Missouri River
RECOVERY PROGRAM

DRAFT

Missouri River Recovery Management Plan and Environmental Impact Statement

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Volume 4

Contents

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4.0 Implementation of Preferred Alternative under Adaptive Management

4.1 Introduction

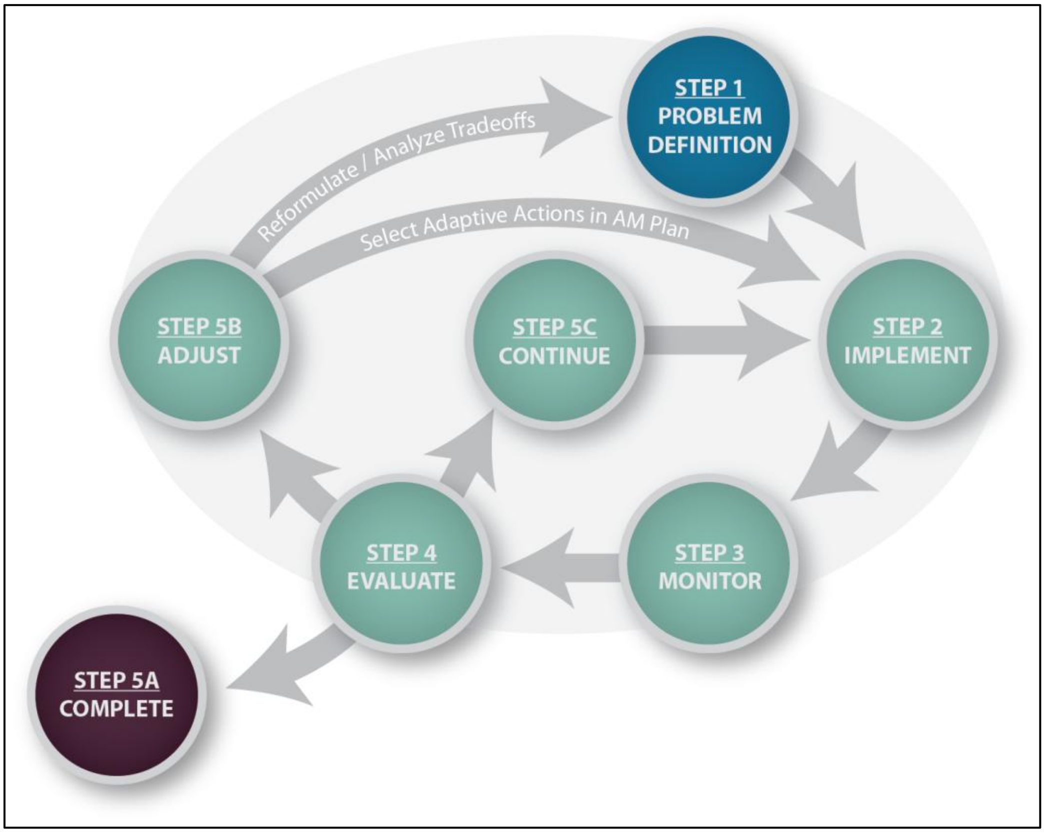
This chapter summarizes how the U.S. Army Corps of Engineers (USACE) would implement the preferred alternative under the Adaptive Management Plan recognizing the remaining uncertainty associated with many of the proposed management actions and with the ecology of the listed species (particularly for the pallid sturgeon). The information source for this chapter is the Missouri River Recovery Program (MRRP) Science and Adaptive Management Plan (AM Plan) (Fischenich et al. 2016). The AM Plan is a companion document to the Missouri River Recovery Management Plan – Environmental Impact Statement (MRRMP-EIS) and the implementation plan for the preferred alternative. The AM Plan identifies the process and criteria to implement the initial actions, assess hypotheses, and introduce new actions should they become necessary. As stated in Chapter 1.0, AM is a discretionary management approach that may be used in conjunction with the National Environmental Policy Act (NEPA) process and is encouraged by the Council on Environmental Quality (CEQ) (NEPA Task Force 2003). NEPA and AM are complementary processes; both emphasize collaboration and working with stakeholders. AM is consistent with the NEPA goal of informed decision-making and takes the NEPA process further in addressing uncertainties and data gaps that may be revealed during implementation of the preferred alternative. This allows decision makers to make corrections based on new learning while observing project performance, thus enabling transition from the planning and designing efforts associated with this MRRMP-EIS to implementation of the selected management actions using AM.

The preferred alternative represents the plan the agencies believe will accomplish the objectives (avoid a finding of jeopardy to the listed species) and will allow USACE to fulfill its other statutory requirements. This chapter describes the preferred alternative and summarizes the AM Plan. However, the reader must recognize that the AM Plan is a living document that can be changed as new information is gleaned from monitoring of actual performance and processed through a governance structure. Components of the preferred alternative are described in terms of the actions that would be implemented during the initial 15-year period (approximate) under the AM Plan. This chapter describes the governance approach and decision-making processes, which would be used to assess, plan and design, implement, evaluate, and finally make adjustments based on new learning. This chapter also explains how specific management actions for the least tern, piping plover, pallid sturgeon would be implemented with associated costs. Finally, this chapter discusses how this EIS may be supplemented in the future to address actions not considered during this NEPA process.

4.2 Overview and Context of Missouri River Recovery Program Science and Adaptive Management Plan

An effects analysis was completed in 2015 to gather and analyze the best available science relative to the MRRP and to evaluate the effects from operating and maintaining the System on the three listed species. The effects analysis provided an assessment of the effects of potential management actions on pallid sturgeon, piping plovers, and least terns. The assessment provided valuable insight into the effectiveness of potential management actions and verified that considerable uncertainty remains regarding the type and extent of management actions ultimately needed to meet the species objectives. This uncertainty is best addressed through

AM: a collaborative, flexible, environmental management strategy that seeks to maximize learning about what management actions will be most effective in meeting multiple objectives. Using this approach, actions are designed and implemented to test hypotheses and reduce critical uncertainties to better inform future management decisions. AM can be characterized as a cycle of assessing the state of knowledge about species needs and management effectiveness and identifying uncertainties; careful planning and designing of actions to reduce these uncertainties; implementing the planned actions; monitoring and evaluating the results; and adjusting based on what is learned (Figure 4-1). The effects analysis provides the scientific basis for the AM Plan.



Source: AM Plan (Fischenich et al. 2016)

Figure 4-1. Simplified Depiction of the Adaptive Management Process

The AM Plan is designed to guide the MRRP implementation process and help meet Endangered Species Act (ESA) requirements while minimizing impacts on human considerations (HC), which includes the authorized purposes of the Missouri River as well as the many other services afforded by the river system.

The AM Plan provides detailed information on the strategy for addressing uncertainties for each species, provides a governance structure for the program, defines the roles and responsibilities of the participants, and describes both how data are managed and how program actions and results will be communicated and reported. The AM Plan is written for and directed to those involved with the day-to-day implementation of the program.

Primary components of the AM Plan include the following:

1. Monitoring program associated with the management actions and broader river system;
2. Research and study activities including those to address hypotheses for which specific management actions have not yet been identified;
3. Assessment methods and processes to evaluate the effectiveness of actions implemented under the preferred alternative;
4. Decision criteria used to determine if changes to the preferred alternative are necessary; and
5. Governance approach to be used in collaboration with stakeholders, states, and Tribes to make decisions.

4.3 Description of Preferred Alternative

The preferred alternative includes the initial suite of management actions, research, and monitoring USACE would implement over the 15 years post approval of the Record of Decision (ROD) aimed at achieving objectives for the pallid sturgeon, piping plover, and interior least tern. The initial set of actions were chosen after careful consideration of species needs, remaining critical management uncertainties, anticipated impacts to authorized purposes and other socioeconomic impacts, and existing impediments to implementation of management actions contained within the other alternatives. The AM Plan serves as the repository of knowledge related to management hypotheses, associated management actions, and remaining uncertainties and impediments. It is possible that in the future, the AM process will conclude that actions which were not part of the preferred alternative may be warranted and feasible.

The ability to incorporate and adjust to new information is a central concept for successful adaptive management; therefore, if these activities lead to an adjustment in the implementation strategy laid out in the preferred alternative, a supplemental NEPA process may be necessary prior to the end of the 15-year period. Sections 4.4 and 4.5 provide a description of the components of the preferred alternative associated with each of the three listed species.

4.4 Adaptive Management Plan for Initial Actions Included in the Preferred Alternative to Avoid a Finding of Jeopardy for Pallid Sturgeon in the Missouri River

Management for pallid sturgeon will rely heavily upon research conducted in conjunction with the implementation, monitoring, and adjustments more commonly associated with AM. This is because the uncertainties associated with pallid sturgeon ecology are both extensive and fundamental to the ability to plan and design effective actions over time. The pallid framework is designed to build the necessary science information upwards from fundamental Level-1 research. Timing and coordination among studies, along with sound experimental designs that facilitate rapid feedback from data to decisions, will be critical to success.

The AM Plan for pallid sturgeon in the upper and lower river segments includes a hierarchical design of management actions. Level 1 is associated with actions that do not change the system (e.g., laboratory or mesocosm experiments, observational studies across gradients in conditions, modeling, other research). Level 2 is associated with in-river testing of management actions at a level sufficient to expect a measurable biological, behavioral, or physiological response in pallid sturgeon or surrogate species, or a related habitat response, but not at a level expected to produce a population response. Level 3 is associated with a magnitude of the in-river management action that is expected to produce a population-level response. Level 4 implements a management action at the ultimate level required to remove a limiting factor from the population. Uncertainties were further expressed as big questions related to potential management actions with underlying uncertainties. There are six big questions in the upper river and six in the lower river (further described in the AM Plan).

4.4.1 Plan and Design

This section summarizes metrics and decision criteria for Level 1 and 2 components, and describes the plan of Level 3 actions for the preferred alternative.

The plan and design step in the AM cycle outlines what actions should be undertaken to address the problem, and the most effective designs for implementing, monitoring and evaluating these actions to facilitate learning. The scope, duration, and contingencies of potential actions are discussed and forecast in sufficient detail to estimate possible outcomes and costs. Planners, subject matter experts, stakeholders, Tribes, and States have and will continue to collaborate regarding risks, benefits, and costs during this step of the AM cycle. A framework was developed in the AM plan to efficiently guide implementation of actions and incorporate research to evaluate relevant hypotheses. To expedite the learning process, independent learning actions were staged to take place concurrently as much as possible. It was also recognized that many hypotheses will not be amenable to robust statistical testing and therefore, a weight-of-evidence approach was proposed for evaluating such hypotheses. Adopting this approach is intended to strike a balance between uncertainty in action effectiveness, and the need to act promptly at a biologically significant level to sustain pallid sturgeon in the Missouri River.

4.4.1.1 Pallid Sturgeon Framework

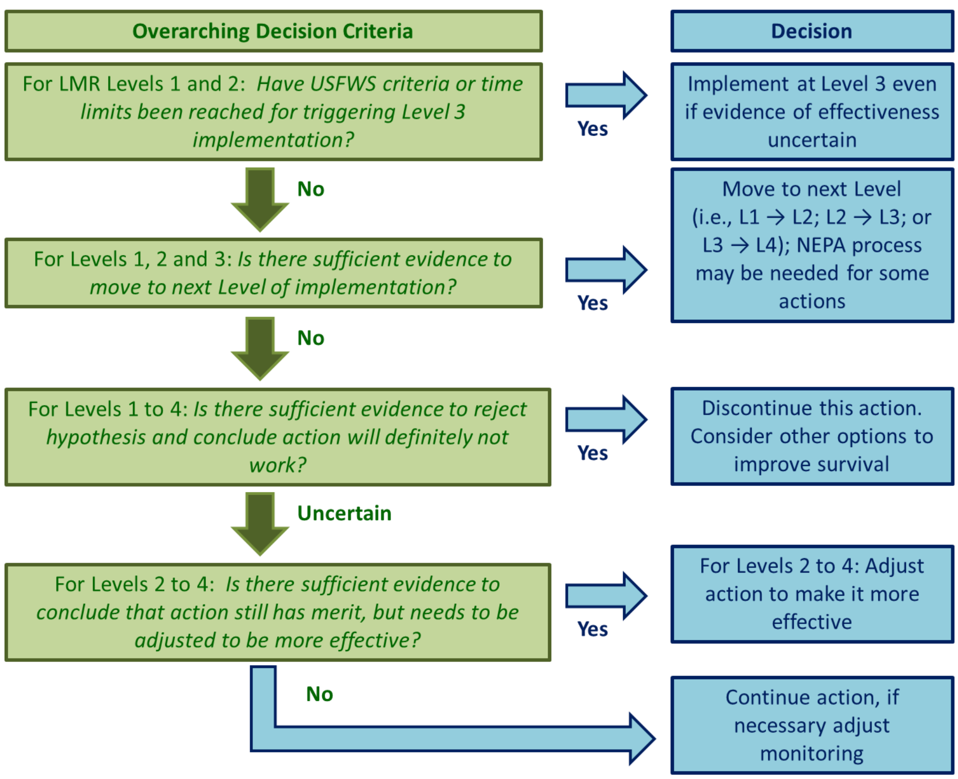
In the AM Plan, questions and their underlying hypotheses would be explored, evaluated, and implemented with increasing intensity using a four-level framework as described below. Under this framework, Level 1 and 2 studies are directly tied to uncertainties and management hypotheses that emerged from the effects analysis. As these uncertainties are reduced or resolved with work at Levels 1 and 2, management actions may be discontinued, adjusted, or expanded to Levels 3 or 4 where a population level response is expected which, as resolved, could significantly affect the implementation of management actions intended to address the objectives (Figure 4-2).

Under the preferred alternative population augmentation will be implemented at Level 3 in both the upper and lower river. The lower river includes two additional Level 3 actions: creation of interception and rearing complexes (which will include both new habitat and rehabilitation of previously constructed habitat); and creation of spawning habitat. Although these actions are being implemented at Level 3, Level 1 and Level 2 learning actions are also being carried out concurrently to address continuing uncertainties.

Specific criteria will guide decisions about whether to move from Level 1 to 2, Level 2 to 3, and Level 3 to 4. The general decision process is summarized in Figure 4-3, with more detailed decision criteria included in the AM Plan for each action at each level.

Level 1: Research	Population Level Biological Response <u>IS NOT</u> Expected	Studies without changes to the system (Laboratory studies or field studies under ambient conditions)
Level 2: In-river Testing		Implementation of actions at a level sufficient to expect a measurable biological, behavioral, or physiological response in pallid sturgeon, surrogate species, or related habitat response.
Level 3: Scaled Implementation	Population Level Biological Response <u>IS</u> Expected	In terms of reproduction, numbers, or distribution, initial implementation should occur at a level sufficient to expect a meaningful population response progressing to implementation at levels which result in improvements in the population. The range of actions within this level is not expected to achieve full success (i.e. Level 4).
Level 4: Ultimate Required Scale of Implementation		Implementation to the ultimate level required to remove as a limiting factor.

Figure 4-2. Four-Level Pallid Sturgeon Framework



Source: AM Plan (Fischenich et al. 2016)

Figure 4-3. Overview of Decision Criteria for Various Decisions in the Pallid Sturgeon Framework

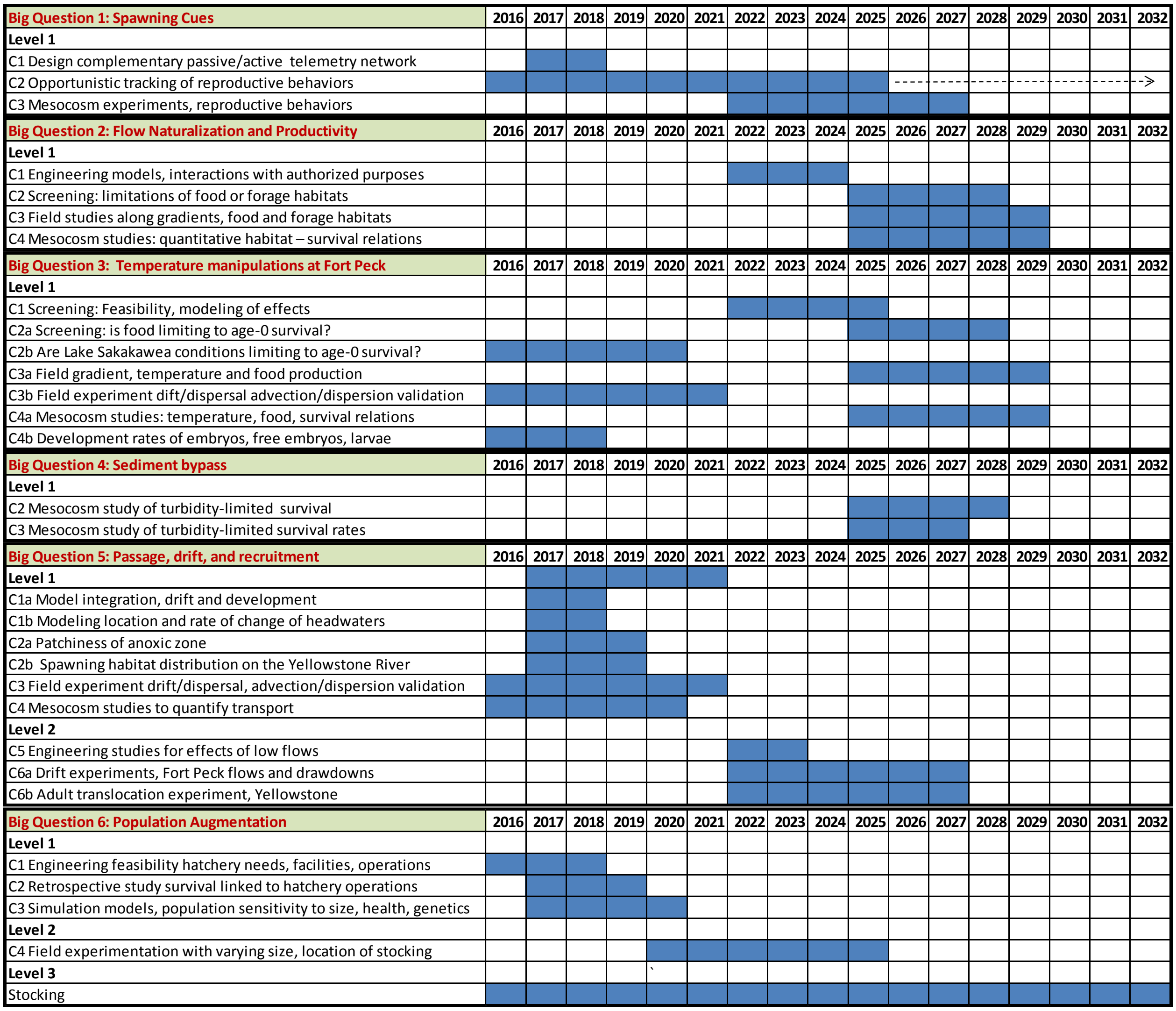
4.4.2 Implementation

This section describes the current schedule for implementation of Level 1, 2, and 3 actions associated with the preferred alternative.

The AM Plan is intended to provide the means of evaluating the effectiveness of actions described in the MRRMP-EIS. The pallid sturgeon framework describes those actions and is a foundational document critical for coordinating implementation of actions. The AM Plan actively seeks to accelerate the pace of learning and implementation to maximize benefits for avoiding a finding of jeopardy to pallid sturgeon against the risk of carrying out ineffective actions by implementing dependent Level 1 components concurrently, or nearly concurrently, rather than sequentially (Figure 4–4 and 4–5). Concurrent implementation will require a substantial investment in early and carefully planned research. As such, Level 1 science components will jointly provide complementary lines of evidence that cumulatively affect decisions to implement field experiments at Level 2.

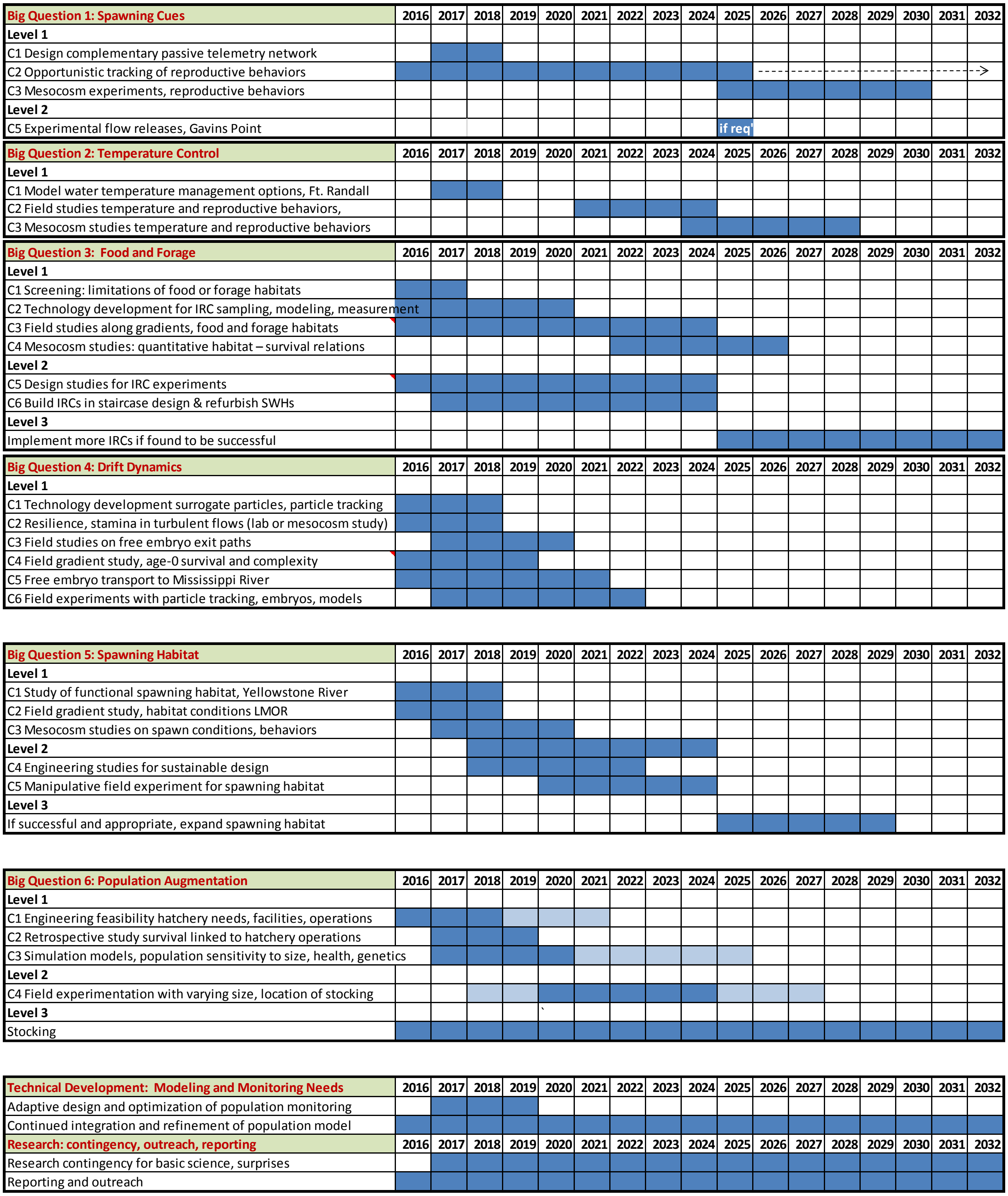
Based on agreement between USACE and USFWS, implementation of management actions at Level 3 for each hypothesis would be required within a specified timeframe ranging from immediate to 9 years post-ROD, provided the hypotheses associated with the action are not rejected by that time.

Time limits for implementation of actions associated with the preferred alternative at Level 3 have been defined in four action categories and discussed in detail in the AM Plan, and are summarized in Table 4-1. The implementation time limits range from “Immediate” for population augmentation to nine years for spawning cue flows if none of the flow events that occur during the first nine years is sufficient to evaluate the spawning cue management hypothesis (Figure 4-5).



Source: AM Plan (Fischenich et al. 2016)

Figure 4-4. Proposed Schedule for Implementation of Actions in Upper Missouri River



Source: AM Plan (Fischenich et al. 2016)

Figure 4-5. Proposed Schedule for Implementation of Actions in Lower Missouri River

At any time during implementation of the framework, it may become apparent that: (1) a particular action is not needed, (2) a proposed action requires modification to be effective, or (3) some new action not previously evaluated is required. In addition to modification of actions, the timeframe for implementation may be adjusted as knowledge is gained from Level 1, 2 and 3 actions, hypotheses are tested, and the likelihood of biological benefits becomes clearer. Moreover, budget allocations may also affect the timing of actions or a suite of actions.

Table 4-1. Summary of Time Limits for Level 3 Implementation and Scope of Actions

Action Category	Time Limit[*]	Minimum Scope	Maximum Scope
Population augmentation	Immediate	Current stocking rate as directed by USFWS Propagation Plan	Variable over time as directed by USFWS Propagation Plan
IRC habitat development	Stage 1: study phase (years 1–3 post-ROD)	Build 2 IRC sites per year (paired with control sites), adding 33,000 ac-d/yr of suitable habitat, using staircase design[a]. Assess potential for refurbishing existing SWH sites as IRCs	
	Stage 2: continue study phase (years 4-6 post-ROD)	Build 2 IRC sites per year (paired with control sites), adding 33,000 ac-d/yr[a] of suitable habitat. Refurbish SWH sites in addition to study sites (rate TBD).	
	Stage 3: Level 3 implementation (years 7-10 post-ROD)	Continue assessing IRC sites and refurbishing new SWH sites, adding at least 66,000 ac-d/yr[a] of suitable habitat. Determine required rate of Level 3 implementation based on stages 1 and 2.	
	Stage 4: Level 4 implementation	Remove IRC habitat limitations to pallid sturgeon survival by implementation at Level 4.	
Spawning habitat[b]	2 years	1 spawning site	See decision tree in the AM Plan
Spawning cue flows	9 years	Requirement for spawning cue flows (and appropriate scope) depends on the outcome of Level 1 and Level 2 monitoring and modeling studies during nine years 1–9. [c]	

Source: AM Plan (Fischenich et al. 2016)

a Units of ac-dy/year are calculated based on how the flow regime and channel configuration result in cumulative days of availability of suitable habitat during the growing season. Progression through each stage of IRC habitat development is contingent on outcomes and hypothesis tests (Kruse 2016); efforts could be halted if evidence shows IRCs are not successful. Experimental design for IRC sites and refurbishment of SWH sites into IRCs are described in the AM Plan.

b Anticipated as a Level 2 pilot projects focused on developing and evaluating high-quality spawning habitat. Spawning habitat implementation will be guided by the decision tree in the AM Plan. The evaluation of spawning areas will be based on comparing attraction, egg survival, and hatch to existing spawning areas.

c An evidentiary framework for deciding if spawning cue flows are required is provided in the AM Plan. Pallid population modeling will be used to set minimum spawning flow needs; bird impacts and status, reservoir levels, and HC impacts will inform decisions regarding spawning cue flows below Gavins Point Dam in any particular year.

Manipulative field experiments with IRCs as described in the AM Plan presents a hierarchical staircase study design to evaluate the response of age-0 sturgeon catch to IRC habitat restoration activities. Twelve paired sites (experimental and control) would be constructed in the first six years of the experiment. It is estimated that the twelve projects will yield about half of the habitat needed to meet Level 3 targets. To the extent possible and where appropriate, the remaining habitat needs would be met through Level 2 or Level 3 projects/activities at existing shallow water habitat (SWH) project sites and/or will incorporate habitat projects that have already been completed. If the designs are successful in increasing interception, interception continues to be hypothesized as limiting, and food and foraging habitat also continue to be hypothesized or proven to be limiting, then sites should be constructed at a rate meeting Level 3 definition.

Science has identified potential to refurbish existing shallow water habitat projects for IRC benefit because much has been learned since USACE began building habitat for pallid sturgeon. Recent findings have allowed the development of a model that can be used to evaluate pallid habitat suitability. This model would be used to evaluate existing habitat projects in terms of suitability and availability to larval, young-of-year, and juvenile pallid habitat. Existing habitat projects would be prioritized for modification according to where it would be most efficient and effective to convert poor/marginal habitat to high quality habitat based on best science. If successfully modified, projects should be considered meeting Level 3 definition.

4.4.3 Monitoring

The AM Plan identifies three types of monitoring necessary as part of the framework and AM process. Implementation monitoring addresses whether an action was successfully completed as intended. Process/action effectiveness monitoring addresses whether there was an ecological response to increased survival or appropriately inform the next framework level toward increasing survival. Population monitoring addresses pallid sturgeon population growth. Tool building and foundational work will be required as framework Level 1 research to support all three forms of monitoring, including the design of new protocols, the establishment of monitoring hardware such as stationary telemetry networks, and the development of models and power analyses to test monitoring protocols and experimental designs. The remainder of this section will summarize the monitoring for each Level 2 and 3 action that is part of the preferred alternative (Table 4-2).

Table 4-2. Metrics for Implementation, Process / Action Effectiveness and Population Monitoring for Level 2 and Level 3 Actions

Note: Hypotheses listed in first column (e.g., H8, H9) are those most relevant to the action, as discussed in the AM Plan.

