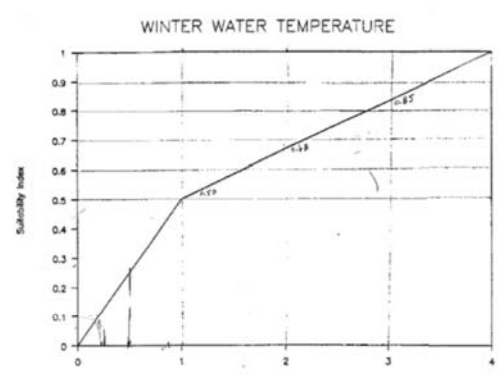
- Work completed by Shawn Giblin, WI DNR, showed a sweet spot for depth between 2 – 3 meters
- This depth allows for “warm” water with adequate dissolved oxygen even when relatively high flows are present
- Fish can use these deeps pockets as refugia during times of increased flow

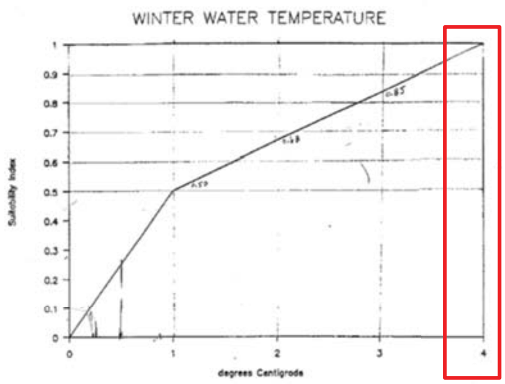




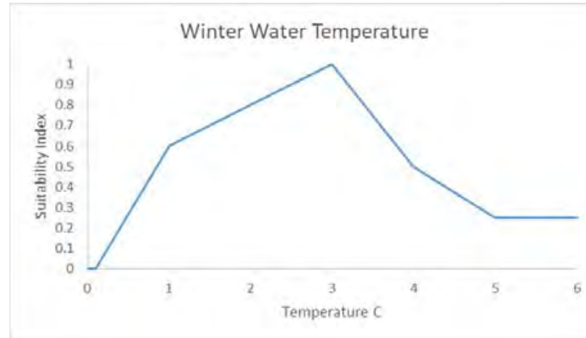








At this temp, often supersaturated or anoxic (Giblin, WI DNR)



ADDITIONAL PARAMETERS DISCUSSED

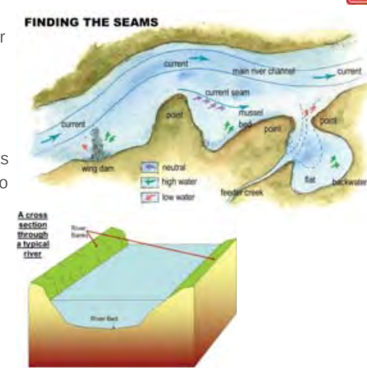
CONNECTIVITY

"The degree/frequency with which a backwater is inundated by overland flooding"

- Can reduce flood frequency with higher constructed features
- Can dredge deeper, mitigate flooding effects

Also considers the connection of backwaters to the main channel

- Size, number, shape, and orientation of openings



COVER

Physical structure(s) that provide habitat and refuge for fish

- Includes rip rap, logs, downed trees, undercut banks, aquatic vegetation
- Currently not much data is available that catalogs the effects and importance of cover to overwintering fish

SIZE OF THE BACKWATER

Backwaters of varying sizes may have different degrees of success as overwintering sites

- Many small pockets vs one large site?
- Even small backwaters act as important overwintering sites
  - If conditions are right, fish will use them
- Evidence of some backwaters being too small
  - Otter predation (Hansen, IA DNR)

RESIDENCE TIME

The amount of time that water stays in a backwater affects the quality of that site as overwintering habitat

- Water entering a backwater and leaving quickly is experiencing higher levels of flow and is often cold
- Water entering a backwater and staying for a significant amount of time warms up and experiences less flow
- ~12 days is considered optimal

NEXT STEPS

- Draft model updates
- Sensitivity test on prior HREP's
- Validity testing
- Proceed with model certification through ECO PCX

HREP Mussel Modeling

Habitat Suitability Modeling for Upper Mississippi River Restoration Projects

Michael Dougherty, Geographer
USACE, Rock Island District

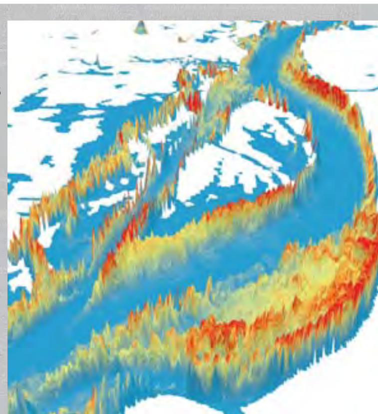
Dan Kelner, Fisheries Biologist
USACE, St. Paul District

Davi Michl, Biologist,
USACE, Rock Island District

May 7, 2019

US Army Corps of Engineers

Upper Mississippi River Restoration



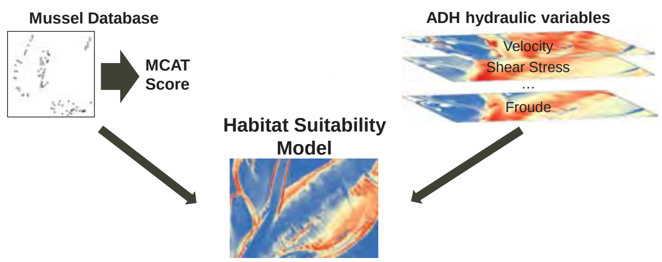
Overview

- What are spatially explicit habitat models?
- Why spatially explicit habitat models?
- Benefits to HREP projects
- Application to other habitat types
- Discussion

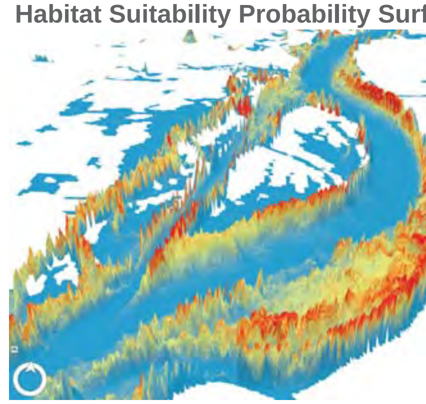
Spatially Explicit Habitat Suitability Models

Dependent Variables

Independent Variables



Habitat Suitability Probability Surface



- Higher values represent more suitable habitat, lower values less suitable habitat
- Habitat suitability can be visualized as a probability surface

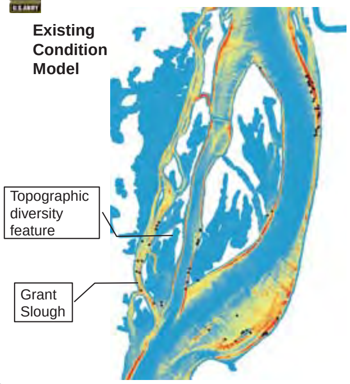
Benefits of Spatially Explicit Habitat Models

- Estimate habitat across the entire study area
- Make the most of currently available biological data
- HREP site-level resolution
- Leverage past investments in system models (e.g., hydraulic, wind-wave, inundation statistics)
- Extrapolate from sampled sites to unsampled sites
- Consistent and repeatable methods
- Based on best available science methods

Benefits of Spatially Explicit Models Applied to HREPs

- Select Features – Identify areas suitable for enhancement
- Assess Impacts – Determine potential impacts
- Design Features – Estimate feature influence on habitat
- Evaluate Alternatives – Measure differences in benefits

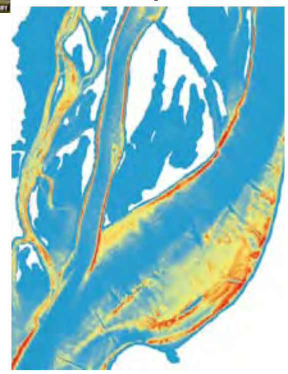
Select HREP Features



Example:

- The model predicts that Grant Slough is moderate-high suitable habitat
- Avoid access dredging in Grant Slough?
- Select another access dredging route?
- Consider as a possible project feature?

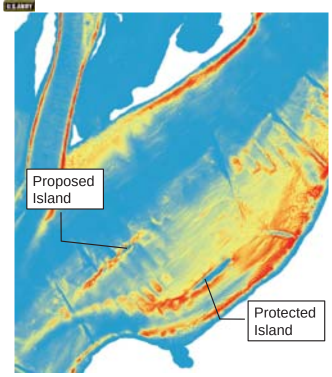
Assess Impacts



Use models to:

- Extrapolate from previous mussel survey investments
- Use best available science to estimate impacts
- Inform future HREP mussel survey design
  - o Focus on areas we expect mussels to be
  - o No need to survey in low probability areas

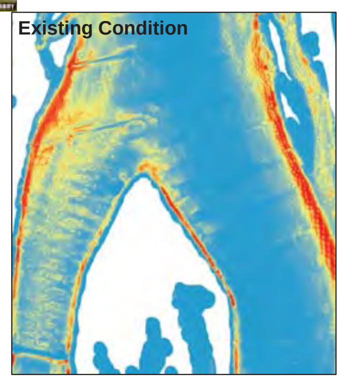
Design Features

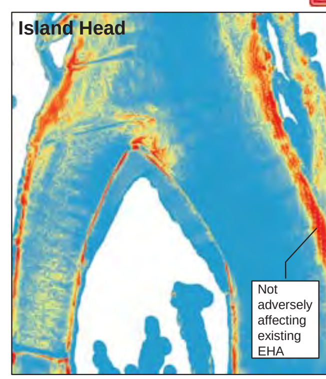


Use models to answer design questions

- What is the protective effect of the proposed island?
- Cost effectively test this future without project (FWOP) assumption.
- Remove the island and examine the habitat suitability effect on the protected island.

Evaluate Alternatives





Application to Other Habitat Types

- **Submersed Aquatic Vegetation**
  - o Dependent variables - Vegetation surveys
  - o Independent variables - Hydraulic models, UMESC Wind-Wave model
- **Floodplain Forests**
  - o Dependent variables – Forest management geodatabase
  - o Independent variables – UMESC inundation statistics

Discussion

Questions:
Michael.P.Dougherty@usace.army.mil

HREP Mussel Modeling Methods
https://mpdougherty.github.io/HREP-Mussel-Manual/index.html

DESIGN GUIDELINES FOR FLOODPLAIN FOREST RESTORATION:

USING INUNDATION CHARACTERISTICS TO SUPPORT FOREST MANAGEMENT ACTIONS

Lucie Sawyer, P.E.- Civil-Hydraulic Engineer, Rock Island District (MVR)

May 7, 2019

US Army Corps of Engineers

Upper Mississippi River Restoration

OUTLINE

- Ecologically Relevant Flooding Attributes
- Forest Management Actions
- Tree Planting w/ Topo Diversity Example
  - Flood Tolerance Categories
  - Hydrologic Analysis using HEC-EFM
  - Evaluating & Applying HEC-EFM Results
  - Design Guideline Limitations & Opportunities
- Floodplain Inundation Model
- Next Steps

Upper Mississippi River Restoration

ECOLOGICALLY RELEVANT FLOODING ATTRIBUTES

"Flood inundation is a fundamental driver of successional patterns in floodplains."

4 Flood Regime Attributes
- Frequency
- Duration
- Depth
- Timing

(De Jager, N.R., Rogala, J.T., Rohweder, J.J., Van Appledorn, M., Bouska, K.L., Houser, Jeffrey, N., and Jankowski, K., 2018, Indicators of ecosystem structure and function for the Upper Mississippi River System: U.S. Geological Survey Open-File Report 2018–1143, 115 p. including 4 appendixes, https://doi.org/10.3133/ofr20181143.)

