Upper Mississippi River Restoration–Environmental Management Program
Long Term Resource Monitoring
FY2012 Scope of Work

Outcome 1

Outcome 2

Outcome 3

Outcome 4

Strategies 1 &2

This Scope of Work (SOW) describes the tasks to be performed by the USGS-Upper Midwest Environmental Sciences Center (UMESC) in La Crosse, Wisconsin, and six state-operated field

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stations (Illinois, Iowa, Minnesota, Missouri, and Wisconsin) in support the Upper Mississippi River Restoration-Environmental Management Program (UMRR–EMP) authorized by Congress in the 1986 Water Resources Development Act and reauthorized in the 1999 Water Resources Development Act. This SOW supports the Long Term Resource Monitoring's (LTRM) "Strategic and Operational Plan for the Long Term Resource Monitoring Program on the Upper Mississippi River System, Fiscal Years 2010-2014" (www.umesc.usgs.gov/ltrmp/ateam/Strategic_Operational_Plan_FINAL_30June2009.pdf). The top priority in the Strategic Plan and this SOW is collection, management, and serving of monitoring data.

UMESC is the designated science leader for the LTRM. USGS LTRM Program Manager/Science Director Dr. Barry Johnson leads and directs the work in this SOW. The tasks in this SOW align with priorities stated in the Strategic Plan. The Scope contains two types of projects: (1) projects that are part of the LTRM FY12 base monitoring plan, and (2) additional projects that were planned in FY11 but are being funded in FY12 and are not part of the base monitoring plan.

Aquatic Vegetation Component

The objective of the LTRM Aquatic Vegetation Component is to collect quantitative data on the distribution and abundance of aquatic vegetation in the UMRS for the purpose of understanding its status, trends, ecological functions, and responses to natural disturbances and anthropogenic activities. Data are collected within three LTRM study reaches in the UMRS (Pools 4, 8, and 13 on the Upper Mississippi River). Data entry, quality assurance, data summaries, standard analyses, data serving, and report preparation occur under standardized protocols. (Strategic Plan Outcome 1; Output 1.1, Outcome 2, Output 2.1 and Outcome 4)

Methods

Aquatic vegetation sampling will be conducted following the LTRM aquatic vegetation standard sampling protocol (Yin et al. 2000). One thousand three hundred and fifty sites will be surveyed, including 450 in Pool 4, 450 in Pool 8, and 450 in Pool 13 (Table 1). The presence/absence and abundance of aquatic plant species at each site will be measured and recorded. Pool-wide estimates of abundance and percent frequency of occurrence will be derived by pooling data over all strata.

Product Descriptions

2012A6: Thirteen years (1998 – 2011) of aquatic vegetation in Pool 4 of the Upper Mississippi River: What are the plants telling us? What are they responding to?

Most river managers and biologists recognize the important roles aquatic macrophytes play in river ecosystems: improving water clarity, taking up nutrients, and providing food and shelter for fish, waterfowl, and invertebrates. Annual reports of aquatic vegetation have been provided and are available at www.umesc.usgs.gov/reports_publications/ltrmp/veg/vegetation_update.html (accessed 9/8/2011). However, a comprehensive trend analysis of aquatic macrophytes in Pool 4 has not been conducted. This report will provide a detailed look at the frequency of occurrence of aquatic macrophytes in Pool 4 and their response to different stressors, most notably total suspended solids and hydrology. During the past 13 years, Pool 4 has cycled through both high and low water years, and concomitantly periods of high and low turbidity. Upper Pool 4 is currently part of a TMDL for exceeding turbidity standards, and is therefore a region of interest to the states of Minnesota and Wisconsin, as well as federal agencies such as the US FWS and US EPA. This report will help meet the goals of Strategic Plan Outputs 1.1, 2.2, and inform decisions necessary for Outputs 3.1 and 4.1.

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2012A7: Rewriting of aquatic vegetation annual summary statistics computer code
2012A8: Modify code for vegetation graphical browser

The Savanna Army Depot, located on the eastern bank of the Mississippi River (Navigation Pool 13), was a 13,062-acre (53 km2) installation. It was opened in 1917 as a proving and testing facility for weapons developed at Rock Island Arsenal. Unfortunately, some unexploded ordinances from the Depot are still being found in that area of the river that is currently being sampled for aquatic vegetation. This is an unacceptable safety hazard for LTRM sampling crews at the Bellevue Field Station. Therefore, the Pool 13 base map of strata showing areas available for the sampling has been adjusted to remove about 58 hectares from potential sampling locations and avoid this safety hazard. This adjustment in sampling strata requires rewriting and recalculating the statistics served on the web for previous years so all years are comparable. This effort will include re-writing of complex statistical computer code and the code that generates displays for the vegetation graphical browser (2012A8).

2012A9: Sampling the impaired reach of the UMR (Pools 2 and 3) for submersed aquatic vegetation using LTRM methods.

Submersed aquatic vegetation information will be collected and analyzed from Pools 2 and 3 of the Upper Mississippi River by LTRM staff located at the Lake City field station. Information collected will be distributed to interested LTRM Partners; but specifically to river managers in Minnesota Pollution Control Agency, Minnesota Department of Natural Resources (MDNR) and Wisconsin Department of Natural Resources as summary graphics showing aquatic vegetation frequencies over-time. The data will be used to test a macrophyte index impairment threshold model (Moore et al. 2012) and to monitor whether the new TMDL-related SAV standard for the impaired reach is being met. This work is fully supported by funding from the MDNR and provides an example of leveraging LTRM expertise to provide wider benefits to the Program.

Products and Milestones

Tracking number	Products	Staff	Milestones
2012A1	Complete data entry and QA/QC of 2011 data; 1250 observations.		
	a. Data entry completed and submission of data to USGS	Popp, Fischer, Bierman	30 November 2011
	b. Data loaded on level 2 browsers	Schlifer	15 December 2011
	c. QA/QC scripts run and data corrections sent to Field Stations	Sauer	28 December 2011
	d. Field Station QA/QC with corrections to USGS	Popp, Fischer, Bierman	15 January 2012
	e. Corrections made and data moved to public Web Browser	Sauer, Schlifer, Caucutt	30 January 2012
2012A2	WEB-based annual Aquatic Vegetation Component Update with 2011 data on Public Web Server.		
	a. Develop first draft	Sauer	30 March 2012
	b. Reviews completed	Popp, Fischer, Bierman, Sauer, Yin	15 April 2012
	c. Submit final update	Sauer	30 June 2012
	d. Placement on Web with PDF	Sauer, Caucutt	31 July 2012
2012A3	Complete aquatic vegetation sampling for Pools 4, 8, and 13 (Table 1)	Yin, Popp, Fischer, Bierman	31 August 2012
2012A4	Web-based: Creating surface distribution maps for aquatic plant species in Pools 4, 8, and 13; 2011 data	Yin, Rogala, Schlifer	31 July 2012
2012A5	Final draft LTRM completion report: FY05-07 data--Analysis and support of aquatic vegetation sampling data in Pools 6, 9, 18, and 19 (2008APE4a)	Yin	30 September 2012

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2012A6	Draft LTRM completion report: Thirteen years (1998 – 2011) of aquatic vegetation in Pool 4 of the Upper Mississippi River.		Moore	30 June 2012
2012A7	Rewriting of aquatic vegetation annual summary statistics computer code		Yin	31 August 2012
2012A8	Modify aquatic vegetation graphical browser code		Schlifer	30 September 2012
2012A9	Summary graphs: Sampling the impaired reach of the UMR (Pools 2 and 3) for submersed aquatic vegetation using LTRM methods.		Moore	30 September 2012
	On-Going			
2009APE1a	Draft manuscript: Have the recent increases in aquatic vegetation in Pools 5 and 8 been the result of water level management drawdowns, HREPs, or natural fluctuations? (2009APE1a)		Yin	28 February 2012
2011A5	Final Draft LTRM Report: Ecological Assessment of High Quality UMRS Floodplain Forests (2007APE12)		Guyon, Battaglia, Chick	30 December 2011
	Intended for distribution			
Completion report: LTRM Aquatic Vegetation Program Review (Heglund; 2007A9)				
Manuscript: Importance of the Upper Mississippi River Forest Corridor to Neotropical Migratory Birds (Kirsch, 2007APE1)				
LTRM Report: Ecological Assessment of High Quality UMRS Floodplain Forests (Chick, Guyon, Battaglia; 2007APE12)				
LTRM Technical Report; Experimental and Comparative Approaches to Determine Factors Supporting or Limiting Submersed Aquatic Vegetation in the Illinois River and its Backwaters (2008APE5, Sass)				

Literature Cited

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Ickes, B. S., and R. W. Burkhardt. 2002. Evaluation and proposed refinement of the sampling design for the Long Term Resource Monitoring Program's fish component. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, October 2002. LTRMP 2002-T001. 17 pp. + Appendixes A–E. CD-ROM included. (NTIS PB2003-500042)

McDonald L., T. McDonald, and D. Robertson. 1998. Review of the Denali National Park and Preserve (DENA) Long-Term Ecological Monitoring Program (LTEM). Report to the Alaska Biological Science Center Biological Resources Division, USGS. WEST Technical Report 98–7. 19 pp.

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Yin, Y., J. S. Winkelman, and H. A. Langrehr. 2000. Long Term Resource Monitoring Program procedures: Aquatic vegetation monitoring. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin. April 2000. LTRMP 95-P002-7. 8 pp. + Appendixes A–C.

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Fisheries Component

The objective of the LTRM Fisheries Component is to collect quantitative data on the distribution and abundance of fish species and communities in the UMRS for the purpose of understanding resource status and trends, ecological functions, and response to natural disturbances and anthropogenic activities. Data are collected within six LTRM study reaches in the UMRS (Pools 4, 8, 13, and 26 and Open River Reach on the Upper Mississippi River and La Grange Pool on the Illinois River). Data entry, quality assurance, data summaries, standard analyses, data serving, and report preparation occur under standardized protocols (Gutreuter et al. 1995; Ickes and Burkhardt 2002). (Strategic Plan Outcome 1; Output 1.1, Outcome 2, Output 2.1 and Outcome 4)

Methods

Fish sampling will be conducted following the LTRM study plan and standard protocols (Gutreuter et al. 1995), as modified in 2002 (Ickes and Burkhardt 2002). Species abundance, size structure, and community composition and structure will be measured over time. Between 250 and 400 samples will be collected in each study area (Table 1). Sample allocation will be based on a stratified random design, where strata include contiguous backwaters, main channel borders, main channel wingdams, impounded areas, and secondary channel borders. Tailwaters in the impounded reaches and tributary mouths in the Open River will be sampled under a fixed site design. Sampling effort will be allocated independently and equally across 3 sampling periods (June 15–July 31; August 1–September 15; September 16–October 31) to minimize risks of annual data loss during flood periods and to characterize seasonal patterns in abundance and habitat use. Pool-wide estimates of abundance will be derived by pooling data over all strata.

Product Descriptions

2012B5: Sturgeon Life History on the Upper Mississippi River

Important management topics of sturgeon related to the Upper Mississippi River and beyond include evaluating reproductive ecology, early-life history, and population demographics. We will continue to collaborate with the USACE and Southern Illinois University to evaluate habitat needs and early-life history of young-of-the-year sturgeon. In collaboration with other Missouri Department of Conservation (MDC) biologists we have collected shovelnose sturgeon demographic information throughout the UMR to provide information that will help managers develop regulations to ensure sustainability for both recreational and commercial fisherman. Several manuscripts authored by Open River and Wetlands field station staff have been published using these data in recent years and additional products are in preparation or have been submitted. This framework follows Output 2.1 of the LTRM's Strategic Plan to provide insights about river structure, and composition, and Outcome 4, to provide enhanced ecological understanding to inform management decisions.

2012B6: Flooding of the New Madrid floodway and Duck Creek Conservation Area

During June 2011, catastrophic flooding occurred throughout the Mississippi River floodplain. Because of this, multiple projects ensued to further our understanding of floodplain ecology. Two primary areas of focus were the New Madrid floodway and Duck Creek Conservation Area. The project at Duck Creek CA was to evaluate fish, amphibian, and reptile usage during high water events that restore connectivity to the floodplain and between pools that are usually isolated. A similar but more comprehensive approach was undertaken at the New Madrid Floodway encompassing fish, invertebrates, and water quality characteristics. Several private ponds were flooded during this event allowing Asian Carp to invade these locations so we have collected young-of-year fishes (Asian Carp, Gizzard Shad, and Buffalo

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spp.) to evaluate their influence on native fishes and plankton. The development of a database with data collected through this effort is on-going and will be available through the Open Rivers and Wetlands Field Station. This framework follows Output 2.2 of the LTRM's Strategic Plan to provide enhanced knowledge about system process by investigating effects of increased floodplain connectivity.

2012B7: Population characteristics and habitat use of American eel

American eels are the only catadromous fish species in North America. A manuscript authored by Open River and Wetlands field station staff evaluating population characteristics and habitat use of American eel throughout the Upper Mississippi River using LTRM data is currently under review in North American Journal of Fisheries Management. In addition, American eel distributional data throughout the state of Missouri have been collected with collaboration from other MDC biologists providing needed information to the USFWS (for potential listing; see September 2011 Federal Register). We will continue to sample at key locations in the Upper Mississippi River to gather information including spawning migration routes and diet of adult American eel. We have removed otoliths from each American eel captured for microchemistry analysis/aging (funded by MDC) and stomachs to determine gut content. Results will be submitted to a peer-reviewed publication and will be the first microchemistry work ever done on Mississippi River eels. Preliminary data suggests that most of the adult eels captured in the Middle Mississippi have never made it up to the Upper Mississippi and that gut content by biomass is overwhelmingly crawfish. This framework follows Output 2.1 of the LTRM's Strategic Plan to provide insights about river structure, and composition, and Outcome 4, to provide enhanced ecological understanding to inform management decisions.

2012B8: Influence of Asian carp on planktivorous fish

LTRM data from the open river is being analyzed to assess influence of Asian carp on other planktivorous fishes (i.e., gizzard shad and bigmouth buffalo). These data have been analyzed and presented at the Annual American Fisheries Society Conference and the Upper Mississippi River Conservation Committee fall fish technical meeting. We are in the preliminary stages of developing a peer-reviewed manuscript from these data to help managers and policy makers develop informed decisions regarding Asian carp. This framework follows Output 2.1 of LTRM's Strategic Plan to provide insights about river structure, and composition, and Outcome 4, to provide enhanced ecological understanding to inform management decisions.

2012B9: Fish Habitat Availability Huron Island Complex Habitat Rehabilitation and Enhancement Project.

The USACE Rock Island District has proposed a Habitat Rehabilitation & Enhancement Project (HREP) at the Huron Island Complex in Pool 18 of the UMRS. Most the backwater areas within the Complex lack habitat diversity. They mainly consist of shallow sand/silt flats, which are devoid of macrophytes but scattered with large woody debris. Data on fish are scarce for all of Pool 18. Limited electrofishing samples and fishing tournament catches indicate centrarchids use the area, but the quantity and quality of fish habitat available, or being utilized by different life stages of the fish community, is uncertain. Before any habitat objectives can be determined for the Huron Island HREP, habitat availability, use, and limitations must be better understood. The goal of this study is to describe and delineate fish habitat (i.e., spawning, rearing, pre-winter staging, and overwintering) available and potentially being used by the fish communities in Pool 18. Results of the study will be used to describe the existing conditions of fish habitat in Pool 18 for the Huron Island HREP and will be the basis for the development of a pre- and post-project fish monitoring plan. Using the LTRM's fish monitoring data and associated environmental characteristics we will describe the preferred habitat exhibited by specific functional feeding and/or reproductive guilds in Pools 13 and 26 (separately) during the spawning season (Period 1),

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rearing/nursery stage (Period 2), and pre-winter staging/feeding timeframe (Period 3). We will deliver an internal report by 31 January 2012 and a manuscript for publication upon approval by the Corps. This framework follows Output 2.1 of the LTRM's Strategic Plan by developing insights about river structure, and composition based on long-term data sets, and 3.1, using LTRM infrastructure, data sets, and expertise to help formulate ecological restoration projects.

2012B10: Asian carp age and growth

Illinois River Biological Station (IRBS) staff began collecting Asian carp cleithral bones (the major bony component of the pectoral girdle of carp) from LTRM and other projects for future age and growth research. These collections will continue in FY2012. To ensure that a representative sample of the bighead and silver carp populations is obtained from the La Grange Reach, cleithrums are removed from Asian carp captured from all the major habitat strata within this reach of the Illinois River: main channel border (MCB), side channel border (SCB), and backwaters (BW). These collections will be supplemented by information from other ongoing projects at the IRBS funded by the Illinois Department of Natural Resources. We will opportunistically seek funding to process the collections and analyze these data in future years, either through funding sources outside of LTRM or through a defined project under LTRM. Preliminary analyses of a limited number of cleithrum samples will be conducted in FY2012 with the goal of identifying and defining the logistics of laboratory processing efforts needed to age Asian carp with these structures.

2012B11: Asian carp control

LTRM staff at IRBS will continue to provide fisheries field sampling assistance in collaboration with John Amberg, of the USGS-UMESC, for collecting Asian carp for use in laboratory research. LTRM staff will continue to provide fisheries field sampling assistance. Dr. Amberg is currently conducting research to develop new methods for the control of Asian Carp, or to mitigate the effects Asian Carp through chemical, biological, or physical means. This work supports Outcome 4 of the LTRM's Strategic Plan to enhance ecological understanding to inform management decisions, including using LTRM infrastructure to assist with development of new management options.