Level 2 / 3 Action	Implementation Monitoring	Process Monitoring	Population Monitoring
Augmentation [H8, H9] [H20, H21]	• Meeting stocking targets by age, hatchery and release location • Meeting health criteria in hatchery • Fulfilling experimental design of Level 2 management experiments	• Number, size, age, location, habitat and origin of released and captured pallid sturgeon • Fish condition, genetics, disease levels • Density of hatchery-origin free embryos and larvae found in preferred rearing habitats	• Estimated survival probabilities of hatchery fish to age-1, -2 and -3, by stocked size, age, hatchery of origin, release location • Modeled long-term change in population based on survival probabilities of hatchery origin fish (e.g., probability of quasi extinction, population growth rates) • Effective population size

Level 2 / 3 Action	Implementation Monitoring	Process Monitoring	Population Monitoring
IRC Habitat [H17, H18, H19]	• "Effective acreage" (acre-days of available IRC habitat/year)	• Habitat metrics based on measures of depths, velocities, substrate, habitat complexity • Trends in % area of SWH with suitable habitat after refurbishment to IRCs • Catch per unit effort (CPUE) and apparent presence at meso-habitat and project level; • Production of food/area • Fish condition (% empty/full stomachs; genetics; lipid content; length frequency distribution of age-0 fish) and bioenergetics modeling	• Survival of hatchery-reared first-feeding pallid sturgeon larvae in IRCs, refurbished SWH, thalweg, and to age-1 • Population size structure analysis (length-frequency distributions of age-1+ fish)
Spawning Habitat [H16]	• Number and area of spawning sites created with suitable characteristics (depth, velocity, substrate, and derivative hydraulic variables)	• Confirmation of site quality • Telemetry data showing relative selection of created spawning sites vs. control sites • Attraction/specificity of adults to different spawning substrates; site confirmation that eggs are not buried • Confirmation of spawning (see row below on spawning cue flows)	• Modeled long term change in population based on estimated proportional increase in successful spawning due to creation of high quality spawning habitat (if such an increase occurs) • Field monitoring of recruitment to age-1, -2, -3
Spawning Cue Flows [H11]	• Level 1- Ambient flow monitoring to record timing, magnitude, and longitudinal spatial distribution • Level 2- Flow monitoring to check whether spawning cue flow had expected timing, magnitude, and longitudinal spatial distribution	• Movement and aggregation of spawning males and females in response to spawning cue flow • Multi-receiver, 3D telemetry and acoustic video to confirm egg release events • Male: female ratios in spawning aggregations • Confirmation of female spawning through captured downstream eggs and embryos, and recapture of spawned females	• Mesocosm and field-inferred benefit of achieved pulse • Modeled long term change in population based on estimated proportional increase in successful spawning due to spawning cue (if such an increase occurs) • Field monitoring of recruitment to age-1, -2, -3 (delayed metric reflecting the cumulative effect of all actions, other stressors and natural variability)

Source: AM Plan (Fischenich et al. 2016)

Existing protocols detailed in the AM Plan will be used and modified as necessary for accomplishing population monitoring. The Pallid Sturgeon Population Assessment Project (PSPAP) is the primary fish monitoring element included in the Biological Opinion (BiOp) (USFWS 2000, 2003) and the MRRP. Data collected through the PSPAP (using modifications to current protocols as described in the AM Plan) will be used to evaluate the pallid sturgeon propagation and population-augmentation actions and provide monitoring data to assess population trends, survival, movement, distribution, and habitat use by pallid sturgeon. The PSPAP also collects pallid sturgeon broodstock each year for meeting existing BiOp stocking requirements. These protocols would serve as a foundation for an integrated approach to population level monitoring, assessment, and modeling in light of current knowledge and management hypotheses from the effect analysis. Refinements to the PSPAP are under consideration as part of the AM Plan to optimize information to support decision making. The results of Level 1 and 2 science components, Level 3 monitoring and assessment, and population-level monitoring can be effectively integrated in a population-dynamics modeling framework, the integrated population model (Jacobson et al. 2016b). Under the approach developed in the AM Plan, the integrated population model will become the central mechanism to assimilate data from diverse sources and provide information for decision-making. The Comprehensive Sturgeon Research Project (CSRP) is another existing interagency research effort in the AM Plan designed to address knowledge gaps in pallid sturgeon ecology. The CSRP has emphasized understanding the reproductive ecology of both adult and young sturgeon; as such the CSRP has established methods and protocols for monitoring Level 2 and Level 3 actions aimed at addressing metrics for Intake dam, spawning habitat, and spawning cue flows. CSRP studies have developed methods for implanting sturgeon with transmitters and data archival tags for use with a combination of active (e.g., boat mounted listening technology) and passive (e.g., permanent bridge mounted listening devices) methods to monitor sturgeon movement and behavior. Additionally, some free-embryo sampling has been carried out under CSRP using a passive sampling approach to address questions about when and where sturgeon spawn. In addition, CSRP has developed state-of-the-art hydroacoustic habitat mapping and modeling protocols that can be used in evaluations of spawning and IRC habitats.

Similarly, existing and new protocols, and guidance for modifying and developing protocols, for process/action effectiveness monitoring are addressed in the AM Plan. A draft monitoring plan for IRCs was designed to simultaneously address implementation and process/action effectiveness monitoring with a hypothesis testing approach. The approach uses a modification of a common and previously employed before-after-control-impact statistical design to improve efficiency given real life constraints of habitat construction rates. The modified before-after-control-impact design outlines a step-wise approach to habitat construction over a period of 6-7 years that allows data to compound, thereby increasing confidence, while maximizing efficiency and allowing for learning and adjustments during the early phases of implementation. Each new IRC site constructed will be monitored simultaneously with a paired control site beginning the year prior to construction. Two IRC site pairs will be added each year to build a "staircase" of IRC projects in this implementation plan, which by the end of the 7-year period will provide statistically reliable inferences regarding the effects of IRCs on the abundance of age-0 fish.

Monitoring of IRC site pairs will include metrics designed to detect effects of IRC construction on both physical habitat and biological responses. Characterizing the geomorphic and hydraulic changes resulting from IRC construction is crucial to the assessment of IRC habitats. Use of hydroacoustic tools to develop high-precision models of water depth and water velocity magnitude and direction will allow further quantification of habitat conditions within both treatment and control bends. The intent is to relate these depth and velocity physical habitat conditions to a concurrently collected dataset on age-0 sturgeon from biological monitoring.

Biological metrics include collecting information on sturgeon body length, frequency, distribution, and catch per unit effort (CPUE) at IRC site pairs.

4.4.4 Evaluation

The methods used to evaluate the effectiveness of various actions are directly tied to the metrics selected for monitoring previously discussed. Evaluation of each action is organized categorically by types of action, and each action is addressed by a series of questions. Table 4-3 summarizes the evaluation methods used to answer each question, based on the experimental designs, metrics, and analytical methods outlined in the AM Plan. Specific analytical procedures that may be used to address each question can be found in Table 4-3 and are generally based on procedures developed and that have undergone some form of peer review from previous research and monitoring work on the Missouri River or pallid sturgeon. However, in some cases for Level 2 and 3 Implementation, analytical methods for evaluation are dependent on development of methods during their respective Level 1 phase.

Table 4-3. Summary of Methods for Evaluating the Effectiveness of Level 3 Actions (some of these actions also have Level 2 management experiments)

Note: Hypotheses listed in first column (e.g., H8, H9) are those most relevant to the action:
[Upper] = Upper Missouri River; [Lower] = Lower Missouri River; L2 = Level 2; L3 = Level 3

Action	Question [Level, Location]	Methods of Evaluating Action Effectiveness
Augmentation [H8, H9] [H20, H21]	What are the optimal sizes of hatchery fish to release (i.e., fingerlings or yearlings)? [L2, Lower]	Use a staircase design over multiple years to compare the survival probabilities of fish stocked as fingerlings vs. yearlings, while accounting for the hatchery of origin and other factors affecting survival rates. See list of metrics in the AM Plan.
	What are the optimal locations to release fish? [L2, Upper and Lower][1]	Compare various metrics (e.g., recapture probabilities, recapture location, condition, survival probabilities) of different groups of marked fish that are released from different locations (e.g., upstream vs. downstream of Intake Dam; Missouri vs. Yellowstone River), and then recaptured at multiple locations and times.
	Is augmentation meeting target survival rates, ensuring a 95% probability of persistence over a 50-year period and supporting positive trends in populations? [L3, Upper & Lower] Is there a self-sustaining population of adult fish in each management unit?	Apply the augmentation strategies developed in Level 2 studies, and compare 3-year running averages of various metrics (see augmentation in the AM Plan) to established targets, (as informed by Level 1 and Level 2 studies, particularly population modeling studies).

Action	Question [Level, Location]	Methods of Evaluating Action Effectiveness
Interception and Rearing Complexes (IRCs) [H17, H18, H19]	Do free embryos and exogenously feeding larvae leave the thalweg and enter IRCs? [L3, Lower] Is there sufficient food in IRCs for exogenously feeding larvae to grow better and maintain a healthier condition than reference areas and times? [L3, Lower] Do age-0 fish that occupy IRCs survive better than age-0 fish in reference areas and times? [L3, Lower] What is the population-level effect of improved survival of age-0 fish in IRCs? [L3, Lower]	Predicted fate of free embryos from advection/ dispersion models, particle tracking in hydrodynamic models. Testing of these predictions with field monitoring (see below). Before-after, before-after-control-impact, or Staircase design comparisons of IRC habitat sites with reference areas and times, using the metrics in the AM Plan (e.g., CPUE, probability of apparent presence, food production/area, condition, growth and survival of age-0 fish), and applying covariates to help explain year to year variation (e.g., index of upstream spawning success). Population model projections of the consequences of improved age-0 survival rates.
Spawning Habitat [H16]	To what extent does successful spawning occur now? [redesigned PSPAP and other monitoring] Has suitable spawning habitat been created and maintained? [L2/L3, Lower] Are created spawning habitats preferred over other areas by pallid sturgeon in reproductive condition? [L2/L3, Lower] Does successful spawning occur in the created spawning habitats? [L2/L3, Lower] Would creation of more high-quality spawning habitat at Levels 3 and 4 have a significant benefit to the population? [L2/L3, Lower]	Compare physical and biological metrics listed in the AM Plan for one or more created spawning areas vs. reference areas (other outside bends used for spawning) Population model projections of the consequences of creating more spawning habitat
Spawning Cue Flows [H11]	Do spawning cue flows lead to greater aggregations of pallid sturgeon in reproductive condition? [L2/L3, Lower] Do spawning cue flows lead to higher rates of successful spawning? [L2/L3, Lower] Would creation of more spawning cue flows at Levels 3 and 4 have a significant benefit to the population? [L2/L3, Lower]	Assemble evidence for and against benefits of spawning cue flows from Level 2 mesocosm and gradient studies. To the degree possible while accounting for confounding effects, compare metrics listed in the AM Plan for years and locations with a strong spawning cue flow vs. years and locations without a spawning cue flow. Population modeling of the consequences of creating more spawning cue flows.

[1] These questions are subject to change as the USFWS completes its Basinwide Stocking and Augmentation Plan (USFWS, in prep).

Source: AM Plan (Fischenich et al. 2016)

4.4.5 Adjustment Decisions

Requirements and decision criteria for Level 3 implementation were developed collaboratively by USACE and USFWS and reflect both the best available science, as well as policy considerations. Implementation of management actions at Level 3 for any limiting factor would commence at the earlier of two triggers: (1) the criteria described in Table 4-4, or (2) the established time limits in Table 4-1 (should the results of studies/tests at Levels 1 and 2 of the associated hypotheses remain equivocal).

The Pallid Sturgeon Framework also provides a suite of five questions to guide decisions on moving to Level 3 implementation for other factors (Table 4-4). Work at Level 1 will help to answer questions 1, 2, 3, and 5. Level 3 implementation will be triggered if all five questions are marked “Yes”, but a 2-year time limit for implementation will be triggered if 4 of 5 are marked “Yes” and either questions 1 or 2 is marked “Uncertain.”

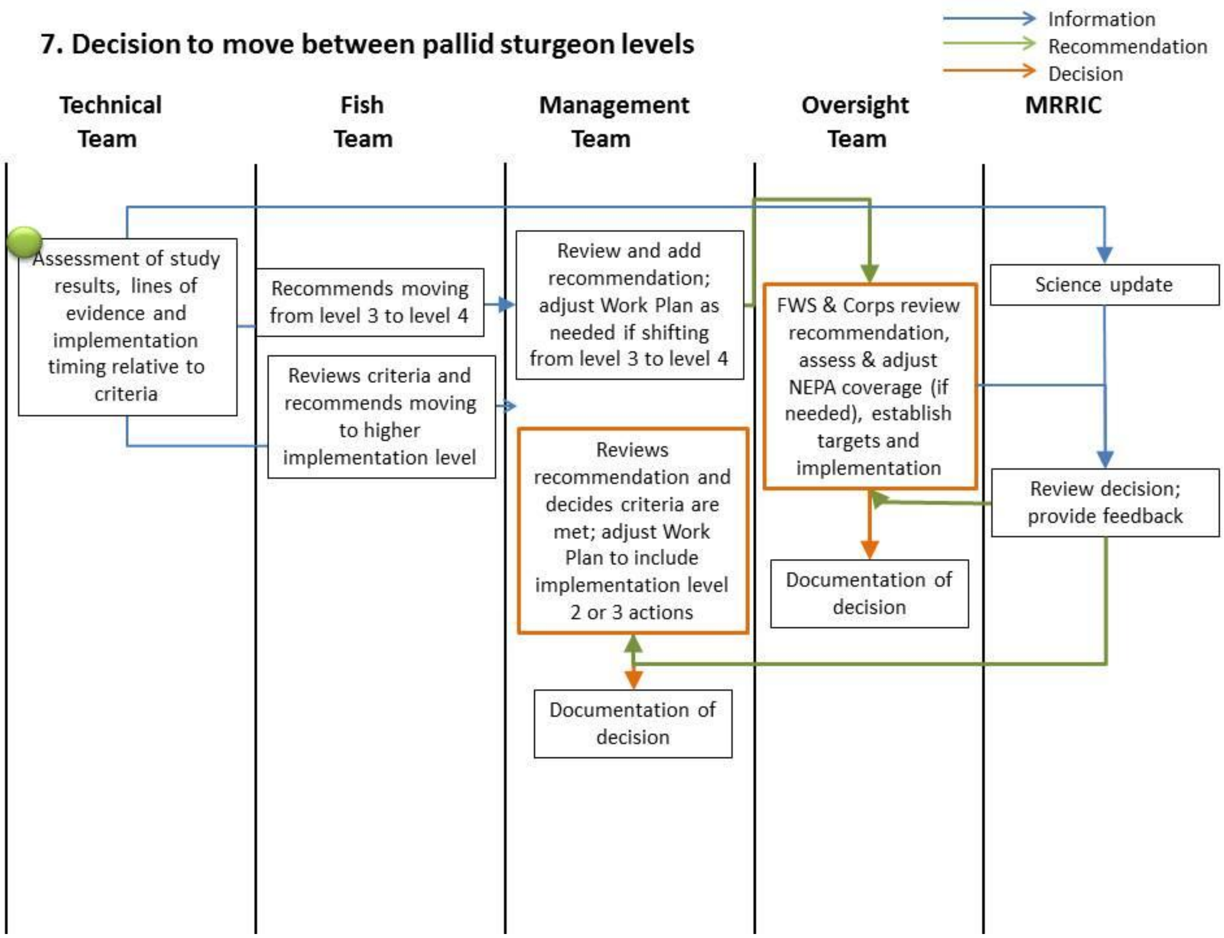
Table 4-4. Supplemental Lines of Evidence Strategy for Triggering Level 3 Implementation

	Question	Y	U	N
1	Is this factor limiting pallid sturgeon reproductive and/or recruitment success?			
2	Are pallid sturgeon needs sufficiently understood with respect to this limiting factor?			
3	Do one or more management action(s) exist that could, in theory, address these needs?			
4	Has it been demonstrated that at least one kind of management action has a sufficient probability of satisfying the biological need?			
5	Have other biological, legal, and socioeconomic considerations been sufficiently addressed to determine whether or how to implement management actions to Level 3?			
Criteria for Level 3 implementation				
1: A "Yes" to all five questions triggers Level 3 implementation 2: A "Yes" to four of five, with an "Uncertain" for either #1 or #2 triggers a two-year clock to either reject the hypothesis or implement at Level 3				

Source: AM Plan (Fischenich et al. 2016)

Detailed decision criteria are described in the AM Plan to help in deciding whether to move hypotheses from Level 1 to Level 2. Level 2 in-river tests of actions will be particularly helpful for providing empirical evidence to address question 4 in Table 4-4; and it is anticipated that strong experimental designs will be required to provide compelling evidence to support decision triggers. In addition to the decision guidance provided by the framework, the AM Plan relies on a decision tree approach to managing decisions for a single action and multiple actions (e.g., examples are provided in Figure 4-3, with more detailed decision trees in the AM Plan).

The AM Plan also details a process for how information will be routed across teams to make decisions on whether to move between different levels of implementation of actions for pallid sturgeon (Figure 4-6).



Source: AM Plan (Fischenich et al. 2016)

Figure 4-6. Workflow for Decision to Move between Pallid Sturgeon Implementation Levels

Evidence is largely about understanding cause and effect. As such, evidence based decisions specific to a single action, as well as accumulating evidence of the relative amount of support for multiple actions, will be scored according to the relative level of support for various questions and decision criteria and more detailed decision criteria (described in the AM Plan). These decision processes are intended to categorize the level of support for the following decisions:

1. Is there enough evidence at Level 1 to proceed with an action at Level 2?
2. Is there enough evidence at Level 1 and Level 2 to proceed with an action at Level 3?
3. Have time limits been reached for implementation of Level-3 actions?
4. Is there enough evidence at Level 3 to proceed with an action at Level 4?

A lines of evidence approach is detailed in the AM Plan is intended to assist decision makers by assimilating complex and variable monitoring information into relatively simple outputs relative to management hypotheses derived from the effects analysis. As information is accumulated and assimilated, the EA hypotheses may be modified to reflect improved understanding.

4.5 Adaptive Management Plan for Initial Actions Included in the Preferred Alternative to Avoid a Finding of Jeopardy for Piping Plovers and Interior Least Terns on the Missouri River

This section summarizes the AM framework developed for the piping plover and interior least tern and is organized according to the steps of the AM cycle.

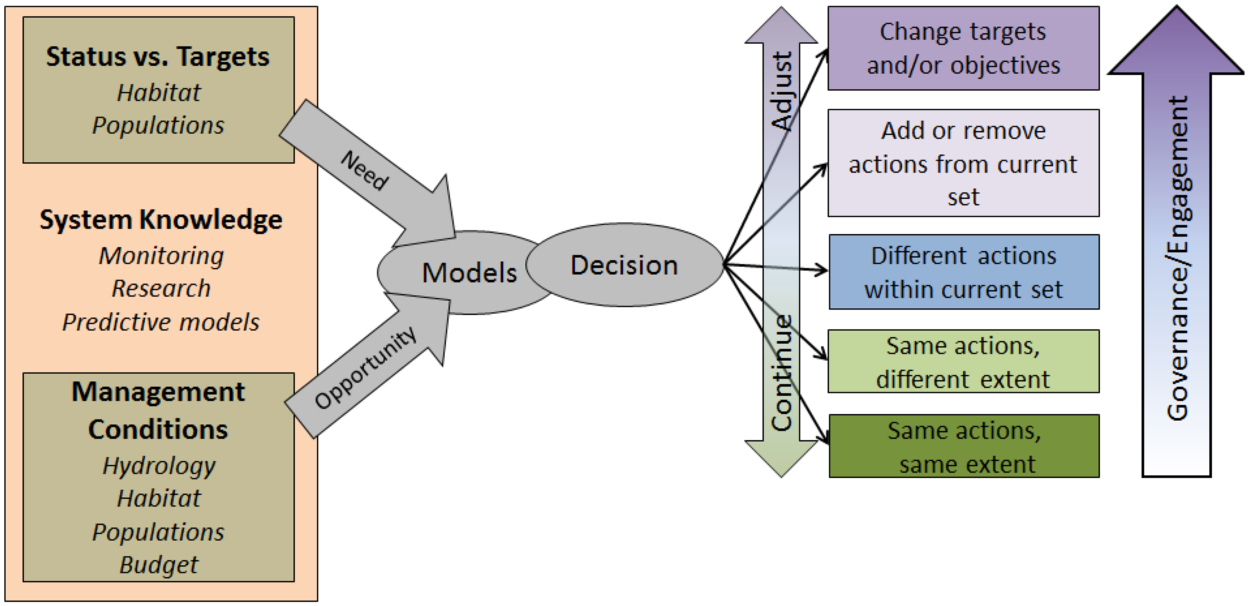
Managing for piping plovers and interior least terns largely involves ensuring sufficient availability of ESH to support nesting and foraging for the birds, while also accounting for any benefits to bird populations from use of reservoir shorelines. The focus of these efforts is on nesting habitat for plovers; provided those needs are met, habitat needs for terns are likely also met. Habitat and population models developed for the plovers provide a powerful planning tool for managing the program, but uncertainty about parameter estimates in the habitat models, coupled with observation errors and uncertainty about dispersal, demographic rates, and their trends in the population models provide significant opportunities for improvements. The greatest source of uncertainty is in estimating future flows, which drive the availability of ESH. Managers will be required to make decisions about how much ESH to mechanically create annually with consideration of the risks that the habitat may fall short of targets. AM will likely revolve around the above issues, but opportunities exist for meaningful improvements to ESH construction methods, vegetation management, predator management, and foraging habitat, among other aspects.

4.5.1 Plan and Design

This step in the AM cycle involves the planning and design of management actions to meet established goals and objectives for the birds. The planning and design of management actions must carefully consider the natural variability of the Missouri River System, the complexity of the ecosystem, and the water management infrastructure and operational rules and constraints.

4.5.1.1 Piping Plover and Interior Least Tern Framework

The key decision-making information and range of decisions are illustrated in Figure 4-7. The information needed to make decisions is provided by System status relative to targets, together with the management conditions that allow for actions to be implemented. That information is interpreted in the context of the current understanding of the system, as synthesized by models, to make decisions. Rather than a dichotomy of continue/adjust, as AM decisions are often portrayed, decisions range from continuing the current activities exactly, to continuing actions while adjusting them, to changing the actions that are implemented, to adjusting fundamental components of the program when necessary based upon new information. As the breadth and significance of decisions increases, the level of governance and engagement with stakeholders, states, and Tribes increases accordingly.



Source: AM Plan (Fischenich et al. 2016)

Figure 4-7. Factors Affecting Adaptive Management Decisions for Birds and the Nature of those Decisions

The variability of the Missouri River and the need to balance multiple, and sometimes competing, species and human considerations objectives support a toolbox approach to managing for plovers and terns. The approach consists of having multiple management actions and options available to ensure effective management in a context of natural variability and socioeconomic uncertainty. As the AM program is implemented, learning about the actions in the toolbox is applied to use them more effectively. Importantly, learning may also result in changes to the actions that are included and the bounds and conditions under which they are applied, or the addition or removal of management actions. Decisions to make changes are evidence-based and made in collaboration with stakeholders, states, and Tribes when human considerations objectives are affected.

4.5.2 Implementation

This step in the AM cycle involves implementing management actions of the preferred alternative to avoid a finding of jeopardy and sustain the piping plover and least tern. Management actions for birds fall into three general categories: (1) those that create habitat, (2) those that improve habitat quality or availability, and (3) those that directly protect nests, chicks, and/or adults to improve survival. Section 3 the AM Plan details implementation plans for each management action listed below.

The following is a summary of the actions to be taken for the piping plover and least tern under the preferred alternative.

Emergent Sandbar Habitat (ESH) Mechanical Construction: This would include implementation of mechanical ESH creation in the Garrison, Fort Randall, and Gavins Point reaches to meet plover population persistence targets specified by the USFWS. Based on hydrology and hydraulics modeling coupled with population models this would result in constructing an average of 391 acres of ESH per year in years where construction is needed.

Modeling estimated construction occurring in 75% of the years modeled (Table 4-5). In real-time, the existing population and ESH status would be assessed, as described in the AM Plan, to determine actual construction needs based on trends in the population and ESH. The rate of construction in a given year is calculated by aiming for the plover persistence probability. ESH targets are a means objective for implementation planning on the five-year time frame.

Table 4-5. Summary of Modeled Construction for the Preferred Alternative

Average ESH Construction in Build Years*	2.5 percentile ESH Construction	Median ESH Construction	97.5 percentile ESH Construction
391 Acres	21 acres	315 acres	1169 acres

* 75% of years were modeled to need construction to meet population persistence targets.

As described in Section 3 of the AM Plan, time frames for ESH and demographic targets have been specified. Median standardized ESH targets (shown in Table 4-6) are to be met 3 out of 4 years. This frequency was calculated based on the proportion of time standardized ESH was above target in the model runs used to calculate the target values. A moving window of 12 years is used for median available ESH. This allows for calculation of the exceedance probabilities over a meaningful time frame, long enough to accommodate naturally occurring periods of drought and high runoff that affect ESH quantities.

Table 4-6. Standardized and Available ESH Targets for the Northern and Southern Regions

		Acres of Emergent Sandbar Habitat					
		Northern Region			Southern Region		
		2.5 percentile	Median	97.5 percentile	2.5 percentile	Median	97.5 percentile
Standardized ESH Acres		200	428	1996	264	782	3907
Available ESH Acres Exceeded for Percentage of Years	75%	140	210	470	280	370	700
	50%	380	630	1000	460	720	1580
	25%	770	1420	2010	780	1370	3285
	10%	1340	2230	3625	1130	2320	5275

- **Reduced Nesting-Season Flow Releases within Capability Provided in Current Master Manual**: Flexibility under the existing Master Manual to allow reduction in releases when there is no navigation traffic scheduled is included as an option. This management action would continue to be an option to extend the life of ESH for nesting terns and plovers under Alternative 3 as conditions permit.
- **Flow Management to Reduce Take**: The steady release flow-to-target operation under the existing water control manual during the nesting season would continue as described in Chapter 2.0. This involves setting initial releases high enough early in the year to discourage birds from nesting on low-elevation sandbars that may get flooded later in the year and releasing less water when possible to avoid flooding tern and plover nests

below the dams. Regular communication between USFWS and reservoir control staff currently occur for this purpose and would continue.

- **Predator Management and Human Restriction Measures**: Predator management and human restriction measures would continue on constructed and naturally created sandbars. Predator management would initially follow the existing plan for predator management developed by USACE in 2009 although this plan could be adjusted based on AM. Proposed management actions in the plan include the use of exclusion cages and exclusion fending to protect nests and hazing of predators in combination with audio or visual frightening devices to deter predators away from nesting sites. Lethal and non-lethal removal of individual target predators that have the greatest impact on least tern and piping plover nests and chick, particularly raccoons, coyotes, mink, and great horned owls, would also occur. Human restriction measures include fencing of nesting areas or signage to alert people of the presence of nesting birds.
- **Vegetation Management**: Vegetation management would initially continue to follow the existing vegetation management strategies as explained in the 2013 Environmental Assessments for vegetation management in Nebraska-South Dakota, and North Dakota although the strategies could be adjusted based on the results of AM. The primary method of vegetation removal from selected sandbars would be spraying from an all-terrain vehicle or hand spraying for smaller areas with less vegetation. In areas that are large and/or densely vegetated aerial spraying from a helicopter would be conducted. USACE would continue to use an imazapyr-based (e.g., Habitat) and/or a glyphosate-based (e.g., Rodeo) herbicide approved by the U.S. Environmental Protection Agency (EPA) for aquatic use. Additional vegetation removal activities may include cutting, mulching, disking, mowing, raking, and removing vegetation from sandbars. The ESH Project Delivery Team (PDT) would continue to meet annually to discuss locations on the river where vegetation treatment could be conducted in an effort to maintain as much ESH as possible while considering other competing needs such as the regeneration of cottonwoods.
- **Monitoring**: Annual productivity monitoring of least tern and piping plover populations on the reservoir and river reaches of the Missouri River mainstem would continue. The current monitoring focuses on an adult census, measurement of fledge ratios, and documentation of incidental take if applicable. ESH habitat monitoring and assessment of management actions to determine their effectiveness would also occur.
- **Research and Modeling**: Modeling and research would also occur related to ESH construction, habitat-creating flow releases, lowered nesting season flow releases, flow releases to reduce take, sandbar augmentation and modification, vegetation management, predation control, human restriction measures, and reservoir water-level management. In addition, focused research projects on various aspects of piping plover demographics and habitat use would be implemented based on the prioritization process developed for the AM Plan. A detailed listing of the associated management questions and study summaries can be found in the AM Plan.

4.5.3 Monitoring

Annual monitoring of habitat and species performance metrics, and as-needed monitoring of action effectiveness and of unusual events will be required to adaptively manage decisions for the birds. Monitoring is necessary for tracking program performance relative to targets and identifying trends that indicate a need for changes to management. It also provides some of the information needed to develop and maintain accurate models (e.g., fledgling production relative to habitat availability and changes in ESH availability as a function of river flow). Monitoring requires flexibility and responsiveness to ensure timely and consistent data collection in a highly variable system. As habitat and populations on the Missouri River have the potential to change rapidly, monitoring for performance metrics must occur annually. Information needs that are not addressed through the monitoring program can be addressed through focused research.

The following priorities have been suggested for ESH and bird monitoring:

1. Provide information to continue advancing the habitat and population models for decision support;
2. Provide information for the evaluation of action effectiveness, including the population response;
3. Track the habitat and population performance metrics annually to determine whether targets are being met;
4. Provide information for assessing incidental take;
5. Be cost effective and practical to implement; and
6. Be comparable with previous monitoring programs to the extent possible while meeting objectives 1–5.

4.5.3.1 Monitoring of Hydrology and Habitat Metrics

Hydrological metrics are monitored and reported daily by USACE Water Management and provide information necessary to estimate reservoir habitat availability, adjust ESH estimates, determine incidental take risk and provide historical inputs to use in ESH model validation. ESH is monitored by acquiring satellite imagery of all riverine habitat during the nesting season, or as close to it as possible. Satellite imagery is classified to land cover type, which can then be used to estimate area of ESH (dry or wet sand with less than 30 percent vegetation cover) and vegetated sandbar.

Work was also initiated in the effects analysis to develop a protocol for estimating quality of habitat based upon land cover and landscape features at relevant scales will be explored for potential use in implementing AM for the birds. Quality assessments would allow for more accurate predictions of bird population dynamics and better allocation of habitat construction or modification resources.

4.5.3.2 Program for Monitoring of Population Metrics

Development of the AM Plan included changes in the piping plover targets, monitoring priorities, and use of the AM models provide an opportunity to re-evaluate the Tern and Plover Monitoring Program. Below is a summary of the current monitoring program. The AM Plan outlines potential changes that need to be assessed as the Management Plan is implemented.

Population monitoring requires adult surveys and monitoring of plover nests and chicks on both riverine and reservoir habitat. Adult counts are needed for estimating population size and growth rate, to help estimate fledge ratios, and to estimate population density for parameterizing density-productivity relationships. As such, count accuracy is vital, but challenging for mobile species that can be spread across large areas, especially on reservoir shorelines, and can fly to forage away from nesting sites.

From 1993 to 2016, the adult population of terns and plovers has been determined by conducting an adult census, an attempt to completely count all adult least terns and piping plovers observed during the third week in June. It is assumed that both of the species are settled on the breeding grounds by that time.

Fledgling and adult counts by segment are required for estimating fledge ratios and density-productivity relationships. These relationships have also been estimated at the sandbar scale, but that information is not currently used in the model. Fledge ratios are currently used by USFWS to assess take of least tern and piping plover eggs, chicks, and adults by factors influenced by but not directly attributable to USACE, and to assess take of piping plover chicks as a result of insufficient forage in river reaches affected by hypolimnetic releases or on created habitats.

Periodic review of the monitoring program (e.g., on a 5-year basis) will be conducted to assess adequacy. If necessary, improvements would be made while keeping in mind that changes to protocols affect the ability to compare data collected before and after the changes are made. Similarly, if methods of collecting information more quickly or cost-effectively become available, they should be explored, but potential impacts to assessment caused by changes to monitoring protocols should be taken into account before changes are made.

4.5.3.3 Management Action Effectiveness Monitoring

The additional monitoring required for action effectiveness depends upon the action and the degree to which existing monitoring is sufficient. For example, bird use and fledgling success on constructed sandbars compared to naturally created sandbars can be assessed using the same ESH monitoring and bird productivity monitoring data collected for evaluating performance metrics, with ability to detect effects depending on the quality of monitoring data. The need for action effectiveness monitoring diminishes with time as information is collected and uncertainty decreases.

4.5.3.4 Natural Events Requiring Additional Monitoring

Natural events can provide important data points for evaluating potential effects of management actions and for understanding natural variability. Obvious examples include unusually high or low flows that require reservoir releases out of the normal range and their effects on habitat dynamics and bird productivity. In that case, additional monitoring would include habitat assessments like those used to track action effectiveness. Survival and dispersal will be especially valuable during unusual conditions (such as very high or low habitat availability, coupled with habitat conditions in other breeding areas) as well as routine conditions.

4.5.3.5 Monitoring and Research to Improve Predictive Models and Action Planning/Design

Focused studies related to specific predictive modeling information needs will be regularly assessed and incorporated into the monitoring and research program for the birds. Studies that would benefit the ESH models are outlined in the AM Plan.