Upper Mississippi River Restoration

FOREST MANAGEMENT ACTIONS CONSIDERED

Silvicultural Prescriptions from MVR Forest Management Plan

I. Timber Harvest (6)
II. Thinning Treatment (6)
III. Tree Planting (9)
w/ topographic diversity (9+)

Example Design Guidelines Using:
Forester Expertise & a Hydrologic Analysis Tool (HEC-EFM)

****Tree Planting with Topographic Diversity****

Upper Mississippi River Restoration

TOPOGRAPHIC DIVERSITY BASED ON FLOOD TOLERANCE

Inundation Duration and Frequency Tolerance Categories

Consecutive Inundation Duration Growing Season Tolerance (Days) ★	Exceedance Probability (%) ★	Tree Species
Minimal (25-35)	25 (4-year)	*Green Hawthorne, Basswood, Dogwood, Elderberry, Persimmon, Kentucky Coffeetree, Honey Locust, Black Walnut*, Shellbark Hickory*. (Black walnut and Shellbark Hickory are the least tolerant)*
Moderate (35-45)	25 (4-year)	*Bur Oak, Northern Pecan, Pin Oak, Swamp White Oak, River Birch, Hackberry, American Elm and Green Ash*
Maximum (45-55)	50 (2-year)	*Buttonbush, Black Willow, Sand-bar Willow, Eastern Cottonwood, Silver Maple*

★ *(1) How long can tree species be wet during the growing season until mortality is likely?*
★ *(2) How frequently can this inundation duration be exceeded without increasing likelihood of mortality?*

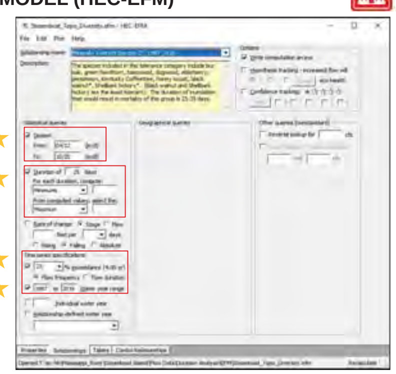
Upper Mississippi River Restoration

HEC-ECOSYSTEMS FUNCTION MODEL (HEC-EFM)

Time series analysis tool designed for determining ecosystem responses to changes in flow regime
https://www.hec.usace.army.mil/software/hec-efm/

Why HEC-EFM?
- GUI- interactive analysis with PDT
- Time-series analysis functionality
- Can utilize stage data

HEC-EFM Input
-Stage record from nearest gage .DSS
★ -Growing Season
★ -Inundation Duration (conservative assumption)
★ -Exceedance Probability
★ -Period of Analysis – most recent 30 yr



Upper Mississippi River Restoration

EVALUATING & APPLYING HEC-EFM RESULTS

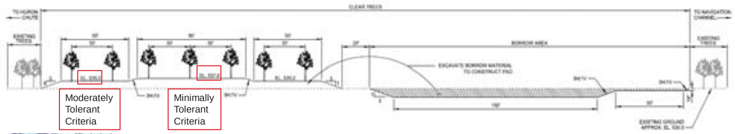
HEC-EFM Output

Elevation at gage location that exceeds the inundation duration tolerance at the specified exceedance probability (frequency)

i.e. El. 532' experiences more than 25 consecutive days of inundation duration every 4 years

HEC-EFM Output Evaluation

-Climate change adaptation
-Interpolate result at gage to project site
-Wetland delineation to verify wetland soils present
-Floodplain impact evaluation



CURRENT DESIGN GUIDANCE LIMITATIONS & OPPORTUNITIES

4 Flood Regime Attributes

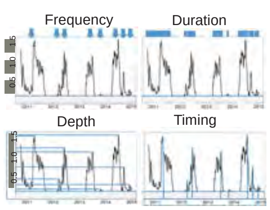
- Frequency
- Duration
- Depth
- Timing

Flood tolerance categories are informed by best professional judgement and have not been "validated" with systemic inundation datasets and forest inventory data

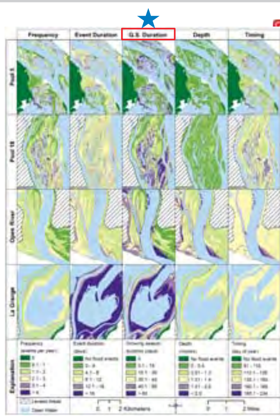
Systemic inundation modeling completed in support of HNA II and development of the Forest Management Geodatabase present opportunities to compare current assumptions with modeled and observed data.

FLOODPLAIN INUNDATION MODELING

Goal:
"Systemically map the UMRS inundation regime in ways that are relevant for ecological investigations"



HNAII Floodplain Functional Class Indicator:
mean total growing season flood inundation duration



credit: Molly Van Appledorn, UMESC
(De Jager et al., 2018
https://doi.org/10.3133/ofr20181143)

NEXT STEPS

- **Forest Management Geodatabase (FMG) & Floodplain Inundation Modeling**
  - Are flooding attributes useful predictors of key forest health attributes?
  - IF YES, are the predictive flooding attributes similar to those currently used to support tree planting with topographic diversity? How can we improve are design guidelines?
  - Identify hydrologic design guidelines to support different forest management actions?

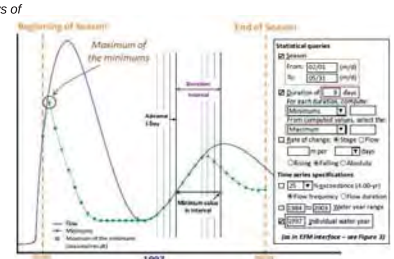
How are flooding attributes changing over time?
How does this affect floodplain forest restoration with a 50 yr project design?

HEC-ECOSYSTEMS FUNCTION MODEL (HEC-EFM)

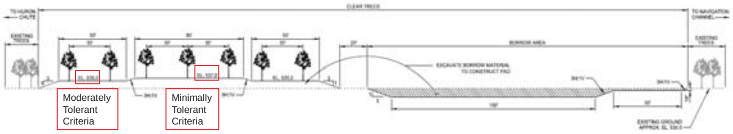
HEC-EFM Output

Elevation at gage location that exceeds the inundation duration tolerance at the specified exceedance probability (frequency)

i.e. El. 532' experiences more than 25 consecutive days of inundation duration every 4 years



EVALUATING & APPLYING HEC-EFM RESULTS



HREP Name	Project Feature RM	Upper Planting Limit	50% ACE (2-year)	20% ACE (5-year)
Huron Island, P18	422.75	537 MSL1912	574.9 MSL1912	537.5 MSL1912
Beaver Island, P14	514	579.8* NAVD88	578.69 NAVD88	581.29 NAVD88
Steamboat Island, P14	504.5	576.2* NAVD88	575.17 NAVD88	576.87 NAVD88

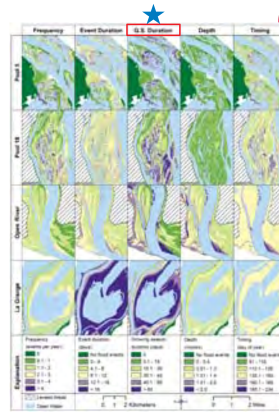
*Climate change considered

FLOODPLAIN INUNDATION MODELING

Model Characteristics

- Spatially explicit
- 4m x 4m pixel resolution
- Topobathy elevation dataset
- WSEL-linear interpolation b/w USACE gages
- Daily timestep
- 40-yr simulation
- Growing season (1 April - 1 Sept)

(De Jager, N.R., Rogala, J.T., Rohweder, J.J., Van Appledorn, M., Bouska, K.L., Houser, Jeffrey, N., and Jankowski, K., 2018, Indicators of ecosystem structure and function for the Upper Mississippi River System: U.S. Geological Survey Open-File Report 2018–1143, 115 p. including 4 appendixes, https://doi.org/10.3133/ofr20181143.)



EXTENDED PLANTING WINDOW

- **Steamboat Island, Pool 14:**
  - 2 growing seasons of cover crop (turnip & radish) to develop dredged soils,
  - Extended planting window to sequence direct seeding, bare root seedling and containerized stock

UMRR MAY 2019 WORKSHOP: POLICY AND GUIDANCE FOR HREP MONITORING

Ben McGuire
Wildlife Biologist
MVP@MVS/PD-P
Date: 7 May 2019

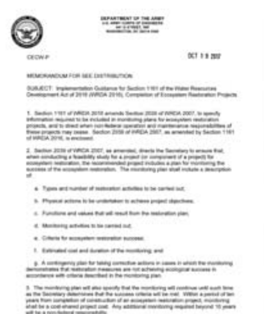
US Army Corps of Engineers

POLICY AND GUIDANCE FOR HREP MONITORING

1. Policy & Guidance
2. How is success measured?
3. Monitoring
4. Documenting Success

POLICY AND GUIDANCE FOR HREP MONITORING

Water Resources Development Act (WRDA) 2016, Sec. 1161
- Implementation Guidance 19 OCT 2017



https://planning.erdc.dren.mil/toolbox/library/WRDA/WRDA16IGSection1161_19Oct17.pdf

HOW IS SUCCESS MEASURED

How is success measured?
- "Success Criteria"
- SMART Objectives

Monitoring plan from feasibility may need to be updated during PED
- Project features could change during PED
- Monitoring should be adequate to address changes

SMART planning is:
S: Specific
M: Measurable
A: Attainable
R: Risk Informed
T: Timely

HREP MONITORING

Monitoring & Adaptive Management
- Risk and Uncertainty
- Document outcomes and change over time

Level of Detail
- "Monitoring plans need not be complex but the scope and duration should included the minimum monitoring actions necessary to evaluate success."

HREP MONITORING

- What's Appropriate?
  - Biological
  - Chemical
  - Physical
  - Other
- Monitoring must link back to project objectives
- Monitoring will continue until success criteria met
  - Within 10 years post-construction = cost-shared
  - Beyond 10 years = sponsor responsibility

DOCUMENTING SUCCESS

- WRDA 2016 Implementation Guidance
  - "…determination by the Division Commander that ecological success has been achieved…"[1]
- How have other districts documented success?
  - MVP, Finger Lakes PER

1. WRDA 2016 Implementation Guidance: https://planning.erdc.dren.mil/toolbox/library/WRDA/WRDA16IGSection1161_19Oct17.pdf

HREPS: PERFORMANCE EVALUATIONS

David Potter
Fish Biologist
MVD/St. Paul District
07 May 2019

Contributors: Kara Mitvalsky, MVR
Kat McCain, MVR
Ben McGuire, MVR

US Army Corps of Engineers

LIVE POLL QUESTION

httpsx`://www.pollev.com/meganmcguire867

Q: Under limited funds, what is your approach to monitoring vs construction for an HREP?

1) Cadillac Monitoring / Kia HREP

2) Kia Monitoring / Cadillac HREP

3) Chevy Monitoring / Chevy HREP

HOW IS HREP PERFORMANCE ASSESSED ACROSS DISTRICTS?

1) Milestones
2) Performance Evaluation Report (PER)
3) Summary by District
   a) MVS
   b) MVR
   c) MVP
4) Challenges
5) Summary

MILESTONES/ACTIVITIES

Construction Sequence	Pre		During			Post										Post				
TARGET YEAR	-10	-5	0	0	0	1	2	3	4	5	6	7	8	9	10	15	20	30	40	50
Monitoring	S	S	S	S	S	CS	CS	CS	CS	CS	CS	CS	CS	CS	S	S	S	S	S	S
Construction			C	C	C															
Discipline Analysis & Reporting						CS	CS	CS	CS	CS	CS	CS	CS	CS		S	S	S	S	S
Initial Inspection										CS										
Initial PER										C										
Adaptive Management Measures											C	C	C	C	C	S	S	S	S	S
Final Inspection															CS					
Final PER															C					
Documentation of Success															C					
Determination of Success															C					
S = Sponsor																				
C = Corps																				

PER TEMPLATE

Executive Summary
Introduction
Project Purpose
Project Description
Project Performance Monitoring
Project Evaluation
Public Support
Lessons Learned

ST. LOUIS DISTRICT (MVS)

- 10 Constructed HREPs; all with PERs (100%)
- 11 PERs completed (10 Initial, 1 Final)
- FY19: Initial PERs for Batchtown, Pool 25 and Pool 26 Islands; Final PER for Swan Lake.

Source: UMRR Database; pers. comm.

ROCK ISLAND DISTRICT (MVR)

- 19 Constructed HREPs; 15 with PERs (79%)
- 60 PERs completed (53 Initial, 7 Final)
- From 2016 – 2018, site inspections for all HREPs.
- FY19: Reports for site inspections, overwintering analysis, & water quality sampling.

Source: UMRR Database; pers. comm.