2012B12: Asian carp reduction

LTRM staff at IRBS will assist with the ongoing Asian Carp Reduction project led by Dr. Jim Garvey, Southern Illinois University Carbondale. LTRM-funded staff will provide LTRM fisheries and water quality data to assist in investigations conducted by Dr. Garvey to assess changes in the fish community associated with reduced Asian carp populations in the Illinois River**.** Initiation and completion of these analyses will depend on when and if the Asian carp reduction goals are achieved. Furthermore, it will take time for the native fish community to respond to reductions in Asian carp populations, so we only anticipate assisting with preliminary analyses during FY2012. This work supports Outcome 2.1 of the LTRM's Strategic Plan to use LTRM data to provide insights about river process, function, and structure.

2012B13: Rehabilitation of backwater habitat in select Pool 12 backwaters

The USACE Rock Island District has proposed a Habitat Rehabilitation and Enhancement Project (HREP) in several backwater areas in Pool 12 of the UMRS. Project construction is scheduled to begin in FY13-14. Beginning in FY07, the Bellevue Long Term Resource Monitoring station, in conjunction with Iowa DNR's Bellevue Fisheries Management station, began collecting pre-project fisheries monitoring data from Pool 12. This work is fully supported by HREP funding from the USACE Rock Island District. The Bellevue LTRM field station's proximity to the project area allows this work to be conducted at relatively

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low cost, and uses existing equipment purchased by the LTRM. We will collect another annual increment of pre-project data in FY2012.

The primary objective of the proposed HREP is to rehabilitate backwater habitat in selected Pool 12 backwaters and improve the fishery resource by increasing overwintering habitat. The "Pool 12 Overwintering" HREP provides an ideal opportunity to assess the effectiveness of overwintering habitat for improving UMR fishery resources. Despite the documented success of HREPs at improving local fish habitat conditions, resource managers on the UMR still seek scientifically quantified information that overwintering HREPs increase the abundance of desirable fish populations at the local and pool scale.

This monitoring will provide several years of "pre-project" fisheries data from Pool 12, and will be carried on for an equal number of years "post-project" (after completion). This work represents a uniquely intensive assessment of the local (individual backwater), backwater aquatic area (all backwaters within a navigation pool), and pool-scale (all aquatic area within a navigation pool) effects of off-channel fish habitat improvement in a UMR pool. We intend to test the following hypothesis: Backwater rehabilitation as implemented through HREP projects on the UMR improves centrarchid population abundance, biomass, and fish available to the recreational creel at the individual-backwater, backwater aquatic area, and pool scale.

This work will directly address the subject of availability of overwintering habitat as a limiting factor for UMR fish populations. This will provide river managers with science-based results of the application of habitat management, which is critical to the optimal use of available fiscal resources, and will subsequently benefit the UMR and UMR users. The sampling design used for the assessment incorporates use of Pool 13 fisheries data collected under standard LTRM protocols as a "control," with hierarchically structured sampling and assessment of treatment effects in Pool 12 (i.e., assessment at the pool, backwater habitat, and individual backwater scales). This work supports Outcome 3.1 of the LTRM's Strategic Plan to use LTRM infrastructure, data sets, and expertise to help formulate, design, and evaluate ecological restoration projects.

2012B14: Fisheries Monitoring in Pool 13, Upper Mississippi River

This report contains summaries and analyses of selected features of fish communities and fish populations from data collected since the LTRM fish component was initiated on Pool 13. This report will focus on: 1) the relative abundance of commonly collected species; 2) trends in catch-per-unit-effort (CPUE) of selected game and prey species; and, 3) the detection of uncommon or rare species. This work supports Outcome 1 of the LTRM's Strategic Plan: Enhanced knowledge about system status and trends.

2012B15: Fish Component Hoop net study feasibility assessment

Our supplier of mechanically extracted and compressed soybean meal (beancake) for the past 20 years, West Bend Elevator in Iowa, has stated when its machinery breaks they will cease production of this product. No other manufacturer of this product has been found. Mechanically processed soymeal, such as beancake, has 38% protein, 10% fat, and 5% residual oil content. More modern processors use chemical solvent (hexane) methods to extract the oil and are nearly 100% effective at doing so. Thus, our primary source of baits for hoop net sampling in the LTRM fisheries component is in danger of not being available in the near future (1-3 years), and compositionally comparable substitutes are not readily apparent. We need to either initiate a study to find a reasonable substitute or simply abandon hoop netting as a standard LTRM method. This feasibility report seeks to determine whether a replacement bait study is possible. This work supports Outcome 1 of the LTRM's Strategic Plan: Enhanced knowledge about system status and trends.

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2012B16: Fish Component Hoop net study

The supplier of mechanically extracted and compressed soybean meal (beancake) used for fish sampling for the past 20 years has stated when its machinery breaks they will cease production of this product. Thus, our primary source of baits for hoop net sampling in the LTRM fisheries component is in danger of not being available in the near future (1-3 years). This study looks to find a reasonable substitute to use as standard LTRM bait.

Open River Reach (Cape Girardeau, MO) and Pool 8 (La Crosse, WI) field stations were selected to perform a full annual allocation for each of our standard bait and the alternative bait, based on minimizing sample size requirements to detect the consensus acceptable error response (20%) at 95% confidence. Because we chose two study reaches, our study design encompasses the full range of physical differences within the sampling environment that may interact with differences in the physical composition of the two baits to affect catches. Our goal is a posterity report (FY13) demonstrating responsible and considered changes in a standardized element of our sampling program.

Design-based poolwide annual means will be calculated for each full allocation of (1) standard bait sets, and (2) alternative bait sets (see Gutreuter et al. 1995; Ickes et al. 2005). Differences between the means calculated from each bait type will be tested with a simple two-way student's t-test, using +/- 20% deviation from the standard bait mean with 95% confidence as the criteria for rejecting a null hypothesis of no difference between bait types.

2012B17: Database addition; Special Project—Stratified random day electrofishing samples collected in Pools 16–19

The Iowa DNR's Fairport Fisheries Management Station has six years of what we to perceive to be the equivalent of LTRM "outpool sampling" data (2006–2011 and presently planned to continue indefinitely) This data will potentially bridge the gap of the fundamental lack of consistent and standardized fisheries information between key LTRM pools—Pools 13 and 26, in this case. Species richness and relative abundance are among some the fisheries metrics that can be gleaned from this data, and they can be directly compared to similar metrics in the LTRM key pools. This data may also serve as a control to assess natural variation when evaluating fisheries responses to HREP projects. This is something that the larger contingencies of river managers have asked for a long time. This work supports Outcome 1 of the LTRM's Strategic Plan: Enhanced knowledge about system status and trends.

2012B18: Database addition, Special project—Fisheries HREP Monitoring; Huron Island (Pool 18)

The Iowa DNR's Fairport Fisheries Management Station has collected two years of pre-HREP randomized fisheries data within Huron Island in Pool 18 of the UMR. Incorporating this data into our database would potentially allow us the opportunity and mechanism to evaluate fisheries responses (within the HREP and at a pool-scale) to backwater rehabilitation, much like the Pool 12 HREP monitoring that is currently being evaluated. This work supports Outcome 3 of the LTRM's Strategic Plan: Enhanced use of scientific knowledge for implementation of ecosystem restoration programs and projects.

Products and Milestones

Tracking number	Products	Staff	Milestones

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

2012B1	Complete data entry, QA/QC of 2011 fish data; ~1,590 observations		
	a. Data entry completed and submission of data to USGS	Popp, Fischer, Bierman, Chick, Sass, Hrabik	31 January 2012
	b. Data loaded on level 2 browsers; QA/QC scripts run and data corrections sent to Field Stations	Schlifer	15 February 2012
	c. Field Station QA/QC with corrections to USGS	Popp, Fischer, Bierman, Chick, Sass, Hrabik	15 March 2012
	d. Corrections made and data moved to public Web Browser	Sauer and Schlifer	30 March 2012
2012B2	Update Graphical Browser with 2011 data on Public Web Server.	Sauer, Popp, Fischer, Bierman, Chick, Sass, Hrabik	31 May 2012
2012B3	Complete fisheries sampling for Pools 4, 8, 13, 26, the Open River, and La Grange Pool (Table 1)	Ickes, Popp, Fischer, Bierman, Chick, Sass, Hrabik	31 October 2012
2012B4	Final draft completion report, compilation of 3 years of sampling: Fisheries (2009R1Fish)	Chick et al.	30 September 2012
2012B5	Draft manuscript: Sturgeon Life History on the UMR	Hrabik, Phelps	30 September 2012
2012B6	Database development: Flooding of the New Madrid floodway and Duck Creek Conservation Area	Hrabik, Phelps	30 September 2012
2012B7	Fisheries sampling and database increment: Population characteristics and habitat use of American eel	Hrabik Ridings, Phelps	30 September 2012
2012B8	Draft Manuscript: Influence of Asian carp on planktivorous fish	Hrabik, Phelps	30 September 2012
2012B9	COE Internal Report: Fish Habitat Availability Huron Island Complex Habitat Rehabilitation and Enhancement Project.	Hrabik, Phelps	31 January 2012
2012B10	Database increment: Asian carp age and growth	Sass, Ruebush, Solomon	30 September 2012
2012B11	Fisheries sampling: Asian carp control	Sass, Ruebush, Solomon	30 September 2012
2012B12	Preliminary analysis: Asian carp reduction	Sass, Ruebush, Solomon	30 September 2012
2012B13	Database increment: Rehabilitation of backwater habitat in select Pool 12 backwaters	Bierman, Bowler	30 September 2012
2012B14	IDNR Fisheries Management Completion Report: Fisheries Monitoring in Pool 13, Upper Mississippi River, 2011	Bierman, Bowler	30 April 2012
2012B15	Fish Component Hoop net study feasibility assessment, internal document	Ickes, DeLain, Bartels, Bowler, Ratcliff, Gittinger, Ridings, Ruebush, Solomon	2 March 2012
2012B16	Fish Component Hoop net study: Field sampling	Bartels, Ridings, Ickes, Schlifer	15 October 2012
2012B17	Database increment: Stratified random day electrofishing samples collected in Pools 16–19	Bierman, Bowler, Schlifer	30 September 2012
2012B18	Database increment: Fisheries HREP Monitoring; Huron Island (Pool 18)	Bierman, Bowler, Schlifer	30 September 2012
	On-Going		
2006B6	Draft manuscript: Spatial structure and temporal variation of fish communities in the Upper Mississippi River. (Dependent on 2008B9 acceptance into journal)	Chick	TBD
2007APE3	Draft LTRM report: Testing the Fundamental Assumption underlying the use of LTRM fish data: Does variation in LTRM catch-per-unit-effort data reflect variation in the abundance of fishes?	Chick	30 December 2012

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2007B4	Draft completion report: Proportional biomass contributions of Non-native fish to UMRS fish communities	Ickes	30 June 2012
2008B9	Draft manuscript: Standardized CPUE data from multiple gears for community level analysis (a previous manuscript was submitted and rejected by the journal, 2006B5; 2008B9 is a revised manuscript)	Chick	30 March 2012
2008APE1a	Draft completion report: Developing an empirical framework for reconstructing and modeling UMRS floodplain disturbance histories: Year 1, historic data extraction and summaries.	Ickes	30 March 2012
2010B4	Draft revision and update of the LTRM fisheries component procedures manual	Ratcliff, Gittinger	30 May 2012
Intended for distribution			
Manuscript: Evaluation of a Catch and Release Regulation for Largemouth Bass in Brown's Lake, Pool 13, Upper Mississippi River (2007B7; Bowler)			
Completion report: LTRM Fisheries Component collection of six darter species from 1989–2004. (2006B13; Ridings)			
LTRM Report: An Evaluation of Macroinvertebrate Sampling Methods For Use In The Open River Reach of The Upper Mississippi River; Kathryn N. S. McCain, Robert A. Hrabik, Valerie A. Barko, Brian R. Gray, and Joseph R. Bidwell (2005C2)			
LTRM report: Relationship of juvenile abundance of select fish species to aquatic vegetation in Navigation Pools 4, 8, and 13 of the Upper Mississippi River, 1998-2007 (2007B5; 2009B5; Popp and DeLain)			
Completion Report: A Proposal to restore Specific Monitoring Elements to the LTRM (Year 1 of restored monitoring; 2007APE8)			
LTRM technical report; Setting quantitative fish management targets for LTRM monitoring (2008APE2; Sass)			

Literature Cited

Gutreuter, S., R. Burkhardt, and K. Lubinski. 1995. Long Term Resource Monitoring Program procedures: Fish monitoring. National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, July 1995. LTRMP 95-P002-1. 42 pp. + Appendixes A–J

Ickes, B. S. and R. W. Burkhardt. 2002. Evaluation and proposed refinement of the sampling design for the Long Term Resource Monitoring Program's fish component. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, October 2002. LTRMP 2002-T001. 17 pp. + Appendixes A–E. CD-ROM included. (NTIS #PB2003-500042)

Ickes, B. S., M. C. Bowler, A. D. Bartels, D. J. Kirby, S. DeLain, J. H. Chick, V. A. Barko, K. S. Irons, and M. A. Pegg. 2005. Multiyear synthesis of the fish component from 1993 to 2002 for the Long Term Resource Monitoring Program. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin. LTRMP 2005-T005. 60 pp. + CD-ROM (Appendixes A–E). (NTIS PB2005-107572)

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Water Quality Component

The objective of the LTRM's water quality component is to obtain basic limnological information required to (1) increase understanding of the ecological structure and functioning of the UMRS, (2) document the status and trends of ecological conditions in the UMRS, and (3) contribute to the evaluation of management alternatives and actions in the UMRS.

Data are collected within six LTRM study reaches in the UMRS (Pools 4, 8, 13, 26, and Open River Reach on the Upper Mississippi River and La Grange Pool on the Illinois River). Data entry, quality assurance, data summaries, standard analyses, data serving, and report preparation occur under standardized protocols (Soballe and Fischer 2004). (Strategic Plan Outcome 1; Output 1.1, Outcome 2, Output 2.1 and Outcome 4)

Methods

Limnological variables (physicochemical characteristics, suspended solids, chlorophyll *a*, phytoplankton [archived], and major plant nutrients) will be monitored at both stratified random sites (SRS) and at fixed sampling sites (FSS) according to LTRM protocols.

Fixed site sampling

Fixed site sampling will be conducted as in FY2006 with addition of 14 sites in Pool 4 and 4 historic and 2 new sites in Pool 8 (Table 1).

Stratified random sampling

Stratified random sampling will be conducted at full effort levels (same as FY2006) for fall, winter, spring, and summer episodes (Table 1).

In situ data collection

For both FSS and SRS *in situ* data will be collected on physicochemical characteristics per the standard protocols (Soballe and Fischer 2004).

Laboratory analyses

Samples for chemical analysis (nitrogen (total N, nitrate/nitrite N, ammonia N), phosphorus (Total P, SRP), and silica) will be collected at all fixed sites and at approximately 35% of all stratified random sampling locations as specified in the sampling design. Samples for chlorophyll and suspended solids (total and volatile) will be collected at all SRS and Fixed sites. We will not collect data on major cations and anions in water samples in FY2012. Sampling and laboratory analyses will be performed following LTRM protocols (Soballe and Fischer 2004) and Standard Methods (American Public Health Association 1992).

Product Descriptions

2012D10: Nutrients, chlorophyll, and suspended sediments in channel and off-channel areas of the Upper Mississippi River (UMR)

The UMR exhibits considerable spatial variability in WQ. The LTRM WQ component has been designed to facilitate quantification and description of that variability. Both longitudinal (differences among pools) and lateral (differences among aquatic areas w/in pools) are important. Longitudinal differences have been documented in a peer-reviewed scientific publication (Houser et al. 2010), but lateral differences have not (though they can be viewed using, for example, the online graphical data browser). The lateral differences are currently an important issue as the UMRBA works with states to establish

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water quality criteria for the UMR (see this report for details: www.umrba.org/publications/wq/umr-wq-science-needs3-3-11.pdf). As a result there is a need for a rigorous, peer-reviewed analysis of where and when there are differences in WQ that are of biological significance. The draft manuscript addresses that need and directly addresses Outcome 1 (Output 1.1) and Outcome 2 (Output 2.1) of the 2010-2014 Strategic Plan.

2012D11: Spatial and temporal dynamics of phytoplankton assemblages in selected reaches of the UMR: Navigation Pools 8, 13, and 26

Relatively few studies have examined large-scale phytoplankton community composition in the UMR. Phytoplankton community composition can serve as an indicator of water quality and may affect the quality of food available at the base of the food web. This study will focus on community composition and the factors that influence it. Specifically this study will examine the spatial and temporal dynamics of phytoplankton community composition within three habitat types of the UMR—main channel, backwater, and impounded areas and their relationship to covariates such as water clarity and nutrient concentration. The results will be submitted as a Master's thesis to the University of Wisconsin La Crosse. These will results will improve our understanding of when and where undesirable algal blooms are likely to occur and in doing so may provide important information for consideration in the management of channel and backwater areas of the UMR. Thus this project will provide information relevant to Outcome 1 (Output 1.1 and 1.2), and Outcome 2 (Output 2.1).