4.5.4 Evaluation

Evaluation of management hypotheses will be used to build a path from monitoring data to management decision making. Annual analysis and reporting, and annual and longer-term synthesis of monitoring data will provide the information needed to assess performance and help decision makers close the AM cycle and adjust on-going management actions. Evaluation includes both analysis of collected data and synthesis of numerous analyses to draw comprehensive inferences regarding critical uncertainties related to management actions and the associated responses of the least tern and piping plover.

4.5.4.1 Evaluation of Habitat Status Relative to Targets

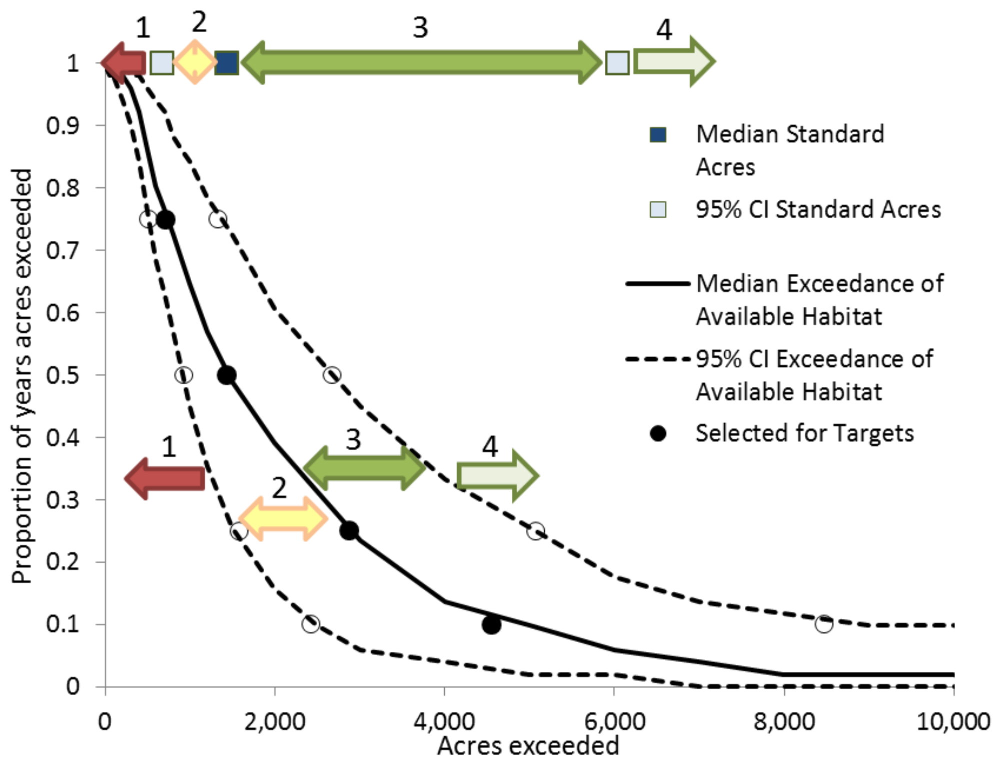
ESH targets are expressed as a quantity of median standardized habitat, to be met 3 out of 4 years, and as a distribution over time of available habitat, as described by the proportion of the most recent 12 years in which available habitat should exceed certain acreages. Both standardized and available habitats are specified by median and 95 percent confidence intervals. The medians provide the goal, but the confidence interval allows for variability around that goal driven by the uncertainty of future flows.

When evaluating the status of ESH relative to targets, the standardized habitat estimate for the year being evaluated is compared with the median and confidence intervals for the ESH target. There are four possible outcomes (Figure 4-8), each suggesting possible or necessary adjustments to habitat management actions:

4.5.4.2 Evaluation of Population Status Relative to Targets and Objectives

The population sub-objectives for birds require that the MRRP (1) maintain the geographic distribution of plovers, (2) maintain a resilient population, (3) maintain a population growth rate that is at least stable, and (4) maintain the success of breeding pair levels that support population growth. Rather than a quantitative target of a number of adults, criteria were set for long-term population persistence (low risk of quasi-extinction). Persistence is supported by population growth rates that are at least stable over time and fledge ratios that allow the population to be at least stable, given current estimates of survival. Therefore assessment of population status requires assessment of observed fledgling production and population growth (trends in population size over time) and assessment of population resiliency under current and proposed management conditions through modeling.

It is most straightforward to evaluate sub-objectives 3 (growth rate) and 4 (fledge ratio) by directly comparing observed rates and running averages with targets. Adjustments may be required if monitoring accuracy varies between years to account for known observation error (process to be determined), in order to compare population sizes from year to year to calculate growth rate. Adjustments may also be required to account for differential detection of adults and fledglings to more accurately calculate fledge ratios.



Source: AM Plan (Fischenich et al. 2016)

Note: Observed habitat acreages can fall within four numbered regions relative to the acreage bounds, as described in the text.

1. Acreage is below the lower confidence bound. Populations are very unlikely to objectives and the pace of habitat creation must increase.
2. Acreage is below the median and above the lower confidence bound. While it is possible that population dynamics will meet objectives, habitat creation to increase ESH to median levels should be a priority, especially when acreage approaches the lower part of the range.
3. Acreage is above the median and below the upper confidence bound. In this case, it is possible but not certain that more habitat is available than necessary to meet population objectives. Habitat should be maintained to the extent possible with new habitat creation focused on ensuring acreage does not drop below the median, particularly as acreages approach the upper confidence bound.
4. Acreage is above the upper confidence bound. It is very likely there is more habitat than is necessary to maintain the desired species status. Habitat creation is not needed, although activities to maintain existing habitat should be considered. For available habitat, the comparison to target exceedances is similar, but requires evaluation of habitat availability over 12 years to create an exceedance curve. That curve can then be compared to the target curve and exceedance values and the associated confidence intervals in the same way as the standard acreage. Changes to habitat management practices will take longer to be reflected in the exceedance curves, as the rolling time window includes data from years prior to the management being evaluated. Modifications of nesting season flow can be used in addition to habitat creation activities to increase the distribution of habitat availability. The upper end of the exceedance curve (10% exceedance) may only be met following high flows, regardless of whether or not high releases are intended to create habitat.

Figure 4-8. Standardized (squares) and Available Acreage Exceedance Targets (circles) with Confidence Bounds (light blue squares, dashed lines)

4.5.4.3 Overall Evaluation of Status and Management Needs

A holistic assessment of the status and trends of bird populations relative to habitat is needed for management decisions. Such an assessment is half of the foundation for decisions regarding whether actions should be implemented and, if so, where and with what intensity. Habitat targets provide guidelines for a resilient population in the long term; the needs of the population in a given year depend on population size relative to habitat availability (population density) and population trends.

4.5.4.4 Evaluation of Management Conditions

The evaluation of management conditions is the other half of the foundation for decisions, providing the necessary information on what actions are possible. Management conditions define the constraints on actions in a given year. Management conditions of standardized acres, vegetated habitat, and population density determine whether habitat creation, vegetation removal, and predator control, respectively, would be effective and how much benefit would likely be gained. Information on storage and tributary flows determines whether flow modification actions are feasible, and budget determines the extent of most non-flow actions. Constraints related to storage, flows, and budget must be determined in the context of the entire program including operation for authorized purposes, pallid sturgeon management actions, research, and other costs.

4.5.5 Adjustment Decisions and Planning Contingencies

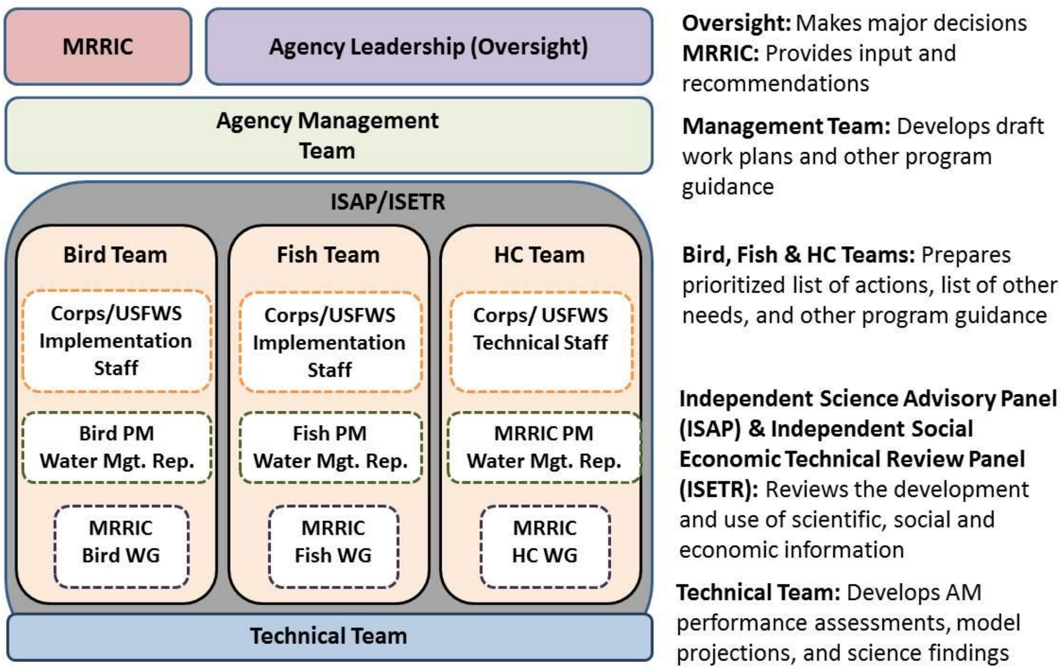
The last step in the AM cycle, adjust (or decision-making), is often described as “closing the loop,” by using what has been learned from monitoring and predictive modeling to make better, more informed decisions. Routine decisions for the birds include when to act, how to act, how much of an action to implement, and how to conduct research and monitoring. These decisions must be made in a programmatic context, incorporating pallid sturgeon management needs and human considerations. Section 3.6 of the AM Plan provides a description of decisions related to actions that are part of the preferred alternative, as well as actions that have been evaluated but not included in the preferred alternative, and a description of the decision making process. Decision criteria have been developed for both categories to represent the AM process across alternatives evaluated in the EIS. Decision-making relies upon the identification of management needs and management opportunities for the next 3-5 years. This information determines the scope of decisions to be made.

4.6 Governance of the AM Program

The term “governance” refers to the approach for decision-making and includes a description of what decisions need to be made, who is involved in the decision process, how decisions are made, and when they are required. Effective systems of governance contribute to trust-building, knowledge generation, collaborative learning, development of priority action listing, and conflict resolution. The governance structure and process for the MRRP is intended to achieve the above aims and to promote collaboration among the lead agencies and stakeholders, including MRRIC, while maintaining the statutory decision responsibilities of USACE and USFWS. A detailed description of proposed program governance can be found in the AM Plan.

Governance under the MRRP would involve making decisions about topics ranging from highly technical considerations, such as the selection of monitoring sites and sample sizes, to policy-and value-laden issues, such as whether to adjust reservoir operations criteria. Major policy decisions would be made by the USACE Division and District Commanders—subject to their authorities and appropriations—with input from USFWS, MRRIC, and the public. Some decision-making would be a joint USACE and USFWS function (e.g., changes to targets, decision criteria, or management actions). The MRRIC would work closely with USACE and USFWS (agency) leaders and may provide consensus recommendations.

As currently proposed, governance starts with interagency teams working together, with support of a technical team to interpret what has been learned to date and apply that knowledge to future decisions. The bird, fish, and HC teams would interact with component MRRIC work groups that may provide expertise and perspective, while serving to keep the full MRRIC aware of the teams' activities and deliberations. The management team and implementation teams (the latter consisting of the bird, fish, and HC teams), together with the technical team and agency leadership, would provide the governance structure for the MRRP (Figure 4-9).



Note: This figure reflects the governance recommendations developed by the MRRIC Adaptive Management Ad Hoc Group for consideration by MRRIC in August 2016.

Figure 4-9. Proposed Governance Structure for Adaptive Management of the Missouri River Recovery Program

The MRRP would also maintain an independent science advisory panel and an independent social economic technical review panel along with several internal and external peer review processes to assess the program, monitoring and study plans and reports, project designs, and other program products. Ensuring that the products used for decision-making are of the highest quality and meet standards of good practice is essential to trust-building and program success.

The AM Plan includes numerous decision criteria that indicate which actions would be taken based on performance of preceding actions, the status of the System, species populations, or the results of hypotheses testing. Occasionally, new information or understanding would dictate adjustments to these criteria or to the targets program objectives, or scope. The governance process for the MRRP would include procedures for making these changes, as well as for adjusting the program's governance structure and process itself.

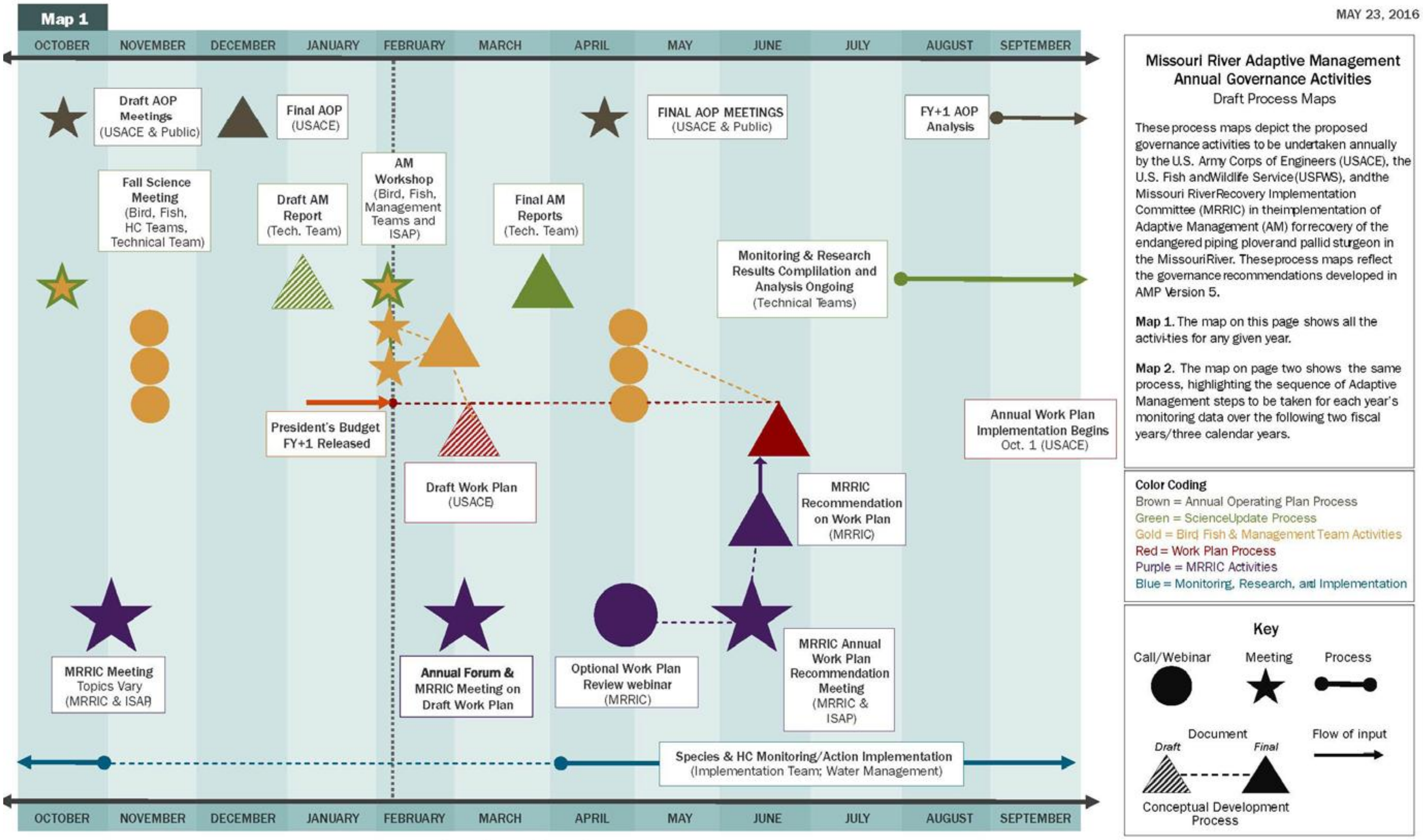
4.6.1 Annual Work Plan

The MRRP would employ a rolling, adaptive, 5-year work plan. Because of the uncertainty regarding some of the management actions required to meet species needs, future implementation decisions for the MRRP would depend upon the performance of earlier actions and results of research addressing critical uncertainties. Knowledge gained from project and system performance would inform adjustments to the work plan. The process would be constrained by several factors, most notably the timing of USACE budget cycles, which would dictate that updates to the work plan include only minor adjustments to the current fiscal year (FY) and the following fiscal year (FY+1) budgets, center on development of the FY+2 activities for budgeting purposes, and include anticipated needs for later years (FY+3 and FY+4).

Figure 4-10 is a draft process map that demonstrates the interactions that might occur annually as part of the work plan updating process. The AM Plan proposes that at the beginning of each fiscal year, the technical team meets with other entities at a fall science meeting to discuss the previous year's activities and to determine emerging analytical needs and needs for modification of research plans. The technical team would then assess actions implemented to date and the overall program performance; summarize significant findings from research, monitoring, and assessment; update the conceptual ecological models and hypotheses; make model projections of habitat and species populations; assess Reservoir System status; and undertake other tasks or studies needed to support decisions.

Information generated by the technical team would be presented at an AM workshop held each February to provide an opportunity for USACE and USFWS decision-makers, technical staff, contractors, and MRRIC to discuss the results of research and monitoring for the previous year and plans for the upcoming years. The bird and fish teams would use information generated by the technical team to develop a set of prioritized actions and program guidance for each species. The HC team would focus on monitoring needs and assessment results related to the program's effects on HC metrics. The teams (including the MRRIC work groups) would meet during and immediately following the AM workshop to prepare a report of recommendations and prioritized actions for submittal to the management team. The MRRIC work groups may prepare a separate joint report to MRRIC and the agencies.

The management team would draft updates to the work plan by integrating recommendations and program guidance from the bird, fish, and HC teams, and applying a programmatic perspective that considers the makeup of the existing work plan, guidance and direction provided by agency leadership, budget trends, the status of the science and risk management, effects on authorized purposes, etc. The draft revised work plan would be prepared in early March and provided to the agencies and MRRIC for review and comment. Proposed updates would be discussed at MRRIC meetings and by webinar, if needed. Additional analyses and adjustments could be made during this process depending on the feedback received from agency leaders or MRRIC. MRRIC may elect to provide a consensus recommendation at their June meeting prior to the agencies finalizing the adjustments to the plan.



Source: AM Plan (Fischenich et al. 2016)

Figure 4-10. General Engagement Process for Science and Development of the Work Plan

4.6.2 Reporting and Communications

Data reporting and communication are essential for decision-making and for fostering understanding by stakeholders, states, Tribes, and the general public. The MRRP serves a wide array of groups with a similarly wide range of interests and needs. Each audience therefore requires different forms of information with varying levels of detail. The products they require will include websites, analytic software, dashboards, databases, catalogues, maps, and reports. In support of the AM Plan, a communication plan would be developed, implemented, and periodically re-evaluated. The communications plan would address the needs of the different audiences and the diverse forms of reporting that are most appropriate to each audience (e.g., decision-oriented syntheses, annual reports, reporting sessions, science workshops, peer-reviewed reports and journal articles, fact sheets, videos, presentation summaries).

Multiple timeframes need to be considered. For example, reporting will need to inform annual decision-making needs but also consider biologically relevant time frames. Reporting will include annual reporting of the state of the System, including things such as the availability of habitat; implementation results (what actions were undertaken and to what extent); results of monitoring for terns, plovers, pallid sturgeon, and HC; and progress toward reducing management uncertainties and answering big questions.

Annual and periodic AM performance reports would serve the critical purposes of communicating what has been learned and the effectiveness of management actions toward meeting species objectives, including reporting the status and trends of the three species and their habitats.

An annual adaptive management report would be a primary vehicle for summarizing research, monitoring, and data analysis results in a manner that optimizes the incorporation of new learning into MRRP decisions and that bases these decisions upon the best available science. The annual reports would be made available to the management team, agency leadership, MRRIC, and the Independent Science Advisory Panel for their review and recommendations. Effective sharing and transparency of the information used in decision-making would be a key guiding principal in reporting.

Each annual adaptive management report would include a MRRP scorecard that communicates the status of new learning in relation to management hypotheses. These report cards and other relevant information would be posted on an open-access web site, which would also serve to communicate program activities, science findings, and other information to the public. Additional reporting and communication activities under the AM Plan would potentially include periodic webinars and the production of fact sheets and technical reports, which would provide the details related to information provided in the annual and periodic reports.

4.7 Human Considerations

Minimizing impacts on HC while fulfilling the requirements of the ESA is an objective of the MRRP. HCs include the authorized purposes that the Reservoir System was developed to support as well as the many other services it provides.

The HCs addressed as part of the MRRP include fish and wildlife, cultural resources, commercial sand and gravel dredging, flood risk management and interior drainage, hydropower, irrigation, navigation, recreation, thermal power, water supply, wastewater, and local government (property tax base). These considerations have been organized into four primary categories for assessment within the MRRMP-EIS:

- Environmental Quality
- National Economic Development
- Regional Economic Development
- Other Social Effects

There are one or more performance metrics for each of the HCs. Most performance metrics are economic and usually require considerable time and effort for full analysis. Therefore, two tools have been developed to allow for faster and easier exploration of the potential impacts of different management decisions on HCs.

A focused set of HC metrics that are sensitive to management actions and their potential effects would be identified and monitored as part of the AM program or provided from other sources. Outcomes identified through monitoring would be reviewed by MRRIC and the agencies, which would collaborate to determine whether changes can and should be made to management actions as a result. In parallel with the scientific review process, outside panels as needed will provide technical review of HC-related products and assist MRRIC in interpreting and responding to HC findings.

In the future, decision rules might be developed for certain HCs to help inform decisions about management actions. Forecasted changes in water level from a contemplated management action would be compared with projected water levels without that action to inform decision-making. Monitoring provides data for the comparison of projected versus actual effects, which would inform and improve the accuracy of future projections and aid in refining decision rules.

The following principles guide the incorporation of HCs into decision-making under the AM Plan:

- Flexibility and responsiveness: AM means adjusting the MRRP as new information about the needs of the species or the effectiveness of management actions becomes available. This applies to the potential effects on HCs as well; particularly the possible impacts of flow management actions, because stakeholders, states, and Tribes have identified them to be a primary concern.
- Predictability: To the extent possible, an effective AM process would retain or enhance the ability of stakeholders, states, and Tribes to know what activities are likely to occur in order to plan accordingly. This would include advanced notice of planned management actions, especially flow actions.
- Openness to win-win situations: The technical criteria in the Master Manual allow for minor adjustments to flows to enhance stakeholder, state, and Tribe objectives where possible and where impacts on other interests are not anticipated to be significant.
- Meet long-term species objectives while maintaining the authorized purposes and minimizing impacts on HCs: Meeting the objectives in the ESA is a legal requirement, but the MRRP also has responsibility to consider impacts on the eight authorized purposes.
- Ensure decisions are made by the right people at the right time: The USACE Missouri River Basin Water Management Division is responsible for preparing annual operating

plans and for making real-time water management decisions within the constraints of the Master Manual. The AM Plan lays out how different types of decisions could be made that are outside the scope of real-time water management.

- Accountability within the sphere of control for the MRRP: Some proposed actions have implications for HCs. However, the Missouri River has highly variable annual inflow patterns and operations sometimes result in negative impacts on HCs independent from the program's actions. In principle, attempts should be made to organize monitoring activities in a manner that helps distinguish between impacts on HCs that occur as a result of the program versus those that would have happened anyway under existing operations.

4.8 Implementation Costs

While our understanding of the needs for the birds is significantly greater than for the pallid sturgeon, costs for managing the birds are high, they respond rapidly to changes in habitat that is very dynamic, and there are many challenges to addressing their needs while minimizing impacts to HCs. These factors contribute to the need for an active, progressive AM strategy as part of the MRRP.

The total estimated cost of the preferred alternative is approximately $3.0 billion and the annual cost in years 1-9 is approximately $94.9 million. This estimate includes program management, integration, and coordination, costs for MRRIC engagement, upper and lower river pallid sturgeon habitat construction, operations, and maintenance, piping plover and least tern habitat construction, operation, and maintenance, real estate acquisition, habitat development and land management, and monitoring/studies costs. Table 4-7 includes total and annual costs for each management action and the number of years each would be implemented.

Table 4-7. Estimated Cost for the Preferred Alternative

Management Actions	Annual Cost (Average)	Years Implemented	Total
Program Management, Integration, and Coordination	$5,690,000	1–50	$284,500,000
MRRIC	$1,500,000	1–50	$75,000,000
Subtotal			**$359,500,000**
ISP			
Propagation and Augmentation Program	$455,167	1–50	$22,758,350
PSPAP	$2,500,000	1–50	$125,000,000
Habitat Assessment Monitoring Program	$1,860,333	1–15	$27,904,995
Lower Pallid Monitoring, Evaluation, and Research Level 1 and 2 Studies	$1,422,171	1–19	$27,021,249
Upper Pallid Monitoring, Evaluation, and Research Level 1 and 2 Studies	$933,027	1–15	$13,995,405
Bird Monitoring	$1,200,000	1–50	$60,000,000
Bird Level 2 Studies/Projects	$1,853,333	1–15	$27,799,995
Subtotal			**$304,479,994**

Management Actions	Annual Cost (Average)	Years Implemented	Total
Pallid Habitat			
Spawning Habitat Construction	$123,304	1–9	$1,109,736
Spawning Habitat Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRRR)	$24,661	1–50	$1,233,050
Existing SWH Operations and Maintenance	$7,383,537	1–50	$369,176,850
Omaha Reaches Construction	$9,651,329	1–15	$144,769,935
Omaha Reaches O&M	$2,106,435	2–15	
	$4,212,870	16–50	
		2–50	$176,940,540
Kansas City Reaches Construction	$40,181,428	1–15	$602,721,420
Kansas City Reaches O&M	$4,118,511	2–15	
	$8,187,950	16–50	
		2–50	$344,237,404
Real Estate Acquisition	$997,707	1–10	$9,977,070
Habitat Development	$141,680	1–15	$2,125,200
Land Management	$22,343	2–15	
	$44,685	16–50	
		2–50	$1,876,777
Subtotals			
Construction			**$762,580,138**
OMRRR			**$891,587,844**
Bird Habitat			
Mechanical ESH Creation	$14,702,500	1–50	$735,125,000
Vegetation Management	$68,000	1–50	$3,400,000
Predator Management	$20,000	1–50	$1,000,000
Human Restrictions Measures	$5,000	1–50	$250,000
Subtotal			**$739,775,000**
Totals (All Year Total Cost, Annual CG Total, Annual O&M Total)			**$3,057,922,976**
Total Annual Costs (average, without discounting)	$94,899,975	1–9	
	$98,055,259	10–15	
	$47,416,541	16–19	
	$45,994,370	20–50	
Total Average-Annual MRRP Implementation (NED) Cost (using FY16 federal discount rate: 3.125%)	**$69,206,597**	**1–50**	

Note: All costs and benefits are in FY 2016 (OCT 2015) dollars

4.9 Future NEPA and Other Environmental Compliance Requirements

The programmatic MRRMP-EIS is the USACE strategic approach to meeting its NEPA responsibilities in implementing the recovery program in a cost effective and streamlined manner. To achieve these goals, it is important that the EIS be developed in a way that considers how it will be used as well as how future projects will be considered and evaluated. A programmatic approach is well suited for the MRRP, as it integrates the management actions being implemented and the adaptive management framework that will be used to assess performance and make adjustments based on new learning. By addressing uncertainties and potential impacts associated with potential future management actions as part of this EIS process, the need to supplement or prepare additional NEPA documents will be reduced. The MRRMP-EIS establishes an AM plan for the next 15 years (approximate) that is flexible and should allow many of the management actions specified within the preferred alternative to proceed without additional NEPA analysis. Information gathered through the adaptive management process will be used to adjust operations within the range of the impacts analyzed in this EIS.

The versatility of this programmatic EIS allows immediate actions to be implemented upon approval of the ROD. Because the adaptive management process may ultimately indicate the need for actions that address hypotheses outside the scope of the preferred alternative, these potential actions are identified in the AM Plan. Several options are available to for future NEPA documentation: (1) tiering from this EIS (2) supplemental EISs or environmental assessments, or (3) standalone NEPA documentation. Figure 4-11 illustrates the NEPA and environmental review process.

4.9.1 Tiering

Implementation of the management actions articulated in the EIS may require subsequent analysis for site-specific actions that can be tiered from the programmatic EIS. NEPA regulations encourage the use of tiering in order to focus on issues ripe for decision making (40 CFR 1502.20.) Using a “tiering” approach allows more general matters to be addressed in this programmatic EIS, with subsequent tiered EISs or environmental assessments to focus site-specific actions and associated environmental analyses. The tiered EIS or environmental assessment would reference the general discussion from this programmatic EIS while focusing on the project-specific impacts important to USACE decision-makers. This programmatic EIS will enable USACE to tier future project proposals from the overarching programmatic EIS analysis, helping to streamline future environmental reviews.

4.9.2 Supplemental NEPA Documentation

NEPA requires agencies to prepare supplements to their draft or final EISs under two circumstances: (1) “the agency makes substantial changes to the proposed action that are relevant to environmental concerns, or” (2) “if there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts” (40 CFR 1502.9(c)). If adaptive management provides significant new information affecting selection of the preferred alternative and the actions and potential impacts are not within the range of impacts and alternatives considered in this MRRMP-EIS, supplemental NEPA analysis would be required. The approach used to address this situation was to develop alternatives that would be initially implemented (over roughly a 15-year timeframe) to begin the adaptive management process. At the end of this timeframe, and potentially sooner, another NEPA process would be undertaken to assess any proposed changes, due to adaptive management. These would be addressed in supplemental NEPA documentation required to augment the MRRMP-EIS.

4.9.3 Standalone NEPA Documentation

Implementation of actions not contemplated in this EIS, or based on a decision not to supplement the EIS, would require a separate NEPA process. This process would be initiated and conducted according to appropriate CEQ and USACE regulations and policies associated with NEPA.