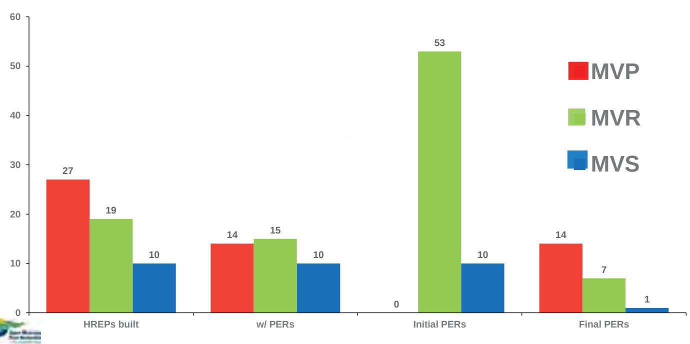
ST PAUL DISTRICT (MVP)

- 27 Constructed HREPs; 14 with PERs (52%)
- 14 PERs completed
- Inspections conducted on 17 HREPs in 2018.
- FY19: Inspections / PERs for Trempeleau & Ambrough HREPs; 2018 Inspections Report

Source: UMRR Database; pers. comm.

ASSESSING HREP PERFORMANCE

SOURCE: UMRR DATABASE / PERS. COMM.



CHALLENGES TO PERFORMANCE EVALUATIONS

- Current PER template
- Not a high priority
- Staff turnover
- No central repository for data/reports
- Long response time (limited sponsor resources?)
- Number of HREPs to monitor
- Connecting monitoring to objectives
- Misalignment of objectives to what was actually built.
- Mother Nature delays monitoring.

SUMMARY

- In accordance with Corps' guidance: Important milestones with assessing HREP performance.
- An important milestone is the PER, which is challenging to complete.
- Similarities and differences in how performance is assessed and implemented across districts.

UMRR MAY 2019 WORKSHOP: CONSTRUCTION DURING AN ERA OF INCREASED FLOWS

Presenter: Scott Baker
Title: Resident Engineer P.E. (Winona, MN)
MVD/MVP/EC-C (Construction)
Date: 07 May 2019

US Army Corps of Engineers

High Water – What does that mean?

<u>Here are some items we will talk about today:</u>

Is high water happening more frequently?

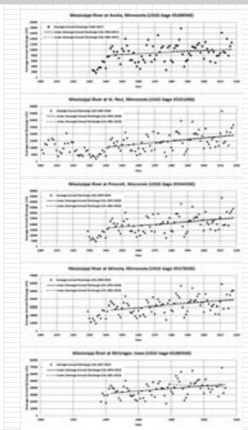
How do higher flows affect pool levels?

How can high water affect our projects?

Why is discussing high water relevant to HREPs?

So, we are going to have some periods of high water.
- How well we manage it will impact success and costs of our projects.

<u>High water is not new.</u>
- We will talk about how we managed it in past and some strategies for managing it in the future.



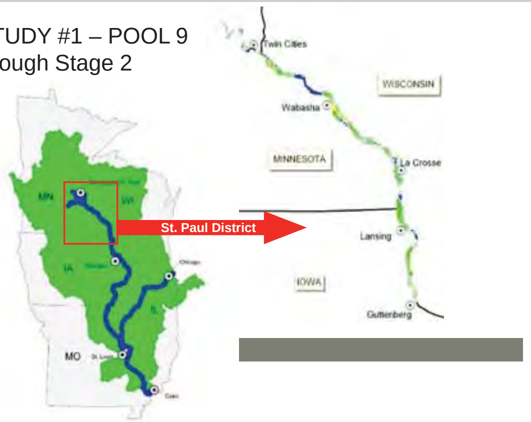
Mainstem Longterm Characteristics

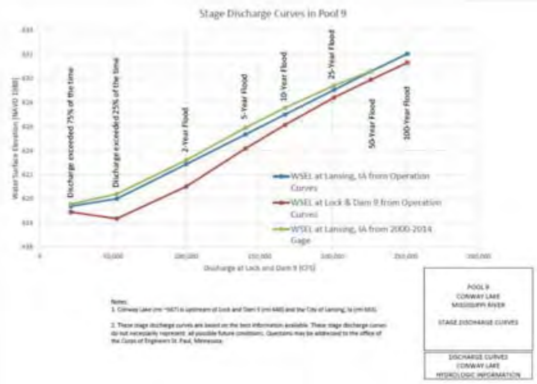
SLIDE FROM HH Model Webinar

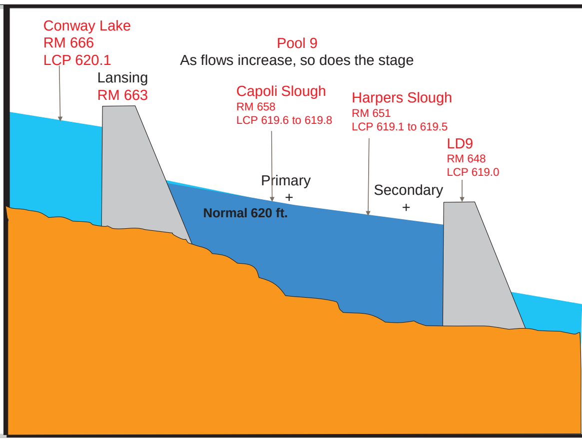
Analysis of average annual discharge at gages in the navigable reach of the Mississippi River indicates:

- **a significant upward trend since the 1940s**
- **A transition to wetter conditions starting in the early 1980s**
- **An upward trend from 1981 to the present**
- **Greater variability 1981 to the present.**

CASE STUDY #1 – POOL 9
Capoli Slough Stage 2

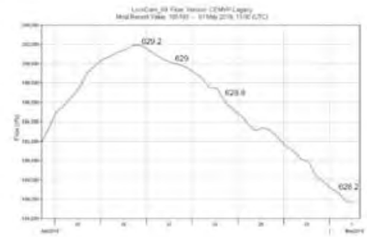






CONSTRUCTION DURING AN ERA OF INCREASED FLOWS

EXAMPLE: APRIL 2019



CAPOLI SLOUGH – PRE- PROJECT IN 2010

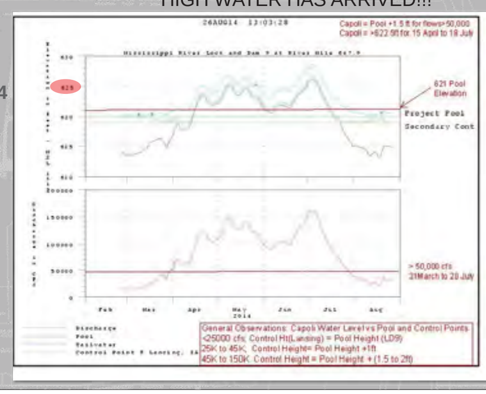
Not Many Islands Left

CASE STUDY #1 – POOL 9 CAPOLI SLOUGH ISLANDS 2014

HIGH WATER HAS ARRIVED!!!

High Water – **March-July 2014**

Short construction window
Is closing….



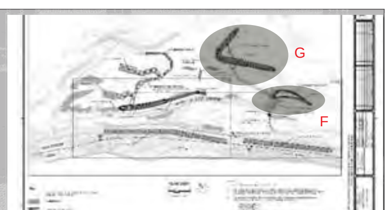
US Army Corps of Engineers

UMRR MAY 2019 WORKSHOP: CONSTRUCTION DURING AN ERA OF INCREASED FLOWS

CASE Study #1 – Pool 9 Capoli Slough

Island G 3200 ft. long, High, and 160 ft. w

Island F – 1800 ft. long, medium high
But only 40 feet wide. Strategic Island.



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UMRR MAY 2019 WORKSHOP: CONSTRUCTION DURING AN ERA OF INCREASED FLOWS

HIGH WATER IS COMING!!

Island G
3200 ft. long, High, and 160 ft. w Island.

Island F
Not as wide, but needed for fines Placement.

LCP ranges from 619.6 at RM 656 to 619.8 at RM 659

STAGE II

ISLAND DIMENSIONS (IN FEET UNLESS OTHERWISE NOTED)

ISLAND NAME	TYPE	A	B	C	D	E	F	TOP EL.	Fine Material Depth
ISLAND C STA. C0+56 TO C3+20	TYPE A ISLAND	40	5	40	5	30	120	623.0	18'
ISLAND C STA. C3+50 TO C6+90	TYPE A ISLAND	40	10	40	10	30	130	624.0	18"
ISLAND C STA. C7+10 TO C12+60	TYPE A ISLAND	40	15	40	15	30	140	625.0	18"
ISLAND C STA. 12+90 TO 15+60	TYPE A ISLAND	40	22.5	40	22.5	30	155	626.5	24"
ISLAND C STA. C15+98 TO C17+80	TYPE A ISLAND	40	32	40	32	30	174	628.4	24"
ISLAND G STA. 0+00 TO 9+30	TYPE A ISLAND	30	5	50	5	40	130	623.0	12"
ISLAND G STA. 10+00 TO 13+50	TYPE A ISLAND	30	22.5	50	22.5	40	165	626.5	4.5 ft
ISLAND G STA. 13+80 TO 18+80	TYPE A ISLAND	30	30	50	30	40	180	628.0	6 ft
ISLAND G	TYPE A ISLAND	30	22.5	50	22.5	40	165	626.5	4.5 ft

Topsoil De

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UMRR MAY 2019 WORKSHOP: CONSTRUCTION DURING AN ERA OF INCREASED FLOWS

High Water Arrives and Contractor has a plan.

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UMRR MAY 2019 WORKSHOP: CONSTRUCTION DURING AN ERA OF INCREASED FLOWS

Survey Set Up

Pushing granular material out to the toe

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UMRR MAY 2019 WORKSHOP: CONSTRUCTION DURING AN ERA OF INCREASED FLOWS

Island G after final grading of granular

Island F - Rock and Island in good shape after overtopping

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WHAT CAN WE DO ABOUT THE HIGH WATER?

<u>Why did this work out well?</u>

Design - included a mix of features, some were >6ft about LCP.
AND, we were lucky to have a contractor who could overcome our design for Island G.

Surveys – We had good bathymetry, and accurate contractor pre-construction surveys.

Planning – Contractor understood hydrology of this area and, and they knew their equipment and their capabilities.

Execution –
-Contractor monitored NWS forecasts and made adjustments as needed.
-Experienced operators, good surveys, allowed Contractor to finish to final grade with a minimum of double handling and additional costs.

UMRR MAY 2019 WORKSHOP: CONSTRUCTION DURING AN ERA OF INCREASED FLOWS

Presenter: Mark Pratt
Title: MVR Area Engineer
MVD/MVR/EC-C (Construction)
Date: 07 May 2019

US Army Corps of Engineers

UMRR HREP CONSTRUCTION-HIGH WATER

Defining High Water

- High water in construction is not a static number
- High water is task dependent and is influenced by
  - Contractor equipment, knowledge, and experience
  - Public and project interests
    - Contract restrictions
- High water can occur at any time of the year.
- Uncontrollable
- Hard to predict
  - When an high water will occur
  - Magnitude
  - Duration
- "Act of God"

Limited option exist to mitigate the impacts of high water on HREP projects. Best construction practices, forward thinking, and good judgment are some of the best options.

RECENT IMPACTS BY HIGH WATER ON HREP PROJECTS

- Pool 12 Stage 2 Stone Lake and Pool 12 Stage 3 Kehough
  - Spring, summer and fall 2018 high water events pushed contract completion into 2019
    - Increased material drying time
    - Pushed shaping and grading into late fall
    - Missed fall seeding window
  - Spring 2019
    - Seeding window likely to be missed
      - Pushing contract completion into the fall 2019
    - High water duration still unknown for spring 2019
- Beaver Island
  - Spring 2019
    - Flooding prevented completion of clearing operations by April 1st
    - Clearing to resuming in the Fall 2019
      - All areas not cleared preventing material from being placed
    - Project on hold till river drops below stage of 17'
      - Crested 5/1 at 22.7' slow decline unknown restart date.
- Huron
  - Spring 2018
    - Seeding had to be aborted midway though due to high water
      - Seeding that was accomplish was assumed to be washed away
      - High-water persisted through seeding window
      - Staging and access area under water
  - Fall 2018
    - High water cause delay in planting trees
      - Once water receded early cold snap prevent trees from being planted
      - Staging and access area under water

HIGH WATER IMPACTS TO HREP PROJECTS

Impact Tasks and Reason for Delay

- Overall Project
- Dredging
- Clearing and Grubbing
- Earthwork, Grading and Shaping
- Rock Work
- Seeding and Planting

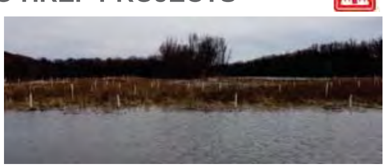
Reason for Delay

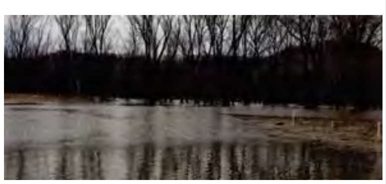
- Contract Restrictions
- Features of work can be constructed under water
- Best construction practices
- Safety
- Access and navigational restrictions
- High water re-saturates previously dry material
- High water saturates native ground
  - Inability to run required equipment
  - Can cause more damage if not adequately dry
- Future high water predictions
- Missing Seeding windows
- Missing Planting windows

HIGH WATER IMPACTS TO HREP PROJECTS

Impact to project environment

- Damage to constructed features
  - Erosion on newly placed dredge material
  - Erosion of completed features
  - Wash out of seeding
  - planting
  - Inundation of trees.
  - Trees high by debris
  - Uprooted plants and trees
- Damage to existing features
  - Erosion of bank lines
  - Scour holes
  - Debris deposited





HIGH WATER IMPACTS TO HREP PROJECTS

Generally per specifications only time is given for high water events, and cost due to the delay is absorbed by the contractor.