2012D12: Temporal evaluation of factors influencing metaphyton biomass, distribution and composition within UMR backwaters

Metaphyton is comprised of duckweed and filamentous algae species and is common in aquatic ecosystems. However, excessive metaphyton production can interfere with public recreation, provides minimal benefits for invertebrates, fish and wildlife, and can cause reductions in submersed aquatic vegetation. Additionally, metaphyton mats can cause reductions in underwater light, dissolved oxygen concentration, phytoplankton growth and abundance, zooplankton growth and abundance, increased sediment oxygen demand, and increased internal nutrient loading.

The information produced by this research will help to determine: (1) The hydrological, weather and water quality conditions that coincide with the emergence of metaphyton in late spring - early summer, (2) How metaphyton tissue nutrient ratios (N:P, C:P, C:N) and metaphyton biomass respond to changing water column nutrient availability through the growing season, (3) Whether particular nutrient concentration thresholds are necessary to sustain metaphyton biomass throughout the growing season, (4) Whether different nutrients (N and P) limit metaphyton abundance at different times during the growing season? This work builds on prior observational studies (2010out2a) by estimating metaphyton biomass and examining metaphyton tissue for indication of nutrients that may be limiting growth. The results of this report can be used to inform the debate regarding the development of numeric nutrient concentration goals for the UMR. It also provides physical targets (i.e. water velocity and water depth) to consider in future projects to reduce influence of excessive metaphyton in future habitat improvement projects.

Much of the research regarding the effects of excessive nutrient input to the UMR has focused on hypoxia in the Gulf of Mexico rather than local eutrophication effects. In recent years there has been a perceived increase in surface mats of metaphyton in the UMR among the public and popular press. The increase in metaphyton has been blamed for decreases in both economic activity and perceived value of the aquatic resource. It is important to determine the chemical and physical factors driving the production of metaphyton biomass within the UMR and to develop management strategies to reduce

metaphyton overabundance. This effort addresses will provide information relevant to Outcome 1 (Output 1.1 and 1.2), and Outcome 2 (Output 2.1). A summary document of this work is planned for FY13.

2012D13: Manipulation of DNR Biology Lab zooplankton data

Zooplankton are an important link in the food web of most aquatic ecosystems. Surprisingly little information is available about zooplankton in the Upper Mississippi River System (UMRS). Analysis of a long term zooplankton data set from Lake Pepin will provide a greater understanding of the factors controlling zooplankton abundance and composition in this unique habitat on the UMRS. This effort will provide baseline data and more detailed analysis of previous work (2006D7) by using non-metric multidimensional scaling to investigate the relationship between water quality attributes and the zooplankton community. Information gained from this effort will be available for future modeling and management decisions on the UMRS. This effort is in the early stages of data manipulation which involves manually transforming an Excel spreadsheet for each sample into a form that is capable of being uploaded into SAS. The results and products of this effort will eventually contribute to outcomes 1 through 4 identified in the Strategic and Operational Plan for the Long Term Resource Monitoring and specifically to outputs 1.3, 1.4, 2.1, 3.1, and 4.1. This data may become especially relevant as planktivorous Asian carps continue to spread throughout the UMRS. The impact caused by these invasive species to zooplankton communities and native fishes is largely unknown. A summary document of this work is planned for FY13.

2012D14: A Decade of Monitoring on Pool 26 of the Upper Mississippi River

LTRM staff (located at the National Great Rivers Research and Education Center) recently submitted for publication the article "A Decade of Monitoring on Pool 26 of the Upper Mississippi River: Water Quality and Fish Data with Cross Component Analyses" to the peer reviewed journal "Bulletin of the Illinois Natural History Survey." Revisions to this manuscript will occur when reviews are received in FY12. See page 42 www.umesc.usgs.gov/documents/reports/2005/fy05_ltrmp_sow_final_4march2005.pdf. This framework follows Output 1.1 and 2.1 of the LTRM's Strategic Plan.

2012D15: Technical review of a YSI Optical sensor

In a collaborative effort with the National Great Rivers Research and Education Center (NGRREC), LTRM staff will be involved with the installation and maintenance of a YSI Optical sensor (NGRREC purchase) for real-time water quality sampling. LTRM staff will ground truth the data using standard LTRM water quality samples. This framework follows Output 1.1 and 2.1 of the LTRM's Strategic Plan, including leveraging LTRM's infrastructure to assess new monitoring technologies.

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Products and Milestones

Tracking number	Products	Staff	Milestones
2012D1	Complete calendar year 2011 fixed-site and SRS water quality sampling	Houser, Popp, Fischer, Bierman, Chick, Sass, Hrabik	31 December 2011
2012D2	Complete laboratory sample analysis of 2011 fixed site and SRS data; Laboratory data loaded to Oracle data base.	Yuan, Schlifer	15 March 2012
2012D3	1st Quarter of laboratory sample analysis (~12,600)	Yuan, Kreiling, Manier, Burdis, Giblin, Kueter, L. Gittinger, Cook, Crites	30 December 2011
2012D4	2nd Quarter of laboratory sample analysis (~12,600)	Yuan, Kreiling, Manier, Burdis, Giblin, Kueter, L. Gittinger, Cook, Crites	30 March 2012
2012D5	3rd Quarter of laboratory sample analysis (~12,600)	Yuan, Kreiling, Manier, Burdis, Giblin, Kueter, L. Gittinger, Cook, Crites	29 June 2012
2012D6	4th Quarter of laboratory sample analysis (~12,600)	Yuan, Kreiling, Manier, Burdis, Giblin, Kueter, L. Gittinger, Cook, Crites	28 September 2012
2012D7	Complete QA/QC of calendar year 2011 fixed-site and SRS data.		
	a. Data loaded on level 2 browsers; QA/QC scripts run; SAS QA/QC programs updated and sent to Field Stations with data.	Schlifer, Rogala	30 March 2012
	b. Field Station QA/QC; USGS QA/QC.	Rogala, Popp, Fischer, Bierman, Chick, Sass, Hrabik	15 April 2012
	c. Corrections made and data moved to public Web Browser	Rogala and Schlifer	30 April 2012
2012D8	Complete FY12 fixed site and SRS sampling for Pools 4, 8, 13, 26, Open River, and La Grange Pool (Table 1)	Houser, Popp, Fischer, Bierman, Chick, Sass, Hrabik	30 September 2012
2012D9	WEB-based annual Water Quality Component Update with 2011 data on Public Web Server.	Rogala	30 May 2012
2012D10	Draft manuscript: Nutrients, chlorophyll, and suspended sediments in channel and off-channel areas of the Upper Mississippi River	Houser	1 September 2012
2012D11	Thesis submission: Spatial and temporal dynamics of phytoplankton assemblages in selected reaches of the UMR: Navigation Pools 8, 13, and 26 (2010OUT2c)	Manier, Houser	30 July 2012
2012D12	Draft Manuscript: Temporal evaluation of factors influencing metaphyton biomass, distribution and composition within UMR backwaters (Continued analysis from 2010out2a)	Giblin et al.	30 September 2012
2012D13	Data preparation: manipulation of DNR Biology Lab zooplankton data (Final product will be a manuscript in FY13 similar to 2006D7)	Burdis	30 September 2012
2012D14	Draft Manuscript: A Decade of Monitoring on Pool 26 of the Upper Mississippi River	Chick et. al	30 September 2012
2012D15	Technical review of a YSI Optical sensor	Chick, L. Gittinger, Lubinski	30 September 2012
2012D16	Final draft completion report, compilation of 3 years of sampling: Water Quality (2009R1WQ)	Giblin, Burdis	30 September 2012
2012D17	Final draft completion report: Temporal evaluation of factors influencing metaphyton biomass,	Giblin et al.	30 September 2012

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

	distribution and composition within UMR backwaters (2010OUT2a)			
On-Going				
2010D6	Draft LTRM Completion Report: Changes in substrate, water quality, aquatic vegetation, zooplankton, and fish community from Geomorphic Reach 1 (above Lake Pepin) to Geomorphic Reach 3 (below Lake Pepin).		Popp, De Lain, Burdis, Moore	30 June 2012

Intended for distribution
Completion report: Examining nitrogen and phosphorus ratios N:P in the unimpounded portion of the Upper Mississippi River (2006D9; Hrabik & Crites)
LTRM report: retrospective, cross-component analysis for Pool 26. (2005APE26; Chick)
LTRM report: Main channel/side channel report for the Open River Reach. (2005D7; Hrabik)
Manuscript: Primary production, and dissolved oxygen dynamics in UMRS backwater lakes and main channel. (2008D8; Houser)
LTRM report: A Decade of Monitoring on Pool 26 of the Upper Mississippi River: Water Quality and Fish Data with Cross Component Analyses Chick et al.; 2005APE26)
Manuscript: Causes and consequences of metaphyton abundance in backwater lakes of the UMR near La Crosse, Wisconsin. (2009APE3, Houser)

Literature Cited

American Public Health Association, American Water Works Association, and Water Environment Federation. 1992. Standard methods for the examination of water and wastewater. 18th edition, American Public Health Association, Washington, D.C. 981 pp. + 6 color plates

Houser, J.N., D.W. Bierman, R.M. Burdis, and L.A. Soeken-Gittinger. 2010. Longitudinal trends and discontinuities in nutrients, chlorophyll and suspended solids in the Upper Mississippi River: implications for transport, processing, and export by large rivers. Hydrobiologia 651:127–144.

Soballe, D. M., and J. R. Fischer. 2004. Long Term Resource Monitoring Program Procedures: Water quality monitoring. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, March 2004. LTRMP 2004-T002-1 (Ref. 95-P002-5). 73 pp. + Appendixes A-J.

Upper Mississippi River Basin Water Quality-Related Science Needs (March 3, 2011). Provided to U.S. EPA Region 7 from the Upper Mississippi River Basin Association Water Quality Executive Committee. http://www.umrba.org/publications/wq/umr-wq-science-needs3-3-11.pdf

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Land Cover/Land Use with GIS Support

In FY2010-11, systemic digital aerial photography was collected in cooperation with USFWS Region 3. The main task under Land Cover/Land Use will be in processing these data (See Development of 2010/11 Land Cover/Land Use GIS Database and Aerial Photo Mosaics). (Strategic Plan Outcome 1; Output 1.1)

However, we will continue to provide on demand GIS technical assistance, expertise, and data production to the Environmental Management Program partnership including, but not limited to:

- Aerial photo interpretation
- Interpretation automation into a digital coverage
- Flight planning and acquisition of aerial photography
- Change detection and habitat modeling
- Georeferenced aerial photo mosaics (pool wide, Habitat Rehabilitation and Enhancement Projects (HREPs), land acquisition areas)
- Georeferenced archival map/plat mosaics (Brown Survey, Mississippi River Commission data, Government Land Office data)
- Produce graphics and summary tables for partnership publications, posters, and presentations
- Conversion of ASCII coordinate data from a GPS to a spatial dataset
- Conversion of all georeferenced data to a common projection and datum for ease of use in a GIS
- Conversion of GIS data to KML and KMZ (Google Earth) formats for ease of viewing and sharing (as requested).
- Maintain, update, and oversee the aerial photo library of over 50,000 print and digital images.
- Maintain, update, and enhance over 20 million acres of land cover/land use and aquatic areas data spanning the late 1800s through the year 2000. This includes improving existing or developing new crosswalks for comparison of existing datasets, cropping datasets to common extents, and ensuring that all datasets are in a common coordinate system.
- Assist in the maintenance and updating of the USGS-Upper Midwest Environmental Sciences Center's (UMESC) web based geospatial data repository.
- Provide hardware and software technical support to UMESC staff and partners, as needed.
- Continue to assess advances in computer technology (hardware and software) for accurate and efficient GIS data production.

Product Descriptions

Although the primary focus of this component is to provide technical assistance and maintain existing databases, *as time allows* work may occur on the following LTRM projects:

- Generate GIS-ready (.xml format) metadata for spatial data being served over the internet. The data being served have metadata included but is in either text format (.txt) or web format (.html). Converting these metadata files to .xml will provide access from within the GIS.
- Continue to update the detailed spreadsheet of all LTRM aerial photography currently housed at UMESC, including date, pool location, format (color infrared, natural color, black-and-white), scan status (yes/no, dots per inch), interpreted status, photo scale, and extent of coverage (partial or complete). This document will be updated as necessary.

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Products and Milestones

Tracking number	Products	Staff	Milestones
Intended for distribution			
Completion Report: Assessment of high-resolution digital imagery for UMRS vegetation mapping and software-based vegetation classification (2007APE13; Robinson)			
Completion report: Aerial Imagery Processing and Classification Training for 2010 LCU (2009LCU1; Robinson)			

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Development of 2010–2011 Land Cover/Land Use GIS Database and Aerial Photo Mosaics

Development of the 2010/2011 Land Cover/Land Use (LCU) Geographic Information System (GIS) database will provide a third systemic dataset to compare the 1989 and the 2000 systemic coverages. Though a crosswalk was needed to compare 1989 and 2000 since different vegetation classification systems were used, the 2000 and 2010/11 LCU datasets will use the same classification and classifiers, making them directly comparable. Once completed, the 2010–2011 dataset will be invaluable in assessing and evaluating long-term vegetation trends and habitat changes over the past 20 years, and in assessing the current state of floodplain vegetation. (Strategic Plan Outcome 1; Output 1.1 and Outcome 4)

Objectives

Develop a 2010/11 LCU GIS database for Pools 1-26, the Open River Reach, the entire Illinois River, and the navigable portions of Minnesota, St. Croix, and Kaskaskia Rivers of the UMRS. Note: Extensive flooding on the Middle Mississippi River below the Quad Cities required aerial photography on Pools 14-Open River to be postponed until the late-summer of 2011. The upper pools of the Illinois River (Lockport, Brandon, and Dresden Pools) were reflown in 2011 due to heavy cloud cover in 2010.

Methods

Aerial photographs Pools 1-13, Upper Mississippi River and the Pools Alton-Marseilles, Illinois River were collected in color infrared (CIR) in August of 2010 at 8”/pixel and 16”/pixel respectively using a mapping-grade Applanix DSS 439 digital aerial camera. In August 2011, CIR aerial photographs for Pools 14-Open River South, Upper Mississippi River and Pools Dresden-Lockport, Illinois River were collected at 16”/pixel with the same camera. These CIR aerial photos will be orthorectified, mosaicked, compressed, and served via the UMESC Internet site. The CIR aerial photos will be interpreted and automated using a 31-class LTRM vegetation classification (see Attachment A). The 2010/11 LCU databases will be prepared by or under the supervision of competent and trained professional staff using documented standard operated procedures and will be subject to rigorous quality control (QC) assurances (NBS, 1995). The LTRM trend pools (Pools, 4, 8, 13, and the La Grange Pool of the Illinois River) will be processed first. The trend pools whose imagery was collected in late summer 2011 (Pool 26 and Open River South) along with Pools 6, 9, 14, 18, and 19 will be completed in FY2012. - The completion order of the remaining pools will be determined at a later date.

- Systemic Flight of UMRS - Fly the entire UMRS in CIR at 8”/pixel for Pools 1-13 and at 16”/pixel for Pools 14-26 and the Illinois River.
- Orthorectify, Mosaic, and Serve the 2010 CIR Aerial Photography - UMESC has the capability to compress and mosaic high-resolution scans of the 2010 imagery. These georeferenced photos would provide a base map on which existing LCU data and future LCU data could be overlaid. These photos also offer the ability to do visual-based land use or habitat analysis. These photos would be made available, by pool or reach, through UMESC's internet home page.
- Trend Pool Automation of 2010/11 Systemic Aerial Photography – Trend pools (Pools 4, 8, 13, 26, the Open River South, and the La Grange Pool of the Illinois River) will be interpreted first using the same 31-class vegetation classification system used to classify the 2000 systemic aerial photography (see Attachments A). Year 2010/11 LCU databases will be prepared by or under the supervision of competent and trained professional staff using documented standard operated procedures and will be subject to rigorous quality control (QC) assurances (NBS, 1995). The LTRM study areas will be processed first, beginning with Pools 4, 8, 13, and the La Grange Pool of the Illinois River. Pool 26 and the Open River South reach will follow once the 2011 aerial photography is complete.