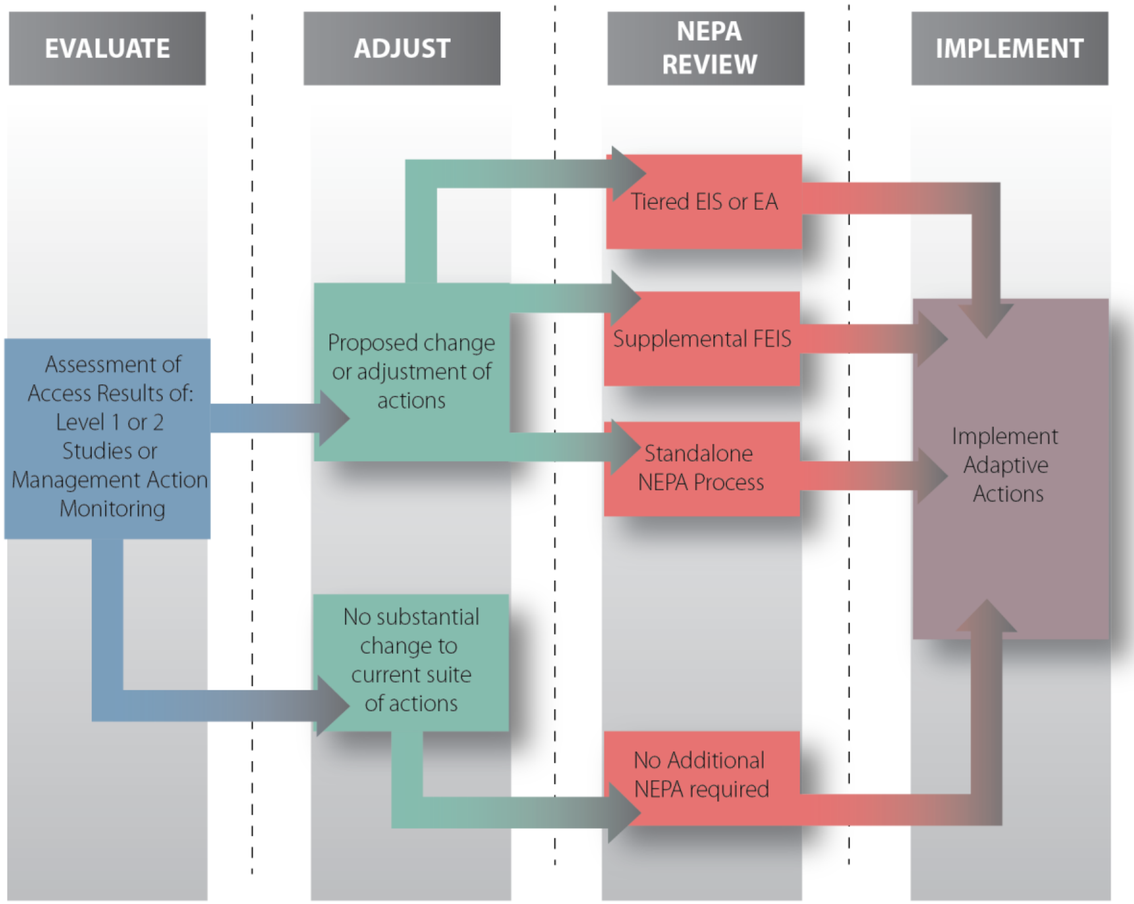


Figure 4-11. Integration of the National Environmental Policy Act and Environmental Compliance Process in the Adaptive Management Framework

5.0 Tribal, Agency, and Public Involvement

This chapter describes Tribal and agency involvement as well as the coordination and public engagement activities that have been conducted as part of the Missouri River Recovery Management Plan – Environmental Impact Statement (MRRMP-EIS).

5.1 Missouri River Recovery Implementation Committee

The Missouri River Recovery Implementation Committee (MRRIC) is an interdisciplinary group charged with making recommendations and providing guidance on a long-term study of the Missouri River and its tributaries and on the existing Missouri River recovery and mitigation plan. MRRIC recommendation letters can be found in Appendix G. The committee was established by the Secretary of the Army in 2008, as authorized by Section 5018 of the 2007 Water Resources Development Act (WRDA). The committee is intended to help guide the prioritization, implementation, monitoring, evaluation, and adaptation of recovery actions, while providing representation for a broad array of interests. MRRIC is comprised of nearly 70 members representing Tribal, local, state, and federal interests throughout the Missouri River Basin. A list of MRRIC members can be found at www.mrric.org. More information on MRRIC Tribal members can be found at www.mrric.org and in Appendix H.

MRRIC has made two substantive recommendations related to the Management Plan process. In August of 2012, MRRIC made a consensus recommendation to the U.S. Army Corps of Engineers (USACE), which was based upon the Missouri River Independent Science Advisory Panel (ISAP) report entitled: Final Report on Spring Pulses and Adaptive Management (ISAP 2011). These documents are available at www.mrric.org. The ISAP report and MRRIC recommendations led to development of the effects analysis, the Science and Adaptive Management Plan (AM Plan), and the EIS process for their implementation. The MRRIC recommendation included seven proposed actions:

1. An effects analysis should be developed that incorporates new knowledge that has accrued since the 2003 Amended Biological Opinion. As part of this analysis:
    - The effects of the Missouri and Kansas River Operations on the listed species should be reviewed and analyzed in the context of other stressors on the listed species;
    - The quantitative effects of potential management actions on the listed species should be documented to the extent possible; and
    - These potential management actions should be incorporated into the conceptual ecological models (CEMs).
2. CEMs should be developed for each of the three listed species and these models should articulate the effects of stressors and mitigative actions (including but not limited to flow management, habitat restoration actions, and artificial propagation) on species performance.
3. Other managed flow programs and adaptive management plans should be evaluated as guidance in development of the CEMs and adaptive management strategy for the Missouri River Recovery Program.
4. An overarching adaptive management strategy should be developed that anticipates implementation of combined flow management actions and mechanical habitat

construction, and this strategy should be used to guide future management actions, monitoring, research, and assessment activities within the context of regulatory and legal constraints.

5. Monitoring programs along the Missouri River should be designed so as to determine if hypothesized outcomes are occurring and the extent to which they are attributable to specific management actions.
6. The agencies should identify decision criteria (trigger points) that will lead to continuing a management action or selecting a different management action. A formal process should be designed and implemented to regularly compare incoming monitoring results with the decision criteria.
7. Aspects of how the entire hydrograph influences the three listed species should be evaluated when assessing the range of potential management actions.

In August 2014, the MRRIC made a consensus recommendation to the USACE regarding human considerations (HC) objectives and performance metrics which is available on the MRRIC website (www.mrric.org). This recommendation established criteria to ensure that adequate consideration is given to the possible interactions of management actions with human uses and interests on the river, and that these criteria are used to evaluate the impacts of alternatives in the MRRMP-EIS. HC objectives and metrics are evaluated in this EIS and include:

- Fish and wildlife
- Cultural resources
- Agriculture
- Commercial sand dredging
- Flood risk management
- Hydropower
- Irrigation
- Navigation
- Recreation
- Thermal power
- Wastewater
- Water supply
- Ecosystem services
- Tribal interests (in addition to those associated with the above categories)

These interests and associated objectives and metrics were key considerations in analyzing and comparing the effects of different alternatives in this EIS. The analysis is documented in Chapter 3.0, Affected Environment and Environmental Consequences.

USACE has coordinated with MRRIC throughout the development of the MRRMP-EIS in addition to receiving the formal consensus recommendations. Coordination includes quarterly in-person plenary meetings, webinars, in-person and virtual meetings with MRRIC workgroups, and collaboration on the preparation and review of multiple technical reports and documents, including the effects analysis and iterations of the AM Plan. The MRRIC has established seven individual work groups consisting of MRRIC members, alternates, agency staff, and others, which meet one to three times per month on average. The purpose of the work groups is to allow MRRIC members to better understand the actions at hand and work directly with the agencies to make recommendations aimed at maximizing the effectiveness of the Missouri River Recovery Program (MRRP), while ensuring public values are sufficiently incorporated into the plans. The work groups include three ad hoc groups which are intended to address specific issues and disband upon completion of their work. A brief summary of each work group is provided below:

- **Agenda Work Group**: The Agenda Work Group collaborates with the MRRIC Chair and agency staff to develop the agenda for each MRRIC plenary meeting.
- **Communications Work Group**: The Communications Work Group is responsible for developing communication materials including press releases, newsletters, reports surveys, and meeting materials such as PowerPoint presentations and other technologies.
- **Science and Adaptive Management Work Group**: The Science and Adaptive Management Work Group collaborates with the ISAP to provide guidance and recommendations to the MRRIC regarding implementation, monitoring, and evaluation of actions associated with the MRRMP.
- **Tribal Interests Work Group**: The Tribal Interests Work Group advises the MRRIC on Tribal-related issues to ensure that Tribal concerns are sufficiently considered, and works to improve Tribal participation in the MRRIC.
- **Adaptive Management Ad Hoc Group**: The Adaptive Management Ad Hoc Group was established to help evaluate and make recommendations to the MRRIC on how the MRRIC, the Independent Science Advisory Panel, and the Independent Socio-Economic Technical Review (ISETR) should engage with the lead agencies in implementation of the AM Plan, including development of the AM governance approach.
- **Human Considerations Ad Hoc Group**: The Human Considerations Ad Hoc Group provides recommendations to the MRRIC to ensure that adequate consideration is given to the possible interactions of management actions with human uses and interests on the river, specifically as they pertain to the evaluation of alternatives in the MRRMP-EIS.
- **Membership, Process and Procedures Ad Hoc Group**: The Membership, Process and Procedures Ad Hoc Group addresses process and procedures related to the operations of the MRRIC and assists the lead agencies (USACE and U.S. Fish and Wildlife Service (USFWS)) with aspects of membership on the MRRIC.

5.2 Tribal Coordination and Consultation

In August 2013, the USACE held a series of six Tribal scoping meetings for the MRRMP-EIS at various locations across five states. Beyond fulfilling the USACE responsibilities under the National Environmental Policy Act (NEPA), the purpose of the Tribal scoping was to inform the tribes about the proposed action and possible alternatives and provide meaningful opportunity for comment and participation in the process. Tribal scoping also allowed the tribes to help identify the scope of issues to be addressed and to identify potentially significant issues related to the MRRMP-EIS. Letters of invitation were distributed to all 29 tribes in the Missouri River

Basin in mid-July 2013. The letters included a description of the project and a complete schedule of the Tribal scoping meetings. Meetings were held in Fort Peck and Billings, Montana; Bismarck, North Dakota; Vermillion, South Dakota; Pawhuska, Oklahoma; and Lawrence, Kansas. Members of the tribes were invited to submit comments in person at the Tribal scoping meetings, by mail, email, or online via the NPS Planning, Environment and Public Comment (PEPC) system. The scoping period was initiated with the publication of a Notice of Intent in the Federal Register on August 9, 2013, and closed on November 4, 2013. The content of these comments can be found in the MRRMP-EIS Scoping Summary Report (available at www.moriverrecovery.org).

Tribal members have also provided guidance and input throughout the Management Plan process through their participation in MRRIC plenary meetings and their involvement in workgroups including the Tribal interests workgroup. The USACE has also held regional and small-group meetings with the Tribes separate from the regular MRRIC process to exchange information and address emerging questions and concerns related to Management Plan development. A description of these engagements is included in Appendix H.

Government-to-Government Tribal consultation for the purposes of the MRRMP-EIS is the responsibility of both the USACE and the USFWS. A draft plan for conducting Government-to-Government consultation is included in Appendix H. All federally recognized Tribes geographically located within the Missouri River basin or that have historical ties within the basin have been identified as potential consulting Tribes. The intent of government-to-government consultation is to provide for identification and resolution of issues related to the alternatives being evaluated in this draft EIS. An invitation to government-to-government consultation was sent in a letter to the Tribes dated October 20, 2016. Coordination and communication with the Tribes will continue throughout the consultation process and will include face-to-face meetings, letters, and email and telephone communications. Consulting Tribes will develop joint procedures for elevation and ultimate disposition of unresolved issues, should such issues arise.

5.3 Agency Coordination and Public Scoping

5.3.1 Cooperating Agencies

The USFWS; Bureau of Reclamation; National Park Service; Western Area Power Administration (WAPA); and States of Nebraska, South Dakota, and Wyoming are cooperating agencies in the Management Plan process. All of the cooperating agencies are also members of MRRIC. Given their MRRIC membership and the high degree of MRRIC involvement in the Management Plan process, much of the cooperating agency involvement in the Management Plan process has occurred in the MRRIC forum. In addition to their participation in MRRIC, the USFWS has provided their technical input and expertise to the process through a series of planning aid letters to the USACE.

Similarly, WAPA, NPS, Bureau of Reclamation, and States of Wyoming, South Dakota, and Nebraska provided their technical expertise and input on draft Management Plan products and provided technical information for the analysis. The USACE worked with WAPA to determine reasonable estimates for the financial impact of the alternatives to WAPA and the RED impact to hydropower. WAPA provided information about their hourly preference customer and pumping load in the Southwestern Power Pool (SPP) footprint and their deliveries external to SPP for 2016. WAPA provided a way to compare generation data from the alternatives to an estimate of actual demand on the system and value those comparisons. WAPA also identified 2012 as a normal generation year in the existing condition and so this year was used as a point of comparison for the alternatives. The Bureau of Reclamation provided information and data on water supply intakes under their purview and the states have provided needed data especially related to the recreation analysis. The National Park Service and the USACE have initiated discussions to determine the manner in which emergent sandbar habitat (ESH) construction would be conducted in the Missouri River National Recreational River reaches where NPS responsibilities under the Wild and Scenic Rivers Act.

5.3.2 Public and Agency Scoping

To solicit public input in the MRRMP-EIS process, the USACE conducted public scoping webinars on September 11 and 18, 2013, which were broadcast live via internet from the Omaha District Office. Members of the public were invited to participate online, or attend a broadcast of the webinars in real time at one of several host sites. The dates and times of the public scoping webinars and the host site locations were announced in the Notice of Intent, published in the Federal Register on August 9, 2013, via a press release from the Kansas City District Public Affairs Office on August 28, through social media, and in mass emails. At least one host site location was offered in each of eight states throughout the Missouri River Basin. Additionally, one of the webinars was recorded, archived, and made available on the Management Plan webpage for members of the public who were unable to attend the live broadcast via internet or at a host site.

Members of the public were invited to submit questions and comments during the live webinar broadcasts, by mail, email, or online via the NPS PEPC system. Host sites managed questions and comments received verbally during the webinars by submitting attendees' questions and comments through the webinar chat function. The comment period was open from August 9 to November 4, 2013, during which 70 correspondences were received. The content of comments received is summarized in MRRMP-EIS Scoping Summary Report (available at www.moriverrecovery.org).

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6.0 Compliance with Other Environmental Laws

This section addresses federal statutes, implementing regulations, and executive orders potentially applicable to the programmatic Missouri River Recovery Management Plan and Environmental Impact Statement (MRRMP-EIS). Applicable requirements are summarized below. For site-specific projects, a tiered analysis would be conducted to ensure compliance with any associated laws prior to implementation.

6.1 Threatened and Endangered Species

6.1.1 Endangered Species Act

The Endangered Species Act (ESA) (16 USC 1531 et seq.) established a program to promote the conservation and facilitate recovery of imperiled species and the habitats in which they are found. As such, ESA prohibits "take" of any species listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS), where "take" is defined as to, "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect," any species listed under ESA. Section 7 of the ESA requires federal agencies to ensure that any actions authorized, funded, or carried out by the agency do not jeopardize the continued existence of a federally listed threatened or endangered species, or result in the destruction or adverse modification of the designated critical habitat of a federally listed species. ESA correspondence is provided in Appendix I.

Following consideration of public, agency, Tribal, and stakeholder review of this draft MRRMP-EIS, the USACE will identify a "proposed action" and prepare a biological assessment (BA) of the effects of that action on the pallid sturgeon, interior least tern, and piping plover. This BA will be transmitted to the USFWS to initiate formal consultation under Section 7 of the ESA. The USFWS will prepare a Biological Opinion (BO) which will include a finding of whether the proposed action will likely jeopardize the continued existence of the listed species and whether any reasonable and prudent alternatives (RPAs) are necessary. The BO will also include an "incidental take statement" which will include "reasonable and prudent measures" (RPMs) which are thought to be necessary to minimize potential incidental take of the listed species. Following receipt of the final BO, the USACE will determine if the terms of the BO are necessary to avoid a finding of jeopardy to the listed species and issue a final MRRMP-EIS and Record of Decision (ROD) which describes the recommended plan for implementation.

Any site-specific action carried out under the recommended plan that has the potential to adversely impact threatened or endangered species or associated habitat would not be implemented without site-specific surveys and assessments to ensure that no threatened or endangered species would be adversely impacted by U.S. Army Corps of Engineers (USACE) actions. When necessary, at specific sites, USACE will complete tiered NEPA and coordination with USFWS to ensure compliance with ESA. All construction timing constraints related to specific listed species within the project area will be observed in order to avoid impacts to federally listed species. Furthermore, USFWS is a cooperating agency for the MRRMP-EIS and has submitted planning guidance to USACE throughout the process (Appendix B).

6.1.2 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 USC §§ 668a–668d) prohibits the take, possession, or sale of bald and golden eagles, with limited exceptions for the scientific or exhibition purposes, for religious purposes of Indian Tribes, or for the protection of wildlife and agriculture or for preservation of the species. In 2009, USFWS created a permit program for non-purposeful take of eagles and their nests. The MRRMP-EIS has analyzed the potential impacts of the considered alternatives and has determined that the alternatives are not likely to result in the take of bald or golden eagles. As part of each site-specific project, USACE would coordinate with USFWS and the appropriate state agencies to avoid incidental take of bald or golden eagles during the implementation of any management action. If a bald or golden eagle were to be found near or on a project site, the appropriate USFWS office would be contacted and USFWS National Bald Eagle Management Guidelines would be implemented in coordination with USFWS.

6.2 Fish and Wildlife Conservation

6.2.1 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) (16 USC 661 et seq.) requires federal agencies to coordinate with USFWS or the National Marine Fisheries Service and appropriate state wildlife agencies to avoid or minimize adverse impacts of federal actions that propose to modify any stream or water body. Modification of a stream or water body includes impoundment, diversion, and deepening of channels. USACE has coordinated with USFWS and various state wildlife agencies throughout the development of the draft MRRMP-EIS and has received and incorporated planning aid letters (Appendix B) into the development of this draft MRRMP-EIS. Preliminary draft chapters of the draft MRRMP-EIS have also been shared with the USFWS and state resource agencies for their review and comment and the USACE will continue to coordinate through completion of the final MRRMP-EIS and Record of Decision (ROD). A final FWCA report will accompany the Final EIS.

Coordination will also continue to occur during implementation of the recommended plan after the Final MRRMP-EIS and ROD.

6.2.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act, originally implemented in 1918, prohibits the take, possession, or sale of migratory birds (16 USC § 703(a)). No significant impacts to migratory birds are anticipated under any of the MRRMP-EIS alternatives. Migratory birds are addressed in Section 3.5, Fish and Wildlife Habitat, and Section 3.6, Other Special-Status Species. USACE coordinates with USFWS and appropriate state agencies prior to construction occurring at site-specific projects. Clearing of vegetation normally is scheduled to occur outside of the primary nesting season further reducing the risk to migratory birds.

6.3 Water Resources and Wetlands Conservation

6.3.1 Clean Water Act

The objective of the Clean Water Act (CWA) (33 USC 1251 et seq.), as amended, is to restore and maintain the chemical, physical, and biological integrity of the nation‘s waters. USACE regulates discharges of dredge or fill material into waters of the United States pursuant to Section 404 of the CWA. This permitting authority applies to all waters of the United States including water deemed jurisdictional by virtue of possession of a significant nexus with traditionally navigable waters. The selection of disposal sites for dredged or fill material is done in accordance with the Section 404(b)(1) guidelines, which were developed by the U.S.

Environmental Protection Agency (USEPA) (40 CFR Part 230). Section 401 of the CWA allows states to grant or deny water quality certification for any activity that results in a discharge into waters of the United States and requires a federal permit or license. Certification requires a finding by the affected states that the activities permitted would comply with all water quality standards individually or cumulatively over the term of the permit. Section 401 water quality certifications would be obtained for site-specific management actions, as required, prior to construction. The CWA also established the National Pollutant Discharge Elimination System (NPDES) for permitting point-source discharges to waters of the United States. A tiered NEPA process will be associated with each site-specific project under the alternative ultimately selected for implementation. Each process will include compliance with Sections 401, 402, and 404 of the CWA through site-specific analysis and coordination.

6.3.2 Executive Order 11988 Flood Plain Management

Executive Order 11988 requires federal agencies to evaluate the potential effects of their actions on floodplains and to consider alternatives to avoid or minimize impacts. This requirement applies to the following actions: (1) acquiring, managing, and disposing of federal lands and facilities; (2) providing federally undertaken, financed, or assisted construction and improvements; and (3) conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities. Implementation of the preferred alternative will avoid, to the extent possible, long- and short-term adverse impacts the floodplain. It will also avoid direct and indirect support of development or growth (construction of structure/or facilities, habitable or otherwise) in the base floodplain. Site-specific designs will be developed to ensure that the project complies with Executive Order 11988 through technical analysis and coordination with local floodplain management authorities. Potential impacts to the Missouri River floodplain are described in Section 3.2, River Infrastructure and Hydrologic Processes.

6.4 Cultural Resources and Heritage

6.4.1 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) (16 USC 470) requires federal agencies to evaluate the effects of federal undertakings on historical, archeological, and cultural resources. To do this, USACE must identify any district, site, building, structure, or object that is located in or near the project area, and is included in or eligible for inclusion in the National Register of Historic Places. In addition to ongoing coordination, the USACE Omaha District has developed a programmatic agreement in consultation with Tribes, THPOs, SHPOs, agencies, and interested parties to address problems associated with cultural and historic resource impacts involved with the ongoing operation and maintenance of the Missouri River System. Additionally, all construction management actions implemented under the management plan will be coordinated with the appropriate THPO and/or SHPO and will be constructed on lands owned in fee title by the federal government, therefore, all federal cultural and historical protection laws will apply to construction projects. Any future actions will be undertaken with the processes outlined and identified in the programmatic agreement (PA) and in compliance with Section 106 of the NHPA. The Kansas City District is planning to consult on the development of a PA in the lower basin of the Missouri River from Rulo to the Mouth. More information regarding cultural resources identification and potential impacts to cultural resources are described in Section 3.9, Cultural Resources.

6.4.2 Archaeological Resources Protection Act

The Archeological Resources Protection Act (16 USC 470aa-470ll) provides for the protection of archeological sites located on public and Tribal lands; establishes permit requirements for the excavation or removal of cultural properties from public or Tribal lands; and establishes civil and criminal penalties for the unauthorized appropriation, alteration, exchange, or other handling of cultural properties. USACE is authorized to issue permits for archeological surveys and exploration and would ensure that all permit requirements are met if excavation of archaeological sites was required. Potential impacts to archaeological resources are described in Section 3.9, Cultural Resources.

6.4.3 Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act (NAGPRA) (25 USC 3001 et. seq.) addresses the discovery, identification, treatment, and repatriation of Native American human remains and cultural items. This Act also establishes penalties for the sale, use, and transport thereof. In recognition of the sensitivity and cultural importance of human remains, funerary objects, sacred objects, or objects of cultural patrimony, each USACE District has developed a standard operating procedure to provide guidance to assure respectful and responsive treatment of human skeletal remains inadvertently discovered on federal lands managed by the district. USACE does not have NAGPRA jurisdiction over human remains or other NAGPRA related collections recovered from private and non-Tribal lands. This is also true if remains are recovered during a federal undertaking on private lands. Under those circumstances, specific state unmarked burial laws would take precedence. Management actions described in the MRRMP-EIS would make the appropriate efforts to avoid adverse impacts to Tribal sites as described in Section 3.9, Cultural Resources.

6.4.4 American Indian Religious Freedom Act

The American Indian Religious Freedom Act (AIRFA) of 1978 (42 USC 1996) provides for the protection and preservation of American Indian rights of freedom of belief, expression, and exercise of traditional religions. Courts have interpreted AIRFA to mean that federal agencies must consider American Indian interests before undertaking actions that might cause unnecessary interference with those traditional practices. USACE recognizes its responsibilities with respect to AIRFA and will coordinate with Tribes in carrying out the requirements of the AIRFA for any actions described in the MRRMP-EIS.

6.4.5 Executive Order 13007 Indian Sacred Sites

Executive Order 13007 requires federal agencies to accommodate access to, and ceremonial use of, American Indian sacred sites by Tribal religious practitioners. The order requires federal agencies to avoid adverse impacts to Tribal sacred sites and maintain the confidentiality of information pertaining to Tribal sacred sites. Tiered environmental analyses will be prepared for site-specific management actions and USACE will coordinate with appropriate Tribes to ensure that all actions comply with Executive Order 13007.

6.5 Water Rights

Tribal water rights are a matter of federal law. The Winters Doctrine, developed by the Supreme Court in Winters v. United States, 207 U.S. 564 (1908), maintains that sufficient water was reserved by implication to fulfill the purposes of the Reservation at the time the Reservation was established. When a Reservation is established with expressed or implicit purposes beyond agriculture, such as fishing and water supply, then water may also be reserved in quantities sufficient to sustain use. The court elaborated upon the holding of Winters in the case of Arizona v. California, 373 U.S. 546 (1963). In that case, the court held that the Tribes need not confine their use of water to agricultural pursuits, regardless of the wording in the document establishing the Reservation, although the amount of water quantified was determined by the amount of water necessary to irrigate the “practicably irrigable acreage” on those Reservations. The court also stated that water allocated should be sufficient for both present and future needs of the Reservation in order to assure the viability of the Reservations as homelands. Case law supports the premise that American Indian reserved water rights cannot be lost, whether or not those rights are exercised.

The MRRMP-EIS does not attempt to define, regulate, or quantify water rights or any other rights that the Tribes are entitled to by law or treaty. The USACE is not directly involved in the process of quantification, but respects a Tribe’s decision to submit to the process or decline to participate in the process.

6.6 Environmental Justice

Executive Order 12898 Federal Actions to Address Environmental Justice in Minority and Low Income Populations

Executive Order 12898, passed in 1994, requires federal agencies to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States. Executive Order 12898 calls for federal agencies to provide opportunities for stakeholders to obtain information and provide comment on federal actions. USACE is complying with this executive order by engaging with MRRIC and providing regular and accessible means for stakeholders in the Missouri River Basin to obtain information and provide comments to USACE related the MRRMP-EIS and its potential effects to their resource or use of concern. A more detailed description of the level of engagement USACE has had with MRRIC is included in Section 5.1, Missouri River Recovery Implementation Committee. In addition to regularly engaging with MRRIC, and seeking input from the general public, USACE has conducted additional meetings throughout the Missouri River Basin in an effort to specifically provide information and seek input from minority and low-income populations. Impacts to environmental justice populations are addressed in Section 3.22, Environmental Justice. USACE would take all appropriate measures to ensure that management actions described in the MRRMP-EIS would not disproportionately adversely impact minority or low-income communities.

6.7 Farmland Protection

Farmland Protection Policy Act

The Farmland Protection Policy Act (7 USC 4201, et seq.) requires federal agencies to coordinate with the USDA to develop criteria for identifying the effects of federal programs on the conversion of farmland to non-agricultural uses. Flow actions described in the MRRMP-EIS may result in the permanent conversion of farmland to nonagricultural use. USACE will coordinate with USDA before implementation of site-specific projects where Management Plan actions have the potential to convert farmland to non-agricultural uses. More information regarding the potential impacts from conversion of farmland from flow actions is described in Section 3.10, Land Use and Ownership.

6.8 Air Quality

Clean Air Act

The Clean Air Act (42 USC 7401 et seq.), amended in 1977 and 1990, was established "to protect and enhance the quality of the Nation's air resources so as to promote public health and welfare and the productive capacity of its population." The Clean Air Act authorizes USEPA to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment. The Clean Air Act establishes emission standards for stationary sources, volatile organic compound emissions, hazardous air pollutants, and vehicles and other mobile sources. USACE does not anticipate impacts to air quality from implementation of actions under the Management Plan. If a site-specific project presents potential for impacts to air quality to occur from a USACE action, it will comply with EPA standards and operations. Potential impacts to air quality from the alternatives are described in Section 3.8, Air Quality.

6.9 Navigation

Rivers and Harbors Act

The Rivers and Harbors Appropriation Act of 1899 (33 USC 1344) prohibits obstruction or alteration of any navigable water of the United States. The purpose of the act was to preserve the public right of navigation and prevent interference with interstate and foreign commerce unless authorized by Congress and approved by the Chief of Engineers and Secretary of the Army. The Missouri River is designated a navigable water under the Rivers and Harbor Act. Actions implemented as part of the Management Plan are not likely to impact navigation because each project will be designed to avoid impacts to the authorized purposes including navigation. Prior to any site-specific construction project, a NEPA analysis will be completed and monitoring will be conducted to detect any issues such as shoaling in the navigation channel. If issues are detected then adjustments will be made to restore the authorized 9-foot-deep by 300-foot-wide navigation channel. Potential impacts to navigation are addressed in Section 3.15, Navigation.

6.10 Recreation

6.10.1 Wild and Scenic Rivers Act

The Missouri River National Recreational River (MNRR) 59-mile and 39-mile reaches were designated in 1978 and 1991 under the Wild and Scenic Rivers Act. The 39-mile segment extends from Fort Randall Dam to Running Water, South Dakota, along with the lowest 20 miles of the Niobrara River and ten miles of Verdigre Creek. The 59-mile segment of the MNRR starts at Gavins Point Dam and ends near Ponca State Park, Nebraska. The Wild and Scenic Rivers Act (16 USC 1278 et seq.) states that certain rivers of the nation, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations. Under the Wild and Scenic Rivers Act, a federal agency may not carry out actions that would have a direct and adverse effect on the free-flowing, scenic, and natural values of a federally designated wild or scenic river. If the action would affect the free flowing characteristics of a designated river or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the area, such activities should be undertaken in a manner that would minimize adverse impacts and should be developed in consultation with the National Park Service (NPS).

The primary focus for the management of the MNRR segments is to "protect and enhance" the outstandingly remarkable values for which the segments were designated. Outstandingly remarkable values are defined by the Wild and Scenic Rivers Act as the characteristics that make a river worthy of protection. The MNRR contains the following outstandingly remarkable values: cultural, ecological, fish and wildlife, geological, recreational, and scenic. As a fish and wildlife value, the MNRR is very important to the piping plover and least tern. Both stretches are designated critical habitat for the piping plover. These species were included in the pre-listing document for the 9-mile segment. The birds are "values" for which the river was designated within the "fish and wildlife" general value. The purpose of the Management Plan is consistent with the desired future conditions identified in the General Management Plans for the two MNRR segment.

Currently USACE is undergoing Wild and Scenic Rivers Act consultation with NPS as part of the development and preparation of the Management Plan. Emergent sandbar habitat (ESH) activities in the Wild and Scenic Rivers Act reaches and balancing the needs of endangered species with needs of other outstandingly remarkable values are the subject of this consultation. After an alternative is selected for implementation, each proposed site-specific project will undergo its own NEPA process, and those activities carried out within areas designated as Wild and Scenic Rivers will be reviewed by the NPS under the Section 7(a) process as they are developed for implementation. The USACE would continue to coordinate with the NPS to avoid and/or minimize impacts to high priority cottonwood regeneration areas and minimize construction related impacts.

6.10.2 Federal Water Project Recreation Act

The Federal Water Project Recreation Act (16 USC 4612 et seq.) requires federal agencies to give full consideration to outdoor recreation and fish and wildlife enhancement in the investigating and planning of any federal navigation, flood control, reclamation, hydroelectric, or multipurpose water resource project, whenever any such project can reasonably serve either or both purposes consistently. Projects must be constructed, maintained, and operated to provide recreational opportunities, consistent with the purposes of the project. Potential impacts to recreation are addressed in Section 3.16, Recreation.

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8.0 Glossary

Accounts – Human Considerations objectives and performance criteria are organized into four accounts that were established to facilitate evaluation and display the effects of alternative plans in accordance with U.S. Army Corps of Engineers Planning Guidelines. The four accounts are:

- Environmental Quality (EQ)
- National Economic Development (NED)
- Regional Economic Development (RED)
- Other Social Effects (OSE)

Active adaptive management – The active form of adaptive management employs management actions in an experimental design aimed primarily at learning to reduce uncertainty; near-term benefits to the resource are secondary.