High water increases Contract duration

- Delays due to the actual high water days
- Delays due to the impacts of high water
  - Access and boat ramps being closed
  - Missing seeding and planting windows
  - Re-saturates previously dry soils
  - Contractor resource allocation
  - Additional work may be required
    - Some at contractor cost
    - Some at government cost

High water increases the cost to the contractor

- Stand by costs of machines, and employees
- Additional mobilization and demobilizations
- Impact to other contracts
- Overhead costs
- Potential rework based on clarity of contract

High water increase cost to the government

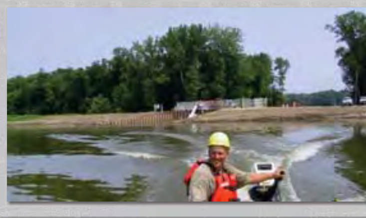
- Increase in S&A cost
- Modifications to repair damage to new or existing features

HIGH WATER LESSONS LEARNED

- Flexibility is required on projects located in the river, both on the government and contractors side. This flexibility needs to be clearing defined in the contract.
- Government should be ready to accept some of the financial burden when out of the control of the contractor, and should be clearing defined in the contract.
- You cannot plan for all possible high water.
- Spring, and Fall Seeding windows have recently not been feasible .
  - Limited footprint due to high water
  - Seed washes away with river fluctuations
  - Area is under water
- Addition of fall a seeding window during active contract increases cost.
- Missing seeding windows interferes with fall tree or shrub plantings.
  - Greatly increase difficulty to seed once trees are planted
- Establishing any ground cover is better than none.
- Adding Fall planting windows increase work required by the contractor.
- Acceptable alternatives need to be to established to mitigate delay's and cost to the project due to high water.

UMRR MAY 2019 WORKSHOP: CONTRACTORS ACCESS HIGH WATER AND CONSTRUCTION ISSUES

Presenter: Mark Games
Title: Construction Manager
MVD/MVS/EC-C (Construction)
Date: 07 May 2019



US ARMY
US Army Corps of Engineers

HOW DO CONTRACTORS SEE HREP PROJECTS?

- High Risk!!!!!!!!!
- Projects are typically unique.
- Difficult to price due to lack of historical cost
- Access can be very difficult.
- Flood events are frequent.
- Control of ground water (high water table)
- Lots of unknowns.

ACCESS ISSUES

Light Duty Access Road Won't Cut It

ACCESS ISSUES

Consider Equipment Access

ACCESS ISSUES

ACCESS ISSUES

ACCESS ISSUES

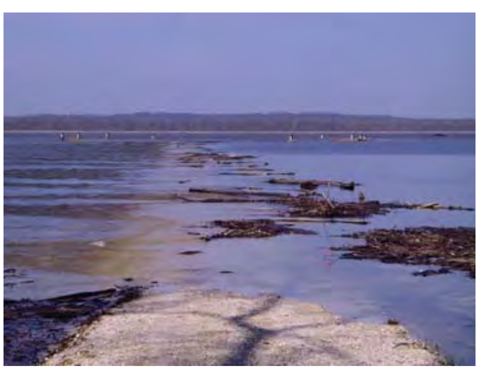
ACCESS ISSUES

ACCESS ISSUES

FREQUENT FLOODING

Projects Frequently Flood

FREQUENT FLOODING



FREQUENT FLOODING

FREQUENT FLOODING

36

FREQUENT FLOODING

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OPPORTUNITIES TO REDUCE RISK

38

- Repetitive Design
- Plan for access in the design (contractor and sponsor)
- Consider possible multiple mobilizations in IGE
- Consider local road access
- Plan for safety
- Plan to conquer to obstacles
- Cooperate with all of the team

DESIGN FOR ACCESS

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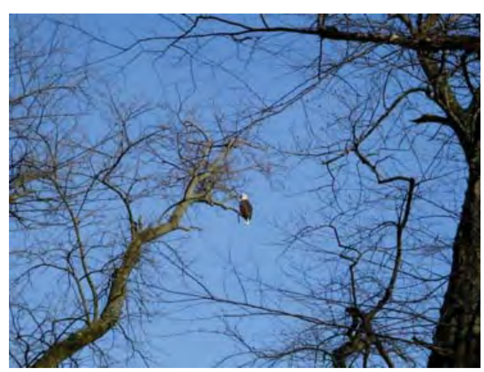
DESIGN FOR ACCESS

40

ENJOY THE SCENERY

41



PLANNING FOR THE FUTURE - So, we are going to have some periods of high water.

How will we successfully manage High Water, especially if it is more frequent event?

PLANNING FOR HIGH WATER ON NEW PROJECTS

Planning Phase

What are your Suggestions?

Here are some we came up with:

Surveys – Make sure to use best available bathymetry and improve when possible.

Locate - New features at locations less subject to abrupt changes in stage.

Include - Some higher elevation features (4Ft+ above LCP).

PDT – "Help Wanted" – Hydrologist(s) with experience IN high water events to participate in planning effort to assure the proper considerations are addressed.

PLANNING FOR HIGH WATER ON NEW PROJECTS

DESIGN - Design for Engineering Resilience. If we don't have engineering resilience we won't have habitat resilience.

PLANS – Can project features withstand erosion effects from high water before turf or trees can get established?

Shore protection – Is rock large enough to accommodate high water impacts, and large enough to permit placement during high water?

SPECS – Did we include a high water action plan. (MVR has used this…)

Engineering Considerations – Developed by PDT and should specifically address high water.

PLANNING FOR HIGH WATER ON NEW PROJECTS

Construction

Access – Access dredging can be reduced or eliminated for some features if constructed during high water.

Rock Structures – Most can be placed in higher water periods.

Higher Features – Some Islands can be placed at 4ft+ LCP. If they are higher and wider it offers even more flexibility.

Seeding, Willows, and Plantings – Prolonged period of high water may prevent contractor from being able to plant for 1-2 years after topsoil is placed on an island feature.

Lessons Learned – Should be documented to inform PDTs on future projects what improvements could be made.

PLANNING FOR HIGH WATER ON NEW PROJECTS

MONITORING

Confirm how project is performing after completion.

If project is not performing well, adaptive management should be considered for making Project upgrades or repairs.

PLANNING FOR HIGH WATER ON NEW PROJECTS

UMRR HREP KNOWLEDGE SHARING

Kara N. Mitvalsky, P.E.
Rock Island District
07 May 2019

EVOLUTION OF THE HOW THE PROGRAM HAS SHARED KNOWLEDGE OF RESTORATION FEATURES..

DATABASES
WEB PAGES
WORKSHOPS
REPORTS TO CONGRESS
DESIGN HANDBOOKS

LTRM DATABASE

- Started early in the program and continues to be active
- With this browser, a user can retrieve **monitoring data** on **fish, water quality, macro invertebrates, and vegetation**. Data can be selected based on a range of criteria (e.g., year, field station, habitat, location) and can also be downloaded in several formats.
- https://www.umesc.usgs.gov/data_library/other/ltrmp_monitoring.html

EARLY 2000-2005 HREP DATABASE

- Microsoft Access Database
- Project cost
- Dates
- Goals and Objectives
- Monitoring Plans
- Project Data Summary Tables
- Report Lists

2006 STARTED PROGRAM-WIDE DATABASE

- Access to Oracle
- Added geometry to the database to get better relationships between data and location
  - Project Characteristics
  - Boundaries
  - Restoration Features
- Started to get better information from the 3 Districts
- Starting to Map restoration Features for all HREPs
- ***Limited USACE access only at this time***

(2000-2010) WEB SITE

- Web team put together to better share information with the public.
- Initial web site created for UMRR Information
- Locating, Scanning and Posting Reports

CURRENT WEB SITE

THE WORKSHOPS

- https://www.mvr.usace.army.mil/Missions/Environmental-Protection-and-Restoration/Upper-Mississippi-River-Restoration/Key-Initiatives/HREPWorkshops.aspx
- Initially intended to occur every 3 years.
- Held in 1996, 1999, 2002, 2005
- 2008 (Big Flood)
- 2011/12 discussed holding another workshop while developing the design handbook, but was determined that one was not necessary
- 2016 Team Meeting (Workshop)
- 2019 Workshop

1996 ENGINEERING AND DESIGN OF EMP PROJECTS WORKSHOP – ROCK ISLAND, IL

The Workshop included the exchange of ideas, techniques and strategies to gain greater efficiencies in executing the UMRR program

1999 RIVER ENGINEERING WORKSHOP, LACROSSE, WI

This workshop focused on engineering, design and construction of UMRR HREPs. The workshop included presentations from State and Federal Agencies, as well as break out sections on planning/design and construction/operation and maintenance. The workshop included innovative concepts, project successes, lessons learned, constructability problems and O&M concerns with EMP habitat projects.

- HREP Design innovations, problems, accomplishments and lessons learned
- Partner perspectives on engineering, design and construction of HREPs
- MVD perspective
- Planning and Design Breakouts
- Construction/O&M Breakouts

Focus A - Planning/Design (Wisc Room) - Jon Hendrickson, facilitator
Potential Discussion Topics: *Aesthetics of projects*
Using natural processes
Designing structures to prevent plugging
Development of design standards
Clear project objectives for quicker designs
Better designs through input from biologists
Kind of biological input needed for E&D
Sedimentation rates
Electronic access to HREP documents
Impacts of EMP reauthorization on E&D work
Impact of cost sharing on E&D
Biological issues
Fish passage

Focus B - Construction/O&M (La Crosse Room) - Barb Kimler, facilitator
Potential Discussion Topics: *Island designs/construction techniques*
Contracting constraints
Corps/Contractor relationships
O&M considerations for structures
Ancillary benefits to other Corps missions
Revising designs based on completed projects

2002 UMRS EMP WORKSHOP

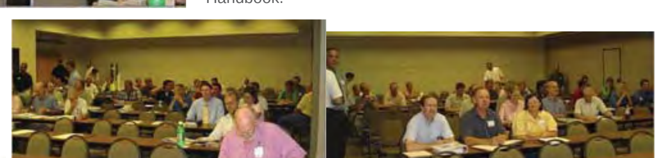
St. Louis, MO

This workshop provided management perspectives and panel discussions on connectivity, natural system design, construction concerns, operation and maintenance concerns, and project performance evaluation.

2005 EMP DESIGN HANDBOOK WORKSHOP

Davenport, IA

The target audience included engineers, planners, biologists and resource agencies. Construction challenges and monitoring were both discussed. The Design Handbook was the primary focus of this workshop, allowing HREP team members to provide input into the development of the first Handbook.



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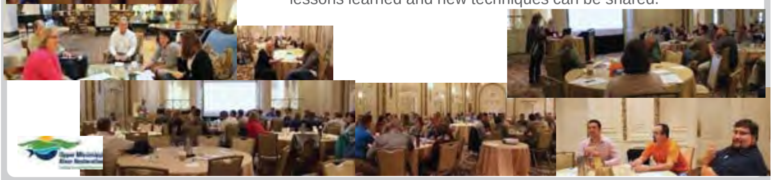
2016 HREP TEAM MEETING

Davenport, IA

Restoring habitat is one of two major focus areas of the Upper Mississippi River Restoration (UMRR) Program. Habitat rehabilitation and enhancement projects (HREPs) utilize a wide range of construction techniques and approaches that mimic natural river processes and provide benefits to the river system at the system, reach, pool, and local scales. The purpose of this meeting was to bring individuals together who help plan, design, build, operate, maintain and monitor these projects such that lessons learned and new techniques can be shared.