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Products and Milestones

Tracking number	Products	Staff	Milestones
2012V1	Complete orthorectified photo mosaics of all imagery collected in 2010 using OrthoVista	Robinson, Ruhser	31 December 2011
2012V2	Complete orthorectified photo mosaics of all imagery collected in 2011 using OrthoVista	Robinson, Ruhser	30 June 2012
2012V3	Complete 2010/11 LCU databases for UMR Pool 26 and Open River South	Robinson, Hoy, Hanson, Langrehr	29 February 2012
2012V4	Complete 2010/11 LCU database for UMR Pool 9	Robinson, Hoy, Hanson, Langrehr	30 April 2012
2012V5	Complete 2010/11 LCU database for UMR Pool 18	Robinson, Hoy, Hanson, Langrehr	31 May 2012
2012V6	Complete 2010/11 LCU database for UMR Pool 14	Robinson, Hoy, Hanson, Langrehr	30 June 2012
2012V7	Complete 2010/11 LCU databases for UMR Pools 6 and 19	Robinson, Hoy, Hanson, Langrehr	31 August 2012

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

ATTACHMENT A

LTRM 31-Class General Vegetation Classification, Version 1.0

CODE	CODE DESCRIPTION	HYDROLOGY DESCRIPTION	DESCRIPTION
OW	Open Water	Permanently Flooded Non-Forest	Open Water; Default to Anderson Classification
RFA	Rooted Floating Aquatics	Permanently Flooded Non-Forest	Permanently flooded temperate or subpolar hydromorphic rooted vegetation
SV	Submerged Aquatic Vegetation	Permanently Flooded Non-Forest	Permanently flooded temperate or subpolar hydromorphic rooted vegetation
DMA	Deep Marsh Annual	Semipermanently Flooded Non-Forest	Semipermanently flooded temperate or subpolar grassland
DMP	Deep Marsh Perennial	Semipermanently Flooded Non-Forest	Semipermanently flooded temperate or subpolar grassland
MUD	Mud	Seasonally Flooded Non-Forest	Seasonally/Temporarily flooded mudflats
SMA	Shallow Marsh Annual	Seasonally Flooded Non-Forest	Seasonally flooded temperate or subpolar grassland
SMP	Shallow Marsh Perennial	Seasonally Flooded Non-Forest	Seasonally flooded temperate or subpolar grassland
SM	Sedge Meadow	Temporarily Flooded Non-Forest	Temporarily flooded temperate or subpolar grassland
WM	Wet Meadow	Saturated Soil Non-Forest	Saturated temperate or subpolar grassland
DMS	Deep Marsh Shrub	Semipermanently Flooded Shrubs	Semipermanently flooded cold-deciduous shrubland
SMS	Shallow Marsh Shrub	Seasonally Flooded Shrubs	Seasonally flooded cold-deciduous shrubland
WMS	Wet Meadow Shrub	Temporarily Flooded Shrubs	Temporarily flooded cold-deciduous shrubland
SS	Shrub/Scrub	Infrequently Flooded Shrubs	Temperate cold-deciduous shrubland
WS	Wooded Swamp	Semipermanently Flooded Forest	Semipermanently flooded cold-deciduous closed tree canopy
FF	Floodplain Forest	Seasonally Flooded Forest	Seasonally flooded cold-deciduous closed tree canopy
PC	Populus Community	Seasonally Flooded Forest	Seasonally flooded cold-deciduous closed tree canopy
SC	Salix Community	Seasonally Flooded Forest	Seasonally flooded cold-deciduous closed tree canopy
BHF	Bottomland Hardwood Forest	Temporarily Flooded Forest	Temporarily flooded cold-deciduous closed tree canopy
CN	Conifers	Infrequently Flooded Forest	Rounded-crowned temperate or subpolar needle-leaved evergreen forest
PN	Plantation	Infrequently Flooded Forest	Plantation
UF	Upland Forest	Infrequently Flooded Forest	Lowland or submontane cold-deciduous closed tree canopy
AG	Agriculture	Infrequently Flooded Non-Forest	Annual row-crop forbs or grasses
DV	Developed	Infrequently Flooded Non-Forest	Developed; Default to Anderson Classification
GR	Grassland	Infrequently Flooded Non-Forest	Tall sod temperate grassland
LV	Levee	Infrequently Flooded Non-Forest	Levee; Default to Anderson Classification
PS	Pasture	Infrequently Flooded Non-Forest	Perennial Grass Crops
RD	Roadside Grass/Forbs	Infrequently Flooded Non-Forest	Roadside Grass/Forb; Default to Anderson Classification
SB	Sand Bar	Temporarily Flooded Non-Forest	Temporarily flooded sand flats
SD	Sand	Infrequently Flooded Non-Forest	Dunes with sparse herbaceous vegetation
NPC	No Photo Coverage	n/a	No Photo Coverage; n/a

VEGETATION MODIFIERS

Density A = 10-33% B = 33-66% C = 66-90% D = > 90%

Height* 1 = 0-20 ft. 2 = 20-50 ft. 3 = > 50 ft. *Trees only

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Thematic accuracy assessment and validation for the Upper Mississippi River System floodplain from 2010/2011 land cover/land use data[1]

The USGS-Upper Midwest Environmental Sciences Center (UMESC) has been responsible for development of several land cover/land use (LCU) systemic data sets of the Upper Mississippi River System (UMRS) floodplain (1989, 2000). These efforts were funded by the UMRR–EMP LTRM. Development of systemic data sets include the acquisition, processing, and serving of high resolution aerial photography and land cover/land use spatial data sets (www.umesc.usgs.gov/data_library/land_cover_use/land_cover_use_data.html). In 2008, the UMRR–EMP reached a collaborative agreement with the U.S. Fish and Wildlife Service's Region 3 Office to collect high-resolution digital imagery of the entire UMRS floodplain in 2010/2011 for the LTRM. The UMESC will help acquire, process, and serve this imagery, as well as produce and serve the 2010/2011 LCU systemic data set of the UMRS floodplain.

While the 1989 and 2000 LCU systemic data sets have not gone through a traditional thematic accuracy assessment in the past, the end products have been of high quality. For each systemic data set produced (1989, 2000, 2010/11), extensive field reconnaissance/groundtruthing is performed before photointerpretation to learn, test, and verify image signatures as they relate to the vegetation types. Questionable areas on the imagery are visited and the plants or land features observed in the area are recorded for reference. This procedure verifies vegetation signatures on the photographs with those on the ground. In addition, once the photointerpretation is complete, the final LCU data set undergoes extensive quality assurance/quality control to ensure the imagery is mapped correctly.

Since the last LCU systemic data set was developed, there has been a growing interest in completing thematic accuracy assessments (AA) for the LTRM LCU spatial data sets. The objective of an AA is to measure the probability that a particular location has been assigned its correct vegetation class. An AA estimates thematic (map class) errors in the data, giving users information needed to determine data suitability for a particular application. At the same time, data producers are able to learn more about the nature of errors in the data. Thus, the two views of an AA are "producers' accuracy," which is the probability that an AA point has been mapped correctly (also referred to as an error of omission), and "users' accuracy," which is the probability that the map actually represents what was found on the ground (also referred to as error of commission). Producers' and users' accuracies can be obtained from the same set of data by using different analyses.

A pilot thematic accuracy assessment study was completed on an UMRS 2001 LCU spatial data set of Pool 8 (May 2002). At the genus level, results of this study calculated the overall accuracy produced with a kappa index to be 83.8%. At the General Wetland Vegetation Map Class (Dieck and Robinson 2004) level, the overall accuracy was calculated with a kappa index to be 88.5%. Currently, the goal is to expand on this work and complete a thematic accuracy assessment on select pools throughout the UMRS using LCU data from the 2010/2011 LCU spatial data sets of the UMRS. (Strategic Plan Outcome 1; Output 1.1, Outcome 2, Output 2.1 and Outcome 4)

Study Area and General Work Plan

This Scope of Work describes an AA for Pools 13 and La Grange. During a thematic accuracy assessment, random points are generated based on area of each natural/semi-natural map class. Field crews are sent into the field to record the vegetation type at each of the selected sites. (Note that there will be issues with accessing private property.) This data would then be brought back to the office, entered into a database, and compared to the map by two individuals not involved with the mapping of the LCU

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spatial data set. The types of errors are then identified and a contingency table is produced showing the map class errors and what they were missed to.

Validation is not a true verification of map class type in the field, however can provide the user of the map with useful information that is very similar to a field accuracy assessment. Validation would involve generating random points based on area for all map classes. Two individuals not involved with the mapping would review each of the points onscreen and record an agreed upon map class. This data would then would be entered into a database and compared to the map. The types of errors are then identified and a contingency table is produced showing the map class errors and the map classes they were missed to.

Accuracy Assessment

Project study areas identified for a field accuracy assessment are Pools 13 and La Grange, UMRS. These are LTRM focal pools and LTRM field station staff associated with these pools have the appropriate skills to conduct the field portion of the accuracy assessment. By targeting these pools, travel costs can be minimized.

Once a pool's LCU spatial data set is finalized, a thematic accuracy assessment will be performed on that pool to determine the accuracy of the map classes. All General Wetland Vegetation Map Classes (Dieck and Robinson 2004) representing National Vegetation Classification Standard (NVCS) natural/semi-natural types (Table 1) (FGDC 2008) will be assessed using the stratified random sampling scheme described in the Thematic Accuracy Assessment Procedures: Version 2.0 (Lea 2010). UMESC staff will use these guidelines to determine the appropriate buffer and the number of sites for each map class in each pool.

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Table 1. The General Wetland Vegetation Map Classes with their respective map codes representing National Vegetation Classification Standard natural/semi-natural types.

Map Class	Map Code
Submersed Vegetation	SV
Rooted Floating Aquatics	RFA
Deep Marsh Annual	DMA
Deep Marsh Perennial	DMP
Shallow Marsh Annual	SMA
Shallow Marsh Perennial	SMP
Sedge Meadow	SM
Wet Meadow	WM
Deep Marsh Shrub	DMS
Shallow Marsh Shrub	SMS
Wet Meadow Shrub	WMS
Scrub-Shrub*	SS
Wooded Swamp	WS
Floodplain Forest	FF
Populus Community	PC
Salix Community	**SC**
Lowland Forest	**LF**
Conifers*	CN
Plantation*	PN
Upland Forest*	UF
Grassland*	GR
Pasture*	PS
Mudflat	MUD
Sand Bar	SB

***** Represents classes typically located on private lands and will require extensive work to gain permission to access

The number of samples needed for each map class (theme) take into account both the statistical and operational aspects of sampling and will be determined for each pool, as suggested in the following scenarios (Lea 2010):

- Scenario A: The class is abundant. It covers more than 50 hectares in total area. The map class receives the maximum sample size of 30.
- Scenario B: The class is relatively abundant. It covers at least 8.33 hectares, but no more than 50 hectares in total area. The map class receives a sample size of 0.6 observations per hectare of the map class (= one observation for every 1.67 hectares of map class area). (This ratio allocates observations at a density rate equal to 30 observations per 50 hectares).
- Scenario C: The class is relatively rare. It covers less than 8.33 hectares in total area. The map class receives 5 observations (the recommended minimum sample size).

UMESC will buffer each sampling site from the polygon boundary to eliminate the possibility that the observed area (a circular area approximately the size of the minimum mapping unit) is of mixed map class identity due to (1) confusion as to whether the observation area is wholly contained within the map class, (2) positional error due to GPS error and (3) allowable positional error in the map data. The National Map Accuracy Standard requirement for positional accuracy of 1:24,000 scale products is 12.2 meters (FGDC, 1998).

To calculate the required buffer distance, the square root of the sum squares of these error sources will be calculated with the following formula:

$$\text{Buffer Distance} = \sqrt{R^2 + F^2 + M^2}$$

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

where R is the radius distance of the observation area, F is the expected (e.g., 90th percentile) field positioning (GPS) error distance, and M is the standard requirement (maximum positional error distance in the map) for positional accuracy.

The minimum mapping unit (MMU) for the 2010/2011 LCU spatial data sets north of Lock & Dam 13, UMRS is 0.4 ha (1 acre). Given this MMU, the radius length of a circular 0.4 ha area is 36 meters, representing the value of R. The value of F is generalized to 15 meters, and the value of M is generalized to 12 meters. Therefore, a buffer distance of 41 meters will be applied to the interior polygon boundaries north of Lock & Dam 13.

The minimum mapping unit (MMU) for the 2010/2011 LCU spatial data sets south of Lock & Dam 13, UMRS and the Illinois River is 1.0 ha (2.47 acre). Given this MMU, the radius length of a circular 1.0 ha area is 56 meters, representing the value of R. The value of F is generalized to 15 meters, and the value of M is generalized to 12 meters. Therefore, a buffer distance of 59 meters will be applied to the interior polygon boundaries south of Lock & Dam 13, UMRS and the Illinois River.

Once the number of sites is determined and the buffer is applied, random AA points will be generated for each map class using Hawth's Tools for ArcGIS (Beyer, H.L. 2004), or equivalent tool. These AA-site coordinates (UTM projection, Zone 15 or Zone 16, using NAD83) will be provided to the field crews to upload into GPS receivers to navigate. UMESC will provide the field crews with 1:12,000-scale hard-copy maps displaying the locations of the accuracy assessment sites, land stewardship, and the pools boundary overlaid on the CIR imagery.

Field observation data will be collected by field station staff. At the start of the project, UMESC staff will support the collection of accuracy assessment points, assist in planning and liaison with field station staff, and lead the training for the field crews. In addition, UMESC will complete a mid-season field visit with the field crews to ensure data collection standards are being maintained. Field crews will navigate to the pre-selected AA sites using GPS and the hard-copy maps. Using a field key, the field crews will determine the appropriate General Wetland Vegetation Class. Field crews will assess a circular area approximately the size of the minimum mapping unit. It is important for the crews to do this assessment in a single vegetation community (i.e., not crossing into another vegetation type). In instances where the point selection process is not able to select points with an adequate distance from other vegetation polygons because the vegetation type was in a very small or linear polygon, the hard-copy maps with AA points will include lines that mark the interpreted boundaries between two map classes.

Within the target assessment area, crews will record GPS coordinate location in the field, dominant species, environmental data, and pertinent comments on the LTRM Accuracy Assessment Field Form . The field key will direct the crew to the General Wetland Vegetation Class that best fits the site, and the map class will also be recorded. If the area was not homogeneous (containing more than one General Wetland Vegetation Class), a second General Wetland Vegetation Class can also be listed on the data sheet. Lastly, problems encountered while keying out the AA point will also be recorded.
Throughout the field season, the LTRM Accuracy Assessment Field Forms will be sent to UMESC where data entry will be done by students. The data will be entered into an Access database, developed by UMESC staff. The database will subsequently be reviewed by a second individual for data entry errors. Once the data entry is complete, UMESC staff will complete a spatial join of the AA data with the LCU shapefile layer, and two individuals not involved with the initial mapping process will complete analyses of the map's accuracy. During this process, the class determined in the field is compared to the designation on the map for each point. If map and field determinations are conflicting, then an attempt is made to reconcile the difference. Differences may occur when points fall in transition zones between

map class types or in areas that are too small to map. GPS errors also account for some discrepancies. These kinds of errors, termed false errors, are corrected, reconciling the land cover map with the field determinations.

After false errors have been identified and reconciled, a contingency table is generated (Table 2). The contingency table shows the accuracy of each map class (along with 90% confidence intervals), with the users' accuracy reflecting errors of inclusion (commission errors) and producers' accuracy reflecting errors of exclusion (omission errors) for each map class. The width of each confidence interval is affected by the sample size used to derive the point estimate. The contingency table also shows the frequency of agreement and placement of disagreements among map classes, as well as the overall accuracy of the map. The goal is to meet the standard of 80% accuracy set by the National Park Service (Environmental Systems Research Institute et al. 1994; Lea 2010) across all assessed map classes.

Validation

Project study areas identified for a validation are Pools 13, 26, and Open River South. Note that Pool 13 is targeted for both a thematic accuracy assessment and a validation. Completing both methods on one LCU spatial data set will give a direct comparison between the two methods. If methods prove to be similar in results, the more cost effective option of validation can be used in land cover mapping conducted in future assessments.
Once a pool's LCU spatial data set is finalized, a validation will be performed on the selected pools to determine the accuracy of the map classes. All General Wetland Vegetation Map Classes (Dieck and Robinson 2004) (Table 3) will be assessed using the stratified random sampling scheme described in the Thematic Accuracy Assessment Procedures: Version 2.0 (Lea 2010). UMESC staff will use these guidelines to determine the appropriate number of sites for each map class in each pool.

The number of samples needed for each map class will be determined for each pool, in the same manner as for the accuracy assessment. UMESC will buffer each sampling site 14 meters from the polygon boundary to eliminate the possibility that the observed area is of mixed map class identity due to allowable positional error in the map data. The National Map Accuracy Standard requirement for positional accuracy of 1:24,000 scale products is 12.2 meters (FGDC, 1998). Once the number of sites is determined and the buffer is applied, random validation points (UTM projection, Zone 15 or Zone 16, using NAD83) will be generated for each map class using Hawth's Tools for ArcGIS (Beyer, H.L. 2004), or equivalent tool. A team of two individuals not involved with the initial mapping process will complete the validation of the map's accuracy. This team will use the 'General classification handbook for floodplain vegetation in large river systems' by Dieck and Robinson (2004) to determine the appropriate General Wetland Vegetation Class. The team will assess an area around the validation point approximately the size of the minimum mapping unit. The agreed upon General Wetland Vegetation Class that best fits the area will be recorded in an Access database. If the two individuals cannot agree on the appropriate map class or the area assessed was not homogeneous (containing more than one General Wetland Vegetation Class), a second General Wetland Vegetation Class can be listed in the

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Table 2. Example of an accuracy assessment contingency table. Columns tabulate the producer's accuracy by showing errors of exclusion (omission errors) present in the map. Rows tabulate the users' accuracy by showing errors of inclusion (commission errors) present in the map. The overall accuracy of the map is also reported.