Adaptive Management (AM) – Adaptive management is a decision process that promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process.

Aggradation (or alluviation) – Increase in land elevation within a river system due to the deposition of sediments; aggradation occurs within river reaches where the supply of sediment is greater than the amount of material the system is able to transport.

Annual Work Plan (AWP) – This document includes real estate actions, habitat creation actions, monitoring of physical and biological responses to actions, and research activities for a particular year within the five-year Strategic Work Plan. It is used by product delivery teams to budget and implement management actions annually.

Baseload power plant – An energy plant devoted to the production of baseload supply.

Benthic – The zone on the bottom under a river or reservoir and the organisms that live there.

Biological Assessment (BA) – A document prepared for the Section 7 process to determine whether a proposed major construction activity under the authority of a Federal action agency is likely to adversely affect listed species, proposed species, or designated critical habitat.

Biological Opinion (BiOp) – Document stating the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) opinion as to whether a Federal action is likely to jeopardize the continued existence of a threatened or endangered species or result in the destruction or adverse modification of critical habitat. Specifically in the MRRP, the USFWS 2000 Biological Opinion (BiOp) found that the operation of the Missouri River Mainstem Reservoir System and the operation and maintenance of the BSNP, as proposed by the USACE, would likely jeopardize the continued existence of three federally listed species: the piping plover, least tern, and pallid sturgeon. The BiOp was amended in 2003 to note that, with additional actions proposed by the USACE, operation of the System and the operation and maintenance of the BSNP would not likely jeopardize terns and plovers, but would jeopardize pallid sturgeon.

Biological nutrient removal – A process used for treating nitrogen, including ammonia-nitrogen, and phosphorus in wastewater. With the new stringent ammonia standards being implemented by the U.S. EPA and states, more and more wastewater facilities are upgrading their treatment systems to use biological nutrient removal or enhanced nutrient removal; with these types of technologies, changes in low flows are not likely to impact water quality.

Capacity value – Represents the capital, fixed operating and maintenance cost of the displaced thermal resource. Measured in units of dollars per kilowatt-year.

Capacity – The maximum amount of power that a generating unity or power plant can deliver under a specified set of conditions.

Carbon monoxide (CO) **–** A colorless, odorless, tasteless, and poisonous gas that is formed when carbon in fuel is not completely burned. It is a component of motor vehicle exhaust, which contributes approximately 56 percent of all CO emissions nationwide.

Carbon sink – Ecosystems that absorb and store more carbon dioxide from the atmosphere than they release, which offsets greenhouse gas emissions; e.g., forests and oceans.

Carbon sequestration – The practice of capture and long-term storage of atmospheric carbon dioxide or other forms of carbon.

Conceptual Ecological Models (CEMs) – CEMs are graphical depictions of an ecosystem that are used to communicate the important components of the system and their relationships. They are a representation of the current scientific understanding of how the system works.

Critical uncertainties – Uncertainties that impede the identification of a preferred alternative management action.

Dependable capacity – A measure of the amount of capacity that a project can reliably contribute towards meeting system peak demand.

Decision criteria – Broadly refers to the set of pre-determined criteria used to make AM decisions. Performance metrics, targets, and decision triggers are considered to be different types of decision criteria. They can be qualitative or quantitative based on the nature of the performance metric and the level of information necessary to make a decision.

Decision trigger – Decision triggers are pre-defined commitments (population or habitat metric for a specific objective) that trigger a change in a management action. Decision triggers are addressed in the Evaluate step (Step 4 of the AM process) specifying the metrics and actions that will be taken if monitoring indicates performance metrics are or are not reaching target values. In some cases a decision trigger may be learning a new piece of information that triggers the Continue/Adjust/Complete step (Step 5 of the AM process).

Degradation – A lowering of a fluvial surface, such as a stream bed or floodplain, through erosional processes.

Disease vector – A carrier of disease, e.g. in malaria a mosquito is the vector that carries and transfers the infectious agent.

Dissolved oxygen – Dissolved oxygen concentrations that are too high **or** too low are harmful to aquatic animal life. Water temperature affects dissolved oxygen concentrations with colder water holding more oxygen. Low oxygen levels can result from decomposition of large amounts organic matter following eutrophication and high levels can result from enhanced photosynthesis activity during the over-production of algae.

Early life stage habitat – Riverine habitat that support the early life stages of the pallid sturgeon (e.g., spawning habitat and interception and rearing complexes).

Effects Analysis (EA) – The purpose of this effort is to conceptually and quantifiably make explicit the effects of operations and actions on the listed species by specifically evaluating the effects of hydrologic and fluvial processes on the Missouri River, as well as ongoing Mitigation and Biological Opinion management actions to the status and trends of the listed species (piping plover, interior least tern, and pallid sturgeon) and their habitats.

Effluent – Liquid waste or sewage discharged into a receiving water body such as the Missouri River.

Emergent plants – A plant which grows in water but which pierces the surface so that it is partially in air; collectively, such plants are called emergent vegetation.

Emergent Sandbar Habitat – Habitat for nesting, brood rearing, and foraging for least terns and the Northern Great Plains piping plover that is a complex of side channels and sandbars with the proper mix of habitat characteristics required by the birds.

Energy value – Represents the fuel cost or variable cost of an alternative thermal generation resource that replaces the lost hydropower generation (cost per megawatt-hour).

Energy – The capability of doing work expressed in terms of kilowatt-hours (kWh).

Ephemeral pool – A seasonal body of standing water that typically forms in the spring from melting snow and/or other runoff that dries out completely in the summer; provides an important breeding habitat for many terrestrial and semiaquatic species.

Erosion – The wearing away of rock and soil found along a river bed and banks; involves the breaking down of rock particles being carried downstream by the river.

Eutrophication – Process whereby water bodies, such as lakes, reservoirs, or slow-moving rivers and streams, receive high nutrient concentrations that stimulate excessive plant growth (e.g., algae and nuisance plants weeds).

Formal consultation – The consultation process conducted when a Federal agency determines its action may affect a listed species or its critical habitat, and is used to determine whether the proposed action may jeopardize the continued existence of listed species or adversely modify critical habitat. This determination is stated in the Service's biological opinion.

Firm power – Capacity and energy that is guaranteed to be available at all times. If insufficient generation is available power must be purchased from alternative resources to meet contractual agreements.

Fledge Ratio – The ratio of adult pairs of birds to the number of fledged chicks; applies in the MRRMP-EIS to least terns and piping plovers.

Floodplain – An area of low-lying ground adjacent to a river formed mainly of river sediments and subject to flooding.

Floodplain connectivity – Maintaining a connection (which may be seasonal) between the Missouri River and its associated floodplain habitats.

Fundamental objectives – Fundamental objectives are used to formalize the desired outcome of the program in terms of biological response. They are derived to achieve avoidance of jeopardizing the three species from USACE actions on the Missouri River and articulate the ends the program is trying to achieve.

Greenhouse gas (GHG) – Gases that trap heat within the earth's atmosphere by absorbing energy and slowing the rate at which the energy escapes. GHGs differ in their radiative efficiency (ability to absorb energy) and lifetime (how long they stay in the atmosphere).

Genotype – The genetic constitution of an individual organism.

Hydrograph – A graph showing the rate of flow (discharge) versus time past a specific point in a river (e.g., Missouri River); typically expressed in cubic feet per second.

Human Considerations (HCs) – A set of objectives with associated metrics and proxy metrics that are related to the wide array of uses and stakeholder interests on the Missouri River. They form the basis for some of the monitoring and decision criteria in the AM Plan.

Hydropower – The converting of energy from running water to produce electricity; a renewable energy source.

Hypolimnion – The lower layer of water in a stratified lake or reservoir, typically cooler than the water above and relatively stagnant.

Implement – Implementation of the selected alternative.

Integrated Science Program (ISP) – The component of the MRRP that is responsible for conducting scientific monitoring and investigations. The ISP monitors federally listed species under the Endangered Species Act (ESA), the habitats upon which they depend, and researches and monitors critical uncertainties.

Interception and Rearing Complexes (IRCs) – The physical definitions of IRCs are currently identified as follows: (1) food-producing habitat occurs where velocity is less than 0.08 meters per second (m/s); (2) foraging habitat is defined as areas with 0.5–0.7 m/s velocity and 1–3 m depth; and (3) interception habitat has been qualitatively described as zones of the river where hydraulic conditions allow free embryos to exit the channel thalweg.

Invasive species – A plant or animal species that is not native to a specific location (an introduced species) and which has a tendency to spread to a degree believed to cause damage to the environment, human economy or human health.

Implementation level (or Level) – Refers to one of four classifications of action that could be implemented to assist pallid sturgeon as part of the MRRP (see also *Pallid Sturgeon Framework*). The levels include:

- **Level 1: Research** – Studies without changes to the system (Laboratory studies or field studies under ambient conditions).
- **Level 2: In-river testing** – Implementation of actions at a level sufficient to expect a measurable biological, behavioral, or physiological response in pallid sturgeon, surrogate species, or related habitat response.
- **Level 3: Scaled implementation** – A range of actions not expected to achieve full success, but which yields sufficient results in terms of reproduction, numbers, or distribution to provide a meaningful population response and indicate the level of effort needed for full implementation.
- **Level 4: Ultimate required scale of implementation** – Implementation to the ultimate level required to remove an issue.

Investigations – Research activities that are intended to generate information that will fill the key gaps in understanding and reduce uncertainty associated with implementation of management actions.

Jeopardy – As defined by the Endangered Species Act (ESA), jeopardy occurs when there is an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

Lower Missouri River – The reach of the river downstream of Gavins Point Dam (RM 810) as it pertains to management for pallid sturgeon.

Management actions – Proposed or potential actions to be taken by the USACE to address species needs on the Missouri River. Original management actions were prescribed by the Biological Opinion as Reasonable or Prudent Alternatives or actions outside the BiOp if necessary to achieve species objectives.

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Master Manual – The Missouri River Master Water Control Manual (Master Manual) is the guide used by the U.S. Army Corps of Engineers to operate the system of six dams on the Missouri River Mainstem Reservoir System (System) – Fort Peck, Garrison, Oahe, Big Bend, Fort Randall, and Gavins Point.

Mixing zone – A mixing zone is defined generically as a limited area or volume of a receiving water body where the initial dilution of a permitted or authorized discharge occurs. Defined mixing zones are intended to dilute or reduce pollutant concentrations below applicable water quality standards (USEPA 1991). It is important to note that mixing zones are designed to ensure that water quality standards are met in the receiving water body a high percentage of the time. For example, flows in a given river will be higher than a 7Q10 low-flow over 99 percent of the time. Thus, if flows were to drop below the established low-flow criterion, water quality standards are waived.

Monitoring – In the context of the MRRMP-EIS, monitoring is the process of measuring attributes of the ecological, social or economic system. Monitoring has multiple purposes, including: to provide a better understanding of spatial and temporal variability, to confirm the status of a system component, to assess trends in a system component, to improve models, to confirm that an action was implemented as planned, to provide the data used to test a hypothesis or evaluate the effects of a management action, and to provide an understanding of a system attribute which could potentially confound the evaluation of action effectiveness.

National Environmental Policy Act (NEPA) – Requires federal agencies to integrate environmental values into their decision-making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. To meet NEPA requirements federal agencies may be required to prepare a detailed statement known as an Environmental Impact Statement (EIS).

Naturalization of the flow regime – Naturalization of the flow regime involves incremental changes which move the flow regime towards the hydrological attributes which would exist in the absence of dams and reservoirs, while recognizing social and economic constraints. It does not mean matching the unaltered, historical flow regime. More generally, naturalization refers to the process of using characteristics of the natural ecosystem to guide elements of river restoration, but constrained by social and economic values.

Navigation season – The period usually between April and December that the USACE supports navigation on the river from Sioux City, Iowa, to St. Louis, Missouri.

Nitrogen and phosphorus – The inorganic nutrients nitrogen and phosphorus support primary productivity (i.e., the production of energy by plants through photosynthesis) in the river. Excessive nutrients present in the water column foster the growth of plants and algae potentially resulting a state of eutrophication and algae blooms and, then following decomposition, depleted dissolved oxygen. Disturbance to bed sediment has the potential to resuspend nutrients into the Missouri River.

Nitrogen dioxide – Nitrogen dioxide has a strong, harsh odor and is a liquid at room temperature, becoming a reddish-brown gas above 70°F. It is released to the air from the exhaust of motor vehicles, the burning of coal, oil, or natural gas, and during processes such as arc welding, electroplating, engraving, and dynamite blasting.

Non-routine repair, replacement, and rehabilitation (R, R, & R) costs – Costs covered include (1) support for two river field offices including any funds necessary for rescues, funds for repairs of equipment, funds for staff, and funds for other expenses; (2) repair, replacement, and rehabilitation of thousands river structures; (3) emergency dredging that is required for extreme river conditions.

Objectives – Objectives define an endpoint of concern and the direction of change that is preferred. Objectives are concise statements of the interests that could be affected by a decision — the “things that matter” to people. In PrOACT, objectives typically take a simple form such as: Minimize costs, Increase population number, increase habitat availability.

Other pollutants – Other pollutants of concern within the Missouri River system are metals, hydrocarbons, organic toxins, pesticides, and treated wastewater. Pollutants and toxic chemicals may adhere to suspended matter that settles to the bottom of the river or remain in suspension, where they can pose a hazard to native species or affect socioeconomic resources such as water supply, irrigation, wastewater treatment, and recreational uses.

Ozone (O_3) – A gas composed of three oxygen atoms. It is not usually emitted directly into the air, but at ground-level is created by a chemical reaction between oxides of nitrogen (NOx) and volatile organic compounds (VOC) in the presence of sunlight.

Ozone precursor – Oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) which chemically react in the atmosphere producing ground-level ozone (O_3).

Particulate matter – A complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

Passive adaptive management – In passive AM, management actions are intended to achieve resource objectives but and are improved using knowledge gained from monitoring and assessment.

Peak and off-peak power – The daily and seasonal variation of energy cost following system demand.

Peaking power plants – Power plants that are generally run only when there is high demand.

Period of Record – A period of record between 1931 and 2012 used to develop predictive models and assess changes in physical river and reservoir conditions.

Performance metric – A specific metric or quantitative indicator that is monitored and can be used to estimate and report consequences of management alternatives with respect to a particular objective.

Plant factor – The ratio of the actual monthly generation to the maximum possible monthly generation.

Population Augmentation – Stocking to supplement year class structure to the pallid sturgeon population due to lack of natural recruitment in the Missouri River.

Power marketing administrations – A U.S. federal agency within the Department of Energy with the responsibility for marketing hydropower. Western Area Power Administration (WAPA) represents the mainstem of the Missouri River hydropower plants.

Preferred alternative – The preferred alternative is the alternative which the USACE believes would best fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical, and other factors.

PrOACT decision making model – An organized, structured decision making approach to identifying and evaluating creative options and making choices in complex decision situations. PrOACT is a decision analysis approach currently employed by USACE in the development of the Missouri River Recovery Management Plan. It is a technique used to provide analytical structure and rigor to values-based questions by clarifying the consequences of alternate solutions, including the impacts on multiple objectives. The unifying features of PrOACT analyses are that they involve: 1) clarifying the Problem to be solved, 2) listing Objectives to be considered (usually with associated performance metrics), 3) developing Alternative solutions to the problem as stated, 4) estimating the consequences of each of the alternatives on each of the objectives in terms of the metrics (usually in the form of a consequence table of alternatives versus objectives) and 5) explicitly evaluating the Trade-offs that are revealed to exist between the alternatives, usually in a discursive setting.

Recovery – An improvement in the status of a listed species to the point at which listing is no longer appropriate under the Endangered Species Act.

Riparian – The natural zone located along the bank of a watercourse (e.g., Missouri River), tributary, or reservoir.

River Segment – A term used to designate an area of study or action. The area begins at the base of a dam and proceeds downstream including the area of the separate area of the river channel and the separate area the lake waters with the segment ending at the top of the next downstream dam.

Run-of-River – Flows that are basically uncontrolled, as was experienced before the construction of the Missouri River dams.

Run-of-river hydroelectric plants – A type of hydroelectric generation whereby the natural flow and elevation drop of the river are used to generate electricity.

Section 7 – The section of the Endangered Species Act that requires all Federal agencies, in "consultation" with the Service, to insure that their actions are not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of critical habitat.

Selected alternative – The alternative identified in the ROD that the USACE intends to implement.

Sediment and turbidity – Turbidity is a measure of the loss of water clarity due to the presence of suspended particles such as eroded sediment and organic matter in the water column. Although sediment and turbidity maintain natural ecological conditions, turbidity also affects the water temperature, can accumulate in reservoirs, and sediment transport can impact water intake pipes and destabilizing intake structures.

Sediment load – The solid material that is transported by a river within the water column.

Service level – The daily minimum discharge required for the level of navigation service determined from available system storage.

Snowpack – A seasonal accumulation of slow melting packed snow; runoff to the Missouri River system.

Snow water equivalent (SWE) – A measurement for the amount of water contained within a snowpack. Specifically, it is the depth of water that would theoretically result if you melted the entire snowpack instantaneously.

Spawning habitat – Functional spawning habitat produces a successful hatch of embryos. For successful hatch to take place, hydraulics and substrate must be conducive first to attraction and aggregation of reproductive adults, followed by egg and milt release, fertilization, and deposition of eggs in a in a protected environment.

Spawning cue – Either a natural or man-made condition that may prompt fish to spawn.

Stage – The water level above some arbitrary point in the river, often with the zero height being near the river bed.

- *Action Stage at Bismarck, ND (12.5 feet):* Unusually high river stage for this reach of the Missouri River. Residents are encouraged to pay close attention to National Weather Service (NWS) updates, local media, and local emergency management for information concerning why the river is this high and its potential for further rises.
- *Minor Flood Stage at Bismarck, ND (14.5 feet):* Flooding of rural areas begins. Inundation of croplands and the potential closure of local boat ramp access is likely. Riverbank erosion rates increase and cause unstable shorelines. If water levels are the result of an ice jam south of Bismarck, water levels will be relatively higher near the jam and cause concerns for residents south of Fox Island.
- *Moderate Flood Stage at Bismarck, ND (16.0 feet):* Flooding of rural areas begins. Inundation of croplands and the potential closure of local boat ramp access is likely. Riverbank erosion rates increase and cause unstable shorelines. If water levels are the result of an ice jam south of Bismarck, water levels will be relatively higher near the jam and cause concerns for residents south of Fox Island.

Structured Decision Making (SDM) – Organized approach to identifying and evaluating creative options and making choices in complex decision situations. It is used to inform difficult choices, and to make them more transparent and efficient. PrOACT is a specific application of SDM to collaborative problem solving.

Success criteria – A qualitative or (preferably) quantitative description of the conditions for which the parties agree that the objectives have been sufficiently met. Usually expressed in terms of the performance metrics.

Target – Targets are a specific value or range of performance metric that define success. Targets can be quantitative values or overall trends (directional or trajectory).

Trade-offs (also trade-off analysis) – A trade-off is when one alternative performs well on one metric but poorly on another relative to another alternative. Reasonable people may disagree about which is the best alternative because they value the two metrics differently, thus value trade-offs involve making judgments about how much you would give up on one objective in order to achieve gains on another objective. By analyzing trade-offs, the PrOACT process tries to help find the alternative a) that eliminates unnecessary trade-offs and b) that people agree is the ‘best balance’ of trade-offs possible.

Temperature – Shifts in the natural frequency, duration, and timing of temperature conditions can affect biological communities as well as recreation uses and the functioning of and permitting related to thermal power uses. Water temperature can also determine the amount of dissolved oxygen present in the water column.

Transportation savings – The difference in the value of resources required to transport commodities between the waterway and overland.

Trigger – A form of decision criteria serving as a threshold or condition that, when met, initiates some action or decision.

Uncertainty – Circumstances in which information is deficient. Leaning while doing under the adaptive management process provides a framework for reducing program uncertainties over time.

Upper Missouri River – Mainstem of the Missouri River between Fort Peck Dam and the headwaters of Lake Sakakawea, and the Yellowstone River for an unspecified distance upstream of the confluence with the Missouri River.

Understory – The layer of vegetation beneath the main canopy of a floodplain or upland forest.

Vegetation management – Control and removal of vegetation on ESH using application of pre- and/or post emergent herbicides or cutting, mulching, disking, mowing, and raking of vegetation from sandbars to maintain suitable habitat conditions for least tern and Northern Great Plains piping plover nesting.

Work Plan (also Strategic Plan) – A rolling, five-year plan outlining the management actions, monitoring, assessment, research and engagement needs for the MRRP. It includes the details for the current FY and the FY+1 President's Budget, and planned activities for FY+2 through FY+4 for budgeting and other purposes.

9.0 List of Preparers

Name	EIS Responsibility	Education	Agency/Firm
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Name	EIS Responsibility	Education	Agency/Firm
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APPENDIX A: HUMAN CONSIDERATIONS PROXIES ROUND 1 AND 2 BIRD ALTERNATIVE PROXY RESULTS

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Missouri River Recovery Management Plan and Environmental Impact Statement

Appendix A: Human Considerations Proxies and Round 1 and 2 Bird Alternative Proxy Results

September 30, 2016

Draft

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Round 1 Bird Alternative Proxy Results (Presented at May 2015 MRRIC Plenary)

Round 2 Bird Alternative Proxy Results (Presented at August 2015 MRRIC Plenary)

Human Considerations Proxies

The term human considerations is used to address the interests of stakeholders. These include the authorized purposes as well as the many other services afforded by the System. The Corps and USFWS have worked closely with the Missouri River Recovery Implementation Committee (MRRIC) since January 2013 to identify the underlying stakeholder interests referred to as human considerations. Human considerations to be assessed when evaluating alternatives are rooted in the economic, social, and cultural values associated with the natural resources of the Missouri River. The MRRIC represents management of these interests. In January 2013, the Corps asked the MRRIC and their constituent stakeholders to provide input on the human considerations relative to their use of the Missouri River and its resources. The Corps requested this feedback to help inform how MRRIC collective interests could be considered in an assessment of consequences associated with management actions for the listed species. The MRRIC formed the Human Considerations Ad Hoc Working Group as a mechanism to provide input on human considerations. The working group gathered and reviewed input from MRRIC members on the following categories: agriculture; commercial dredging; environmental conservation / fish and wildlife; flood risk management; irrigation; hydropower; local government; navigation; recreation; Tribal and cultural; water quality and water supply; thermal power; and wastewater.

The MRRMP-EIS project delivery team (PDT) developed a suite of models for use in assessing the effects of management actions and alternatives to the human considerations. A subset of these models was used to calculate “proxy metrics” for the human considerations. Proxy metrics were used in the alternatives development process to inform PrOACT discussions with MRRIC (Table A-1). Proxy metrics were developed to be efficiently modeled and calculated, responsive to changes in reservoir operations and/or channel geometry modifications, and indicative of the potential for impacts to a human consideration. In most cases, the proxy metrics were not representative of the complete impacts analysis as presented in this draft MRRMP-EIS. Additional economic models were developed to facilitate impacts analysis of each alternative carried forward for detailed consideration in this draft MRRMP-EIS. These economic models were also the basis for calculation of National Economic Development (NED) and Regional Economic Development (RED) effects consistent with Corps planning requirements. The models used to evaluate each human consideration are described in a series of technical reports that accompany this draft MRRMP-EIS.

Round 1 and 2 Proxy Results

The human considerations proxies were calculated for the Round 1 and 2 bird alternatives. These results were used to facilitate trade-off discussion with MRRIC held in May and August of 2015.

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TABLE A-1. HUMAN CONSIDERATIONS PROXY METRICS USED IN THE PROACT PROCESS WITH THE MISSOURI RIVER RECOVERY IMPLEMENTATION COMMITTEE

Human Consideration (Interest Category)	Proxy Metric	Units	Description
Agriculture	Peak flows and stages during flood events, and also duration of high stages for interior drainage analysis	Annual and seasonal number of days damage thresholds are exceeded	Change in number of days per year and per season that damage thresholds would be exceeded.
Commercial Dredging	Average annual change in sediment accumulation rate	Tons/year	The base year is 2013 for the sediment modeling, and the model is run forward 50 years. Evaluation will be conducted on how the change in sediment accumulation over the 50-year period differs from on potential alternative versus another potential alternative.
Environmental Conservation / Fish and Wildlife	Change in aquatic / floodplain habitat	Acres	Change in acres of all native habitat types for the baseline condition to each alternative condition.
	Acres of wetland habitat classes	Acres	Acres of wetland habitat classes potentially occurring under each alternative.
	Total # of occurrences of flows below 9,000 cubic feet per second (cfs)	Number of occurrences	Number of occurrences that a flow of 9,000 cfs or less occurs in the Fort Randall to Gavins Point Dam reach based on daily or hourly timesteps.
Flood Risk Management	Peak flows and stages during flood events, and also duration of high stages for interior drainage analysis	Annual and seasonal number of days damage thresholds are exceeded	Change in number of days per year and per season that damage thresholds would be exceeded.
Irrigation	Intake operating conditions	Number of days water surface elevation falls below normal operating conditions	This unit of measure will determine the number of days per year that an irrigation intake along the Missouri River will function below a normal operating level under a given alternative scenario versus the No-Action Alternative. These days are averaged and presented by county.
Hydropower	Total seasonal generation	Generation (MWh)	Seasonal generation (summer, winter).
Local Government	Number of acquisition acres per mile	Acres/mile	For a given alternative, an estimate of the number of acres/mile planned for acquisition.

Human Consideration (Interest Category)	Proxy Metric	Units	Description
Navigation	Number of days per year during the navigation season when at least minimum service is supported by operations	Days/year	Minimum service level refers to when there is approximately an 8-foot depth in the Missouri River navigation channel.
	Number of days per year during the navigation season when operations supports navigation at or above full service levels	Days/year	Full service is when there is a 9-by-300 foot channel in the Missouri River navigation channel.
	The length of the season as measured by the number of days per year navigation is supported by operations during the season; Measured at system level	Days/year	The navigation season on the Missouri River is limited to the normal ice-free period with a full-length flow support of 8 months.
	Number of days per year during the possible navigation season when at least minimum service occurs at one of four target locations (Sioux City, Nebraska City, Omaha, and Kansas City)	Days/year	Minimum service level refers to when there is approximately an 8-foot depth in the Missouri River navigation channel.
	Number of days per year during the possible navigation season when at or above full service occurs at one of four target locations (Sioux City, Nebraska City, Omaha, and Kansas City)	Days/year	Full service is when there is a 9-by-300 foot channel in the Missouri River navigation channel.

Human Consideration (Interest Category)	Proxy Metric	Units	Description
Recreation	Number of days with operate boat ramps	Average number of days/year; Number of boat ramp days/year	Operable boat ramps are when stages and elevations fall between minimum and maximum normal boat ramp elevations during four seasons: spring, summer, fall, and winter.
	Number of chutes, backwaters, or shallow water habitat (SWH) areas	Numbers	The number of chutes or number of SWH areas provide a proxy for recreation in terms of potential opportunities for recreational access, slower river water velocities, and safety.
	Number of days above the conservation pool elevation, the mid-2000s drought elevation, and an elevation between these elevations at upper three reservoirs	Number of days/year	Conservation pool elevations represent important elevations to support both access and fisheries health. Drought pool elevations from the mid-2000s represent important elevations to evaluate how severe drought affects access and fisheries health effects. The pool elevations between the conservation pool and drought elevations represent important elevations to evaluate alternatives. Four seasons are evaluated: spring, summer, fall, and winter.
	Normal to improved fishing success at three upper reservoirs	Number of years criteria are met	Fishing success is defined at upper three reservoirs through rising spring reservoir elevations and the onset of drought.
Tribal and Cultural	Sites at risk	Average number of days at which the water-surface elevation puts cultural resource sites at "high" or "very high" risk	This unit of measure will determine the average number of days per year that each cultural resource site along the Missouri River is subject to higher than normal risk, given an alternative scenario versus the No-Action Alternative.
Water Quality and Water Supply	Intake operating conditions	Number of days below normal operating elevations	This unit of measure will determine the number of days per year for each year over the period of record that a water supply intake along the Missouri River will function below a normal operating level under a given alternative scenario versus the No-Action Alternative.

Human Consideration (Interest Category)	Proxy Metric	Units	Description
Thermal Power	Intake elevations	Number of days per year when river and reservoir elevations are below critical intake operating elevations by power plant location, evaluated annually and for peak summer and winter periods	Sum of number of days per year when river and reservoir elevations are below intake elevations annually and in the peak summer and winter periods.
	Critical low-flow elevations	Number of days per year below the critical low flow condition by power plant location, evaluated annually and for peak winter and summer periods	Sum of number of days per year below critical low flow condition annually, and in the peak summer and winter months.
	Water temperature	Number of days per year when river water temperature is above temperature threshold by power plant location, evaluated annually and for peak summer and winter periods	Sum of number of days per year when water temperature is above temperature threshold annually and in the peak summer and winter months.
Wastewater	Low-flow conditions	Low-flow conditions in cfs calculated by facility location	Calculated the low-flow conditions at each power plant location under the alternatives to compare the changes in low flow conditions under the action alternatives.