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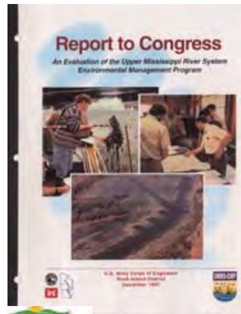
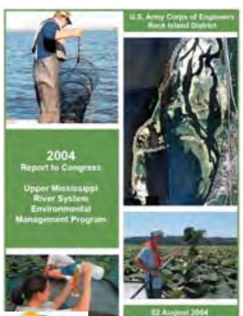
1997 REPORT TO CONGRESS



- History and Background
  - Comprehensive Master Plan for Management of the UMRS
  - 1985 Supplemental Appropriations
  - WRDA 1986
  - Partnership
- The Ecological State of the UMRS
- LTRM
- HREP (including Eligible Project Types. Purposes, Goals)
- Public Perspectives
- Program Alternatives
- Conclusions and Proposed Program Implementation Modifications
- Recommendations to the US Congress

15

2004 REPORT TO CONGRESS



- History and Background
- EMP Accomplishments and Update
  - HREP
  - LTRM
- Implementation Issues
  - NGOs
  - Cost Sharing
  - HREP O&M
  - Delegated Authority
  - HREP
  - Land Acquisition
  - HREP Project Planning and Priorities
  - Coordination between LTRM and Other Programs
- Conclusions and Recommendations

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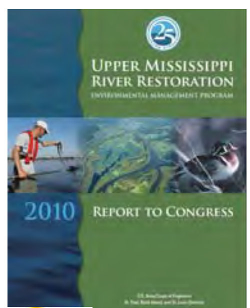
2010 REPORT TO CONGRESS



- History and Background
- Highlights and Accomplishments
  - HREP
  - LTRM
  - Program
- EMP-NESP Transition
- Conclusions and Recommendations

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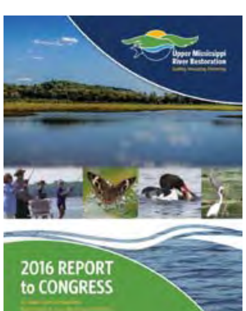
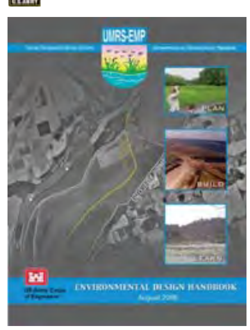
2016 REPORT TO CONGRESS



- Leading, Innovating, Partnering
- Improving Ecological Health and Resilience
- Advancing Knowledge of Ecological Health and Resilience
- Engaging and Collaborating
- Policy Recommendations
- Conclusions and Recommendations

18

2006 DESIGN HANDBOOK



"When the EMP began, Habitat Rehabilitation and Enhancement Project (HREP) designers implemented and refined construction techniques in ways not previously imagined. The intent was to improve habitat through site-specific modifications. Since 1986, the Environmental Management Program's HREP component has evolved into a successful program that combines a broad range of construction techniques with approaches that strive to use or mimic natural riverine processes, providing benefits to the river at system, reach, pool and local scales.

There has been significant documentation on individual HREPs, including feasibility level studies, as built construction drawings, operation and maintenance manuals, and performance evaluation reports. However, these reports have generally been project specific, and often do not describe project lessons learned. It was therefore determined that a design handbook should be created to describe project features common in HREPs. The EMP program covers separate rivers and extends through several U.S. Army Corps of Engineers Districts, which requires some individual attention be paid to new projects. However, there are numerous similarities in the design of these project features that the design process can be summarized in this document. Each chapter has been prepared by several different individuals, but in general the design methodology, case studies, lessons learned, and references are included in each chapter."

2012 DESIGN HANDBOOK

19

- 2012 Revision
  - Ecosystem Restoration Objectives
  - Conceptual Models
  - Adaptive Management
  - New lessons learned

This revision incorporates not only the engineering lessons learned during this period but it also shows the linkage between regionally adopted goals and objectives and the restoration techniques being used within the UMRR-EMP to meet those goals and objectives. Additionally, while the UMRR-EMP has utilized an adaptive management philosophy from its inception, this revision explores the UMRR-EMP's efforts to more explicitly apply adaptive management techniques to address restoration practices which continue to have elements of risk and uncertainty come.

WHERE DO WE GO FROM HERE?

20

- Larger projects
- More people
- New people
- Challenging climate conditions
- So many ways to share knowledge….

Need to document and incorporate the latest information into a central location to ensure that the UMRR continues to develop a high standard of restoration projects.

BREAKOUT SESSIONS: WHY YOU SHOULD PARTICIPATE…

21

As our circle of knowledge expands, so does the circumference of darkness surrounding it. - Einstein

All difficulties are easy when they are known. Shakespeare

BREAKOUT SESSION OBJECTIVES

22

- Gather project specific knowledge in all stages of HREPs (planning, design, construction, O&M and monitoring) which need to be shared within the Program. Information may be added to the Environmental Design Handbook (revision 3), the UMRR HREP Database, and/or used in feasibility studies.
- Identify areas to expand the Environmental Design Handbook.
- Identify how to better incorporate habitat needs into HREPS.

HREP FEATURE TECHNIQUES

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Same list has been used since first Report to Congress
List is used in Both Design Handbooks
List is also the general basis for the database feature types

- Shoreline and Riverbank Protection
- Localized Water Level Management
- Dredging
- River Training Structures and Secondary Channel Modifications
- Floodplain Restoration/Floodplain Forest
- Islands
- (Aeration)
- (Other)

BREAKOUT GROUP SELECTION

24

Choose a group based on which topic you are most interested. Note that some groups may decide to break into sub groups. If that occurs, ensure that the reporters have all of the pertinent information at the end of the session. The group topics are:

- Localized Water Level Management
- Dredging
- River Training Structures and Secondary Channel Modifications
- Floodplain Restoration/Floodplain Forest
- Islands, Shoreline and Riverbank Protection

We think the groups would work best if there is a good mix of disciplines and agencies within each break out area. Feel free to self regulate! If you do not have the opportunity to comment on one of your favorite techniques, you are welcome to fill out a form or share the information with Kara at Kara.N.Mitvalsky@usace.army.mil at a future time.

VOLUNTEER LEADERS

Identify volunteers from your table to take on the roles of scribe, note-taker, and reporter. The facilitator is a subject matter expert and has already been selected to lead your table. **The facilitator and the reporter will remain with the group for the entire time period and can be the same person.**

- **Facilitator:** Subject matter expert. Keep discussion on track; make sure everyone participates; keep an eye on the time. Ensure the Report Out Forms are complete, legible, and collected.
- **Scribe:** Capture discussion points and thoughts for table participants.
- **Note-taker:** Record notes to capture group discussion highlights for verbal report out. Complete Report Out Forms for team meeting documentation.
- **Reporter:** Verbally report highlights from table's group discussion to the full group.

DISCUSSION

Select Discussion Questions, and discuss them with your table group. You will have 30 minutes to discuss the questions you choose. You may choose to discuss as many questions as time allows, but at a minimum choose at least two.

After 30 minutes, you may choose to move to a separate group, or continue in the current group to answer additional questions

QUESTIONS ABOUT YOUR GROUP'S SPECIFIC HREP TECHNIQUE:

What habitat types can be restored or enhanced with this technique?

What new design elements have occurred (i.e. different dredging methods, planting survivability improvements?)

What are some constructability lessons learned?

If site inspections or performance monitoring has been conducted, what have we learned?

What operation and maintenance lessons or changes have been made?

What studies, reports, or projects have been completed since 2012 that should be included or referenced in upcoming HREP feasibility reports and/or the next version of the Environmental Design Handbook?

QUESTIONS RELATED TO HREP IN GENERAL

How can we better incorporate HNA-II into the planning and design of new HREPs?

What are some methods or tools that can help us identify the best HREP features for different habitat types?

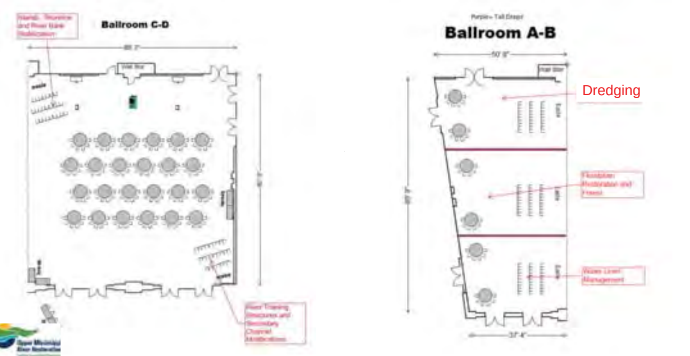
How can we better share lessons learned at all project stages with all planning and designing HREPS?

– Planning
– Design
– Construction
– Operation and Maintenance
– Monitoring

VERBAL REPORT

Verbally report your table's Discussion Questions, highlights, and recommendations to the full group. Each table will have 10 minutes to report back, including time for questions. You may only have time to verbally report out on two to three questions even if your table discussed additional questions.

BREAKOUT GROUPS



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BREAK OUT

32

REPORT OUT

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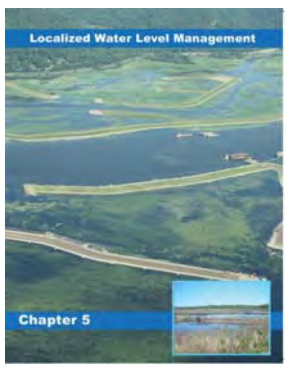
Localized Water Level Management



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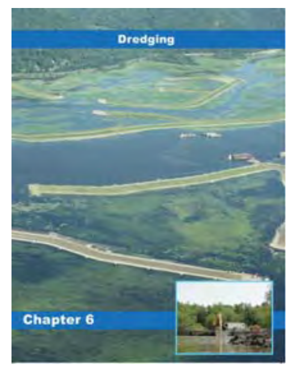
Dredging



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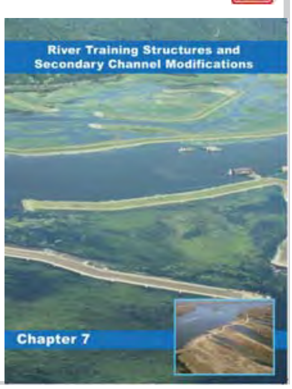
River Training Structures and Secondary Channel Modifications



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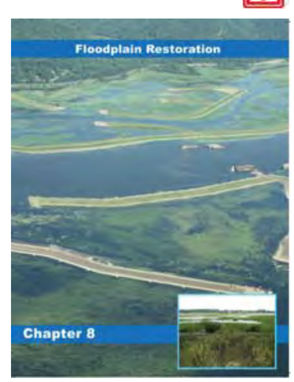
Floodplain Restoration and Floodplain Forest



Islands
Plus
Shoreline and Riverbank Protection

Day 3 Presentations
May 8, 2019

- **UMRR Science in Support of Restoration**
  - ***Presenter Jeff Houser (USGS)***

- **Integrating HREP and LTRM: Examples and Ideas**
  - ***Presenter Dave Bierman (Iowa DNR)***

- **Habitat Modeling Applied to HREPs**
  - ***Presenter Nate Richards (RPEDN)***

- **FY21-25 UMRR HREP Next Generation Project Selection**
  - ***Presenter Marshall Plumley (MVR)***

UMRR Science in Support of Restoration

UMRR HREP Workshop

6-8 May 2019

Science in support of river restoration and management

UMRR Vision: "A healthier and more resilient Upper Mississippi River Ecosystem that sustains the river's multiple uses."

Habitat rehabilitation
- Which habitats?
- Where?
- How?
- How'd we do?

Science and Monitoring
- Current condition of the river?
- How is it changing?
- How does the river function?
- How do drivers that restoration actions alter affect the river?

USGS

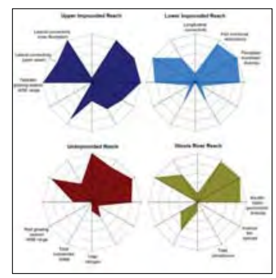
How do research and long term monitoring support and inform habitat rehabilitation and river management?