		FIELD SAMPLES - REFERENCE DATA																		COMISSION			
	MAP CODES	SV	RFA	DMP	SMA	SMP	SM	WM	DMS	SMS	WMS	SS	FF	PC	SC	LF	UF	GR	PS	TOTAL	USERS' ACCUR-ACY	90% Confidence Intervals	
																						-	+
MAP DATA - PREDICTION DATA	SV	11						1			1									13	85%	64%	105%
	RFA		13								1									14	93%	78%	108%
	DMP			6																6	100%	92%	108%
	SMA			1	9	1														11	82%	58%	105%
	SMP					10														10	100%	95%	105%
	SM						5													5	100%	90%	110%
	WM							0												0	x	x	x
	DMS								11											11	100%	95%	105%
	SMS	1			1					25	3									30	83%	70%	96%
	WMS				1						28									29	97%	89%	104%
	SS											2	1							3	67%	5%	128%
	FF												3							3	100%	83%	117%
	PC													1						1	100%	50%	150%
	SC														5					5	100%	90%	110%
	LF															2				2	100%	75%	125%
	UF																2			2	100%	75%	125%
	GR																	1		1	100%	50%	150%
	PS																		1	1	100%	50%	150%
OMISSION	Total	12	13	7	11	11	5	1	11	25	33	2	4	1	5	2	2	1	1	147			
	PRODUCERS' ACCURACY	92%	100%	86%	82%	91%	100%	0%	100%	100%	85%	100%	75%	100%	100%	100%	100%	100%	100%	135			
	90% Confidence Interval -	74%	96%	57%	58%	72%	90%	-50%	95%	98%	73%	75%	27%	50%	90%	75%	75%	50%	50%	Total Samples = 147			
	90% Confidence Interval +	109%	104%	115%	105%	110%	110%	50%	105%	102%	97%	125%	123%	150%	110%	125%	125%	150%	150%	Total Correct = 135			

OVERALL ACCURACY = 91.8% KAPPA INDEX = 90.7% KAPPA INDEX LOWER 90% CONFIDENCE LEVEL = 86.4% KAPPA INDEX UPPER 90% CONFIDENCE LEVEL = 95.0%

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Table 3. The General Wetland Vegetation Map Classes assessed for validation with their respective map codes.

Map Class	Map Code
Open Water	OW
Submersed Vegetation	SV
Rooted Floating Aquatics	RFA
Deep Marsh Annual	DMA
Deep Marsh Perennial	DMP
Shallow Marsh Annual	SMA
Shallow Marsh Perennial	SMP
Sedge Meadow	SM
Wet Meadow	WM
Deep Marsh Shrub	DMS
Shallow Marsh Shrub	SMS
Wet Meadow Shrub	WMS
Scrub-Shrub	SS
Wooded Swamp	WS
Floodplain Forest	FF
Populus Community	PC
Salix Community	SC
Lowland Forest	LF
Agriculture	AG
Conifers	CN
Plantation	PN
Upland Forest	UF
Developed	DV
Grassland	GR
Levee	LV
Pasture	PS
Roadside	RD
Mudflat	MUD
Sand Bar	SB
Sand	SD

Access database as a second call. Lastly, any difficulties identifying the appropriate General Wetland Vegetation Class for each validation site will also be recorded in the database.

Once all of the validation sites are assessed, the same two individuals will complete analyses of the map's accuracy. During this process, the map class determined during the initial mapping will be compared to the map class determined by the two individuals who assessed each validation point. Errors in the map will be identified, and a contingency table generated (Table 2). The contingency table shows the accuracy of each map class (along with 90% confidence intervals), with the users' accuracy reflecting errors of inclusion (commission errors) and producers' accuracy reflecting errors of exclusion (omission errors) for each map class. The width of each confidence interval is affected by the sample size used to derive the point estimate. The contingency table also shows the frequency of agreement and placement of disagreements among map classes, as well as the overall accuracy of the map. The goal is to meet the standard of 80% accuracy set by the National Park Service (Environmental Systems Research Institute et al. 1994; Lea 2010) across all assessed map classes.

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Products and Milestones

There are no product deliverables for FY12 (see time schedule below), but analyses will be conducted in FY12. Pool 13 and La Grange Pool accuracy assessment began in summer FY11 with analysis to begin in FY12. Pool 13 validation analysis will begin in FY12. Other work will be in FY12 and FY13 pending funding.

A draft LTRM Completion Report that includes an accuracy assessment contingency table for Pool 13 and La Grange Pool, a validation contingency table for Pools 13 and 26 and Open River Reach south (OR South), plus a comparison of the two methods (thematic accuracy assessment & validation) will be delivered 30 September 2013 pending funding.

Products and Milestones

Tracking number	Products	Staff	Milestones
2012AA1	Pool 13 accuracy assessment analysis	Lubinski, Langrehr, Ruscher	30 June 2012
2012AA2	Pool 13 validation analysis	Lubinski, Langrehr, Ruscher	30 June 2012
2012AA3	La Grange Pool accuracy assessment analysis	Lubinski, Langrehr, Ruscher	30 June 2012
2012AA4	Pool 26 validation analysis	Lubinski, Langrehr, Ruscher	30 June 2013
2012AA5	Open River South validation analysis	Lubinski, Langrehr, Ruscher	30 June 2013
2012AA6	Draft LTRM Completion Report	Lubinski, Langrehr, Ruscher	30 September 2013

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Beyer, H. L. 2004. Hawth's Analysis Tools for ArcGIS. Available at www.spatialecology.com/htools.

Dieck, J. J., and Robinson, L. R., 2004, Techniques and Methods Book 2, Collection of Environmental Data, Section A, Biological Science, Chapter 1, General classification handbook for floodplain vegetation in large river systems: U.S. Geological Survey, Techniques and Methods 2 A–1, 52 p.

Environmental Systems Research Institute, National Center for Geographic Analysis, and The Nature Conservancy (1994). Accuracy assessment procedures: NBS/NPS vegetation mapping program. Final draft. Prepared for: United States Department of the Interior-National Biological Survey and National Park Service. November 1994.

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[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Lea, C. 2010. Thematic Accuracy Assessment Procedures. Version 2.0. National Park Service Vegetation Inventory. National Park Service, Fort Collins, CO.

May, M.S. 2002. Thematic map accuracy assessment of Pool 8, Upper Mississippi River: A pilot study. MSc Thesis, St. Mary's University of Minnesota, Winona, Minnesota.

Thematic accuracy assessment and validation for the Upper Mississippi River System floodplain from 2010/2011 land cover/land use data. LTRMP FY10 Scope of Work www.umesc.usgs.gov/ltrmp/fy11_sow_base_v6.pdf Page 13

LiDAR and Bathymetry[1]

A focus on collecting Light Detection and Ranging (LiDAR) and bathymetry data in 2010 yielded a substantial amount of the data needed to complete systematic databases for the Upper Mississippi River System (UMRS). Final products derived from these data as defined in previous work plans include raw LiDAR digital elevation models (DEM), edited LiDAR DEM, viewable LiDAR products (e.g., hillshades, contours), bathymetry DEMs, and a seamless bathymetry and LiDAR DEM. This scope of work provides a plan for progress in generating LiDAR and bathymetry products in 2012. (Strategic Plan Outcome 1; Output 1.1 & 1.3 and Outcome 4)

The proposed work for 2012 includes only work under Tier 2 (www.umesc.usgs.gov/mapping/resource_mapping_ltrmp_lidar.html). Tier 1 work will not be completed under this SOW due to poor LiDAR data collection conditions in FY11. LiDAR Tier 2 products for Pools 8 and 13 were previous completed, but are considered partial products and will be modified based on new methods. Tier 2 products for Pool 2 will be completed on the lower two-thirds of Pool 2 only, due to the absence of LAS LiDAR data files for Pool 1 and the upper one-third of Pool 2.

Products and Milestones

Tracking number	Products	Staff	Milestone
2012LB1	LiDAR Tier 2: Pools 2-7, 8 (p), 9, 11-12, 13 (p), 20, 22-24, St. Croix. Further process LiDAR data: QA/QC, reclassify data errors, mask water, and smooth contours	Dieck, Rohweder, Nelson, Fox	30 December 2012

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Bathymetry Component

The overall goal of the LTRM's Bathymetry Component is to complete a system-wide GIS coverage of UMRS bathymetry used to quantitatively and qualitatively assess the suitability of essential aquatic habitats. Presently, eight pools (Pools 4, 7, 8, 9, 13, 21, 26, and La Grange Pool) are complete, and these data are served in standard formats on the LTRM's website. Funding from the American Recovery and Reinvestment Act of 2009 allowed for survey data collection for most of the remaining pools in the system. These data have been delivered to UMESC, and will be processed into standard products under separate SOW's as funding becomes available. Under Output 1.1, the LTRM will maintain some level of expertise to provide basic assistance with using the existing bathymetry data, as described below. (Strategic Plan Outcome 1; Output 1.1 & 1.3 and Outcome 4)

Provide on demand technical assistance related to the bathymetric database to the EMP partnership including, but not limited to:

- Deliver data in non-standard formats, such as raw point data in GIS or text files.
- Adjust bathymetry data to selected water surface conditions (presently only available at "flat-pool" conditions)
- Calculate summary statistics (e.g., hypsographic curves and volume) for geographical subsets of the data
- Advise partner agencies on data collection methods and locations that meet LTRM need
- Assist in spatial modeling using the bathymetric data
- Processing of bathymetry point data available upon request as time allows www.umesc.usgs.gov/aquatic/bathymetry.html

Jim Rogala will be the principal investigator.

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Statistical Evaluation

Statistical support for the LTRM provides guidance for statistical analyses conducted within and among components, for contributions to management decisions, for identifying analyses needed by the Program, for developing Program-wide statistical projects, and for reviewing LTRM documents that contain statistical content. The 'Guidance for statistical analyses' purpose is designed to save money for the LTRM, at both UMESC and the field stations, by helping LTRM staff use data and analytical time more efficiently. The statistician is also responsible for ensuring that newly developed statistical methods are evaluated for use by LTRM. This guidance would include assistance for LTRM additional program element projects requiring a minor amount of the statistician's time, but projects needing more assistance would build statistical support into that specific scope of work.

Guidance for management includes assistance with modifications to program design, with standardizing general operating procedures, and with estimating power to detect changes and trends. For example, the LTRM's focus on long term rather than on annual changes has important implications for program design.

The statistical component will help ensure that potentially useful analyses of data from within and across components are identified, that methods for analysis are appropriate and consistent, and that, when possible, multiple analyses work together to achieve larger program objectives regardless of which group (UMESC, field stations, COE, etc.) conducts analyses. The statistician is also responsible for reviewing LTRM documents that contain substantial statistical components for accuracy, and for ensuring that quality of analyses is consistent among products. A primary goal of statistical analyses is to avoid drawing inappropriate conclusions leading to ineffective or even harmful management actions. Within the UMR, there are a variety of confounding factors and conditions that could produce spurious correlations or lead to inappropriate conclusions regarding cause and effect. Appropriate statistical analysis and interpretation is critical to understanding the inferences from LTRM data. This, in turn, is critical in efforts to distinguish between natural variation and human effects and in evaluating the long-term effects of management actions, such as HREPs, water level manipulations, or increases in navigation. (Strategic Plan Outcome 2, Output 2.5 and Outcome 4)

Product Description

2012E1: Trend depiction approaches for LTRM water quality constituents

Estimating trends is a primary goal of the LTRM, but the program does not currently have protocols for depicting trends in indicators, including in indicators of water quality. This effort will survey methods used by other federal long-term monitoring programs in the United States to estimate and depict temporal trends in water quality constituents. The results will provide information on the range of approaches used by other programs and their potential strengths and weaknesses. This product addresses Outcome 1, Output 1.2b in the Strategic and Operational Plan.

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

2012E2: Summer water temperature in the Upper Mississippi River

Water temperature was selected for recording at the outset of the water quality component of the LTRM. Although LTRM depicts water temperature patterns using an on-line graphing tool, quantitative estimates of trends in water temperature are not depicted. A previous unpublished analysis of LTRM data that corrected for time-of-day and date effects estimated that summer water temperature in LTRM key pools in the Upper Mississippi River increased by an average of 0.31°C per year over the period 1993 through 2003 [95% confidence interval: (0.28, 0.35) °C]. This effort will update the unpublished result by incorporating water temperature data through 2010, and to also address associations between water temperature and both air temperature and water discharge. This effort addresses will provide information relevant to Outcome 1 (Output 1.1 and 1.2), and Outcome 2 (Output 2.1).

Products and Milestones

Tracking number	Products	Staff	Milestones
2012E1	Draft completion report: Trend depiction approaches for the LTRM.	Gray	30 September 2012
2012E2	Draft completion report: Summer water temperature in the Upper Mississippi River	Gray, Robertson, Rogala, Houser	30 June 2012
2012E3	Final draft completion report: An assessment of trends in water temperature in La Grange Pool as functions of water discharge and mean air temperature (using LTRM water temperature data) (2011E1)	Gray, Robertson, Rogala, Houser	30 September 2012
Intended for distribution			
Completion report that describes methods of estimating variance components from LTRM water quality data (2008E1; Gray)			
Completion Report: Duckweed and filamentous algal associations with submersed aquatic vegetation in contiguous floodplain lakes of the Upper Mississippi River. Gray and Holland. (2009APE3a)			
Manuscript: Inferring decreases in among- backwater heterogeneity in large rivers using among-backwater variation in limnological variables (2010E1, Gray, Rogala, Houser)			
Manuscript: Among-lake variability in limnological characteristics of backwaters of the Upper Mississippi River (2010E2, Rogala, Gray, , Houser)			

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Data Management

The objective of data management for the LTRM is to provide for data collection, correction, archive, and distribution of a 90 million dollar database that consists of over 2.2 million records located in 195 tables. The 2.2 million data points currently in the system require regular maintenance and upgrading as technologies change. Also, having a publicly accessible database requires a significant level of security. This is accomplished by having the systems Certified and Accredited by a rigorous, formal process by the USGS Security team. (Strategic Plan Outcome 4 and Strategy 1)

Methods

Data management tasks include, but are not limited to:

- Review daily logs to ensure data and system integrity and apply application updates.
- Develop and maintain field notebook applications to electronically capture data and begin the initial phase of Quality Control/Quality Assurance (QA/QC).
- Administer and maintain the Oracle LTRM database.
- Administer and maintain LTRM hardware, software, and supplies to support LTRM program needs.
- Administer, maintain, and update the LTRM public and intranet data browsers to insure access to all LTRM data within USGS security policy.

Product Description

2012M4: Development of indicator figures

In February 2011 additional analyses for indicators was requested by the LTRM's Analysis Team ad hoc Indicator Group. Following are additional graphs that will be generated:

- Catch per unit effort of recreationally harvested native fishes (19 species; see page 75; Johnson and Hagerty 2008)
- Forage Fish (Incorporate all fishes <80 mm in addition to all gizzard, threadfin shad, and emerald shiners)
- Bluegill Indicator (backwater and main channel border bluegill CPUE)
- Non-Native Species Indicator (percent total biomass of the pool)
- Commercial Fish Indicators (Modify current indicator to include non-native species)
- River Hydrology Discharge Indicator (seasonal discharge)

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Products and Milestones

Tracking number	Products	Staff	Milestones
2012M1	Update vegetation, fisheries, and water quality component field data entry and correction applications.	Schlifer	30 May 2012
2012M2	Load 2011 component sampling data into Oracle tables and make data available on Level 2 browsers for field stations to QA/QC.	Schlifer	30 June 2012
2012M3	Integration of SAS and SQL QA/QC code into one cohesive QA/QC program for aquatic vegetation	Schlifer, Yin, Sauer	30 November 2011
2012M4	Development of indicator figures	Schlifer, Ickes, Rogala	30 September 2012

Literature Cited

Johnson, B. L., and K. H. Hagerty, editors. 2008. Status and trends of selected resources of the Upper Mississippi River System. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, December 2008. Technical Report LTRMP 2008-T002. 102 pp + Appendixes A–B.

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Landscape Pattern Research and Application[1]

The goal of landscape pattern research on the Upper Mississippi River System is to develop concepts, maps and indicators that provide both regional-level decision makers and local-level resource managers with information needed to effectively manage the UMRS.

As described in the LTRM's Landscape Pattern Research Framework (http://www.umesc.usgs.gov/ltrmp/ateam/landscape_patterns_research_framework_final_june2011.pdf), landscape pattern research on the UMRS focuses on linking decisions made at regional scales with restoration actions carried out at local scales. While regional program managers and decision makers are concerned with improving the overall ecological condition of the entire UMRS, local resource managers work to address site specific habitat and resource limitations. Landscape ecology, which focuses on the linkages between patterns visible at broad scales and ecological patterns and processes that occur at local scales, can help to integrate these two scale-dependent management activities. (Strategic Plan Outcome 2, Output 2.2 and Outcome 4)

Objectives

1) To develop indicators of landscape pattern for the purpose of identifying areas for ecosystem restoration at broad scales and to track systemic status and trends.

2) To connect broad-scale landscape pattern indicators with local-scale ecological patterns and processes critical to HREP project development.

Product Descriptions

2012L1 and 2012L2: Landscape patterns: lessons learned and future opportunities

Funding to support application of landscape ecology principals to the UMRS was provided from 2008-2010, leading to several new manuscripts and additional unpublished analyses. We will summarize the lessons learned so far, the challenges in applying landscape ecology to the UMRS and highlight opportunities for others to contribute to future studies in the form of a summary letter to the COE and a published LTRM fact sheet. These documents will help EMP and LTRM program managers, local resource managers, and other researchers: 1) identify areas for ecosystem restoration at broad scales, 2) track systemic status and trends of landscape patterns, and 3) connect broad-scale landscape patterns with local-scale ecological patterns and processes critical to HREP project development.