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Round 1 Bird Alternative Proxy Results (Presented at May 2015 MRRIC Plenary)

10th Worst

Human Considerations (10th Percentile Worst Years)

Human Consideration	Proxy	No Action	All Mech	Spring Rel B + Mech	Fall Rel C + Mech	Spring Rel B + LSF + OA + Mech	Fall Rel C + LSF + OA + Mech
Commercial Sand & Gravel							
Cultural	Lakes - Ft Peck, Sask, Oahe			↑		↑	↑
	Lake Sharpe & Lake Francis-Case					↓	↓
	Rivers						
F&W	Wetland						
	Forest						
Flood Risk / Agriculture	Major flood risk						
	Int. Drainage, North of St Joseph			↑	↓↓	↓↓↓	↓↓↓
	Int. Drainage, South of St Joseph			↑↑	↑		
Hydropower	Summer Generation			↓		↑↑	↑↑
Irrigation	Montana					↓	↓
	Southern Nebraska					↓↓↓	↓↓↓
	Elsewhere						
Local Government							
Navigation	Length of season			↓		↓↓↓	↓↓↓
Recreation	Boat ramp access					↑↑	↑↑
	Fishing SAK						
	Fishing OHA						
Thermal Power	Shutdown Intake			↓			
	Temperature					↓↓	↓↓
Wastewater	Bismarck Reach (2 facilities)						
	Downstream						
Water Supply	Northern munis				↑	↑↑↑	↑↑↑
	Southern munis			↓		↑	↑
	Comm & Industrial			↓		↓↓	↓↓

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Median

		No Action	All Mech	Spring Rel B + Mech	Fall Rel C + Mech	Spring Rel B + LSF + OA + Mech	Fall Rel C + LSF + OA + Mech
ESA and MRRP Program							
Birds			↑↑↑	↑↑↑	↑↑↑	↑↑↑	↑↑↑
Pallid *						↑	↑
Cost of Mechanical ESH Construction			↓↓↓	↓↓	↓↓	↓↓↓	↓↓↓
Human Considerations (Median Years)							
Commercial Sand & Gravel							
Cultural	Lakes - Ft Peck, Sask, Oahe					↑↑	↑↑
	Lakes - Sharpe, Francis-Case, L&C						
	Rivers						
Fish and Wildlife	Wetland				↑	↓	
	Forest			↑↑		↑↑	
Flood Risk / Agriculture	Major flood risk						
	Int. Drainage, North of St Joseph			↓	↓	↓↓	↓↓
	Int. Drainage, South of St Joseph						
Hydropower	Summer Generation			↓	↓	↓↓↓	↓↓↓
Irrigation	Montana					↓↓↓	↓↓↓
	Elsewhere			↓		↑↑	↑↑
Local Government							
Navigation	Length of season					↓↓↓	↓↓↓
Recreation	Boat ramp access			↑	↑	↑	↑
	Fishing SAK					↓	↓
	Fishing OHA					↓	↑
Thermal Power	Bismarck Reach				↓	↓↓	↓↓
Wastewater	Bismarck Reach (2 facilities)				↓	↓↓	↓↓↓
	Nebraska and Iowa			↓	↓		
	Kansas and Missouri						
Water Supply	Northern munis					↓	↓
	Southern munis						
	Comm & Industrial			↑	↓	↑↑	↑↑

↑↑↑	Most distinct positive changes
↑↑	Some distinct positive changes
↑	Generally relatively minor positive changes
[blank]	Small or generally mixed or uncertain changes
↓	Generally relatively minor negative changes
↓↓	Some distinct negative changes
↓↓↓	Most distinct negative changes

* benefits if foraging and / or food-producing habitat are limiting

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Round 2 Bird Alternative Proxy Results (Presented at August 2015 MRRIC Plenary)

			Dir	SPR_335L + M (A32)	SPR__42MAF + M (A30)	SPR_31MAF + M (A29)	FALL_35L + M (A28)	FALL_42MAF + M (A22)	FALL_31MAF + M (A21)	FALL_42MAF + LSF + M (A26)
Birds				ESA OK	ESA OK	ESA OK	ESA OK	ESA OK	ESA OK	ESA OK
Pallid				NA	NA	NA	NA	NA	NA	NA
Cost of Mechanical	(Assuming no annual budget caps, % change from All Mechanical)			-30%	-64%	-65%	-39%	-43%	-56%	-51%
Human Considerations (All % change from No Action 82 year total unless otherwise noted)										
Water Supply	Shut Down Elevation	Upper Basin Municipal	L	4.9%	3.8%	6.0%	2.5%	13.5%	19.4%	2.5%
		Lower Basin Municipal	L	1.8%	3.5%	6.5%	1.5%	3.1%	1.4%	-3.3%
		Commercial & Industrial	L	1.9%	2.6%	4.0%	5.3%	7.2%	8.0%	2.9%
Waste Water	Low Flow Conditions	Annual Criteria	L	2.9%	1.0%	3.8%	0.0%	2.1%	3.4%	-7.2%
		Spring Criteria	L	0.0%	-1.8%	-1.8%	0.0%	0.0%	1.8%	0.0%
		Summer Criteria	L	4.8%	2.4%	13.7%	0.0%	-4.6%	45.8%	-18.5%
		Winter Criteria	L	1.7%	-2.2%	0.2%	0.0%	1.9%	-12.2%	-0.4%
Thermal Power	Shut Down Intake Elevation	Bismarck Reach and Lake Sak -- Annual	L	5.9%	22.7%	21.2%	0.9%	0.0%	8.7%	12.1%
		Below Gavins -- Annual	L	2.0%	2.6%	4.8%	1.1%	2.3%	2.3%	-2.7%
	Shut Down Intake Elev + 1ft	Bismarck Reach and Lake Sak-- Annual	L	0.7%	11.7%	15.4%	2.9%	4.2%	15.4%	10.4%
		Below Gavins -- Annual	L	1.7%	2.6%	4.6%	1.4%	2.2%	2.6%	-2.6%
	Low Flow Thresh., Labadie	Summer (July-Sept)	L	1.8%	4.8%	9.5%	0.0%	2.1%	7.7%	35.4%
	Temperature	Below Gavins -- days <30kcfs -- Summer	L	1.5%	10.6%	11.6%	1.3%	3.6%	5.6%	26.1%
Irrigation	Outside Normal range	Irrigation Season	L	2.3%	2.8%	4.3%	2.1%	3.6%	5.2%	0.4%
Navigation	Service Level for the System	At Least Min	H	-0.2%	-0.5%	-0.8%	0.0%	-0.6%	-2.4%	-16.5%
		At Least Full	H	-6.9%	0.4%	-4.9%	-3.0%	-12.6%	-11.1%	-26.6%
	Service Level at Target locs	At Least Min	H	-0.3%	-1.5%	-1.8%	-0.1%	-0.4%	-1.2%	-2.7%
		At Least Full	H	-1.2%	-2.6%	-2.6%	-0.5%	-1.1%	-0.8%	-5.8%
Flood Risk	Flood Stage - Greenwood and Niobrara	Annual	L	16.1%	38.1%	44.0%	29.2%	29.2%	47.2%	48.5%
		Spring	L	148.2%	324.1%	416.9%	13.3%	10.3%	11.3%	22.6%
		Fall		4.7%	3.4%	-9.7%	115.9%	137.3%	192.4%	170.0%
	Flood Stage -- All Other Locations	Annual		-0.4%	-0.8%	-1.1%	-1.0%	-1.0%	-1.4%	-0.2%
		Spring	L	0.9%	2.0%	2.4%	-0.2%	-0.9%	-0.5%	-0.2%
		Fall		-0.3%	-0.3%	-1.9%	2.8%	3.8%	-0.3%	12.9%
	Flood Stage + 5ft	All Locations -- Annual	L	-0.4%	-1.4%	-2.6%	-0.2%	-1.9%	-1.8%	-1.8%
	Flap gate	Annual	L	1.5%	2.1%	2.9%	1.2%	1.5%	1.8%	1.4%

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			Dir	SPR_335L + M (A32)	SPR__42MAF + M (A30)	SPR_31MAF + M (A29)	FALL_35L + M (A28)	FALL_42MAF + M (A22)	FALL_31MAF + M (A21)	FALL_42MAF + LSF + M (A26)
Recreation Boat Ramp operability (% change in ramp-days)	Fort Peck	Summer	H	-1.1%	-1.4%	-3.5%	-1.3%	-2.2%	-6.1%	-0.4%
		Fall	H	-1.1%	-2.3%	-5.2%	-1.6%	-3.3%	-6.2%	1.6%
	Lake Sakakawea	Summer	H	-1.4%	-1.5%	-2.9%	-1.6%	-3.5%	-5.8%	-1.0%
		Fall	H	-1.7%	-0.8%	-2.4%	-2.7%	-5.7%	-8.2%	-2.1%
	Lake Oahe	Summer	H	-1.1%	0.0%	-1.5%	-0.8%	-2.1%	-3.6%	1.2%
		Fall	H	-1.4%	0.2%	-1.2%	-1.5%	-3.3%	-4.1%	0.9%
	Lower Three Reservoirs	Summer	H	0.0%	0.0%	-0.1%	0.0%	0.0%	0.1%	0.0%
	Rivers Between Reservoirs	Summer	H	-0.8%	-0.9%	-1.3%	-0.5%	-0.8%	-0.8%	-0.5%
		Fall	H	0.1%	-0.4%	-0.2%	0.1%	1.3%	1.0%	0.8%
	Lower River	Spring	H	1.6%	3.0%	4.4%	-0.3%	-0.7%	-1.0%	-2.6%
		Summer	H	-0.9%	-2.0%	-2.3%	-0.5%	-1.3%	-1.5%	-2.7%
		Fall	H	-0.7%	-1.5%	-2.2%	3.8%	5.8%	8.2%	9.1%
		winter	H	-1.0%	-1.2%	-1.5%	-1.4%	-2.1%	-2.6%	-1.0%
Recreation Conservation Pool change	Fort Peck Lake	summer	H	-6.4%	-1.9%	-5.9%	-9.2%	-8.8%	-12.6%	-8.1%
	Lake Sakakawea	summer	H	-4.9%	-0.1%	-5.9%	-7.4%	-9.5%	-11.3%	13.1%
	Lake Oahe	summer	H	-2.4%	-0.3%	0.5%	-4.9%	-2.8%	-3.5%	-0.9%
Recreation (Number of Years Difference from NA)	"Good" Fishing Years	Fort Peck Lake	H	1	2	3	-2	2	1	2
		Lake Sakakawea	H	1	-3	5	1	0	5	1
		Lake Oahe	H	5	-2	0	0	-2	3	4
Hydropower	Average Seasonal Generation	Annual	H	-0.2%	-0.4%	-0.6%	-0.4%	-0.7%	-0.8%	-0.7%
		Summer	H	-1.0%	-1.5%	-2.2%	-1.0%	-1.4%	-1.6%	-2.9%
		Winter	H	-1.0%	-1.5%	-1.8%	-2.2%	-3.0%	-3.9%	-1.8%
	Total Season Value	Annual	H	-0.4%	-0.8%	-1.1%	-0.6%	-1.0%	-1.3%	-1.4%
Cultural Resources (%Change in Mean Average Site-Days Affected)	Reservoirs	Sites Below (very high) - Lake Oahe	L	3.4%	-0.4%	-0.5%	4.3%	4.4%	6.6%	-3.4%
		Sites Below (very high) - Lake Sak	L	2.5%	0.8%	1.8%	5.3%	5.5%	6.4%	2.8%
		Sites Above (high and very high) - Oahe	L	-28.9%	-17.7%	-16.0%	-26.3%	-8.9%	-5.6%	9.3%
		Sites Above (high and very high) - Sak	L	-5.8%	-7.0%	-5.6%	-20.2%	-6.1%	-3.9%	4.3%
	Rivers	Sites Not Behind Levees (All States)	L	-0.1%	0.0%	-0.1%	0.0%	-0.4%	-0.2%	-0.1%
		Sites Behind Levees (IA, NE, KS, MO)	L	-1.2%	-2.1%	-2.8%	-1.8%	-1.6%	-1.7%	-1.9%
Fish & Wildlife	Aquatic/Floodplain Habitat		H	-0.30%	-0.50%	-0.60%	-2.80%	-0.80%	-0.50%	-2.10%
	Wetland Habitat		H	-1.14%	-0.06%	-0.36%	-0.30%	-0.27%	-0.55%	-3.63%
	Flows below 9,000cfs		L	1.20%	4.00%	6.00%	1.30%	1.70%	2.20%	1.60%

Dir = L = Lower numbers are better

Dir = H = Higher numbers are better

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APPENDIX B: FISH AND WILDLIFE COORDINATION ACT CORRESPONDENCE

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Appendix B: Fish and Wildlife Coordination Act Correspondence

June 18, 2014: Planning Aid Letter Regarding Task B2 in the Missouri River Recovery Program Fish and Wildlife Coordination Act Scope of Work – Fiscal Year 2014

March 24, 2015: Planning Aid Letter Regarding the Appendix A of the Adaptive Management Plan: Adaptive Management Governance

- February 13, 2015: email from Nebraska.gov re: FWCA Adaptive Management Governance Document for review
- February 13, 2015: email from Iowa DNR re: FWCA Adaptive Management Governance Document for review
- February 19, 2015: email from Kansas Department of Wildlife, Parks and Tourism re: FWCA Adaptive Management Governance Document for review

November 2, 2015: Planning Aid Letter Regarding the Missouri Recovery Management Plan Lower Missouri River Pallid Sturgeon Framework, Targets and Decision Criteria

October 27 2015: Planning Aid Letter Regarding Task B1 in the Missouri River Recovery Program FWCA Scope or Work – FY 2015

November 5, 2015: Planning Aid Letter Regarding the Missouri River Recovery Management Plan-EIS: USFWS 2003 BiOp Projected Actions Alternative

November 13, 2015: Planning Aid Letter Regarding Task B3 in the Missouri River Recovery Program FWCA Scope or Work – FY 2015

December 4, 2015: Planning Aid Letter regarding development of the Missouri River Recovery Management Plan/EIS

December 4, 2015: Planning Aid Letter Regarding the Missouri River Recovery Management Plan and Environmental Impact Statement (MRRMP-EIS) fish and wildlife proxy

April 28, 2016: Missouri River Recovery Management Plan and Environmental Impact Statement (MRRMP-EIS) Preliminary Draft Chapter 2: Alternatives

September 14, 2016: USFWS letter to U.S. Army Corps of Engineers regarding Interception Rearing Complex Targets

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Mountain-Prairie Region
31247 436th Avenue
Yankton, SD 57078

IN REPLY REFER TO:
FWS/R6/ES

June 18, 2014

Ms. April Fitzner
Missouri River Recovery Program
Senior Program Manager
U.S. Army Corps of Engineers
601 E 12th Street
Kansas City, Missouri 64106

RE: **Planning Aid Letter Regarding Task B2 in the Missouri River Recovery Program Fish and Wildlife Coordination Act Scope or Work – Fiscal Year 2014**

Dear Ms. Fitzner:

The U.S. Fish and Wildlife Service (Service) provides this planning aid letter (PAL) regarding the development of the U.S. Army Corps of Engineers' (Corps) Missouri River Recovery Management Plan (Management Plan) and associated Environmental Impact Statement (EIS) in accordance with the Fiscal Year (FY) 2014 Fish and Wildlife Coordination Act (FWCA) scope of work (SOW), Task B2 (Purpose and Need). As a cooperating agency on the Management Plan and EIS, the Service provides the following pursuant to the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 et seq.), the NEPA of 1969 (42 U.S.C. 4321-4347), and the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 et seq.).

This PAL does not constitute the final report of the Secretary of the Interior as required by Section 2(b) of the FWCA, nor does it constitute reconsultation of the 2000 and 2003 Amended Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project (BSNP), and Operation of the Kansas River Reservoir System (BiOp) under section 7 of the ESA.

The Management Plan provides a tremendous opportunity for the Corps to objectively consider the results of its ongoing actions to: (1) implement the BiOp; (2) assess recent scientific findings regarding the life history of the three federally listed species; (3) review progress to address impacts to, and recovery of, Missouri River habitats and river processes; (4) incorporate human interests; (5) utilize this knowledge while working transparently with Missouri River basin stakeholders and the Service to develop innovative and contemporary actions to achieve species conservation; and (6) remove impediments to implementation of these actions in order to realize a sustainable Missouri River ecosystem.

Service Perspective on Purpose and Need

Purpose

The Service believes it is important for the Corps to better define the purpose for the Management Plan. It remains unclear to the Service whether the purpose of the Management Plan will be to prepare a new project description on how the Corps will meet its ESA responsibilities, or to develop an adaptive management (AM) strategy for the Missouri River Recovery Program (MRRP).

Congress directed in section 7 of the ESA that all federal agencies "7(a)(1)...use their authorities in the furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species..." and that all federal agencies "7(a)(2) ensure that any action ... authorized, funded, or carried out... was not likely to jeopardize a listed species or cause destruction or adverse modification of critical habitat." Accordingly, we recommend the Management Plan re-evaluate past and ongoing operations of the Missouri River system in relation to threatened and endangered species and determine if there are different operational scenarios, along with AM, that would achieve these purposes. These operations should seek to be more scientifically informed and cost effective, while addressing the jeopardizing effects of the Missouri River operations as currently implemented.

The Service views the purpose of the Management Plan as the development and eventual implementation of a fully functioning AM program as included in the 2003 BiOp reasonable and prudent alternative (RPA). AM involves formulating alternative actions to meet measurable objectives, predicting the outcomes of alternatives based on current knowledge, implementing one or more alternatives, monitoring the effects, and then using the results to improve knowledge and adjust actions accordingly.

With that in mind, the Service recommends the purpose description within the Management Plan recognize the need to develop an ecologically viable, resource efficient, legally defensible AM program that provides for the basic life requisites of listed species while maintaining the authorized purposes of the Missouri River system.

Need

After review of the Need section in the Management Plan, the Service believes that it would benefit from a reorganization. The section could be parsed out into three sub-sections: (1) historical overview; (2) current status of the ecosystem and species; and (3) what the Corps has done to meet its ESA obligations under previous BiOps and how that leads us to development of this Management Plan.

Much of the information needed for sub-sections (1) and (2) already exists and can be incorporated into development of the Need section. Together, these sections would "tell a story" of how the Missouri River ecosystem became imperiled, the current status of the system and its species, and how the Corps is remedying this by mitigating for fish and wildlife habitat losses using various authorities.

For the historical overview, a more comprehensive discussion of the historical events that have led up to the "*need for the Corps to take action and develop the Management Plan*" is needed. We recommend this section include how the construction of the Mainstem Dam system (Flood

Control Act of 1944) on the Missouri River, as well as other development (including implementation of the BSNP) by the Corps, has come at the expense of the river's native fish and wildlife. The reader should finish reading this section with no doubt as how the conditions on the Missouri River necessitate action by the Corps.

For the sub-section detailing current ecosystem and species status, the Corps has already included an overview of the circumstances (historical and current) that have led to the precipitous decline in the pallid sturgeon, piping plover and interior least tern. The Service would recommend including some type of overview of habitat losses (they are partially interwoven in to the species status paragraph), perhaps in a table format and then also relocating Table 1-1 (Decline in Native Species) to this sub-section as well.

Finally, the Need section would also benefit from a simplification of Section 3.2.4 (Acquisition and Development of Land Needed for Creation of Habitat). As is, the section while informative regarding how the Corps is mitigating for lost fish and wildlife habitat, is also mired down in a complex discussion of different authorities, acreage requirements and percent reductions in native wildlife. The overview on page 10 is lengthy and tends to overshadow the actual discussion of "need." The section could be improved with a simple discussion of what the Corps has done and is doing (per different authorities) to mitigate for the adverse impacts to the natural Missouri River ecosystem and the loss of habitat for both native and federally listed species.

The Service looks forward to our continuing collaboration with the Corps and other conservation partners in support of this important effort. State Fish and Wildlife agencies were contacted and informed of the recommendations that the USFWS was making to the USACE regarding Purpose and Need. To date no comments have been received. We believe a Programmatic Management Plan with a well-designed adaptive management program is critical to ensuring the success of the program, and the conservation of the fish and wildlife resources of the Missouri River. If you have any questions, please feel free to contact me at (605) 665-4856.

Sincerely yours,

Casey D. Kruse

Casey D. Kruse
USFWS Missouri River Coordinator
Yankton, SD

cc: USFWS, Region 6 ARD/ES, Lakewood, CO (Thabault)
USFWS, Region 3 ARD/ES, Bloomington, MN (Lewis) ARD
State F&W Directors: MT, ND, SD, NE, IA, MO, KS
Dave Ponganis, USACE
Mark Harberg, USACE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Missouri River Coordinator
31247 436th Avenue
Yankton, SD 57078

IN REPLY REFER TO:
FWS/R6/ES

March 24, 2015

Ms. April Fitzner
Missouri River Recovery Program
Senior Program Manager
U.S. Army Corps of Engineers
601 E 12th Street
Kansas City, Missouri 64106

RE: Planning Aid Letter Regarding the Appendix A of the Adaptive Management Plan: Adaptive Management Governance

Dear Ms. Fitzner:

The U.S. Fish and Wildlife Service (Service) provides this planning aid letter (PAL) regarding the development of the U.S. Army Corps of Engineers' (Corps) Missouri River Recovery Management Plan (Management Plan) and associated Environmental Impact Statement (EIS) in accordance with the Fiscal Year 2015 Fish and Wildlife Coordination Act (FWCA) scope of work. As a cooperating agency on the Management Plan and EIS, the Service provides the following comments in coordination with the seven Missouri River mainstem state fish and wildlife agencies pursuant to the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 et seq.), the NEPA of 1969 (42 U.S.C. 4321-4347), and the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 et seq.). Enclosed are emails from three state fish and wildlife agencies, Nebraska Game and Parks Commission, the Iowa Department of Natural Resources, and Kansas Department of Wildlife, Parks and Tourism, containing their comments.

This PAL does not constitute the final report of the Secretary of the Interior as required by Section 2 (b) of the FWCA, nor does it constitute reconsultation of the 2000 and 2003 Amended Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project (BSNP), and Operation of the Kansas River Reservoir System (BiOp) under section 7 of the ESA.

The following comments are specifically in regards to the draft Appendix A: Adaptive Management (AM) Governance document. They are a compilation of comments provided by the three state agencies listed above and Service staff.

General Comments

The Service is pleased that a governance plan is being included in the management plan. Such a document will allow other entities, including the public, to understand how the decisions will be made during implementation of the Management Plan. Overall, the document is coming together well and will provide a means for the implementation phase of the process. At the same time, we have a few concerns and recommendations listed below to improve the Management Plan, and its comprehensive approach.

The governance document fails to adequately recognize the statutory and constitutional responsibilities of the state fish and game agencies and Tribes throughout the decision making processes. Just as the federal government has certain responsibility for various natural resources, so do the state fish and game agencies and Tribes. The document should address the Corps' responsibilities to coordinate with the Tribes through government-to-government consultation as directed by Federal statutes or administrative actions such as Executive Order (EO) 13175, and agency policies. Not only does the Corps have statutory (FWCA) responsibilities to coordinate with state fish and game agencies; each state also has responsibilities, through various federal and state statutory and constitutional authorities, for management of water quantity, water quality, and fish and wildlife resources within their boundaries that could be affected in this process (in either a positive or negative way). State fish and game agency and tribal consultations throughout the AM process will help ensure that future Federal actions are achievable, comprehensive, long-lasting, and reflective of state and Tribal input.

Failure to fully inform and involve the state fish and game agencies and Tribes has the potential to slow recovery of the currently listed species as well as the overall system if unintended conflicts occur due to failure to adequately engage them in the process. We recommend that the state fish and game agencies and Tribes be included in the governance document.

The governance document presents a confusing description of the AM governance or decision making structure and process. It appears that there are six tiers of information processing and/or decision making: 1) an Oversight Team, 2) an Oversight Sub Team, 3) a Management Team, 4) a Management Sub Team, 5) a Technical Team, and 6) finally a Technical Sub Team. Figure 1, however, suggests that there are three tiers. The document should be revised to ensure a consistent message/ process is presented.

Adding to the confusion for the reader, terms are not used consistently throughout the document. For example on pages 3-4, the headings describe three **Sub**-Teams [Oversight **Sub**-Team (OT), Management **Sub**-Team, Technical **Sub**-Team (TT)]; then in Figure 1 the same acronyms are used (OT, MT, and TT) but the use of **Sub** has been dropped from the names for these teams [e.g. Oversight Team (OT)]. The description of the team membership in Figure 1 does not match that described in the text that precedes the figure. For example, page 2 describes the Oversight Team as the Corps Division and Service Regional Director, whereas Figure 1 has different description of the team membership for the Oversight Team.

If the intent is truly to have six tiers, this may prove to be a very inefficient, redundant, and unmanageable composition that will likely result in cumbersome decision making and implementation. The Colorado River Recovery has a three tiered process (multiple technical teams, a management team, and implementation team (SES level agency representatives) that works very well.

Specific Comments

Page 1 and 2, Categories of Decision Making. The document suggests that certain categories will only be handled by specific tiers. Although this may be the standard process, programmatic decisions may have to be made at the Oversight level, when agreement cannot be reached at the Management Team level.

Page 2, last sentence of top paragraph. This sentence describes the composition of the Oversight Team. The document needs clarification on who is the Corps representative (the whole Division and the Service Regional Director or one person and the Service Regional Director).

Page 2, Table 1, and Figures 1 and 2. In the three tiers of decisions, project specific design and implementation appear to be missing. They are not policy, or programmatic, or monitoring. They are designing and building habitat. Those types of decisions and who will be included in those decisions need to be included in the text and in Figures 1 and 2. Those types of action decisions should have significant involvement by our state fish and game agency partners and Service field staff (i.e. ES FOs, refuges, fisheries). We recommend adding a section to show how states and tribes are included in the process. The Governance structure would benefit with some discussion of the complementary processes also required for Corps projects. That could provide a better understanding of the way the Corps intends to integrate input from the various agencies, groups, and partners beyond MRRIC.

Page 3. It appears in the document that the management sub-team is the implementation entity and that the two federal agencies will coordinate through Missouri River Recovery Implementation Committee on project implementation. Historically, it has been the role of the state fish and game agencies to assist in putting projects on the ground. It is important to ensure there is no disconnect between the field and the various organizational levels in the AM governance structure. We recommend including the state fish and game agencies in this discussion as well.

Page 4, Technical Sub-Team section. The second sentence of this section states "the TT consists of three teams of scientists……;" however, four teams are listed.

The Service, in coordination with Missouri River mainstem state fish and wildlife agencies, is looking forward to continuing to work collaboratively in support of this important effort to ensure the success and ultimate implementation of the Management Plan for the recovery of the fish and wildlife resources of the Missouri River, while also taking into consideration the human resources. If you have any questions, please feel free to contact me at (605) 665-4856.

Sincerely yours,

Casey D. Kruse

Casey D. Kruse
USFWS Missouri River Coordinator
Yankton, SD

Enclosures

cc: USFWS, Region 6 ARD/ES, Lakewood, CO (Thabault)
USFWS, Region 3 ARD/ES, Bloomington, MN (Lewis)ARD

State F&W Directors: MT, ND, SD, NE, IA, MO, KS
Dave Ponganis, USACE
Mark Harberg, USACE

From: **Zuerlein, Gene** <gene.zuerlein@nebraska.gov>
Date: Fri, Feb 13, 2015 at 11:53 AM
Subject: RE: FWCA Adaptive Management Governance Document for review
To: "NelsonStastny, Wayne" <wayne_nelsonstastny@fws.gov>

Wayne,

Thanks for sending the AM document out for review. Since the states have public trust responsibilities for fish and wildlife species, it appears to me the document should include more involvement from state fish and wildlife agencies in the basin since we have expertise in many fish and wildlife topics and managers on the landscape. I only saw the word mitigation one time and since this program has Congressional authority to purchase 167,000 acres of land, especially within the accretion zone below Sioux City, the probability of bringing health back to the river sooner as well as the health of listed species is greater if everyone keeps this in mind.

Gene

From: **Larson, Chris J [DNR]** <Chris.Larson@dnr.iowa.gov>
Date: Fri, Feb 13, 2015 at 10:53 AM
Subject: RE: FWCA Adaptive Management Governance Document for review
To: "NelsonStastny, Wayne" <wayne_nelsonstastny@fws.gov>, "Adams (Topeka) Steve" <steve.adams@ksoutdoors.com>, Chris Longhenry <Chris.Longhenry@state.sd.us>, "dfryda@nd.gov" <dfryda@nd.gov>, Don Skaar <dskaar@mt.gov>, Gene Zuerlein <gene.zuerlein@nebraska.gov>, Kasey Whiteman <Kasey.Whiteman@mdc.mo.gov>, sdalbey <sdalbey@mt.gov>, "J. Campbell-Allison" <jennifer.campbell-allison@mdc.mo.gov>

Need to make mitigation an integral part of any recovery plan.

CHRIS LARSON, Southern Iowa Regional Fisheries Supervisor

Iowa Department of Natural Resources
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57744 Lewis Rd | Lewis, IA 51544

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Leading Iowans in Caring for Our Natural Resources.

From: "Adams (Topeka), Steve" <steve.adams@ksoutdoors.com>
Date: February 19, 2015 at 11:51:22 AM CST
To: "NelsonStastny, Wayne" <wayne_nelsonstastny@fws.gov>
Cc: "Chris J [DNR] Larson" <Chris.Larson@dnr.iowa.gov>, Chris Longhenry <Chris.Longhenry@state.sd.us>, "dfryda@nd.gov" <dfryda@nd.gov>, Don Skaar <dskaar@mt.gov>, Gene Zuerlein <gene.zuerlein@nebraska.gov>, Kasey Whiteman <Kasey.Whiteman@mdc.mo.gov>, sdalbey <sdalbey@mt.gov>, "J. Campbell-Allison" <jennifer.campbell-allison@mdc.mo.gov>, Carol Smith <carol_smith@fws.gov>, Jane Ledwin <Jane_Ledwin@fws.gov>, Casey Kruse <Casey_Kruse@fws.gov>
Subject: Re: FWCA Adaptive Management Governance Document for review

Wayne;

Thank you for the opportunity to review these documents. We have reviewed the documents associated with the Adaptive Management Governance process that proposes a structure for decision making and responsibility of various federal agencies and interests. First, we want to clarify the intent of these documents. It appears these documents outline the decision process related to Adaptive Management related actions associated with the overall recovery effort, not just interaction with MRRIC. Is that correct? With that as the context, the issue of concern to us is these documents appear to fail to recognize the statutory and constitutional responsibilities of the states and adequately include the states throughout the decision making processes. Just as the federal government has certain responsibilities for various natural resources, so do the states. Through various statutory and constitutional authorities, each of the states have responsibilities for the management of water quantity, water quality, and fish and wildlife resources within their boundaries that could be affected in this process (in either a positive or negative way).

Failure to fully inform and involve the states has the very real potential to slow recovery of the currently listed species as well as the overall system if unintended conflicts occur due to failure to adequately engage the states in the process. We would urge the federal agencies to correct this deficiency before these documents are finalized.

Steve Adams
Kansas Department of Wildlife, Parks and Tourism

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Mountain-Prairie Region
31247 436th Avenue
Yankton, SD 57078

November 2, 2015

Ms. April Fitzner
Missouri River Recovery Program
Senior Program Manager
U.S. Army Corps of Engineers
601 E 12th Street
Kansas City, Missouri 64106

RE: Planning Aid Letter Regarding the Missouri River Recovery Management Plan
Lower Missouri River Pallid Sturgeon Framework, Targets and Decision Criteria

Dear Ms. Fitzner:

The U.S. Fish and Wildlife Service (Service) provides this planning aid letter (PAL) regarding the development of the U.S. Army Corps of Engineers' (Corps) Missouri River Recovery Management Plan (Management Plan) and associated Environmental Impact Statement (EIS) in accordance with the Fiscal Year 2015 Fish and Wildlife Coordination Act (FWCA) scope of work agreed to by our agencies. The Service provides the following comments pursuant to the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 et seq.), the NEPA of 1969 (42 U.S.C. 4321-4347), and the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 et seq.).

This letter confirms the USFWS support for the Lower Missouri River Pallid Sturgeon Framework, Targets and Decision Criteria, (enclosed), for the Missouri River Recovery Management Plan EIS (MRRMP-EIS). We appreciate the dialogue that has occurred between the Corps and Service staff to date on this effort. We look forward to further discussions to finalize the Level 1 and 2 Components and Decision Criteria.

The Service recognizes the lingering uncertainties regarding the scale and scope of management actions necessary for the Corps to avoid jeopardizing the continued existence of the pallid sturgeon. The Framework document should accelerate the reduction of uncertainty and ultimately lead to a more strategic and focused implementation of appropriate management actions. The acquisition of knowledge and reduction of uncertainty do not, in themselves, constitute avoidance of jeopardy. Avoidance of jeopardy is only achieved through taking action and the Service fully supports the Framework and expects a commitment to a strategy reliant upon a progressive adaptive management (AM) program. The AM program, including this Framework should provide and illustrate a commitment and pathway to the scope of actions, including level 4, necessary to abate the effects of the Federal action and avoid jeopardizing the continued existence of pallid sturgeon on the lower Missouri River. At the same time, the AM decision process should ensure the flexibility to adjust actions, objectives, timelines and decision criteria while maintaining a focus on the fundamental objectives.