- Describe current condition and long term trends for the UMRS
  - How is the river changing?
  - What problems need solved?
  - Provides better understanding of basic structure, function, health, and resilience of the river to inform river management and restoration.
- Provide useful information for river restoration and management
  - Existing data and expertise
  - Additional focused research
  - Models using long term data may improve predictions of HREP effects and project design
  - Provide context required for effective shorter-term, smaller-scale studies of HREP effectiveness.
- Directly study effects of some HREPs

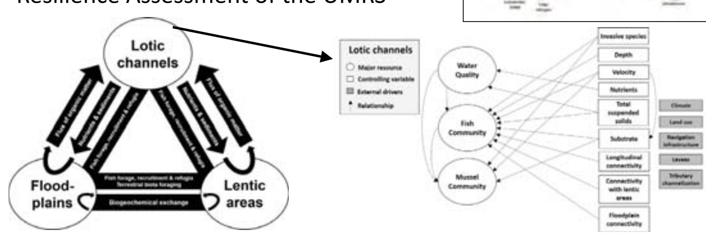
USGS

Two examples…

HNA II



Resilience Assessment of the UMRS



UMRR 2018 Science Meeting

Participating Agencies
- USACE, USGS, USFWS
- MDNR, WDNR, IADNR, INHS, MDC, UMRBA
- National Great Rivers Research and Education Center
- UW-La Crosse, UW-Stevens Point, Southern Illinois University, West Virginia University

USGS

2018 UMRR Science Meeting: The Basic Idea

Previous work
- River science
- Restoration projects
- Restoration objectives

(2018 Focal areas)

\+ River/Floodplain scientists; Restoration professionals

\+ Time; Resources

→ Collaborative, Relevant, Projects

Photo provided by J. Janvrin (WDNR)

USGS

UMRR 2018/19 Science Focal Areas

- Purpose: Distill existing research frameworks, and previous reports & publications into a few focal areas for 2018 Science Meeting
- Premise:
  - Restoration projects generally modify/restore river geomorphology (depth, connectivity, fetch, topographic diversity, etc.) in order to rehabilitate various physical, chemical and biological conditions.
  - Selection and design of restoration projects would benefit from a better understanding of the likely future geomorphology of the river and the implications for biota.
- Initial draft of focal areas distributed in November as read ahead for a November UMRR Webinar.
- Webinar feedback and written comments were incorporated into working draft used for the science meeting.

USGS

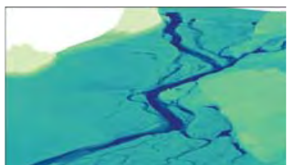
Themes for 2018 focal areas

- Theme 1: Understanding changes in hydrogeomorphology and their implications for the future condition of the UMRS
- Theme 2: Understanding relationships between hydrogeomorphic conditions and the distribution/abundance of biota
- Theme 3: Understanding the physical, chemical, and biological processes behind the observed spatial and temporal patterns in biota and water quality described by the LTRM data

USGS

UMRR is well-equipped to address these themes

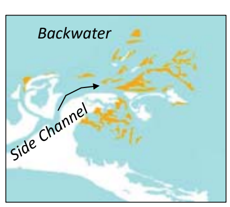
- LTRM
  - Systemic data sets (topobathy, land cover)
  - Detailed biotic and biogeochemical data
  - Extensive analytical and ecological expertise
  - Infrastructure and expertise to strategically and efficiently collect additional data
- HREP
  - Large scale manipulations of fundamental ecological drivers
  - Ongoing opportunities to learn about how the river responds (e.g., Finger Lakes; Pool 12 overwintering studies)



Working Groups	Leads
Working Group 1. Geomorphic Change in the UMRS	Jim Rogala (USGS) and Jon Hendrickson (USACE)
Working Group 2. Interactions among water quality, aquatic vegetation, and wildlife	Deanne Drake (WDNR), Eric Lund (MDNR), and Stephen Winter (USFWS)
Working Group 3. Native freshwater mussels in the UMRS: identification of associations among critical biological processes and hydrogeomorphology	Teresa Newton (USGS)
Working Group 4. Understanding relationships among floodplain hydrogeomorphic patterns, vegetation and soil processes, and nutrient cycling	Nate De Jager (USGS)
Working Group 5. Woody debris in the UMRS: Quantity, distribution, and role in the hydrogeomorphology and ecology UMRS:	KathiJo Jankowski (USGS) and Molly Van Appledorn (USGS)
Working Group 6. Understanding critical biological rates for select fishes of the UMRS and how they vary across hydrogeomorphic, climatic, and biological gradients	Kristen Bouska (USGS), Andy Bartels (WDNR), and Quinton Phelps (WVU)

WG1: Understanding changes in geomorphology

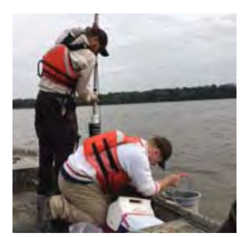
- Develop a better understanding of geomorphic changes (J. Rogala, USGS)
  - changes in bed elevation of side channels and backwaters.
  - Planform changes resulting from backwater delta formations, levee breaches, island loss/gain, channel widening / narrowing
- Water Exchange Change in UMRS Channels and Backwaters, 1980 to Present (J. Hendrickson, USACE)
  - Objective: synthesize available data (MVP) on water exchange rates to assess:
    - Change in water exchange rates due to geomorphic processes, and HREPS
    - Trajectory of water exchange rates through time.
- Conceptual Model and Hierarchical Classification UMRS Hydrogeomorphology (F. Fitzpatrick, USGS)

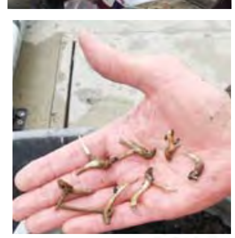


USGS

WG2: Vegetation, Wildlife and Water Quality

- Understanding constraints on submersed vegetation distribution in the UMRS: the role of water level fluctuations and water clarity (J. Kalas, A. Carhart, WDNR)
  - Objective: Assess the distribution of areas suitable for SAV based on water level fluctuations and clarity.
- How well does LTRM vegetation data quantify waterfowl habitat quality? (S. Winter, USFWS)
  - How strong is the relationship between LTRM SAV data and wild celery winter bud biomass in Pools 4, 8, and 13?
  - Model waterfowl habitat quality using LTRM SAV data.
- Internal and external drivers of water clarity in Pools 4, 8, 13, and 26 (D. Drake, WDNR)





WG3: Native Freshwater Mussels

Systemic analysis of hydrogeomorphic influences on native freshwater mussels (Teresa Newton, UMESC)

- Question: Are hydrogeomorphic features predictive of mussel distribution, abundance, diversity, and recruitment?
- Conduct surveys of mussel distribution in Pool 8 and 13.
  - Inform the designs of future HREPs to support mussel assemblages
  - Provide baseline data in advance of waterlevel drawdowns

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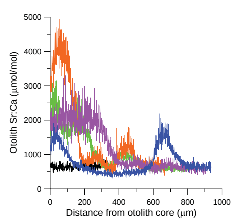
WG4: Understanding relationships among floodplain hydrogeomorphic patterns, vegetation and soil processes...

- Forest canopy gap dynamics: quantifying forest gaps and understanding gap-level forest regeneration (Lead: Andy Meier, USACE)
  - What is the current abundance/distribution of forest canopy gaps in the UMRS?
  - What site and landscape level characteristics are associated with herbaceous invasion vs. forest reestablishment?

- Reforesting UMRS forest canopy openings occupied by invasive species (2019; L. Guyon (NGRREC), R. Cosgriff (USACE))
- Using dendrochronology to understand historical forest growth, stand development and gap dynamics (B. Vandermyde, USACE)

WG6: Investigating vital rate drivers of UMRS fishes to support management and restoration (K. Bouska (UMESC) A. Bartels, WDNR, Q. Phelps, WVU)

- Vital Rates (recruitment, growth, mortality)
  - K. Bouska (UMESC), A. Bartels (WDNR), Q. Phelps (WVU)
  - How are vital rates within and across species associated with differences in abiotic and biotic conditions across LTRM reaches?
- Microchemistry
  - G. Whitledge (SIU)
  - To what extent are observed patterns in year class strength driven by "local" recruits vs. immigrants from other reaches of the river?
  - Which natal environments consistently support strong year classes?
- Genetics (2019 Funds; Wes Larson, USGS/UWSP)
  - How does habitat diversity shape population diversity?
  - How has population diversity changed over time?
  - What are the implications of current population diversity for river management and restoration?



WG5: Woody debris in the UMRS: Quantity, distribution, and role in the hydrogeomorphology and ecology UMRS

- The role of large wood in the restoration of habitat in the UMRS (K. Jankowski, UMESC)
  - What is the fate and effectiveness of large wood features of HREPs?
  - What is the abundance of natural large wood at HREP sites and what influences this?
  - What vertebrate animals use large wood on HREPS and how does their use vary seasonally and spatially?

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Additional 2019 funded work on Science Focal areas

- Development of a standardized monitoring program for vegetation and fish response to Environmental Pool Management practices in the UMRS (B. Lubinski, INHS; G. McGuire, USACE)
  - Evaluate response of aquatic vegetation (Pools 24-26) and fish (Pool 26) to EPM practices
- A year of zooplankton community data from the habitats and pools of the UMRS (M. Sobotka, MDOC)
  - Do zooplankton communities differ among aquatic areas (MC, BW, etc), study reaches, seasons, and reaches with/without Asian carp.

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Next UMRR Science Meeting: Winter 2020

≋USGS

Integrating HREP and LTRM: Examples and Ideas

UMRR HREP Workshop
May 8, 2019
Dubuque, IA

Collaborators:

Megan Moore – Minnesota DNR
Jim Fischer – Wisconsin DNR
Matt O'Hara – Illinois DNR
Kirk Hansen – Iowa DNR

HREP and LTRM Integration

- Survey of workshop attendees shows this is not well understood or is unclear; lots of questions about what "integration" actually looks like
- 83% of survey responses regarding HREP/LTRM integration are either "has been marginally incorporated" or "has not been incorporated"
- Main LTRM data sets used are Land Cover/Land Use, Bathymetry, and Lidar
- Lower usage of long term biological data

Integration of LTRM and HREP – Pool 4; Peterson Lake

General Goals

- The general goals of the project were to reduce sedimentation in Peterson Lake, stabilize the barrier islands bordering the lake, improve migratory waterfowl habitat, and to improve winter habitat conditions for fish in the upper portion of the lake (USACE 1994).

Project Objective	Attainment:
>5 mg/l DO	Yes
<1 cm/sec Vel	No
>1 °C	No

DEPARTMENT OF NATURAL RESOURCES

Upper Mississippi River Restoration

Proposed changes to HREP

DEPARTMENT OF NATURAL RESOURCES

Upper Mississippi River Restoration

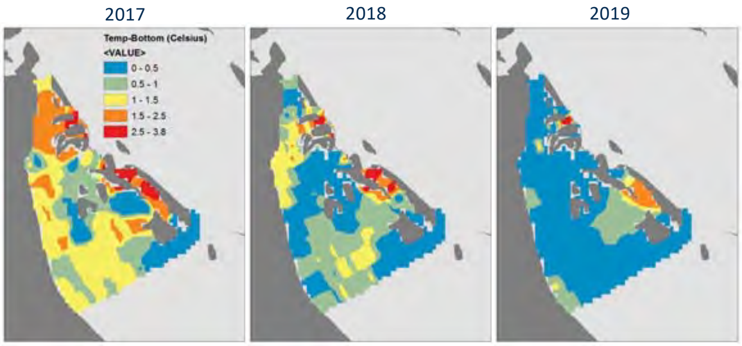
Current Velocity

2017 2018 2019

DEPARTMENT OF NATURAL RESOURCES

Upper Mississippi River Restoration

Temperature



DEPARTMENT OF NATURAL RESOURCES
Upper Mississippi River Restoration

Integration of LTRM and HREP

- An example of direct integration of LTRM and HREP
- 3 years monitoring pre-construction shows variability in temps and velocity and the value & importance of multi-year data sets.
- Long-term trends in hydrology point to continued high water discharge. Lower discharge should provide warmer water and slower velocity. This modification could be effective at reducing impacts of high discharge and help provide more suitable overwintering habitat.

DEPARTMENT OF NATURAL RESOURCES
Upper Mississippi River Restoration

Early LTRM-HREP Integration

Fischer, Hodge-Richardson, Hoff, Mauel

Condition Monitoring Was Common

- 1991 Winter WQ at Pool 8 Horseshoe Islands
- 1995 Winter WQ at Pool 8 Horseshoe Islands
- 1995 Summer WQ at Pool 8 Horseshoe Islands
- 1995 Winter WQ at Pool 5 Spring Lake
- 1995 Winter WQ at Pool 9 Cold Springs
- 2000 Winter WQ at Pool 7 Long Lake
- 2000 Winter WQ at Pool 9 Harpers Ferry
- 2000 Winter WQ at Pool 8 Stoddard
- 2001 Winter WQ at Pool 9 Conway Lake

Recent Integration

Drake, D.C., Gray, B.R., Forbes, N.