2012L3: Beta-version Graphical Browser with landscape pattern indicators

Over the past three years we have developed a number of indicators of landscape pattern. We will develop a Beta-version of an online database browser so that EMP and LTRM program managers, local resource managers, and other researchers will have access to quantitative measures that can help them: 1) identify areas for ecosystem restoration at broad scales, 2) track systemic status and

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trends of landscape patterns, and 3) connect broad-scale landscape patterns with local-scale ecological patterns and processes critical to HREP project development.

2012L4, 2012L5, 2012L6:

Over the past two years we have provided assistance and information to local US Army Corps of Engineers foresters (Randal Urich et al.) to guide forest restoration at a site just south of La Crosse, WI. In cooperation with personnel at the University of Wisconsin-La Crosse, studies were conducted from winter 2010 to summer 2011 on the role(s) herbivory by white-tailed deer and flooding might play in determining the success of restoration actions. This work will also be used to connect landscape patterns of flood inundation with local factors (e.g., plant competition, herbivory and nutrient cycling) to help managers understand where they may encounter various obstacles to restoration success. Two manuscripts are currently being developed from this work and will be available by the end of FY 2012. One manuscript documents regional plant food selection and foraging behavior of white-tailed deer in relation to geomorphic complexity (i.e., islands vs mainland sites) and tree community composition (2012L4). The other manuscript reports how herbivory and flooding interact to alter plant growth, mortality, community composition and diversity (2012L5). This summer, we will begin sampling soil nutrient concentrations and cycling rates to determine how nutrients may influence and be influenced by the development of different plant community types (2012L6).

Products and Milestones

Tracking number	Products	Staff	Milestones
2012L1	Summary letter on work completed 2010-2012	De Jager	30 September 2012
2012L2	Draft fact sheet: Landscape Ecology on the Upper Mississippi River: lessons learned, challenges, opportunities	De Jager	30 September 2012
2012L3	Develop a beta-version Graphical Browser with landscape pattern indicators	De Jager, Rohweder, Schlifer	30 September 2012
2012L4	Draft manuscript: Regional food selection and functional response of white-tailed deer in floodplain forest restorations of the Upper Mississippi River valley, USA	Ben Cogger& Meredith Thomsen (UWL), De Jager	30 September 2012
2012L5	Draft manuscript: White-tailed deer herbivory increases flood-induced tree mortality in an UMR floodplain forest	Ben Cogger& Meredith Thomsen (UWL), De Jager	30 September 2012
2012L6	Develop database: reciprocal effects of flood inundation on plant community type and nutrient cycling in an UMR floodplain forest	Eric Strauss (UWL), Yin, De Jager	30 September 2012

Intended for distribution
Manuscript: De Jager, N.R. Thomsen, M.T., Yin, Y., and J.C. Nelson. Threshold effects of flood duration on the vegetation and soils of the Upper Mississippi River floodplain, USA (2010OUT2b1)
Manuscript: Houser, J.N. and De Jager, N.R. In press. Spatial clusters of high and low concentration of total nitrogen (TN), total phosphorous (TP), and TN:TP in the Upper Mississippi River, USA (2010OUT2b2)
Manuscript: De Jager, N.R, Rohweder, J.J., and J.C. Nelson. Past and Predicted Future Changes in Land-Cover of the Upper Mississippi River Floodplain, USA. (DeJager, 2009APE4a&b)

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Development of vital rates to assess the relative health of UMRS mussel resources[1]

Over the past 50 years, about 20 mussel species have been lost or greatly diminished from the Upper Mississippi River System (UMRS) basin and overall abundance of mussels has substantially declined in many portions of the river. Because of the long life spans of native mussels (30-100 years) and the slow response times for aquatic ecosystems to respond to human-induced alterations, sensitive indicators of mussel population responses to river conditions and management need to be developed. Traditional measures such as species richness and abundance of adults may not be sensitive enough to detect subtle environmental changes. Rather, indicators such as population vital rates (e.g., mortality, recruitment, growth) may be more appropriate. The lack of information on these functional metrics makes it difficult for resource managers to evaluate the effects of management actions such as habitat restoration projects on this imperiled faunal group.

We propose to develop and measure two vital rates (mortality and recruitment) in a well-sampled mussel assemblage in the UMRS. In the recent pool wide surveys (Pools 5, 6, and 18), mortality of several species was estimated from age-frequency curves. This indirect method is restricted to species with high abundance, and is subject to assumptions that limit interpretation; a more direct method of assessing mortality would be useful. Passively integrated transponder tags (PIT tags) could be used to follow the fate of individual mussels thereby providing mortality estimates on both common and less common species. PIT tag life is infinite, so this method might allow long-term monitoring of mussels. In the pool wide surveys, the proportion of juvenile mussels (< 5 yrs old) was fairly high (~40-60%). However, this rate was estimated at only one point in time. For this vital rate to be developed into a sensitive metric of the response of mussels to an anthropogenic stress, the variability of this rate over time needs to be estimated. The proposed research supports question 4b (*How can we assess the health of the mussel assemblage?*) of the "Scientific Framework for Research on Unionid Mussels in the UMRS" (http://www.umesc.usgs.gov/ltrmp/ateam/unionid_research_framework_final_sep2010.pdf). The overarching question we are asking is "What is the temporal variation in population vital rates in mussel assemblages in the UMR". This research is broken down into a series of objectives in each of two research phases. Across both phases, we will utilize the Minnesota Department of Natural Resources' (MN DNR) existing long term monitoring program of mussel beds. MN DNR currently has 4 years of quantitative data (e.g., density, age, species composition) at a mussel bed in West Newton Chute, Pool 5 and they have plans to sample this bed annually into the foreseeable future. The objectives and associated tasks are outlined below.

Phase 1

- Objective 1 is to develop the methodology to use PIT tags in a deep water field setting to determine if recapture rates are sufficient for this to be a viable technique.
    - Task 1.1: PIT tag ~200 individuals of 2 abundant species and ~100 individuals of 1-2 less common species and develop the technology to re-locate tagged mussels the following year.
- Objective 2 is to estimate the mortality of common species using age-frequency curves.

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

    - Task 1.2: Use MN DNR's existing quantitative data (2008-2011) to estimate mortality of common species using age-frequency curves. For this analysis we would use traditional age-frequency curves as was done in Newton et al. (2011).
- Objective 3 is to estimate inter-annual variability in recruitment of mussels.
    - Tasks 1.3: (1) Use MN DNR's existing quantitative data (2008-2011) to estimate recruitment rate of mussels; and (2) conduct preliminary analyses to explore potential relations between the rate of recruitment and hydrologic conditions (e.g., discharge events). Recruitment would be estimated as in Newton et al. (2011). Preliminary analyses of the relation between recruitment cohorts and hydrologic conditions would follow Payne and Miller (2000).

Phase 2

- Objective 1 is to estimate the mortality rate of common and less common mussel species over time.
    - Tasks 2.1: (1) Re-locate mussels tagged in year 1; (2) estimate the mortality rate of abundant and less common mussels in years 2 and 3; and (3) tag additional less common species as available. Mortality will be estimated using mark-recapture methods (e.g., as in Villella et al. 2004) and using models within the software program MARK (White and Burnham 1999) or similar software.
- Objective 2 is to estimate the recruitment rate of mussels over time.
    - Tasks 2.2: (1) Obtain quantitative data on mussels to estimate the rate of recruitment of mussels in years 2 and 3; and (2) follow discrete cohorts with respect to hydrologic events (e.g., discharge patterns). These tasks will provide 7 years of data on mussel recruitment—a phenomenal data set (2008-2011 from MN DNR's existing data and 2012-2014 resulting from this proposal). Recruitment will be analyzed in several ways including the descriptive methods in Newton et al. (2011) and Payne and Miller (2000). We will also evaluate whether variability in recruitment of abundant species over time can be adequately assessed from catch-curve analyses. Studentized residuals of the catch curves will be used to assess relative year class strength among years (Maceina 1997; Paukert and Willis 2004). Relations of residuals (relative year class strength) and hydrologic variables will be explored with simple correlations or multiple regression as appropriate.

We will leverage these dollars with in-kind funds from USGS. Over this 3 year period, we expect to leverage salaries, training, and software. Some of the leveraged salaries will go towards obtaining hydroacoustic data at this mussel bed. We anticipate using an acoustic Doppler current profiler (ADCP) to obtain detailed hydroacoustic data that could be used to look for patterns in mortality and recruitment across different hydrophysical environments. These data could be used to help better design habitat rehabilitation and enhancement projects to the benefit of mussel assemblages. (Strategic Plan Outcome 2, Output 2.2 and Outcome 4)

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Products and Milestones

Tracking number	Products	Staff	Milestones
2012U1	Summary letter describing results to date from Phase 1, Objective 3	Ries, Newton, Zigler	30 November 2012

Funding level does not include work under Phase 1, Objectives 1 & 2 and Phase 2, Objectives 1 & 2
This work includes an in-kind contribution by USGS-Upper Midwest Environmental Sciences Center ($11,600)

Literature Cited

Maceina MJ. 1997. Simple application of using residuals from catch-curve regressions to assess year-class strength in fish. Fisheries Research 32:115-121.

Newton TJ, SJ Zigler, JT Rogala, BR Gray, and M Davis. 2011. Population assessment and potential functional roles of native mussels in the Upper Mississippi River. Aquatic Conservation: Marine and Freshwater Ecosystems 21:122-131.

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Payne BS, and AC Miller. 2000. Recruitment of *Fusconaia ebena* (Bivalvia: Unionidae) in relation to discharge of the lower Ohio River. American Midland Naturalist 144:328–341.

Villella RF, DR Smith, and DP Lemarie. 2004. Estimating survival and recruitment in a freshwater mussel population using mark-recapture techniques. American Midland Naturalist 151:114–133.

White GC, and KP Burnham. 1999. Program MARK: survival estimation from populations of marked animals. Bird Study 46 Supplement:120-138.

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Continuing existing work on survival of mussels using PIT tagging

In 2011, the UMESC native mussel team initiated Phase 1 of a study derived from the Mussel Research Framework that is designed to estimate vital rates (i.e., survival, growth, and recruitment) of native mussels in the UMR. There are no good estimates of background mortality for mussels in the UMR, which hampers accurate assessment of EMP and HREP projects. In 2011, we completed analysis of the effects of the Pool 6 drawdown on survival and movement of mussels and completed the first phase of a mussel community assessment tool. Collectively, these projects are helping us develop the tools and techniques needed to evaluate the relative health of mussel communities in the UMR.

In 2012, we will collaborate with the MN DNR and measure vital rates at a mussel bed in Pool 5 where the DNR does annual sampling (this reduces our costs because the divers will already be on site). Survival estimates will be based on regressions of number at age (similar to previous years). To estimate survival directly in the field for comparison to regression methods, we plan to mark mussels with PIT tags (passive integrated transponder tags) in 2012 and recover them in 2013. We have existing funds, which we will combine with in-kind contributions of time from UMESC biologists, to cover the labor and diver costs to collect and tag mussels in 2012 and to recover mussels in 2013. But, we lack funds to purchase the PIT tags. We request $5,000 to purchase 800 tags, which would allow us to tag two abundant and two less common mussel species. This will allow us to complete the 1st task of Phase 1 and to begin work on Phase 2 (looking at associations between vital rates and hydrophysical parameters). This research will provide field-based survival estimates (available in fall 2013) for comparison to those derived from age-based survival curves. This information will be provided in a letter report by the end of 2013.

Products and Milestones

Tracking number	Products	Staff	Milestones
2012U1	Letter report with field-based survival estimates	Newton	31 December 2012

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

LTRM Staff Contributions to an External Research Framework on Lateral Connectivity for the Upper Mississippi River System

Dr. Ken Lubinski, USGS, UMESC, is leading a multi-institutional effort to develop a research framework to quantify Upper Mississippi River System floodplain connectivity relationships. Jeff Houser and Jim Rogala, USGS, LTRM, will contribute about 1% of their time to the project, and Katherine McCain, Corps, St. Louis, will provide additional support.

The research framework will be a science-based document addressing lateral connectivity issues. The project will take a broad approach and seek input from a wide spectrum of scientists, managers, agencies, and users of the river and floodplain, regarding issues that require scientific input. Steps in the process will include a literature review, developing a conceptual model, a questionnaire seeking input on needed information from river managers and stakeholders, a workshop to review information needs and identify studies to address those needs, developing recommendations for priority research, and a review of existing science capacity to support the needed science. The LTRM staff will provide insight gained from river monitoring data and previous LTRM analyses and research regarding how river processes can be affected by connectivity. The resulting research framework will consider science that could be used to address biological, chemical, physical, and social questions. The product of this effort should provide ideas for river science that can be addressed by a variety of agencies or institutions, singly or in partnership.

In the LTRM Strategic Plan, "Connectivity of the river to its floodplain" was identified as one of 5 priority research areas for developing a 5-year focused research plan. Upon completion of the research framework by Dr. Lubinski's team, LTRM will consider whether this product can act as the 5-year plan called for in the Strategic Plan, either wholly or by using selected parts of the framework to create a separate document to meet the specific needs of an LTRM-focused plan. This work addresses Outcome 2, Output 2.2 of the LTRM's Strategic Plan.

Products and Milestones

Tracking number	Products	Staff	Milestones
2012CRF1	Time Contribution to an External Research Framework on Lateral Connectivity for the Upper Mississippi River System	Houser, Rogala, McCain	30 September 2012

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Development of Initial Strategies for LTRM/HREP Integration

The LTRM's Strategic Plan calls for better integration of LTRM and HREP's (Outcome 3), and a strategic planning effort for HREP is due to begin in 2012. To support those efforts, we will develop and revise a set of concepts for specific steps to help integrate LTRM and HREP. These concepts include:

1. Developing standardized HREP project sampling protocols;
2. Developing computer tools for data capture and database development within HREP;
3. Develop web-based applications for serving and reporting HREP project monitoring data;
4. Create tools to help design and deploy project monitoring activities;
5. Explore use of meta-analytic approaches for determining the impacts of multiple HREP projects.

These concepts would use existing LTRM technology and information to provide HREP Project Development Teams and river managers with tools that can make HREP planning easier and make HREP monitoring data more comparable among projects. Initial efforts would likely focus on fish responses. These concepts will provide a basis for further discussion, to be vetted with the partnership. In 2012, we will submit a proposal that outlines approaches to these concepts, then scope out next steps as they relate to other planning activities and to LTRM's Strategic Plan Outcome 3.

The LTRM's Management Team will work with the UMRCC, the A-Team, and the HREP component to discuss next steps regarding how these concepts can be integrated and applied within EMP by partners, collaborators, contractors, and academic institutions. Initially, we will focus on concepts 1-3 above.

Currently, HREP projects for Huron Lake and for Pool 12 Overwintering are attempting to use LTRM data and protocols as part of project development and evaluation. We will review work on these projects to help determine how to move forward with broader scale applications. We will also attempt to identify other HREP projects where these concepts can be piloted in on-the-ground field applications. The outcomes of these discussions are expected to be incorporated into the HREP strategic planning process, the FY13 LTRM's Scope of Work, and HREP projects, when appropriate.

Product Descriptions

2012H3: Description due from Marvin

Products and Milestones

Tracking number	Products	Staff	Milestones
2012LH1	Proposal outlining concepts for integration of LTRM and HREP	Ickes	30 December 2011
2012LH2	Initiate discussions regarding next steps for instituting concepts. Incorporate outcomes into HREP strategic planning, LTRM FY13 Scope of Work, and HREP's, as appropriate.	Johnson, Hubbell	30 September 2012
2012H3	initiating monitoring at an HREP	Hubbell, Johnson	30 Sept 12

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Quarterly Activities

To enhance communication with the UMRR–EMP Partnership, LTRM staff at USGS-UMESC and the six state-run field stations will track activities not explicitly listed in this current scope of work. These quarterly activity lists will document activities and accomplishments by Program partners that are not tracked in the milestone table. Activities will include such items as presentations, outreach, technical assistance, data retrieval, and consultation for LTRM Partners including state and federal agencies, NGOs, and academia. These activities demonstrate the value of LTRM data and expert scientific knowledge to clients and customers, and help to identify potential new collaborations that will benefit EMP and river managers. Activity lists will be placed on the web under the LTRM ATeam Corner page (http://www.umesc.usgs.gov/ltrmp/ateam.html). This effort addresses a need for increased communication and dissemination of information relevant to Outcome 4 (Output 4.1) of the Strategic Plan.

Products and Milestones

Tracking number	Products	Staff	Milestone
2012QR1	Submittal of quarterly activities	All LTRM staff	30 January 2012
2012QR2	Submittal of quarterly activities	All LTRM staff	13 April 2012
2012QR3	Submittal of quarterly activities	All LTRM staff	13 July 2012
2012QR4	Submittal of quarterly activities	All LTRM staff	12 October 2012

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

LTRM Fact Sheets

Product Descriptions

2012FS1: Fact Sheet on LTRM Data Flow

To communicate with LTRM Partners and others on program accomplishments, LTRM staff at USGS-UMESC and the field stations will develop a fact sheet highlighting the flow of data to information to knowledge. This will be the 3rd fact sheet in a series highlighting LTRM accomplishments. This effort addresses information relevant to Outcome 4 (Output 1.1) of the Strategic and Operational Plan.