The Service acknowledges the ongoing refinement of actions and development of alternatives for the MRRMP-EIS. We anticipate that as the MRRMP-EIS moves forward that the decision criteria outlined in this Framework may need fine-tuning.

We look forward to continued discussions on this topic with the Corps. Please contact me at (605) 665-4856 or Wayne Nelson-Stastny at 605 660-5349 for further questions and clarification. The Service looks forward to our continuing collaboration with the Corps and other conservation partners in support of this important effort.

Sincerely yours,

Casey D. Kruse
USFWS Missouri River Coordinator
Yankton, SD

Enclosure

cc: USFWS, Region 6 ARD/ES, Lakewood, CO (Thabault)
USFWS, Region 3 ARD/ES, Bloomington, MN (Lewis) ARD
State F&W Directors: MT, ND, SD, NE, IA, MO, KS
Dave Ponganis, USACE
Mark Harberg, USACE

LMR Pallid Sturgeon Framework, Targets and Decision Criteria

Summary: This draft document outlines the Lower Missouri River pallid sturgeon framework (Framework) with an emphasis on the required implementation targets and decision criteria for management actions at level 3. The criteria outlined below represent a joint USFWS/USACE characterization of the necessary elements for managing uncertainty and associated risks under the Adaptive Management Plan as envisioned, and is intended to guide alternative formulation for the MP-EIS. The Framework is based on four levels of activity. Level 1 and 2 components include, respectively, research and field studies/experiments aimed at resolving critical uncertainties regarding the management actions needed to offset the effects of the Federal action. Management actions at levels 3 and 4 are aimed at avoiding or offsetting impacts of the Federal action by increasing the pallid sturgeon population. The nature and details of actions needed at level 4 remain uncertain, but a suite of level 3 actions organized around four categories have been identified for planning purposes and would be implemented unless certain decision criteria are met. The relevant decision criteria and implementation requirements are summarized in the following sections. It is intended that implementation of the actions through level 4 following decision criteria with associated studies collectively encompassed in the Framework **would** avoid jeopardizing the pallid sturgeon while minimizing unnecessary and potentially impactful actions. Additional details of the Framework will be incorporated into the MRRP AM plan.

Underpinning Principles: Given the lingering uncertainties regarding the scope and scale of the management actions necessary for the Corps to avoid jeopardizing the continued existence of pallid sturgeon, a strategy reliant upon a progressive adaptive management (AM) program is the most effective way to manage risks to the pallid sturgeon. This strategy is evident in the Pallid Sturgeon Framework (Framework) advanced through the Effects Analysis (EA) and further refined by the Corps and Service. The Framework is expected to accelerate the identification of recruitment bottlenecks, resulting in a more strategic and focused implementation of appropriate management actions. This approach has the added benefit of minimizing impacts to stakeholders and avoiding unnecessary implementation costs.

While both the uncertainty and the scale of required actions point to a need for the Framework, the acquisition of knowledge and reduction of uncertainty do not, in themselves, constitute avoidance of jeopardy or directly reduce risks to the species. For these reasons, the Service requires a set of decision criteria to guide execution of the Framework so as to ensure that the knowledge gained results in a thoughtful but rapid progression through the implementation levels to actions providing a meaningful, population-level response of the pallid sturgeon. The intent is that the implementation of this framework through a progressive adaptive management program will be sufficient to abate the effects of the Federal actions and avoid jeopardizing the continued existence of the pallid sturgeon on the lower Missouri River.

The decision criteria (outlined below) include two stipulations that supplement risk management for the species beyond that afforded by AM alone. First, the artificial propagation program would be continued throughout the Framework's implementation, and improvements to that program related to genetic concerns, disease, stocking size, etc., would be pursued consistent with the propagation plan under development for the Recovery Program. Second, implementation of management actions at level 3 for each hypothesis would be required within a specified timeframe, provided the hypotheses associated with the action are not rejected by that time. This stipulation should not be construed to mean that level 3 actions should not or cannot be implemented earlier than the time limits; the criteria below ensure that progression from one level to the next (or possibly skipping one or more levels, rejecting the associated hypotheses, etc.,) would occur as soon as dictated by the metrics and decision criteria outlined at the end of the framework.

The actions at levels 2 and 3 outlined in this framework and in more detail in the AM Plan provide the basis for the Adaptive Management Plan as described and evaluated in the Missouri River Recovery Management Plan and Environmental Impact Statement (MP-EIS)[1]. Thus, any of the actions identified as part of this alternative may be implemented in whole or in part, subject to the bounding decision criteria, and other logistical constraints. The scope of implementation for each action is expressed using bounding rates. The overall implementation scope will be established once a sufficient population-level response has been observed to permit development of level 4 targets.

It is important to note that the actions needed to address the pallid sturgeon life requisites remain uncertain and the actions currently outlined in the Framework are subject to change. At any time during the Framework's implementation, it may become apparent that 1) a particular action is not needed, 2) a proposed action requires modification to be effective, or 3) that some new action not previously evaluated is required. In the first instance, the criteria outlined in the AM Plan would permit abandonment of further implementation of associated management actions and describe other lines of study (if any). In the latter two cases appropriate engagement with MRRIC, and/or other requirements or procedures needed for compliance with NEPA may be necessary prior to implementation.

Lower River Pallid Sturgeon Framework: The Framework for the lower river consists of four levels of activity as described in Table 1. The lower river refers to the mainstem Missouri River downstream of Gavins Point Dam, including the influences (to the extent they are relevant) of upstream reservoirs like Fort Randall and Lewis and Clark Lake, influences of major tributaries, and some portion of the Middle Mississippi River.

The studies and other activities at levels 1 and 2 listed herein are described in detail in Appendix C of the AM Plan. These efforts are organized so as to efficiently address the hypotheses identified in the EA. Activities at level 3 identified herein are described further in the MRR MP. They include various management actions aimed at eliciting a population-level response from the pallid sturgeon. Level 4 actions are not presently described but will evolve through implementation of the AM plan. The extent to which specific studies or actions at any level are implemented will depend upon several circumstances and is guided by the objectives and a set of associated decision criteria.

Table 1. Pallid sturgeon framework for the lower Missouri River

Level 1: Research	Population Level Biological Response IS NOT Expected	Studies without changes to the system (Laboratory studies or field studies under ambient conditions)
Level 2: In-river testing		Implementation of actions at a level sufficient to expect a measurable biological, behavioral, or physiological response in pallid sturgeon, surrogate species, or related habitat response.
Level 3: Scaled Implementation	Population Level Biological Response IS Expected	In terms of reproduction, numbers, or distribution, initial implementation should occur at a level sufficient to expect a meaningful population response progressing to implementation at levels which result in improvements in the population. The range of actions within this level is not expected to achieve full success (i.e. Level 4).
Level 4: Ultimate Required Scale of Implementation		Implementation to the ultimate level required to remove as a limiting factor.

Components, Actions and Decision Criteria for the Pallid Sturgeon Framework: Objectives for the pallid sturgeon have been defined at each of the Framework levels (including means objectives for actions) as well as for the overall program (i.e. the fundamental objectives). For each objective, the AM Plan presents corresponding metrics, decision criteria (performance measures, triggers, etc.) monitoring needs and protocols, and (sometimes) contingency plans. Near-term implementation of the Framework will focus on those objectives outlined for levels 1 through 3 with an increased focus over time on the fundamental objectives and sub-objectives. There are also objectives and associated criteria relating to general program implementation that address concurrent plover, tern and pallid sturgeon considerations.

As information is developed from level 1 and 2 studies or through monitoring of effectiveness of management actions, the Framework's decision criteria will be used to determine when and what action should follow. Decisions might include:

a) accepting that the scientific information supports the hypothesized action and:
    1. moving to the next most important science question pending for each big question; or:
    2. moving to implementation of higher level (i.e. level 2, 3 or 4) actions;
b) determining that the scientific information does not support the hypothesized action and:
    1. refining the hypothesis and continuing scientific investigations; or
    2. rejecting the hypothesis and promoting an alternative hypothesis that better explains observed information.
c) to begin implementing at level 3 because a time limit for a hypothesized action has been reached and results remain equivocal (studies at levels 1 and 2 might continue concurrently)

In general, the details of contingent actions are difficult to specify because the scope, scale, timing, distribution, etc., of those actions will depend upon the knowledge gained from previous levels of implementation. However, contingent actions at level 3 that are triggered by the time limits are an exception. These are specified in the form of a required minimum and maximum implementation rate that is to be followed unless and until knowledge gained from those actions and from previous and ongoing studies at levels 1 and/or 2 demonstrate that a different rate is required.

Level 1 and 2 Components and Decision Criteria: Levels 1 and 2 include activities focused on increasing the state of scientific knowledge about the factors most likely limiting pallid sturgeon survival and are intended to systematically and efficiently address critical uncertainties regarding what management actions are needed to address impacts of the Corps' Missouri River operations on pallid sturgeon. Level 1 and 2 studies are directly tied to those uncertainties and management hypotheses highlighted in the Effects Analysis that, if resolved, could significantly affect the implementation of management actions. They can continue concurrently with level 3 efforts, but are generally intended to inform actions at level 3. Although level 2 studies have learning as a primary objective, they can also provide measurable benefits to pallid sturgeon populations and, in such cases, would be counted toward targets in the same manner as level 3 actions. Criteria for accepting or rejecting specific hypotheses, for assessing the results of scaled experiments, and for moving from level 1 to level 2 or level 2 to level 3 actions are described in Appendix C of the AM Plan. A summary is presented in Table 2.

Table 2. Summary of decision criteria associated with level 1 and 2 studies.

Question, Level and Study Components	Metrics and Decision Criteria
Big Question 1:Spawning Cues	
L1/C1-Design complementary passive telemetry network	
L1/C2 - Opportunistic tracking or reproductive behaviors	
L1/C3 - Mesocosm experiments, reproductive behaviors	
L2/C*4* - Engineering study effects on other authorized purposes	
L2/C5 - Experimental flow releases, Gavins Point	
Big Question 2:Temperature Control	
L1/C1 – Model water temperature management options, Gavins Point	
L1/C2 - Field studies temperature and reproductive behaviors, surrogates	
L1/C3 - Mesocosm studies temperature and reproductive behaviors	
L2/C4 - Field tests of water temperature management, Gavins	

Point	
L2/C5 - Experimental warm water releases, Gavins Point	
Big Question 3:Food and Forage	
L1/C1 - Screening: limitations of food or forage habitats	
L1/C2 - Technology development for IRC sampling, modeling, measurement	
L1/C3 - Field studies along gradients, food and forage habitats	
L1/C4 - Mesocosm studies: quantitative habitat-survival relations	
L2/C5 - Design studies for IRC experiments	
L2/C6 - Manipulative field experiments with IRCs	
Big Question 4:Drift Dynamics	
L1/C1 - Technology development surrogate particles, particle tracking	
L1/C2 - Resilience, stamina in turbulent flows	
L1/C3 - Field studies on free embryo exit paths	
L1/C4 - Field gradient study, age-0 survival and complexity	
L1/C5 -Free embryo transport to Mississippi River	
L1/C6 - Field experiments with particle tracking, embryos, models	
L2/C7 - Engineering designs for interception experiments	
L2/C8 - Field experiment: discharge and dispersion	
L2/C9 - Field experiment: IRC complexes	
Big Question 5: Spawning Habitat	
L1/C1 -Study of functional spawning habitat, Yellowstone River	
L1/C2 - Field gradient study, habitat condition s LMOR	
L1/C3 - Mesocosm studies on spawn conditions, behaviors	
L2/C4 - Engineering studies for sustainable design	
L2/C5 - Manipulative field experiment for spawning habitat	

Big Question 6:Population Augmentation	
L1/C1 - Engineering feasibility hatchery needs, facilities, operations	
L1/C2 - Retrospective study survival linked to hatchery operations	
L1/C3 - Simulation models, population sensitivity to size, health, genetics	
L2/C4 - Field experimentation with varying size, location of stocking	

Level 3 Actions, Targets and Decision Criteria: Requirements for level 3 were developed collaboratively by the USACE and USFWS and reflect both best available science and policy considerations. The nature, scope and implementation timeframe of management actions at level 3 outlined in this document are intended to 1) provide a commitment and pathway to the scope of actions (including at level 4) necessary to abate the effects of the Federal action and avoid jeopardizing the continued existence of the pallid sturgeon on the lower Missouri River, 2) afford an opportunity for study and learning while also ensuring risks to the pallid sturgeon are managed, and 3) serve as a basis for the range of actions to be assessed as part of the MP-EIS. Further refinement of the accompanying decision criteria and added detail will be developed through subsequent interagency discussions as part of development of the AM Plan. The AM decision process will ensure the flexibility to adjust actions, objectives, timelines and decision criteria while maintaining a focus on the fundamental objectives. This flexibility will be assessed through analysis of several scenarios that highlight need for change; the scenarios will be addressed with both internal and external parties, including the MRRIC ad hoc work groups.

Implementation of management actions at level 3 for any limiting factor would commence at the earlier of two triggers: 1) within two years of affirmative results from level 1 and/or 2 studies indicating an action is needed for a limiting factor, or 2) the established time limits should the results of studies/tests at levels 1 and 2 of the associated hypotheses remain equivocal. The first trigger might be affected by the criteria summarized in Table 2 and presented in detail in the AM Plan appendices. In many cases, definitive criteria for accepting or rejecting hypotheses are not readily identifiable, or the available data is not likely to provide unequivocal results. In those situations, a lines-of-evidence approach may be applied.

To help find an appropriate balance between taking action versus decreasing uncertainty, a series of five questions (Table 3) were developed as a proposed checklist to guide decisions to advance to implementation at level 3 for any of the hypotheses identified by the EA. If all five questions can be answered “Yes”, advancement to Level 3 implementation would be triggered. If an affirmative answer to four of the five questions exists and either question 1 or question 2 is equivocal, implementation of level 3 management actions would be triggered within two years (unless the hypothesis is rejected in that timeframe). The five questions are listed in Table 3.

Table 3. Supplemental lines of evidence strategy for triggering level 3 implementation.

	Question	Y	U	N
1	Is this factor limiting pallid sturgeon reproductive and/or recruitment success?			
2	Are pallid sturgeon needs sufficiently understood with respect to this limiting factor?			
3	Do one or more management action(s) exist that could, in theory, address these needs?			
4	Has it been demonstrated that at least one kind of management action has a sufficient probability of satisfying the biological need?			
5	Have other biological, legal, and socioeconomic considerations been sufficiently addressed to determine whether or how to implement management actions to Level 3?			
	Criteria for level 3 implementation			
	1 - A "Yes" to all five questions triggers level 3 implementation			
	2 - A "Yes" to four of five, with an "Uncertain" for either #1 or #2 triggers a two-year clock to either reject the hypothesis or implement at level 3			

Table 4 lists the actions currently defined for the Lower basin pallid sturgeon and evaluated under the MP-EIS. In the absence of affirmative results from level 1 and 2 studies or the lines-of-evidence analyses, the time limit column in the table reflects the latest point in time (in years after the Record of Decision) to initiate the listed actions. Targets are defined in terms of implementation rates, and the acceptable range is shown by the Minimum and Maximum Scope columns. For example, if the ROD is signed in 2016, the IRC habitat actions (time limit 2 years) must begin no later than 2018, and are to be implemented at a rate of 260-500 new ac-day/yr of IRC habitat (note that these values are placeholders until actual targets are calculated). Progress toward the targets will be determined by field measurement of project outcomes (as part of the monitoring program), and could be derived from either Level 2 or Level 3 actions. The implementation scope could deviate from that described below as dictated by the results of level 1 and/or 2 studies. However, management actions outside the scope of that evaluated under the MP-EIS would require additional (i.e. supplemental) environmental assessment and coordination with MRRIC.

Table 4. Summary of time limits for level 3 implementation and scope of actions.

Action Category	Time Limit*	Minimum Scope	Maximum Scope
Population augmentation	Immediate	Current avg. stocking rate	Variable over time
IRC habitat development	2 years	260K ac-d/yr	Add 500k ac-day/yr
Spawning habitat	2 years*	3 spawning sites	See decision tree**
Spawning cue flows	9 years	Max. implementation scope assumed to be 1 in 3 years for impacts analysis within MP; minimum and maximum required implementation scope will be developed and informed by population models and impact assessments***	

* Anticipated as Level 2 pilot projects focused on developing and evaluating high-quality spawning habitat.

** Spawning habitat implementation will be guided by the decision tree and associated decision criteria as described in the section below on spawning habitat.

*** Pallid population modeling will be used to set minimum spawning flow needs; bird impacts and status may inform decisions regarding spawning cue flows below Gavins Point Dam in any particular year.

Because of the uncertainty regarding the hypotheses and the effectiveness of proposed management actions in increasing pallid sturgeon recruitment, the targets are based on the best information currently available for that particular management hypothesis. As knowledge is gained from level 1, 2 and 3 actions, the timeframe for implementation may be adjusted, targets may be changed, management actions may be refined, and hypotheses may be dismissed. The “rules” by which these decisions will be made are outlined in the decision criteria for the respective management hypotheses, subject to the overarching MRRP governance and decision process laid out in the AM Plan.

Population Augmentation

<u>Action Description</u>: Population augmentation (stocking) of pallid sturgeon is already taking place at a level having a measurable effect on the population (i.e. level 3), and will continue under the Framework. While population augmentation is *necessary* for recovery of the pallid sturgeon, by itself it is not *sufficient* as the Endangered Species Act requires a self-sustaining population. Augmentation can help severely depleted populations recover numbers of individuals needed to evaluate what works and what doesn’t in recovering the population. Additionally, some concurrent level 1 and level 2 components are proposed to develop information to improve on the level 3 implementation (see Figure 1 for an approximate schedule).

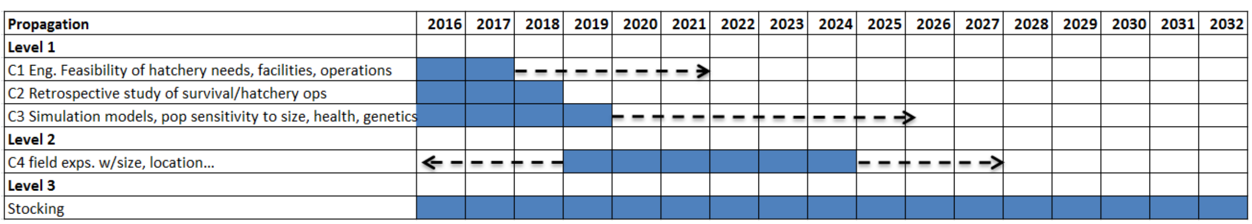

Figure 1. Preliminary schedule of actions related to propagation.

This action will be closely coordinated with the new Pallid Sturgeon Propagation Plan being developed by the Pallid Recovery Team (Wyatt Doyle is the Lead) because of important concerns related to fish health/disease, genetics, stocking size, stocking practices, etc. Once the Propagation Plan is developed, the target values in Table 4 will be adjusted to reflect the role of the MRRP in meeting plan objectives. The target values in the table may best be represented by running averages In addition to or rather than annual minimums or maximums. It is important that the Propagation Plan rely upon the population model being developed as part of the Effects Analysis and Adaptive Management Plan (and in support of the recovery plan) and not other, competing models. The rationale for these decisions will be further articulated in Chapter 4 of the AM Plan.

<u>Objectives</u>: The stocking rate and target number of fish stocked is intended to ensure a 95% probability of persistence for the species over a 50-year period. Short-term objectives are to increase the number of adult pallid sturgeon in the lower Missouri River. Long-term objectives are to reduce and eventually eliminate the need for supplemental stocking by demonstrated wild recruitment at a level sufficient to meet the fundamental objectives. In addition to the above primary objectives, more specific, means objectives for propagation have been identified and include increased fitness and genetic diversity of

released fish, improved brood stock collection, and adjusting hatchery capacity. Some of these efforts are being addressed through Level 1 and 2 studies.

Metrics: The metric for reporting and assessing stocking rates will be yearling equivalents; performance measures will be based on a three-year running average of annual yearling equivalents. Number and survival rates for stocked pallid sturgeon by stocked size, hatchery of origin, and condition; Catch rates of adult pallid sturgeon, along with other measures of fitness or genetic makeup might be employed as supplemental metrics for the primary objective, and metrics for the more specific objective listed above will be identified in the Propagation Plan. *(Note: this is subject to adjustment upon coordination with the Recovery Team on the new Propagation Plan)*

Decision Criteria: Adjustments to the number of fish and their age structure will be based on the results of population modeling and sensitivity analyses using the most up-to-date version of the model available each year. Until the model is sufficiently robust to meet this need, a target of 5000 adult pallid sturgeon in each management unit will serve to guide stocking rates. *(Notes: 1. This is subject to adjustment upon coordination with the Recovery Team on the new Propagation Plan. 2. Criteria for more specific objectives listed above will be presented in the Propagation Plan).*

Triggers for Moving to Higher Implementation Level: No clear transition from level 3 to level 4 exists; implementation at level 3 will continue until such time as supplemental stocking is no longer required.

Trigger for abandoning population augmentation actions: Population augmentation may be halted when population monitoring demonstrates that a self-sustaining population in excess of 5000 fish exists in each management unit, when the threat of extirpation is less than 5 percent in 50 years, or as based on new criteria introduced through the Propagation Plan.

Triggers for adjusting augmentation practices to optimize fitness or genetic diversity: TBD

Timeframe: No specific timeframe for transition is identified. Implementation at level 3 is to begin immediately (i.e. continue from present) following issuance of the ROD.

Level 3 Contingent Actions: Contingency plans for artificial propagation are limited to those associated with the secondary objectives; adjustments to the propagation program will focus on achieving the necessary fitness and genetic diversity.

Monitoring Requirements: See Appendix D of AM Plan

Interception and Rearing Complexes (IRCs)

Action Description: Interception and rearing complexes (IRCs) are areas that meet the functional definitions laid out in the Effects Analysis Integrative Report. For the purpose of establishing targets and measuring progress, the physical definitions of IRCs are currently identified as follows: 1) food-producing habitat occurs where velocity is less than 0.08 m/s, 2) foraging habitat is defined as areas with 0.5 – 0.7 m/s velocity and 1-3 m depth, and 3) interception habitat has been qualitatively described as zones of the river where hydraulic conditions allow free embryos to exit the channel thalweg. A functional IRC exists where the juxtaposition of the described habitats is such that all three functions are performed and collectively contribute to survival to age-0. The above requirements will be adjusted as needed based on new knowledge regarding the suitability of conditions for IRC habitat.

The availability of food-producing and foraging habitats varies with flow, as does the local hydraulic field at any location (and hence the potential for interception and retention). Consequently, IRC habitat is flow-dependent and time-variant and can be affected by both mechanical manipulations of river geometry and flow management actions. For the timeframe addressed by this EIS (approximately 15 years), flow management will not be required to meet any IRC targets associated with Level 3 unless information developed during Level 1 and Level 2 implementation unequivocally demonstrates the need for flow manipulation. Because flow manipulations will not be assessed under the current actions for Level 3, additional NEPA analysis of those actions would be required before any implementation efforts are undertaken.

Level 1 and 2 activities associated with IRCs focus on 1) the need for additional IRC habitat, 2) refining the relationship between the habitat components, flow (utilizing current operations), and the biological requirements of each habitat type, 3) the needed habitat characteristics and their spatial and temporal distributions, and 4) determining the effectiveness of various mechanical activities and the potential for flow management actions to contribute to future IRC needs. A proposed sequencing for actions associated with IRCs is shown in Figure 2. To the extent possible and where appropriate, Level 1 and 2 activities will incorporate habitat projects which have already been completed. Although the habitat focus has changed from SWH, there is likely much that can be learned from existing SWH projects.

Level 3 actions include physical manipulation of habitats and structures on the Missouri River to create or improve areas having hydraulic conditions to intercept drifting free embryos combined with food-producing habitats and foraging habitats. Actions might be directed at one or any combination of the three components of IRCs. Examples include adjustments to navigation training or bank stabilization structures, channel widening, floodplain modifications or other adjustments to channel geometry, placement of structures to encourage development of needed habitat or habitat complexity, chute development or adjustments to existing chutes, etc. In addition to development of functional IRCs, management actions will be aimed at ensuring availability of IRC habitats over a wide range of flows as well as the necessary spatial characteristics (distribution, concentration, proportions, etc.,) on the lower Missouri River such that interception, food production, and foraging are not preventing the achievement of the pallid sturgeon fundamental objectives.

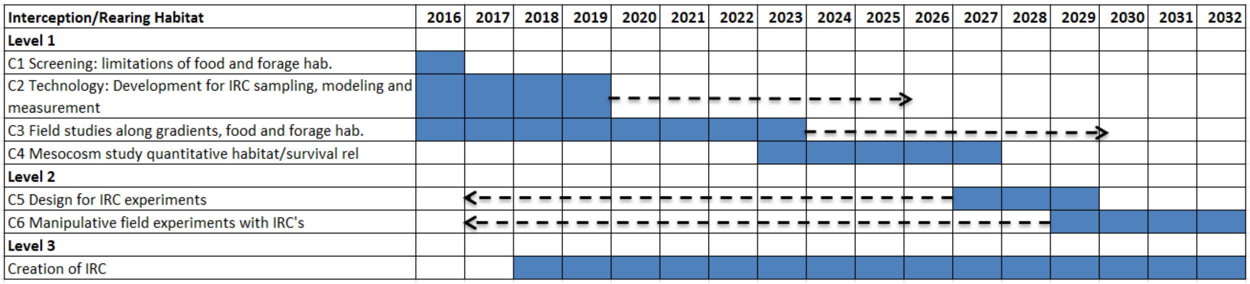

Figure 2. Preliminary timeline for IRC action Implementation.

The targeted longitudinal distribution of IRCs will be influenced by biological needs as outlined in the EA and supported by results of larval drift modeling as well as other practical considerations. It is anticipated that IRCs will be concentrated downstream from RM 595 but, due to uncertainty regarding drift behavior and potential benefits of temporal retention, IRCs will not be restricted to areas below RM 595, and the strategy for site selection will be based on maximizing knowledge. Projects with potential to quickly reduce uncertainties will be emphasized to the extent practicable. New IRC habitat resulting from both level 2 and level 3 actions that meets the IRC criteria will be counted as contributing to the targets for level 3 (i.e. credit is based on measured project outcomes). Level 3 actions and outcomes are focused on helping understand and describe what level 4 actions and targets will be.

Long-term (Level 4) targets will be based on bioenergetics requirements of the Missouri River pallid sturgeon population. Lacking the ability to reliably establish those needs at present, Level 3 targets for IRC are to be based on the rate the Corps has demonstrated that they can create shallow water habitat (SWH). The SWH historical implementation rate (acres/year) will be converted into a flow-variant metric for IRCs (in acre-days per year) that accounts for food-producing and foraging habitat availability in proximity to areas of effective interception and retention of larval pallid sturgeon. The result of this transformation will be to characterize (as a range, an average over some reasonable timeframe, or both) the expected amount of “lift” in availability of IRC habitat during the (temperature dependent) growth period for pallid sturgeon. Growth period for larval and juvenile pallid sturgeon occurs from May through October. Because of early life history transition to first feeding the month of June will be the highest priority with a focus on learning and refining our understanding of the relationship between temperature, flow and river geometry. We will continue to look into the best way to categorize time frame to assess this relationship.

Associated Hypotheses: 1). Interception habitat - Improved or increased interception of drifting free embryos from the thalweg and transport to supportive channel-margin habitats will increase survival of free embryos to exogenously feeding age-0. 2). Food production habitat - A lack of food limits survival of age-0 pallid sturgeon. 3). Foraging habitat - An increase in availability and quality of foraging habitat will increase survival of age-0 pallid sturgeon.

Objectives: Primary - Ensure that interception of drifting free embryos, food production and effective foraging for age-0 pallid sturgeon do not seriously limit recruitment in the lower Missouri River, either locally or systemically; Secondary - 1) progress toward the Targeted amount and distribution of IRC habitat, and 2) number of specific means objectives will be established as appropriate to promote the optimization of IRC development and to protect HC interests.

Metrics: The means objectives by which the Corps will be evaluated in meeting their obligations under the BiOp are based on the net increase in “effective” acreage of IRC habitat (in acre-days/yr) listed in Table 4. “Effective” acreage is determined by integrating the developed or available IRC habitat with mean daily flows for June through September, expressed as acre-days. These dates correspond with the period of growth for pallid sturgeon (T>13^0 C). IRC habitat occurs where foraging habitat is collocated with or proximal to and downstream of food-producing habitat, and is intersected with hydraulic conditions in June that would promote interception and retention of free embryos drifting in the channel. Habitat metrics will be based on measures of depths, velocities, and substrate, including central tendency and variance, potentially complemented with metrics of spatial complexity. Figure 3 below is an example of how IRC habitat is counted. The algorithm for calculating IRC habitat might weight the hydrograph in June higher because of the importance of first feeding to survival. Distribution will be evaluated as deviation from a target distribution.

(need Figure)

Figure 3. Example of IRC habitat accounting.

Performance of IRC actions will also be based on a subset of metrics addressing the primary objectives outlined above. The effectiveness of projects in promoting interception will be based on CPUE of age-0 sturgeon at project (pre- and post-implementation) and reference sites in the months of June through September. Effectiveness in terms of food production will be based on production of food per unit area, survival and indicators of starvation or impending death of age-0 pallid sturgeon (percentages of empty/full stomachs; lipid content). Effectiveness in terms of foraging will be based on gut content and survival of age-0 pallid sturgeon with consideration for bioenergetics requirements of age-0 pallid sturgeon. Survival rates of hatchery-reared first-feeding pallid sturgeon larvae released in the Missouri River may serve as a metric for all three IRC elements.

A suite of metrics for assessing the hypotheses underpinning IRCs and the associated Level 1 and 2 studies are presented in the AM Plan.

Decision Criteria: The targets for implementation rate afford a straight-forward measure of compliance with the means objectives for IRCs at level 3. Net increases in habitat will be computed on an annual basis. To permit flexibility to address needs while promoting learning through level 2 actions and to address programmatic requirements related to piping plovers, performance relative to targets will be assessed using a running average of annual lift in IRC habitat. Acceptable performance is meeting or exceeding targets based on a three-year running average for at least 4 of every 5 years (80% success rate).

A host of additional decision criteria are expected in association with specific management actions and level 1 or 2 studies. These will be summarized in the AM Plan. Assessment of overall performance of many actions with statistical relations will likely not be robust, and decisions will therefore require a judgement based on lines of evidence. If experimental results in level 2 studies fail to support systematic increase in habitat and fish condition, then the hypothesis may need to be refined or abandoned. If the experimental results support the hypothesis that channel reconfigurations can provide increased food-producing and foraging functional habitats, and increase pallid sturgeon condition, then the decision would be to move toward level 3 implementation.

Triggers for Moving to Higher Implementation Level: The decision to move from level 3 to full implementation at level 4 will be based on a systematic relation between IRCs and increases in growth and survival of age-0 sturgeon that permits modeling of the needed scope of IRC implementation to meet the fundamental objectives. This judgement should be based on the strength and replicability of relations between abiotic habitat variables describing food and forage habitats, and growth and survival of age-0 sturgeon. In addition, the need for supplemental flow management at level 3 or 4 would be based on the availability of sound relations between flow conditions, IRC habitat, and growth and survival of age-0 sturgeon.

Timeframes: Implementation of IRC habitat at level 3 will occur no later than two years post-ROD. No time limit for transition to level 4.