Aquatic Vegetation Responses to Island Construction (Habitat Restoration) in a Large Floodplain River.

River Research and Applications. August 2018

- Prevalence and diversity of aquatic vegetation increased in both restored and unrestored areas, suggesting a large-scale improvement unrelated to the restoration project.
- Further increases in Pool 8 in areas at least 400 m downstream of the islands
- Restoration goals appear to have been partially achieved in the context of broadly improving conditions. The improvements might be linked to a combination of the effects of reduced wind fetch and large-scale ecosystem changes.

Ongoing Integration

Kalas, Carhart, Drake, Rogala, Rowheder

Understanding constraints on SAV due to water level fluctuations and photic zone

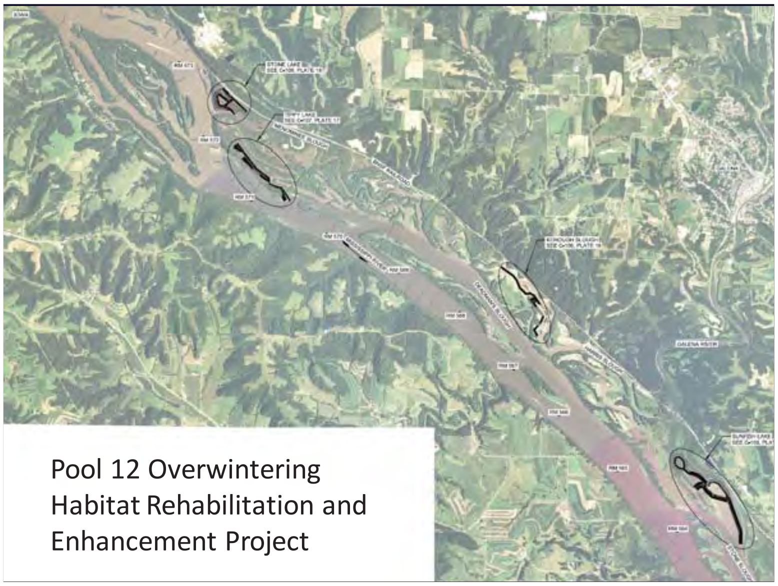
- o Will help identify areas in each pool (4, 8, and 13) where vegetation could potentially exist based on light, water level fluctuations, and depth
  - o Will predict area of each pool with suitable light and water depth fluctuation
  - o System-wide daily stage and photic zone data at each gage
  - o Evaluating relations between SAV and light/water fluctuations (using LTRM SRS data from Pools 4, 8 and 13)
  - o Identifying light conditions and dewater tolerance of SAV

Ongoing Integration

Kalas, Rogala, Hoff, La Fond

Backwater Sedimentation Rates

- o Will document rates of depth change in multiple habitats
- o Improve our ability to forecast future depth conditions
- o Help understand factors affecting HREP longevity
  - o Installing permanent benchmarks for traditional sediment transect surveys
  - o Integrating new GPS technology for possible future work



Pool 12 Overwintering Habitat Rehabilitation and Enhancement Project

Pool 12 Overwintering HREP Monitoring and Assessment

- Pre-project monitoring began in 2006
- Assess impacts at three spatial scales:
  - Navigation Pool Scale: all aquatic area in the pool
  - Contiguous Backwater Aquatic Area: all backwaters within the pool
  - Individual Backwater Scale
  - Use LTRM fisheries data from Pool 13 as control
  - IA DNR field station personnel and equipment

Pool 12 Overwintering HREP Radio Telemetry

Telemetry

- Determine pre-project habitat utilization
- Measure again post project
- Also identify project features that work or could be improved

Telemetry

- How many, at what size, and at what interval is overwintering habitat needed in a pool to restore or reestablish healthy centrarchid populations?
- How do fish disperse from overwintering habitat? When? Over how large an area?
- Answering these questions will lead to greater efficiency and effectiveness of overwintering project design and placement

Lower Pool 10 Vegetation Monitoring

- Establish a pre-project baseline of vegetation
  - Provides information to compare vegetation response after the HREP; will be repeated and resampled after HREP completion
  - Follows LTRM vegetation monitoring protocols

2018 data already being used by USACE to inform project planning process

Lake Chautauqua HREP

- Though this project was to primarily benefit waterfowl, IRBS mined LTRM fisheries data from the area because they knew the area produced large amounts of YOY fish
- Pooled data from the pre-and post-HREP periods and evaluated temporal variation at the pool and local scales. Differences were tested to determine potential fish community changes in pre- and post-construction periods

Lake Chautauqua HREP
Summary

- Study results did not detect the Lake Chautauqua HREP's influence on the Illinois River fish community at the pool-wide scale (La Grange reach of the Illinois River)
- Some increases in catch per unit effort were detected within the immediate area of the HREP

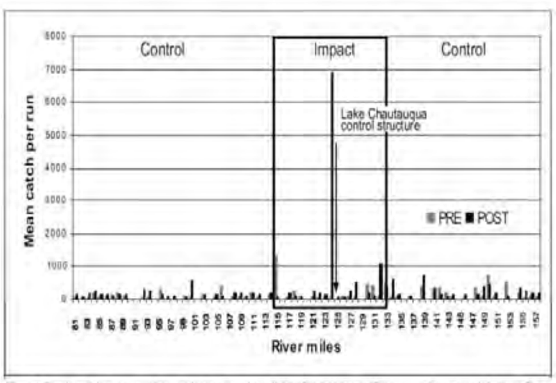


Figure 2. Day electrofishing mean catch per run for the pre- and post-Habitat Rehabilitation and Enhancement Project periods by Illinois River mile (pre-HREP mean catch = -55.564+1.878* river mile, n = 59, df = 1,57; f = 2.328, P = 0.133, r^2 = 0.022; post-HREP mean catch = -17.305+2.356*river mile, n = 59; df = 1,57; f = 0.306, P = 0.583; r^2 = 0)

6

Lake Chautauqua HREP
Lessons learned

- Results may indicate that the spatial and temporal sampling frequencies of LTRM may be insufficient to detect the effects of individual HREPs
- It is critical to establish a scientifically rigorous and explicit monitoring design to ensure future HREP contributions can be measured not only within the project area, but also beyond the project boundaries and pool-wide (if that is your objective)

Take Home Messages:

- Typically a long term commitment – BE PATIENT
- If possible, begin monitoring well in advance and establish a control
- Sampling design should be robust and flexible enough to adapt to changes in actual project features and locations
- LTRM Trend Pool data can be used as a control, or at least as a surrogate for biological information on adjacent pools in many instances

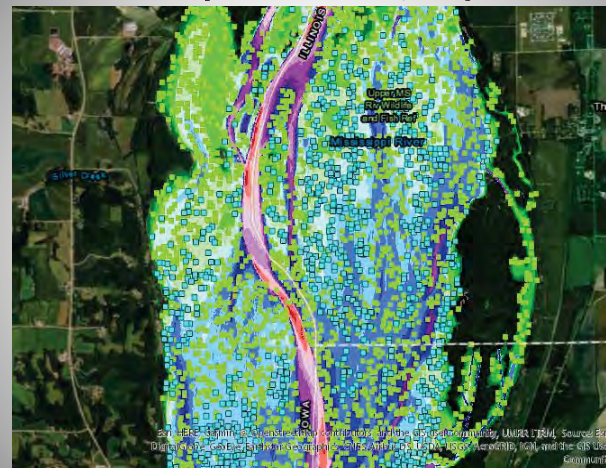
Take Home Messages:

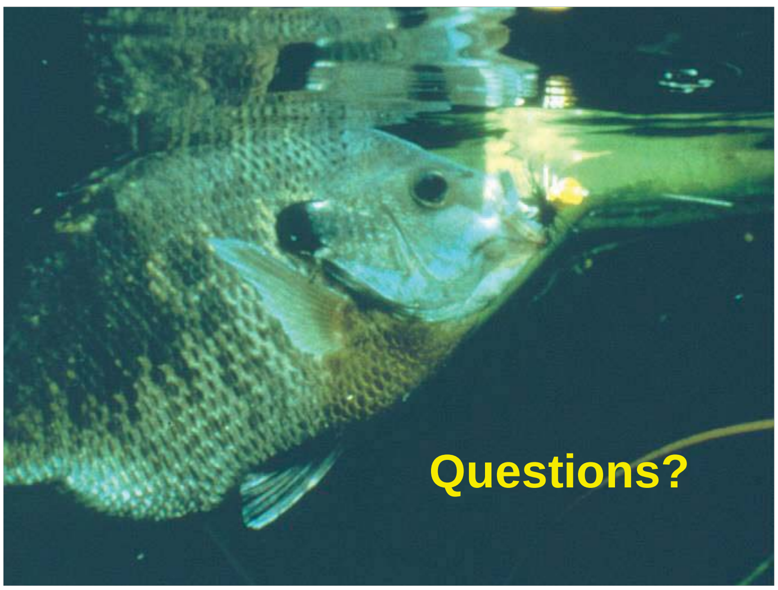
- LTRM datasets are great for long-term trends and to tease out annual variations, but may be inadequate at the project scale
- LTRM datasets provide the biological and physical templates to which we can compare post-project results to in order to determine project "success"
- LTRM data can help differentiate between natural variation in the system and any changes detected at the HREP scale

Next Steps Towards Integration

- We recommend consistent and standardized monitoring of HREPs using LTRM sampling design and protocols when possible
- Centralized data repository for HREP monitoring data (by USACE District? – help with PERs)
- Ideally, the monitoring design for one type of HREP should be carried over to other HREPs of the same type if project objectives are the same – “apples to apples” (e.g., comparing one overwintering project to another)
- HNA II and Resiliency work are big steps towards integration which are already completed

LTRM Spatial Data Query Tool





Upper Mississippi River Restoration

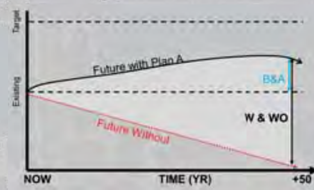
HREP and LTRM integration

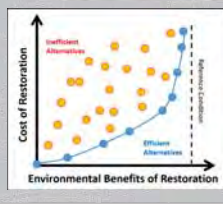
How do you envision HREP and LTRM working together in the future?

How can LTRM data sets be used in new ways to inform HREP planning and design?

ECOSYSTEM RESTORATION PLANNING & MODELING OVERVIEW

Presenter: Nate Richards
Title: Regional Technical Specialist
MVD, MVP, Plan Formulation Branch
Date: 08-May-2019





US Army Corps of Engineers

OBJECTIVES

Provide foundational information related to ER environmental benefit analysis

–Basic Concept of ER

–EBA Overview

–Benefits Quantification

USACE ECOSYSTEM RESTORATION MISSION

Restore Ecosystem:

- Structure
- Function
- Dynamic Processes

To a less degraded, more natural condition.

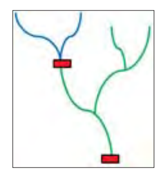
Objective: Identify plan demonstrating best ecosystem "value" - quantitative non-monetary benefits

WHY DO WE USE ECOLOGICAL MODELS?

- To ***distinguish*** between different actions
- To characterize return on investment expected
- To prioritize restoration given finite resources (funding, time, …)
- To evaluate ***efficiency*** of the different actions

Which dam should we remove?
What did the taxpayer get?

Is this the best bang for the taxpayer's buck?



BENEFITS

- Quantitative = non-monetary (USACE policy…at least currently)
  - Most popular form is the habitat unit
  - HU = Quality (ecological model output; usually 0-1) X Quantity (usually acres)
  - Quality should be based on ecological parameters…think structure and function
- Additional qualitative preferences
  - Essentially everything else not quantified but important to decision-making
  - Just as important!!
  - Resource significance – limiting habitat, biodiversity, scarcity
  - Other Social Effects
  - Ecosystem Services?

ENVIRONMENTAL BENEFIT ANALYSIS

Phase	Steps
Qualitative	1. Develop a robust understanding of the ecosystem. 2. Set restoration objectives and identify metrics. 3. Identify the restoration measures and alternatives to be evaluated.
Quantitative	4. Compute baseline benefits of no-action. 5. Forecast project outcomes for action alternative. 6. Conduct any needed sensitivity, uncertainty, or scenario analyses. 7. Apply any additional value/qualitative assessments to inform decision.
Decision	8. Conduct cost-effectiveness and incremental cost analyses (CE-ICA). 9. Compare alternatives. 10. Recommend an alternative.
Verification	11. Monitor and adaptively manage.