2012FS3: Upper Mississippi River Restoration–Environmental Management Program Long Term Resource Monitoring Historical Fact Sheet

Because of the success of the LTRM Component over our 25 year history, the LTRM Component has become an internationally recognized leader in monitoring of large river systems. We are often viewed as a model program that other agencies would like to emulate, thus we are often asked to tell our story to others. Information about the LTRM Component, our structure, and our accomplishments exists in a number of large publications (Reports to Congress, Status and Trend Report, etc.), and has been conveyed through slide shows by many LTRM staff members to other agencies and professionals. However, no concise narrative of our story has been produced in a form that is easy to disseminate. Such a publication would provide a quick and easy way to inform others of the LTRM story, purpose, and accomplishments, including how it functions as part of the overall UMRR-EMP. We expect this USGS Fact Sheet publication to include the historical perspective on the need for LTRM, our experiences in developing the program, our accomplishments and advancements, administrative structure and forums, partnership and mechanisms for collaboration, development of the strategic plan, leadership as a model program for other agencies, infrastructure and resources available for cooperative efforts, and future directions. This effort will help meet the goals of Strategic Plan Output 4.1 and provide better communication for the LTRM Component.

Products and Milestones

Tracking number	Products	Staff	Milestone
2012FS1	Draft Fact Sheet: Taking the Pulse of a River System #3	LTRM staff as needed	29 June 2012
2012FS2	Final Draft Fact Sheet: Taking the Pulse of a River System #3	LTRM staff as needed	28 September 2012
2012FS3	Draft Fact Sheet on LTRM history, accomplishments, and future direction	LTRM staff as needed	28 September 2012

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

A-Team and EMPCC Participation

USGS-UMESC and Field Station staff are often called upon to participate at quarterly A-Team (http://www.umesc.usgs.gov/ltrmp/ateam.html) and EMP-CC (www.umrba.org/meetings.htm) meetings. The field station team leaders, component specialists, and UMESC LTRM management staff are expected to participate in the A-Team meetings, if possible. Additional staff may participate as appropriate. Participation at EMP-CC meetings will be by request only. This participation could include sharing of scientific knowledge and/or presentations on current projects. Any participation by LTRM staff at A-Team and/or EMP-CC meetings will be listed in the quarterly activity products. (Strategic Plan Outcome 4).

AFS Symposia

TITLE: Upper Mississippi River Restoration: Combining Habitat Rehabilitation, Monitoring, and Research to Enhance Fish Communities.

ORGANIZERS:

David Potter, U.S. Army Corps of Engineers, St. Paul District;
david.f.potter@usace.army.mil

Barry Johnson, U.S. Geological Survey, Upper Midwest Environmental Sciences Center;
bljohnson@usgs.gov

DESCRIPTION:

Congress authorized the Upper Mississippi River Restoration - Environmental Management Program (UMRR-EMP) in 1986 to help address ecological needs on the Upper Mississippi River System. The Corps of Engineers administers the program, which emphasizes habitat rehabilitation with long-term monitoring and research. The habitat rehabilitation component includes techniques such as dredging backwater areas and channels, constructing dikes, creating and stabilizing islands, modifying flow into channels and backwaters, and controlling water levels to address habitat needs. The long-term monitoring component addresses status and trends of selected resources, conducts research on river processes and functions, develops products to help make resource management decisions, and maintains river information databases. The Program is implemented through a partnership including the U.S. Army Corps of Engineers; U.S. Fish and Wildlife Service; U.S. Geological Survey; U.S. Environmental Protection Agency; U.S. Department of Agriculture; the states of Illinois, Iowa, Minnesota, Missouri, and Wisconsin; and various non-governmental organizations, business interests, and private citizens.

UMRR-EMP was the first program in the nation to combine ecosystem restoration with scientific monitoring and research efforts on a large river system. The Program has completed 54 habitat projects benefitting approximately 100,000 acres of aquatic and floodplain habitat and contributed significantly to our scientific understanding of this complex system through monitoring and research. UMRR-EMP has served as a model for other river restoration and monitoring programs, both nationally and internationally.

The objective of this symposium is to address two main questions: (1) what have we learned, and (2) how have we affected the system? Presentations will address program history and organization, development of desired future conditions, insights gained from monitoring, restoration designs and planning tools, ecological and social benefits realized, case studies of rehabilitation projects, and application of adaptive management.

List of Potential Topics:

1) Historical degradation of the Upper Mississippi River
2) History/Overview of UMRR–EMP
3) Habitat Needs and Vision for Future
4) HREP
    a. Engineering tools/considerations for fish
        i. Windfetch modeling
        ii. 2-D Hydraulic Modeling
        iii. The U of IA and U of Il modeling work: combining hydrodynamics and ecology to predict management effects
        iv. HREP Design Manual
    b. Biological Response of Selected Projects
        i. Pool 4 – Finger Lakes
        ii. Pool 5A – Polander Lake
        iii. Pool-wide drawdowns (could be a few presentations on this: plant response, mussel issues, changes in river hydraulics)
            1. Vegetation response
            2. Mussel response
        iv. Pool 8 islands
        v. Pool 11/12 – fisheries response (CPUE) / telemetry
        vi. Spring Lakes
        vii. Side channel restoration

5) LTRM
    a. Fish/mussel/invert Analyses
        i. Analysis of fish communities
        ii. Asian carp (XX, Illinois NHS)
        iii. New Madrid Floodway (Quinton Phelps, Missouri DC)
    b. Landscape analysis of changes in vegetation distribution in pool 8 vs pool 13 over time
    c. Asian carp effects on other fishes (XX, UMESC or FS's)

6) Integrating LTRM and HREP using an adaptive management approach
7) Socio-economic benefits - What is the socio-economic value of EMP at the local and regional level? (Panel Discussion)
    a. MVP- Economist or Recreation Planner
    b. Stoddard Island
    c. Duck Hunters
    d. Wildlife
    e. Marina
    f. Bait-shop/outfitter
    g. Restaurant
    h. Contractor
    i. Politician
8) What have we learned and how have we affected the system? (Panel Discussion??)
9) Future direction of the program

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Equipment Refreshment 2012 Allotment 1[1]

LTRM field equipment (boats, motors, sampling equipment, etc) need to be well maintained and replaced when necessary to maintain a safe and functional work environment. (Strategy 2)

Field Station	Equipment
Bellevue Field Station	Flowmeter
Bellevue Field Station	Outboard motor (Net Boat; 115hp)
Illinois River Biological Station	WQ data logger
Illinois River Biological Station	Ruggedized laptop (WQ)
Illinois River Biological Station	Hydrolab minisonde
Illinois River Biological Station	Boat Trailer for net boat
Illinois River Biological Station	Electrofishing Power Control Box
Illinois River Biological Station	Ruggedized laptop (Fish)
La Crosse Field Station	Additional money airboat trailer
La Crosse Field Station	Ruggedized laptop
NGRREC	Outboard motor (Net Boat; 115hp)
NGRREC	Ruggedized laptop (Fish)
NGRREC	Ruggedized laptop (WQ)
NGRREC	Turbidimeter
NGRREC	GPS/depth meter (Fish)
NGRREC	Fitted Canopy for WQ Boat
Open Rivers and Wetlands Field Station	Turbidity meter
Open Rivers and Wetlands Field Station	Generator
Open Rivers and Wetlands Field Station	Electronic fish scale

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Equipment Refreshment 2012 Allotment 2

LTRM field equipment (boats, motors, sampling equipment, etc) need to be well maintained and replaced when necessary to maintain a safe and functional work environment. (Strategy 2).

Field Station	Equipment
Bellevue Field Station	Electronic scale
Bellevue Field Station	Velocity meter
Bellevue Field Station	GPS
Bellevue Field Station	Ruggedized laptop (Veg)
Bellevue Field Station	Nonportable vacuum/pressure station (lab)
Illinois River Biological Station	Turbidimeter
Illinois River Biological Station	Velocity meter
La Crosse Field Station	130 HP Outboard (ES)
La Crosse Field Station	Complete ES Outfitting
La Crosse Field Station	115 HP Outboard (Net)
La Crosse Field Station	GPS/Depth (2)
La Crosse Field Station	Laptop
La Crosse Field Station	Refrigerator
La Crosse Field Station	Flow-Mate velocity meter
Lake City Field Station	Net boat trailer
NGRREC	Temp/Cond/DO meter
NGRREC	GPS/depth meter (Fish)
NGRREC	GPS/depth meter (WQ)
Open Rivers and Wetlands Field Station	Hydrolab Minisonde

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

On-line Tracking Form for Equipment Refreshment

Outcome 1, Enhanced knowledge about system status and trends (Output 1.1: Status and trends information based on long-term data sets for aquatic vegetation, water quality, fisheries, and land use/land cover) is the top priority of the LTRM Partnership. To be able to accomplish this outcome LTRM facilities and equipment (boats, motors, sampling equipment, etc) need to be well maintained and replaced when necessary to maintain a safe and functional work environment. (Strategic Plan Strategy 2)

Documentation and tracking of LTRM field and laboratory equipment, and computer servers is currently tracked via state and federal property inventories at the field stations and USGS-UMESC; respectively. To assist staff in documentation and tracking, we will develop an on-line tracking form. The tracking document will include items such as model, make, and date purchased.

Products and Milestones

Tracking number	Products	Staff	Milestone
2012ER1	Property inventory and tracking	Sauer, Mulholland, Yuan, Popp, Langrehr, Bartels, Giblin, Bierman, Chick, Hrabik, Sass	On-going
2012ER2	Beta-version: Development of an Intranet-based field equipment life cycle tracking tool	Schlifer, Sauer, Popp, Langrehr, Bartels, Giblin, Bierman, Chick, Hrabik, Sass, Caucutt	30 September 2012

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Maintenance of the Water Quality Laboratory Information Management System: Part I[1]

Since 1988, the congressionally mandated Environmental Management Program on the Upper Mississippi River System has tracked the ecological health of this historic and critical water resource. Limnological monitoring within the UMRR–EMP LTRM results in about 6,000 electronic data sheets and 36,000 water samples collected by six state-operated field stations each year that are sent to the LTRM water quality laboratory at the USGS Upper Midwest Environmental Sciences Center (UMESC) in La Crosse, Wisconsin, for processing and analysis (totaling 60,000 individual chemical parameters). Advanced automation makes it possible for just two full-time employees (and part-time staff) to process this large volume of samples and data. Dr. David Soballe designed the Laboratory Information Management System (LIMS) at UMESC, which uses bar codes to connect electronic data sheets (sent over the Internet), water samples (sent by overnight courier), and lab test results (captured electronically from analytical instruments), then create the final data file. The LIMS system also generates and sends email messages to the six field stations. These messages automatically acknowledge receipt of samples and data, report problems, give instructions for further action when needed, and offer routine reminders.

The LIMS is critical to the effective operation of the LTRM's water quality component. This effectiveness is based on many complex and sequential operations, including transfer of data from computer systems at the field stations to computers at UMESC, ability to interface electronically with analytical equipment at the water quality lab, capacity to integrate data from multiple sources and multiple software programs, ability for automatic email communication with field stations through their state-administered email provider, seamless operation of code for data quality checks, and the ability to connect to the UMESC servers. Regular updates and modifications are needed to keep the LIMS system running smoothly, especially when hardware, software, and operating systems are modified or upgraded at UMESC or at field stations. In addition, updates to the LIMS system generally include improvements to increase its effectiveness and capability. Dr. Soballe will work with LTRM water quality laboratory staff and data manager to update and improve the LIMS system. His work with the LTRM data manager provides training in operation and troubleshooting for the LIMS that allows the data manager to perform general repair and maintenance on the system with minimal input from Dr. Soballe.

This work will give us continuing functionality of critical WQ component infrastructure, improved operations and continued high quality of data files at the UMESC water quality lab through maintenance and enhancement of computer code for the LTRM Laboratory Information Management System. (Strategic Plan Outcome 1; Output 1.1 and Strategy 2)

Products and Milestones

Tracking number	Products	Staff	Milestone
2012LAB1	Maintenance of computer code for the LTRM Laboratory Information Management System	Soballe, Yuan, Schlifer, Kreiling, Houser, Rogala	30 September 2012

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

LTRM Team Meeting[1]

To foster communication between USACE, USGS-UMESC and state field station staff, a joint meeting of all staff will be held in FY2012. The primary objective of the meeting is what can we do to keep the Program strong. Potential topics will include Program management processes, scientific protocols, Program accomplishments, and future science direction.

This effort will require participation by all LTRM staff at USACE, USGS-UMESC, and the field stations. This may include presentations on select science projects. Any work on development of these presentations will be tracked in quarterly activities. (Strategic Plan Outcome 3, Outcome 4, and Strategy 2)

The meeting will be held at USGS, Upper Midwest Environmental Sciences Center in La Crosse, Wisconsin.

Products and Milestones

Tracking number	Products	Staff	Milestone
2012FM1	Meeting date coordination	All LTRM Staff	7 October 2011
2012FM2	Agenda development	All LTRM Staff	30 November 2011
2012FM3	Meeting logistics	Johnson, Sauer	On-Going
2012FM4	Meeting participation	All LTRM Staff	15-17 February 2011

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

USACOE Technical Support

INTRODUCTION

The Upper Mississippi River Restoration - Environmental Management Program (UMRR-EMP) combines ecosystem restoration with monitoring and scientific research that is critical to defining, developing, measuring, and meeting ecosystem objectives for the Upper Mississippi River System (UMRS). The UMRR-EMP has 2 major components; Habitat Rehabilitation and Enhancement Projects (UMRR-EMP-HREP or HREP) and Long Term Resources Monitoring (UMRR-EMP-LTRM or LTRM). The management experience gained through HREP activities combined with the scientific knowledge and technical capabilities developed through LTRM activities provide a solid foundation upon which to further develop, evaluate, and track progress towards the restoration objectives of the UMRS ecosystem.
The LTRM component of the UMRR-EMP combines monitoring, applied research, and modeling with data management and reporting in an effort to provide a solid scientific foundation upon which to base management actions. Data collection and analysis of selected biological and physical attributes and reporting on the status and trends of these attributes for the UMRS is the primary activity of the LTRM. LTRM is implemented by the USGS's Upper Midwest Environmental Sciences Center (UMESC), in cooperation with the 5 UMRS states. The Corps of Engineers provides guidance and has overall Program responsibility. The broad goals of the LTRM are to:

1. Develop a better understanding of the ecology of the UMRS and its resource problems;
2. Monitor resource change;
3. Develop alternatives to better manage the UMRS; and
4. Provide for the proper management long term resource monitoring program information.

The data, information, and understanding of the ecology of the UMRS are gained by system monitoring, research, and also by project monitoring. All of these together, within an adaptive management framework, support successful ecological restoration under UMRR-EMP.
This paper describes the roles of the district LTRM Technical Representatives, which are supported by regional UMRR-EMP-LTRM funds to help facilitate the two directional communications between each home district and the Regional Program. These individuals shall serve as a point of contact with each district for LTRM data and information, and the use of LTRM data in the identification, formulation, and evaluation of HREPs. Funding for the LTRM Technical Representatives has remained stable for the last 5-7 years; with $15,000 for labor and $1,500 for travel allocated annually to each of the 3 Corps Districts. As the UMRR-EMP evolves, so will the roles and responsibilities of these representatives.

This SOW captures an anticipated level of effort to accomplish the tasks herein, which is reflected in the funding allocated. The identified level of effort in this SOW assumes that the UMRR-EMP annual appropriation is sufficient to fund LTRM Base Monitoring in full. It is anticipated that the tasks in this SOW would represent approximately 12.5% of each Representative's time or approximately 260 hours in fiscal year 2012.

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

[NOTE: In years when the annual appropriation is less than the amount needed to fully fund Base Monitoring, the amount available for the Corps' LTRM Technical Representatives will be reduced proportionately and the SOW will be adjusted accordingly.]

MAJOR DUTIES

1. Technical Support to Regional UMRR-EMP-LTRM Manager (high priority)

Estimated Level of Effort (~40 hours)
For all Document Review – Each document review should be coordinated throughout home district as appropriate, all comments received should be consolidated, and transmitted to the UMRR-EMP-LTRM Manager (copy furnish the other 2 district LTRM Representatives). A minimum of 2 weeks of review and comment preparation time should be provided, if possible.
a. Annual SOW (translation of the 2010-2014 Strategic & Operational Plan annually for base and above base efforts) – participate in conference calls as needed (1-2)
b. Other reports - varies, as needed, and could include research frameworks, research proposals, *ad hoc* Indicator Report, Science Coordination Plan
c. Regular bimonthly conference calls with the UMRR-EMP Regional Manager, LTRM Regional Manager, 2 HREP coordinators, 3 LTRM Technical Representatives (~6)

2. Represent UMRR-EMP-LTRM and home district at all regular A-Team Meetings (high priority)

Estimated Level of Effort (~40 hours)
Work under this heading includes two directional communications – regional coordination, bringing information back to the districts, and bringing local knowledge, issues, or questions to the A-Team. The level of effort hours will vary with length of meeting, meeting location, and level of prep/follow up.
a. Conference calls – 2/year
b. Meetings – ~2/year
c. Support A-Team activities as appropriate

3. Serve as LTRM data and resource contact for district PDTs (HREP-LTRM Integration) (high priority)

Estimated Level of Effort (~80 hours)
Generally, each district's LTRM Technical Representative serves as a proactive resource, promoting the use and/or application of LTRM data (including research, models, etc) in their home district, primarily for project planning and monitoring. Knowledge of the available datasets (online and others), models, graphical browsers, etc, and personnel at UMESC and the field station(s) is critical for this task.

In addition to funding through LTRM and the work described above, each home district is expected to include the LTRM Technical Representative on at least 2 HREP PDT's (funded through district UMRR-EMP-HREP funds).

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Also funded by district HREP funds, each district LTRM Technical Representative should be responsible for keeping up to date on HREP monitoring accomplishments, developing the annual monitoring program for each HREP, utilizing the standardized LTRM monitoring methods when appropriate, determining who will do the monitoring work, evaluating and summarizing monitoring results, and coordinating with the LTRM program component at USGS-UMESC. All of the information could be used for each Report to Congress, as well as periodically updating the HREP Environmental Design Handbook and the HREP database.
4. Special Projects (require separate SOWs and funding)

Estimated Level of Effort (~up to 60 hours)

Some instances will arise when uses of LTRM data or expertise are needed for more extensive investigations. For those instances, each district's LTRM Technical Representative should lead the effort to identify and scope their district's needs from LTRM. These needs must satisfy both of criteria below:

1. Identified need must directly support the UMRR-EMP authorization, and
2. Identified need must comply with the initiatives and priorities identified in the LTRM 2010-2014 Strategic and Operational Plan.

Proposals shall be developed by each district's LTRM Technical Representative and will be submitted to the Regional UMRR-EMP-LTRM Regional Manager. These proposals will be evaluated and selected, as UMRR-EMP priorities and funds dictate. Scopes of Work shall then be developed by the LTRM Technical Representative for those proposals that are selected and will be submitted to the UMRR-EMP-LTRM Regional Manager. The UMRR-EMP-LTRM Regional Manager will coordinate with the UMRR-EMP Regional Program Manager, and, if appropriate, will coordinate the SOWs with UMESC and/or the field station(s).

Current Special Projects:
Potter
1. SOW for updating/upgrading Wind Fetch/Wave model; Deadline Feb. 2012
2. Organize UMRR-EMP American Fisheries Society meeting symposium

Theiling
1. Technical support for Adaptive Management for Pool 12 HREP; Deadline 30 Sept. 2012
2. Coordinate development of Habitat Suitability Model for Backwaters; Deadline 30 Sept. 2012

McCain
1. LTRM Floodplain Connectivity Research Framework
2. Writing support for *ad hoc* Indicators Report; Deadline 30 Sept. 2012
5. Other Meeting Attendance (if funding and time allow)

Supported Level of Effort (~40 hours)

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Work under this heading includes dissemination of information, etc, from meeting/conference attendance to district personnel, PDT's, as appropriate. Discretion in choosing meetings is strongly recommended since the **funding level does not support attendance at all of these listed below**.
a. MRRC–Held in conjunction with April A-Team meeting
b. UMRCC –annual and/or technical session meetings
c. FWWG, FWIC or RRAT (tech) for meetings in home district

REPORTING

Each LTRM Technical Representative will provide quarterly activity reports to the UMRR-EMP-LTRM Regional Manager; due one week after the end of each quarter of the fiscal year. These reports will capture specific activities under any of the items above and any other significant LTRM activity.

BUDGET

Labor Budget per Representative
a. Salary for 260 hours annually for each Technical Representative, resourced annually but distributed quarterly, for regular duties described above. The individual dollar amounts allocated reflect the pay grades of the Technical Representatives. The total amount budgeted for all 3 Representatives for FY12 is $73,000.

> 1) Could be augmented for special projects to provide **regional** support UMRR-EMP-LTRM (*e.g*. A-Team *ad hoc* Indicator Team or sub group work); must have supplemental SOW or formal agreement prior to funding (funding dependent).
> 2) Could be augmented for special projects that address district needs, as described in Items 3 & 4 above; must have supplemental SOW prior to funding (funding dependent).
> 3) Could be augmented for Above Base SOW projects (aka APEs), will be included in project SOW and funding, as appropriate (funding dependent).

b. Travel funds of $1,500 will also resourced annually, with a partial distribution in the 1st quarter, and full distribution upon receipt of final UMRR-EMP appropriation.

TOTAL estimated commitment
Approximately 12.5% of annual time (260 hours each)
$73,000 labor + $ 4,500 travel = **$77,500**

POC for the UMRR-EMP-LTRM Technical Representatives is the UMRR-EMP-LTRM Regional Manager, Karen Hagerty.

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Geospatial Data Upgrades

UMESC has created several high-resolution datasets for the UMRS and LTRM that are used by partners and collaborators to understand the UMRS and to develop plans for management actions. ArcGIS is currently the standard GIS software used by LTRM partners to access and work with these datasets. To streamline this process and allow easier and more direct us of LTRM datasets within ArcGIS, some simple upgrades are needed. The first is creation of projection (.prj) files and metadata (.xml) files. UMESC will upgrade files to serve all vector-based spatial data as ESRI Shapefiles in UTM Zone 15, NAD83 and we will remove files not in this projection or file format. Ideally, this type of work should be funded under routine operating procedures. Unfortunately because of budget cuts in 2005, many day-to-day operational issues needed to be delayed and therefore additional funds are solicited from the program.

Current versions of ArcGIS allow for on-the-fly projections so multiple versions of the same data are no longer needed. This will simplify data management and make it easier for users to locate the files they need.

Products and Milestones

Tracking number	Products	Staff	Milestones
2012G1	Projection files (.prj) and metadata files (.xml) will be created for all publically served data (vector and raster).	Nelson	One year from funds allocation

Definitions

Raster GIS defines the geographic surface as rows and columns of pixels. There are no points, lines or polygons.

In a vector-based system, overlay operations are much more complex than in a raster-based system. This is because the topological data is stored as points, lines and/or polygons.

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Maintenance of the Water Quality Laboratory Information Management System: Part II[1]

Since 1988, the congressionally mandated Environmental Management Program on the Upper Mississippi River System has tracked the ecological health of this historic and critical water resource. Limnological monitoring within the UMRR–EMP LTRM results in about 6,000 electronic data sheets and 36,000 water samples collected by six state-operated field stations each year that are sent to the LTRM water quality laboratory at the USGS Upper Midwest Environmental Sciences Center (UMESC) in La Crosse, Wisconsin, for processing and analysis (totaling 60,000 individual chemical parameters). Advanced automation makes it possible for just two full-time employees (and part-time staff) to process this large volume of samples and data. Dr. David Soballe designed the Laboratory Information Management System (LIMS) at UMESC, which uses bar codes to connect electronic data sheets (sent over the Internet), water samples (sent by overnight courier), and lab test results (captured electronically from analytical instruments), then create the final data file. The LIMS system also generates and sends email messages to the six field stations. These messages automatically acknowledge receipt of samples and data, report problems, give instructions for further action when needed, and offer routine reminders.

The LIMS is critical to the effective operation of the LTRM's water quality component. This effectiveness is based on many complex and sequential operations, including transfer of data from computer systems at the field stations to computers at UMESC, ability to interface electronically with analytical equipment at the water quality lab, capacity to integrate data from multiple sources and multiple software programs, ability for automatic email communication with field stations through their state-administered email provider, seamless operation of code for data quality checks, and the ability to connect to the UMESC servers. Regular updates and modifications are needed to keep the LIMS system running smoothly, especially when hardware, software, and operating systems are modified or upgraded at UMESC or at field stations. In addition, updates to the LIMS system generally include improvements to increase its effectiveness and capability. Dr. Soballe will work with LTRM water quality laboratory staff and data manager to update and improve the LIMS system. His work with the LTRM data manager provides training in operation and troubleshooting for the LIMS that allows the data manager to perform general repair and maintenance on the system with minimal input from Dr. Soballe.

This work will give us continuing functionality of critical WQ component infrastructure, improved operations and continued high quality of data files at the UMESC water quality lab through maintenance and enhancement of computer code for the LTRM Laboratory Information Management System. (Strategic Plan Outcome 1; Output 1.1 and Strategy 2)

This SOW covers time and travel to Lake City, MN and Alton, IL to fix connectivity issues. Ideally, this type of work should be funded under routine operating procedures. Unfortunately because of budget cuts in 2005, many day-to-day operational issues needed to be delayed and therefore additional funds are solicited from the program.

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Maintenance and Calibration of Equipment

A variety of instruments are used to collect data within LTRM. Calibration and proper maintenance of field instruments are critical to quality assurance and quality control. LTRM standard procedures require periodic calibration of field instruments to ensure data meets the requirements of precision, accuracy, representativeness, completeness, and comparability. Ideally, this type of work should be funded under routine operating procedures. Unfortunately because of budget cuts in 2005, many day-to-day operational issues needed to be delayed and therefore additional funds are solicited from the program.

Marsh-McBirney Flo-Mate – for Measuring Water Velocity

The Marsh-McBirney Flo-mate^{tm} Model 2000 velocity meters are used by LTRM water quality crews to measure current velocity under conditions ranging from low-flows in backwaters to channels during flood conditions. The LTRM water quality procedures manual calls for calibration checks of these meters, by comparison to a recently factory-calibrated meter, at least annually. Factory calibration of LTRM meters allows us to continue to meet high quality assurance standards.

Mapping Electrical Fields Surrounding Electrofishing Boats and Updating Wiring Diagrams

The electrical field emanating from all electrofishing boats should be mapped periodically especially after repair of electrical components or purchase of new electroshocking boats. The effective electrical field is measured with an oscilloscope and probe. The oscilloscope is used to measure the voltage gradient between the two pins. This procedure allows us to continue to meet high quality assurance standards.

This work will also include contracting with a certified electrician who has integral knowledge of the LTRM electroshocking boats to revise the standard wiring diagrams for the boats. These diagrams will be inserted into the revised fish procedures manual.

Replacement of Autoclave in WQ Laboratory

An autoclave is used in the WQ laboratory for digesting Total N and Total P samples. The current autoclave is over 15 years old. Recently, this unit developed holes in the interior chamber that could cause an explosion when under pressure, thus it must be replaced. (Partial funding)

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Table 1. Sampling effort within the Long Term Resource Monitoring during fiscal years 2010–2014, and data collected by each component.

Component	Study Area						Summary of data collected[1]
	4	8	13	26	La Grange	Open River	
Aquatic Vegetation	450 stratified random sample sites over growing season.	450 stratified random sample sites over growing season.	450 stratified random sample sites over growing season.	—[2]	—[2]	—[2]	Species, abundance, frequency, distribution, depth, substrate, detritus
Fisheries Added fish monitoring for 2010–2014	~160 samples; 2 periods: Aug. 1–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites. 1st period, June 15 – July 31, 82 samples	~180 samples; 2 periods: Aug. 1–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites. 1st period, June 15 – July 31, 82 samples	~200 samples; 2 periods: Aug. 1–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites. 1st period, June 15 – July 31, 100 samples	~180 samples; 2 periods: Aug. 1–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites. 1st period, June 15 – July 31, 92 samples	~270 samples; 2 periods: Aug. 1–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites. 1st period, June 15 – July 31, 120 samples	~165 samples; 2 periods: Aug. 1–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites. 1st period, June 15 – July 31, 82 samples	Species; catch-per-effort; length; subsample for weight, age, & diet; secchi; water depth, temperature, velocity, conductivity; vegetation density; substrate; dissolved oxygen
Water Quality Added water quality monitoring for 2010–2014	135 stratified random sites done in each episode (winter, spring, summer, and fall); 14 fixed sites[3] 14 fixed sites in Pools 4 biweekly during July and August.	150 stratified random sites done in each episode (winter, spring, summer, and fall); up to 19 fixed sites[3] 4 historic + 2 new fixed sites, biweekly from April through August.	150 stratified random sites done in each episode (winter, spring, summer, and fall); 12 fixed sites[3] none	121 stratified random sites done in each episode (winter, spring, summer, and fall); 9 fixed sites[3] none	135 stratified random sites done in each episode (winter, spring, summer, and fall); 11 fixed sites[3] none	150 stratified random sites done in each episode (winter, spring, summer, and fall); 9 fixed sites[3] none	Suspended solids, major plant nutrients, chlorophyll a, silica, pH, secchi, temperature, dissolved oxygen, turbidity, conductivity, vegetation type & density, wave height, depth, current velocity, depth of snow/ice, substrate, phaeophytin, phytoplankton (archived),
Land Cover/Land Use	Land Cover/Land Use digital aerial photography will be acquired in 2010 and processed in subsequent years. Systemic land cover data for the Upper Mississippi River System is collected approximately every 10 years. To date, systemic land cover has been mapped twice through the Long Term Resource Monitoring Program, in 1989 and 2000.						

[1]A full list and explanation of data collected by each component is available through the LTRM data web site at http://www.umesc.usgs.gov/data_library/other/ltrmp_monitoring.html.
[2]Aquatic vegetation is not sampled in Pool 26 and La Grange because previous sampling revealed very low abundance, or in Open River due to a lack of suitable habitat.
[3]Frequency of fixed site sampling is bi-weekly in April, May, and June, and monthly in all other months, with no sampling in December and February (i.e., winter sampling in January only)

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

LTRM FY12 Budget Summary

Base Monitoring		FEDERAL GROSS	FEDERAL NET	NON-FEDERAL GROSS	NON-FEDERAL NET	COE	TOTAL
Outcome 1; Output 1.1	Aquatic Vegetation Sampling	$ 310,155	$ 208,630	$ 306,572	$ 297,643	$ -	$ 616,727
	Fisheries Sampling	$ 296,978	$ 199,766	$ 1,129,444	$ 1,100,975	$ -	$ 1,426,422
	Water Quality Sampling	$ 634,548	$ 426,837	$ 1,040,047	$ 1,005,328	$ -	$ 1,674,595
	Bathymetric Component	$ 23,151	$ 15,573	$ -	$ -	$ -	$ 23,151
	Land Cover/Use	$ 227,508	$ 153,036	$ -	$ -	$ -	$ 227,508
	Land Cover Processing	$ 349,008	$ 234,765	$ 28,214	$ 27,392	$ -	$ 377,222
Outcome 2, Output 2.1	Statistical Evaluation	$ 139,879	$ 94,091	$ -	$ -	$ -	$ 139,879
	Data Management	$ 397,584	$ 267,440	$ -	$ -	$ -	$ 397,584
	Science Management Support	$ 310,052	$ 208,560	$ -	$ -	$ -	$ 310,052
	COE Tech	$ -	$ -	$ -	$ -	$ 77,500	$ 77,500
	TOTAL	$ 2,688,863	$ 1,808,697	$ 2,504,277	$ 2,431,338	$ 77,500	$ 5,270,640
Above Base Monitoring		FEDERAL GROSS	FEDERAL NET	NON-FEDERAL GROSS	NON-FEDERAL NET	COE	TOTAL
Outcome 2, Output 2.2	Continuing existing work on survival of mussels using PIT tagging	$ 7,433	$ 5,000				$ 7,433
Strategy 1	Geospatical data upgrades	$ 21,110	$ 14,200				$ 21,110
Strategy 2	Software maintenance	$ 520	$ 350			$ 10,000	$ 10,520
	Velocity Meters calibration			$ 2,472	$ 2,400		$ 2,472
	ES boat electrical fields	$ 5,947	$ 4,000				$ 5,947
	Revision fish procedures manual	$ 4,460	$ 3,000				$ 4,460
	Autoclave (partial funding)	$ 3,594	$ 2,418				$ 3,594
	Equipment refreshment			$ 32,548	$ 31,600		$ 32,548
							$ -
							$ -
	TOTAL	$ 43,064	$ 28,968	$ 35,020	$ 34,000	$ 10,000	$ 88,084
	GRAND TOTAL	**$ 2,731,927**	**$ 1,837,665**	**$ 2,539,297**	**$ 2,465,338**	**$ 87,500**	**$ 5,358,724**

Deferred FY11 Funding[1]

	FEDERAL GROSS	FEDERAL NET	NON-FEDERAL GROSS	NON-FEDERAL NET	COE	TOTAL
Development of vital rates to assess the relative health of UMRS mussel resources	$ 48,326	$ 32,507				$ 48,326
Tier 2 LiDAR (Mask Water, Smooth Contours, QA/QC, Reclassify Data Errors)	$ 155,629	$ 104,686				$ 155,629
Landscape Pattern Research and Application FY 13-15	$ 507,791	$ 341,572				$ 507,791
Equipment FY 11			$ 83,510	$ 81,078		$ 83,510
Tech APEs - Sci Mgmt	$ 10,000	$ 6,727				$ 10,000
LTRM Meeting			$ 8,122	$ 7,885		$ 8,122
Maintenance of the Water Quality Laboratory Information Management System: Part 1					$ 5,000	$ 5,000
Accuracy Assessment	$ 50,791	$ 34,165	$ 31,364	$ 30,450		$ 82,154
Total	$ 772,537		$ 122,995		$ 5,000	$ 900,532

[1]These items were deferred from FY11 and are not considered to as part of the normal FY12 SOW or its normal funding.

Report Definitions

Draft: A draft that has been submitted to the USGS LTRM's Science Leader or his designee which is ready for review by USGS, COE, A-Team, or blind review, as needed.

Final draft: A document that the authors have edited based on review comments and has been submitted to the USGS LTRM's Science Leader or his designee

Intended for Distribution: Indicates a final printed version or Web-based report is awaiting distribution and USGS final approval. For other products (i.e., manuscripts) this indicates submission to a journal. *Staff time is still expended at this stage of the report process.*

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