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BENEFIT QUANTIFICATION

- **Step 1: Model Selection**

  - Level of detail necessary for the decision at hand
  - Model should align with study goals and objectives
  - Needs to be able to evaluate critical components of restoration actions
  - Data requirements?
  - Suitable to show relative rankings of alternatives

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BENEFIT QUANTIFICATION

- **Step 2: Apply Model**
  - Future Without-Project Condition
    - Perhaps the most important scenario to quantify (also has most uncertainty)
    - May have more than one – sensitivity analysis
    - Make assumptions about trends, actions, etc. Document!!
  - With-Project Condition
    - Purpose is to provide the narrative for evaluating effects of the plan
    - Different for each alternative

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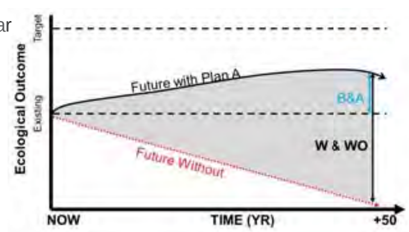
BENEFIT QUANTIFICATION

- **Step 3: Annualize (AAHU)**
  - Benefits are annualized over 50-year planning horizon
  - FWOP and FWP

- **Step 4: Calculate Benefit for each alternative**
  - = Future Without – Future With



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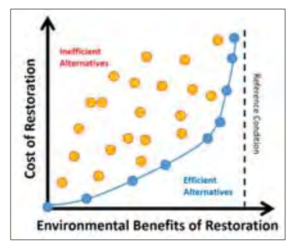
DECISION MAKING

1. Conduct cost-effectiveness and incremental cost analyses (CE-ICA).

   – Compares monetary costs and non-monetary outputs (AAHUs)

   – Identifies the least cost solution for each possible level of output – Best bang for the buck!

   – CE/ICA does NOT give the answer!



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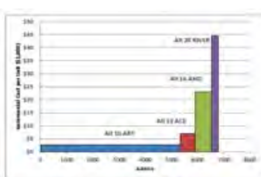
DECISION MAKING



2. Compare alternatives.
   – What information does the decision maker need?
   – Build a decision-making matrix.
3. Recommend an alternative
   – Most important is the OTHER decision-making criteria (significance, completeness, risk & uncertainty, reasonableness of cost)

Alternative	Cost	Ecological Benefit	Potential for Contamination?	Historical Preservation?
0: No action	0	0	No	No
1: Fish ladder	$$	+	No	Yes
2: Dam removal	$	++	Yes	No
3: Removal with sediment mngmt	$$$	+++	No	No

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KEY TAKEAWAYS

****Level of detail or complexity required to make the next decision! Just because we can doesn't mean we should.**

Evidence gathering

1. Data gathering and modeling should be commensurate with the level of certainty required in decision-making. Risk and uncertainty!

Models

1. Ecological models should be good enough to distinguish among different plans and rank plans from least to most efficient.
2. Don't provide the recommendation.

Decisions

1. Ecological models only provide a portion of the information needed to make a decision.
2. The OTHER decision-making criteria (significance, completeness, risk & uncertainty, reasonableness of cost) are equally important

BREAKOUT SESSION

1. Two Main Groups
   1) Habitat Scale (e.g., floodplain forest, backwater, riverine)
   2) Complex Scale (e.g., island, backwater, secondary channel complex)

2. Work in smaller groups to conceptualize your scale/focused area from an ecological planning and modeling perspective. Use your past experience in UMRR project planning as a guide.

3. Example questions and thoughts:

- Problems/Gaps:
  - What do you see as problems with our environmental benefit analysis or current suite of models in UMRR?
  - Gaps?
- Opportunities for improvement:
  - What opportunities do you think we have to improve or capture additional benefits?
  - Other benefit categories to demonstrate value of HREPs?
  - Metrics?
- Identify areas of uncertainty which limits our ability to demonstrate value of HREPs.

UPPER MISSISSIPPI RIVER RESTORATION HREP WORKSHOP

Marshall Plumley
Regional Program Manager
St. Paul District
Rock Island District
St. Louis District

8 May 2019

Upper Mississippi River Restoration
Leading · Innovating · Partnering

US Army Corps of Engineers

NEXT GENERATION OF PROJECTS

- 14 March Face to Face Meeting
  - UMRR CC, River Team Chairs, District Program Managers
- Sideboards
  - Identify HREP Needs for FY 21-25
  - June – December 2019 River Teams
  - Collaborative Project Development with Partners and Sponsors
  - HNA II Indicators will considered in development of Projects

NEXT GENERATION OF PROJECTS

- HREP Planning and Sequencing Framework Goals
  - Optimize investment in restoring, rehabilitating and maintaining the quantity and quality of habitats within the UMRS
  - Ensure that habitat projects address UMRS ecological needs at pool to system scales and integrate with Habitat Needs Assessment
  - Enhance public understanding and trust in the decision making process by making evolution criteria explicit and transparent
  - Retain flexibility to ensure efficient and effective program execution and apply adaptive management principles

Upper Impounded[A]	Middle Impounded[A]	Poo 15[B]	Lower Impounded[A]	Open River[C]	Upper Illinois[B]	Lower Illinois[B]
Aquatic Functional Class (AFC1)	**Aq Veg**	**Aq Veg**	**Open Water**	**AFC1**	[illegible]	[illegible]
Aquatic Functional Class 2 (AFC2)	**FP Fanal Class**	FP Veg	**AFC1**	**AFC2**	**FP Veg**	**FP Veg**
Floodplain Functional Class Diversity (FP Fanal Class)	**AFC1**	FP Fanal Class	**AFC2**	**FP Fanal Class**	[illegible]	**FP Fanal Class**
Floodplain Vegetation Diversity (FP Veg)	**AFC2**	TSS	**FP Fanal Class**	**FP Veg**	AFC1	AFC1
Aquatic Vegetation Diversity (Aq Veg)	**FP Veg**	Nat Area	FP Veg	[illegible]	AFC2	[illegible]
Longitudinal Connectivity – Natural Area (Nat Area)	Nat Area	AFC1	[illegible]	[illegible]	TSS	Leveed Area
Total Suspended Solids Concentrations (TSS)	Open Water	AFC2	[illegible]	Nat Area	TW Flux	[illegible]
Lateral Connectivity – Open Water (Open Water)	TSS	TW Flux	Nat Area	[illegible]	Nat Area	Open Water
Pool Flux Difference (Pool Flux)	TW Flux	Open Water	TSS	% Time	Leveed Area	TW Flux
Tailwater Flux Difference (TW Flux)	Pool Flux	Leveed Area	TW Flux	[illegible]	Open Water	Pool Flux
Lateral Connectivity – Leveed Area (Leveed Area)	Leveed Area	Pool Flux	Pool Flux	TSS	Pool Flux	Nat Area
% Time Gates Open (% Time)	% Time	% Time	% Time	Pool Flux [illegible]	% Time	% Time

High — Order of Importance — Low

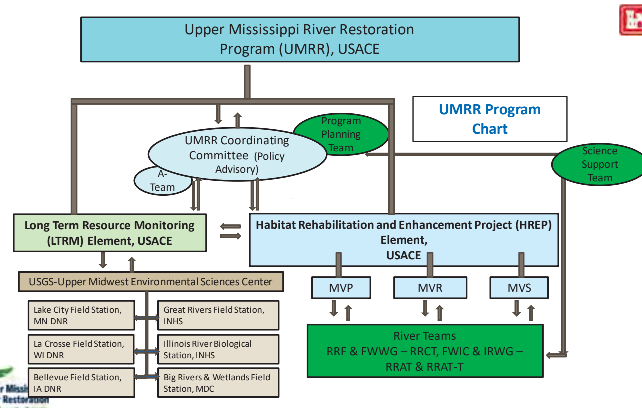
Cluster Name	Navigation Pools	River Team
Upper Impounded	Pools 3-9, 13	FWWG/FWIC
Middle Impounded	Pools 10-12, 14, 16, 19	FWIC
Pool 15	Pool 15	FWIC
Lower Impounded	Pools 17,18, 20-22, 24-26	FWIC/RRAT
Open River	OR1, OR2	RRAT
Upper Illinois	Dresden, Marseilles, Starved Rock	FWIC
Lower Illinois	Peoria, LaGrange, Alton	FWIC/RRAT

Figure ES-1: Summary of ratings of the 12 indicators of ecosystem structure and function for each of the clusters of navigation pools. The order (first row most important) of the indicators corresponds to the importance of that indicator as determined by the paired comparison conducted by the agencies. Bolded refers to high importance. Overall cluster ratings were achieved through three methods: [A] FWWG cluster ratings are presented in tables are averaged agency ratings, but the FWWG desired the reader to see Appendix A for individual agency ratings which captures the diversity of opinion among individual agencies. [B] FWIC overall ratings were agreed upon average-based. [C] RRAT overall ratings were consensus based.

TOP 4 INDICATORS

WHAT INDICATORS ARE CONSIDERED TO BE THE MOST IMPORTANT BY THE PARTNERSHIP?

Aquatic Functional Classes (e.g., deep and shallow lentic areas, connectivity, river structures)
Floodplain Functional Class (e.g., flood inundation)
Floodplain Vegetation (e.g., wet meadows, willows, cottonwood, maple, and oak forests)
Aquatic Vegetation (e.g., emergent marsh, submersed vegetation)



ROLES AND RESPONSIBILITIES – RIVER TEAMS

River Teams (RTs) –

Through a collaborative, thorough, and interdisciplinary vetting process, the three RTs evaluate habitat objectives within their respective Districts (St. Paul - MVP, Rock Island - MVR, St. Louis - MVS), formulate restoration ideas, develop project proposals, and sequence the project proposals based on merit.

RTs will also engage the candidate cost share sponsors and the public as appropriate.

Membership consists of MVP's Fish and Wildlife Work Group (FWWG), MVR's Fish and Wildlife Interagency Committee (FWIC), and MVS's River Resource Action Team - Technical Section (RRAT-tech) and their respective executive-level river teams. District river team chairs can structure the RTs as desired – whether as a full river team or as an ad hoc group.

ROLES AND RESPONSIBILITIES - SST

Science Support Team (SST) –

Provide expertise and decision support visualizations and tools to the PPT and RTs as they develop the fact sheet template, consider restoration opportunities and advance project proposals.

Support the RTs in ensuring the project proposals incorporate the best available knowledge and assist in articulating how the proposed projects will advance ecological goals and habitat needs at various spatial scales.

Membership includes experts in the areas of ecological resilience, landscape ecology, hydraulics and hydrology, HNA II, fisheries, and vegetation.

ROLES AND RESPONSIBILITIES - PPT

Program Planning Team (PPT)

Structure the overall HREP planning and sequencing process and provide guidance to the District-based, executive and technical-level river teams.

Establish program priorities, facilitate engagement of Science Support Team (SST) members with the River Teams, evaluate project proposals based on ecological and implementation merit, consult with the District HREP managers regarding administrative factors, and review the draft FY 2021-2025 UMRR Next Generation HREP Implementation Strategy.

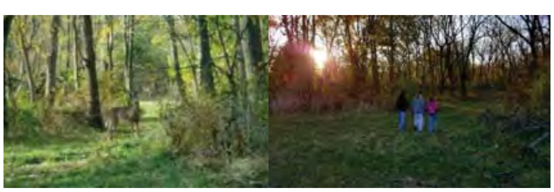
Provide briefings at the UMRR Coordinating Committee meetings and seek input and concurrence from the Committee.

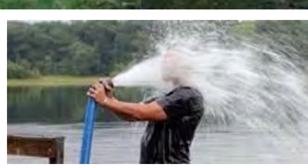
Membership includes the UMRR Program Manager (Marshall Plumley), the UMRR Coordinating Committee, District HREP Managers, District-based river team chairs or their designee.

NGO SPONSOR ENGAGEMENT

- Communication to Sponsors
  - ➢ Invitation Letter
  - ➢ Roles of the River Teams
    - o POC from River Team
  - ➢ What to Expect (Process)
  - ➢ Fact Sheet Template
  - ➢ Schedule
  - ➢ Sponsor Requirements

RECAP AND QUESTIONS





ADJOURN