Level 3 Contingent Actions: Contingency plans for IRCs are mainly associated with the secondary objectives (e.g. structure manipulations will not adversely affect navigation); however, adjustments to the targets, habitat criteria, methods, etc. might be required if performance fails to meet expectations. Details of contingency plans will be presented in the AM Plan.

Monitoring Requirements: See Appendix D of AM Plan

Spawning Habitat

Hypothesis: The spawning habitat hypothesis is highly uncertain with multiple hypotheses influencing potential directions and action. The hypothesis with the highest potential to provide rapid learning and insight is that high quality spawning habitat is limiting. Pilot projects (at Level 2) to address this hypothesis can be implemented within a few years and could greatly improve our understanding of the relationship between spawning habitat and successful reproduction. The decision tree below shows the strategy for moving forward on this hypothesis and potentially it's alternate.

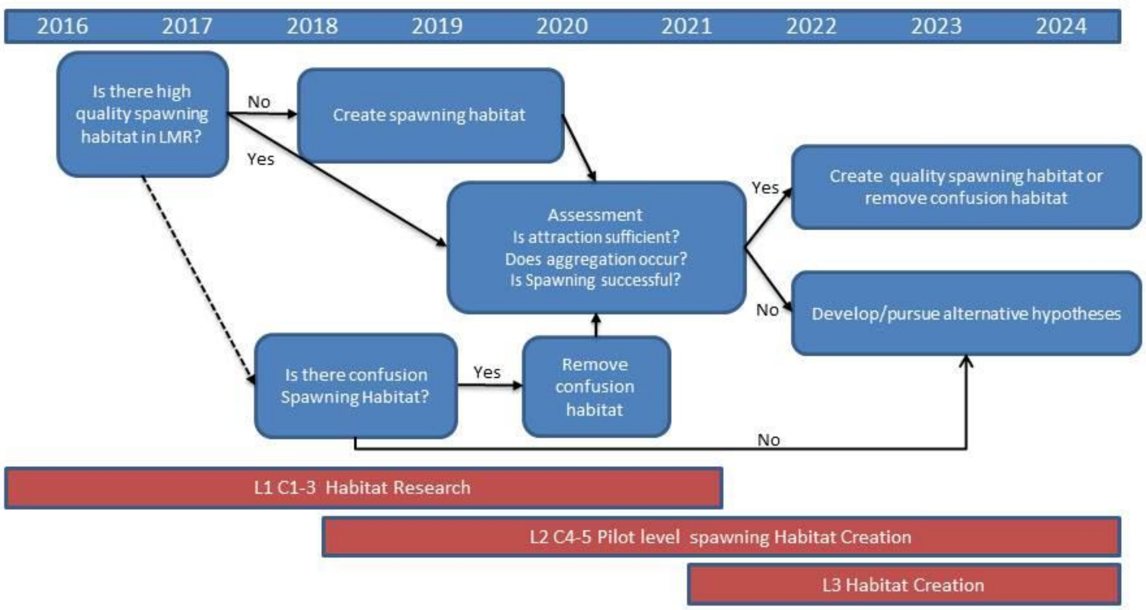

Figure 4. Decision tree for spawning habitat.

Description and Objectives: We presently do not have sufficient understanding to characterize the necessary actions at level 3 or determine quantifiable targets for spawning habitat. The focus of Level 1 and 2 will be to reduce the uncertainty regarding spawning habitat characteristics and needs for successful recruitment. There are two competing high-level hypotheses regarding spawning habitat concerns; one hypothesis is that additional high-quality spawning habitat is needed, while the opposing hypothesis is that too much poor-quality (i.e. "confusion") spawning habitat exists on the river. Because the first hypothesis is much easier to test, the AM strategy will focus on that hypothesis first and pursue the confusion habitat hypothesis only if Level 1 or 2 studies reject the first hypothesis or provide added support to the second. A decision tree has been developed to guide the development of decision criteria related to the spawning habitat activities at levels 1 through 3.

An early emphasis will be to utilize information from the Yellowstone River to inform Level 2 pilot projects on the Lower Missouri River, which will be monitored for effectiveness based on metrics ranging from observed aggregation to the number of free embryos in the water column. Level 3 targets for spawning habitat may be beyond the 15 year timeline under the planning process, depending on the rate of learning from Level 2 activities. However, the amount of habitat required to support successful spawning, the relative costs and ease of construction, and the anticipated low level of impacts to other uses suggests that even arbitrary and conservative targets for spawning likely won't have a big impact when associated with the first hypothesis. In contrast, should the confusion hypothesis bear out, the impacts and costs are likely to be substantial.

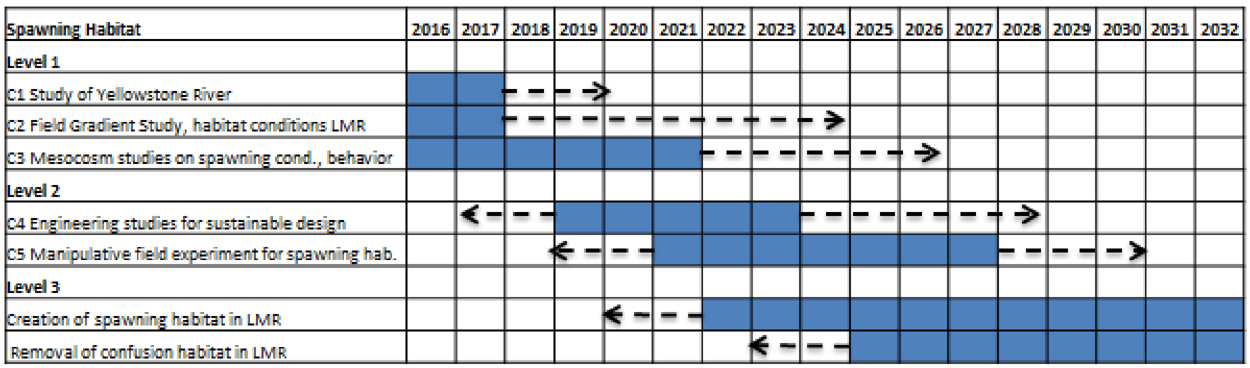

Figure 5. Preliminary sequencing of actions and studies for spawning habitat.

<u>Metrics</u>: The ultimate metric for spawning habitat is hatch rate as a function of habitat availability. Habitat might be characterized using different combinations of depth, velocity, substrate, and derivative hydraulic variables, with covariates relating to water quality and fish behaviors. Intermediate metrics will be fundamental measures of fish aggregation and spawning behaviors (for example, optimum male: female ratios in spawning aggregations), degree of attraction/specificity of adults to different spawning substrates, and biomechanics of egg adhesion and dispersal.

Several other metrics will provide information on relative performance of different designs. Repeat high-resolution multibeam maps of the spawning patches during incubation will indicate whether the substrate is subject to burial or erosion, which is likely to result in zero hatch. Measured hydraulic variables can be compared to fall velocities of unfertilized eggs to evaluate whether eggs are likely to be deposited in the manipulated habitats; multi-receiver, 3D telemetry and acoustic video can be used to evaluate behaviors of reproductive adults on the spawning patches to identify spawning aggregations and egg-release events.

<u>Decision Criteria:</u> The relevant decision for the level 2 studies associated with the first hypothesis would be whether to move forward into full implementation, change the experimental patch design, or abandon the habitat quality hypothesis and pursue the confusion habitat hypothesis. Robust statistical results cannot be expected for the preferred metric (hatch rate) because of the difficulties in enumerating this under field conditions. However, the results of other metrics described above should contribute to a lines-of-evidence decision of whether the spawning patches are functioning as intended.

<u>Criteria for Accepting or Rejecting Hypotheses</u>: Lines of evidence.

Triggers for Moving to Higher Implementation Level: (list time, performance, or other criteria for moving from L1 to L2, L2 to L3 and from L3 to L4) Evidence based criteria: Fish use of created habitats in multiple years; larval fish below spawning sites; increased catches of 2-3 year old pallid.

Timelines: No specific timeline for these hypotheses has been established, though the timelines in the above figures provide a sense of the expected outlay of effort and the sequencing/dependencies of certain activities.

Level 3 Contingent Actions: Information provided through field experimentation will indicate whether channel geometries and/or substrate should be altered to improve performance of spawning patches, and whether additional locations would contribute to spawning success and population growth. Rejection of the "quality habitat" hypothesis would result in pursuit of the alternative "confusion habitat" hypothesis, though the daunting nature of that undertaking has prevented an outlay of the necessary actions to date.

Monitoring Requirements: See Appendix D of AM Plan

Spawning Cue Flows

Hypothesis: Spring flow pulses from Gavins Point will provide aggregation and spawning cues.

Action Description: A description of a spring pulse sufficient to define a level 3 implementation is presented below. The frequency highlighted in Table 4 is uncertain due to insufficient understanding of the requirements for pallid sturgeon and potential effects of frequency on tern and plover nesting success. Further sensitivity analyses will be conducted with both population models to provide greater understanding of the bounds of this action through evaluation of the effects of releases on the bird and fish population trends and the pallid sturgeon population model will be used to guide the ultimate frequency of pulse implementation. A suggested maximum frequency of 1 in 3 years was agreed upon as an estimate for the purposes of assessing effects on stakeholders.

Level 3 spawning cues consist of deliberate bi-model pulse flows from Gavins Point dam as described below. The flows would be implemented at a frequency sufficient to elicit successful spawning in at least 1 of 3 years, or as dictated by the results of the population model *(<needs further characterization>)*. Options for increasing the variability in the overall pulse height should be explored to more closely mimic the variability that occurred naturally as a means of precluding impacts on sandbar nesting birds.

The first pulse from Gavins Point would conform to the following guidelines:

- Rise begins on first day after flow to target navigation flows are achieved.
- Peak release from Gavins Point is equal to double the flow to target level release the first day of navigation flow to target levels are achieved from Gavins Point
- Increase to peak by 2,200 cfs per day
- Maintain peak for 2 days

- Reduce pulse by 1,700 cfs/day until releases are back to base flow to target levels

The second pulse is cued by water temperature (**16-18 degrees**) at a particular point as follows.

- Checks to implement release increases
  - > 40.0 MAF in System Storage on March 15 storage check
  - Steady release has been set and implemented for 3 days
- Releases from Gavins Point
  - Rise begins on May 18 or later based upon water temperature and implementation of steady release for at least 3 days
  - Increase to peak by 2,200 cfs per day
  - Peak release from Gavins Point is equal to twice the steady release from Gavins Point
  - Maintain peak for 2 days
  - Reduce pulse by 1,900 cfs per day until the steady release flows are reached
- Flood targets will be the full service flood targets increased by the steady release level
  - If the steady release is 31 kcfs and the full service flood targets are 41 kcfs, 47 kcfs, and 71 kcfs at Omaha, Nebraska City, and Kansas City, respectively, the new flood targets will be 72 kcfs at Omaha (31 + 41), 78 kcfs at Nebraska City (31 + 47), and 102 kcfs at Kansas City (31 + 71).

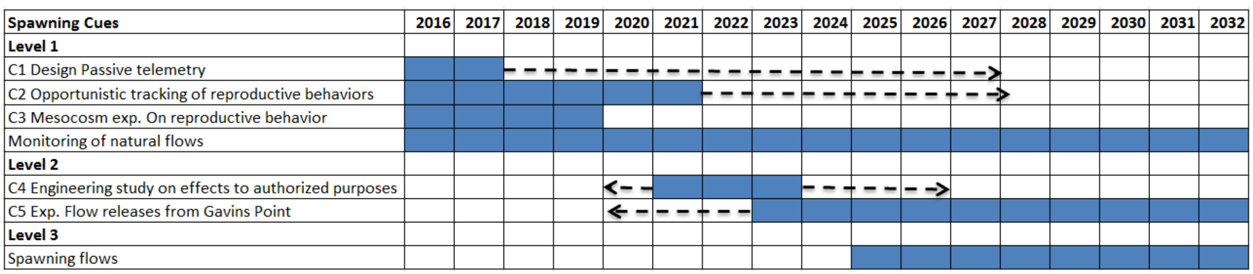

Figure 6. Preliminary sequencing of actions and studies for spawning flow cues.

<u>Objectives</u>: Spawning cue flows are intended to 1) elicit a movement response in gravid pallid sturgeon that 2) results in an aggregation of reproductively ready pallid sturgeon

<u>Metrics</u>: Success metrics for spawning cues are generally related to fish behavior (reproductive migrations and successful spawning with monitored experimental flow pulses) and successful reproduction (hatch rate, capture of free embryos, etc.). Practical assessment of spawning success in the near-term is extremely difficult, so the need to rely upon behavioral monitoring is likely. Intensive telemetry tracking data of reproductive adults (males and females) will be evaluated against time series of hydrologic characteristics and will be analyzed for degree of association. Reproductive success or failure could be inferred by recapturing reproductive fish soon after expected spawning events to determine if they have released gametes. Monitoring of a series of pulsed flow releases over several years may be required to establish a functional relationship between flow-pulses and probability of producing viable larvae.

Decision Criteria: The significant experimental control that could be exerted over this action (for the upper river) will add to the ability to detect and quantify reproductive behavioral changes related to flow pulses; however, the flow pulses will still take place within a system where many sources of variability are not controlled, such as weather systems and tributary inputs. It is therefore unlikely that these experiments will result in a statistically rigorous result. Instead, a decision to accept the value of manipulated flow pulses in increasing pallid sturgeon reproductive success, or to reject it, will probably be based on judgement of multiple lines of evidence.

Timelines: The time to implementation at Level 3 and sequencing of this action should be considered in light of other actions, i.e., before we run a flow pulse, availability of spawning habitat with reasonable expectation of functionality and a sufficient number of fish in the system to assess aggregation should be assured. This could mean that additional engineered spawning habitat be in place (see previous section), but presently available spawning sites may suffice to address behavioral metrics. A nine-year time limit for Level 3 implementation was agreed upon to allow for habitat and propagation efforts to enhance the potential success of spawning cue flows. Information derived from Level 1 or 2 studies and/or passive monitoring of natural flow events could move the time frame up or could result in a rejection of the hypothesis. At nine years we would expect a minimum of two implemented pulses to have occurred within the temporal scope of the current EIS. This would allow for future NEPA analysis to better discern how and/or if pulses should be subsequently implemented.

Triggers for Moving to Levels 3 or 4: TBD

Level 3 Contingent Actions: TBD

Monitoring Requirements: See Appendix D of AM Plan

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Mountain-Prairie Region
31247 436th Avenue
Yankton, SD 57078

October 27, 2015

Ms. April Fitzner
Missouri River Recovery Program
Senior Program Manager
U.S. Army Corps of Engineers
601 E 12th Street
Kansas City, Missouri 64106

RE: Planning Aid Letter Regarding Task B1 in the Missouri River Recovery Program FWCA Scope or Work – FY 2015

Dear Ms. Fitzner:

The U.S. Fish and Wildlife Service (Service) provides this planning aid letter (PAL) to assist in the development of the U.S. Army Corps of Engineers' (Corps) Missouri River Recovery Management Plan / Environmental Impact Statement (MRRMP-EIS) in accordance with the Fiscal Year 2015 Fish and Wildlife Coordination Act (FWCA) scope of work agreed to by our agencies. This letter fulfills Task B1 contained in the FY-2015 scope of work. As a cooperating agency on the MRRMP-EIS, the Service provides the following comments pursuant to the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 et seq.), the NEPA of 1969 (42 U.S.C. 4321-4347), and the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 et seq.).

This PAL does not constitute the final report of the Secretary of the Interior as required by Section 2 (b) of the FWCA for the MRRMP-EIS, nor does it constitute reconsultation of the 2000 and 2003 Amended Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project (BSNP), and Operation of the Kansas River Reservoir System (BiOp) under section 7 of the ESA.

The purpose of the MRRMP-EIS is to develop a suite of actions to meet ESA responsibilities for the threatened Northern Great Plains (NGP) population of the piping plover (Charadrius melodus), the endangered interior least tern (Sternula antillarum) (ILT) and the pallid sturgeon (Scaphirhynchus albus); and the authorized purposes of the operations of the dams using Corps authorities. The geographic scope of the MRRMP-EIS encompasses the main stem portions of the Missouri River from Fort Peck, Montana to St. Louis, Missouri. The EIS will assess the current Corps programmatic impacts, cumulative effects and a range of potential alternatives. The MRRMP-EIS will include an adaptive management process for all Missouri River Recovery Program (MRRP) activities to ensure management decisions and actions are continuously improved by the learning that takes place from research and regular monitoring of the river.

To support the development of the MRRMP-EIS, Service staff assisted with the effects analysis of the piping plover and least terns, pallid sturgeon, and habitat (hydraulics and hydrology) of the Missouri River. Three working groups, lead by Dr. Kate Buenau (Pacific Northwest National Laboratory), Dr. J. Craig Fischenich (U.S. Army Engineer Research and Development Center (ERDC)), and Dr. Robert B. Jacobson (U.S. Geological Survey), produced the Draft Interim Effects Analysis Integrated Reports.

The Service hereby acknowledges the receipt of these three reports and fully supports their results and use in completion of the MRRMP-EIS for the Missouri River Recovery Program.

We look forward to our continuing collaboration with the Corps and other conservation partners in support of this important effort to ensure the success and ultimate implementation of the MRRMP-EIS for the recovery of the fish and wildlife resources of the Missouri River, while also taking into consideration the human resources. If you have any questions, please feel free to contact me at (605) 665-4856.

Sincerely yours,

Casey D. Kruse

Casey D. Kruse
USFWS Missouri River Coordinator
Yankton, SD

cc: USFWS, Region 6 ARD/ES, Lakewood, CO (Thabault)
USFWS, Region 3 ARD/ES, Bloomington, MN (Lewis)ARD
State F&W Directors: MT, ND, SD, NE, IA, MO, KS
Dave Ponganis, USACE
Mark Harberg, USACE

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Mountain-Prairie Region
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Yankton, SD 57078

November 5, 2015

Ms. April Fitzner
Missouri River Recovery Program
Senior Program Manager
U.S. Army Corps of Engineers
601 E 12th Street
Kansas City, Missouri 64106

RE: Planning Aid Letter Regarding the Missouri River Recovery Management Plan-EIS: USFWS 2003 BiOp Projected Actions Alternative

Dear Ms. Fitzner:

The U.S. Fish and Wildlife Service (Service) provides this planning aid letter (PAL) regarding the development of the U.S. Army Corps of Engineers' (Corps) Missouri River Recovery Management Plan Environmental Impact Statement (MRRMP-EIS) in accordance with the Fiscal Year 2015 Fish and Wildlife Coordination Act (FWCA) scope of work agreed to by our agencies. The Service provides the following comments pursuant to the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 et seq.), the NEPA of 1969 (42 U.S.C. 4321-4347), and the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 et seq.).

This letter transmits parameters for modeling the USFWS 2003 Biological Opinion (BiOp) Projected Actions Alternative for the MRRMPP-EIS as part of the alternative development process and should not be construed as Section 7 input. We appreciate the dialogue that has occurred between the Corps PDT and Service staff to date on this effort. We especially appreciate the efforts of the Corps modeling team of Jeff Tripe, Don Meier, Dan Pridal, Jean Reed, Christine Cieslik, Ryan Larsen, Alex Flanigan and others who worked patiently and professionally through the modeling parameters with our staff. Please include the USFWS 2003 BiOp Projected Actions Alternative within the MRRMP-EIS.

The USFWS 2003 BiOp Projected Actions Alternative provides our interpretation of the ultimate implementation of the BiOp RPA. Whereas the No-Action alternative projects only current actions being implemented long term, the USFWS 2003 BiOp Projected Actions Alternative includes projections of additional iterative actions and expected actions which the Service anticipated would ultimately be implemented as part of the BiOp Reasonable and Prudent Alternative (RPA) through adaptive management and as impediments to implementation were removed. The Service recognizes that all of the actions listed and included for modeling from the 2003 BiOp would not have been implemented immediately. Nevertheless, we believe it is important to understand the projections, consequences and benefits from the ultimate implementation of the 2003 BiOP through complete analysis of the USFWS 2003 BiOp Projected Actions Alternative. We believe including the USFWS 2003 BiOp Projected Actions Alternative provides a necessary portion of a complete range of alternatives. Moreover, it is a necessary component for the Service to assess the difference and benefits of any of the other alternatives in terms of the efficacy in achieving objectives for the pallid sturgeon, interior least tern and piping plover.

Modeling parameters and documentation of rationale follow and are separated into three components: Flows, Shallow Water & Floodplain Habitat, and Emergent Sandbar Habitat. Specific relationships of BiOP actions to species needs/actions are included to enable direct comparison of the USFWS 2003 BiOp Projected Actions Alternative with other MRRMP-EIS alternatives.

FLOWS:

The Service provides these relationships to facilitate comparison with other alternatives. The flow parameters are associated with the lower Missouri River pallid sturgeon, the interior least tern and the piping plover specifically as follows:

- Least terns and piping plovers – Reservoir Unbalancing
- Pallid Spawning Cue – First and Second Pulse
- Spring ESH Creation – First and Second Pulse
- IRC Habitat – First and Second Pulse & Summer Low Flows
- Low Nesting Season Flows – Summer Low Flows

FLOW PARAMETERS

- Reservoir unbalancing as described in the master manual
- If "no service" is determined on March 15, GAPT releases are to be determined based on meeting water supply targets until the winter season; first and second pulses will not be carried out.
- Max winter GAPT release: 16 kcfs
- First Spring Pulse from GAPT
  - Start about March 15 to coincide with normal come-up for navigation
  - Rise to 31 kcfs
  - 7 day ascending limb
  - 7 days at peak (31 kcfs)
  - 7 day descending limb
  - Disregard pulse if storage evacuation service level is determined by March 15 assessment
- Following first spring pulse, return to flow to target (FTT) operations based on service level from March 15 storage check
- Second pulse to initiate between May 1 and May 15
  - Ascending limb not less than 7 days, but no longer than 10

    - Descending limb not less than 7 days
    - Pulse rise based on March 1 runoff forecast
        - Median = 16 kcfs
        - Upper quartile or higher runoff = 20 kcfs rise
        - Lower quartile or lower runoff = 12 kcfs rise
    - Pulse duration at peak
        - 14 days – lower quartile or lower runoff
        - 25 days – median runoff
        - 35 days – upper quartile or higher runoff
    - Flood control constraints
        - Add pulse magnitude to the current USACE flood control constraints outlined in Tables VII-7 and VII-8 in master manual
        - Limit max pulse release from GAPT to 60 kcfs.
- End of second pulse to June 23: return to "steady release" scenario to specify GAPT releases
    - Use June release value from the Annual Operating Plan "Gavins Point releases Needed to Meet Target Flows"
        - Median, Upper Q, Upper D: 27.9 kcfs full service, 21.9 kcfs min service
        - Lower Q, Lower D: 31.2 kcfs full service, 25.2 kcfs min service
- Summer Low Flows
    - If steady releases are lower than 25 kcfs – stay on the steady release level until the summer low flow reduction to 21 kcfs.

    June 23rd to July 1

        - 25 kcfs GAPT release
    - July 1: Assess navigation season length
        - If there is a shortened navigation season as determined by the Master Manual
            - GAPT releases are to be determined based on meeting water supply targets (open channel non-navigation season)
            - The duration of those releases is equivalent to that of the number of days the season is shortened less the 8 days in June (eg. if season is shortened 30 days,
            - Following that duration, set flow to 25 kcfs until July 15 then drop the release to 21 kcfs until August 15 and then return to 25 kcfs until Sept 1
            - FTT operations from Sept 1 until Dec. 1
        - If there is not a shortened navigation season
            - Continue 25 kcfs from July 1-July 15 then drop the release to 21 kcfs until August 15 and then return to 25 kcfs until Sept 1
            - Flow to target operations from Sept 1 until Dec. 1 or Dec 10 if a ten day extension is determined

Frequency of the bimodal pulse and summer low flows

- An attempt should be made to run the bimodal pulse every year. The Service recognizes that the full bimodal pulse will only be realized about once in every eight years based upon preliminary modeling results and discussions with USACE staff.
- Summer low flows should only be implemented in years when the full bimodal pulse occurs.

The flow parameters are primarily outlined in RPA VII of the 2003 Amended BiOP.

Variations of the technical criteria within RPA VII are founded in the following statements resulting in a shift from those criteria and ultimately projecting implementation of an Adaptive Management Program as defined in RPA I.

> *"The long-term flow regime shall be reflective of the normalized river hydrology in order to be responsive to dry, intermediate, and wet conditions." p. 234 of the 2003 Amended BiOP*

We have included the following excerpt to clarify why the USFWS 2003 Biological Opinion Projected Actions Alternative includes low summer flows:

> *"the Corps shall ensure that the Master Manual and the corresponding NEPA document provide the latitude for the eventual implementation of a spring rise and summer low flow of at least a magnitude identified in the Draft Environmental Impact Statement (USACE, 2001) as alternative GP2021." p. 233 of the 2003 Amended BiOP*

SHALLOW WATER HABITAT and FLOODPLAIN HABITAT

Shallow Water Habitat and Floodplain Habitat are both associated with lower Missouri River pallid sturgeon.

The Service provides this relationship to facilitate comparison with other alternatives. Shallow water and floodplain habitat are associated with the lower Missouri River pallid sturgeon as follows:

- IRC Habitat – Shallow water habitat and Floodplain habitat

Key references to the suite of parameters include the following:

Pallid Sturgeon RPA
III. Habitat Restoration/Creation/Acquisition

> *"Continued survival of pallid sturgeon depends on restoration of riverine form and functions, as well as some semblance of the pre-development or natural hydrograph.*

Missouri River habitat restoration is, therefore, multi-faceted, and involves a combination of reservoir operational changes (e.g., hydrograph and temperature), structural modifications (e.g., chute restoration), and non-structural actions (e.g., floodplain acquisition or easements). The maximum benefits of physical habitat projects to listed species can only be realized when coupled with complementary hydrology." p. 226 of the 2003 Amended BiOP

VI. Feasibility, Flow Development, and Adaptive Management

"determine impediments to implementing the flows necessary to ensure the survival of pallid sturgeon, and identify mitigation measures to address the impacts of removing impediments to implementation (e.g. floodplain easements, scouring easements, navigation off-sets)." p. 231 of the 2003 Amended BiOP

VII. Flow Modification

"flows that provide for connection of low-lying lands adjacent to the channel. Inundation of low-lying lands is important processes for pallid sturgeon survival. This provides organic material and redistribution to produce forage for rearing fish at a time synchronized with the presence of larval and juvenile fish. Flows that are sufficiently low to provide for shallow water habitat as rearing refugia and foraging areas for larval, juvenile, and adult pallid sturgeon are also necessary." p. 232-233 of the 2003 Amended BiOP

"This long-term flow regime must address, based on the best available information, spawning, rearing, maximization of floodplain connectivity, forage production and shallow water habitat." p. 234 of the 2003 Amended BiOP

"By providing flows that are sufficiently high in the spring, connectivity to low-lying lands will be enhanced thereby providing additional production and input of nutrients and forage items for YOY fish at a time needed to enhance survival through the first year. Habitat flows will subsequently provide low velocity refugia habitat, enhanced in-channel productivity and provide for the spatial and temporal concentration of forage and prey items to areas where YOY and adult fish can exploit the prey base." p. 235 of the 2003 Amended BiOP

IX. Habitat Development, Shallow Water and Floodplain

"Floodplain inundation and connectivity is essential in order to maximize the production of the forage base for pallid sturgeon. The forage base production must occur at a time that coincides with larval sturgeon becoming active, free swimming feeders. Floodplains

are highly productive habitats in the late spring and early summer when warm, shallow water floods over the area and produces a bloom of forage that is of the appropriate size for larval fish to eat. Since larval and juvenile pallid sturgeon feed along the river margins, the productivity must be transported from the inundated low-lying lands to the river as flows recede. Additionally, low-lying are an extremely important source for other floodplain spawning fish which subsequently support the forage base for adult pallid sturgeon through the summer and fall. Highly productive floodplains are necessary on a frequent annual basis to provide necessary life requisites for pallid sturgeon survival." p. 237 of the 2003 Amended BiOP

"Shallow water and floodplain habitat... maximize habitat potential under the range of flows that will be provided under the flow enhancement components of this opinion...shallow water habitat elements should consider, and be implemented with, a flexible and diverse flow regime in mind." p. 237 of the 2003 Amended BiOP

"The Corps shall design and implement floodplain connectivity to produce the intended ecological functions for production of nutrients and forage fish and plankton over a range of flow regimes developed under elements VI and VII above." p. 238 of the 2003 Amended BiOP

The 2003 Amended BiOP also considered interrelated and interdependent actions during consultation. It is assumed that these actions would be completed and factors into the Service determination and resultant opinion. It was assumed that 100,000 of the 166,750 acres of the Missouri River Fish and Wildlife Mitigation Project would be utilized for shallow water habitat and available for floodplain connectivity (Mike Thabault, ARD-ES USFWS Region 6, pers. comm.).

INTERRELATED AND INTERDEPENDENT ACTIONS

Least Tern, Piping Plover, and Pallid Sturgeon
Missouri River Fish and Wildlife Mitigation Project
In the Water Resources Development Act of 1999, the Missouri River Fish and Wildlife Mitigation Project (MRFWMP) was reauthorized to include an additional 118,650 acres of land to be purchased from willing sellers on which to develop, restore or enhance fish and wildlife mitigation sites along the Missouri River. The total acres for the program now stand at 166,750." p. 173 of the 2003 Amended BiOP

FLOODPLAIN HABITAT

We provide the following criteria to allow for analysis/comparison/contrasting/modeling of what the 2003 BiOp did say for this process:

1. Maximize floodplain habitat by ensuring that 77,410 acres of connected floodplain are inundated at a 20% annual chance exceedence (ACE) (or 5-yr).
2. Distribute floodplain habitat to the extent possible based on the table below:

State *	Portion of authorized acres available for floodplain connectivity	Existing acres of floodplain connectivity (20% ACE inundation)*	Additional acres of floodplain habitat to add to HEC-RAS model
Iowa	14,228	16,120	0
Kansas	6,976	8,560	0
Missouri	62,813	99,980	0
Nebraska	15,983	31,820	0
Total	100,000**	156,480***	0

*Does not imply ownership, includes both public and private lands.

**The 100,000 inundation acreage includes both the main channel and connected floodplain area. The 77,410 inundation acreage includes only the connected floodplain area.

***Does not include main channel acres as defined by median August flows.

3. Acres of existing floodplain connectivity were reported by USACE based on HEC-GeoRAS mapping. Upper Mississippi River System Flow Frequency Study (UMRSFFS) 20% ACE flows were run as steady flows in the existing conditions HEC-RAS model, and inundation boundaries were created using the best available terrain data.
4. Existing acres of floodplain inundation with connectivity includes:
    a. Areas lower in elevation than the computed 20% ACE water surface and judged to be connected to the main channel.
    b. Private lands not protected by levees, including fringe areas between levees and river bank and areas without any discernable protection that would be inundated at the reference flow.
5. Excluded from existing floodplain acres:
    a. Area behind all active/maintained levees, including federal levees, levees in the PL 84-99 program and smaller agriculture levees often found between the federal/program levees and the river bank. No distinction was made as to levee reliability or performance risk. All levee areas were excluded from the count of existing acres of floodplain connectivity.
    b. Inundated area well outside the bluff line or in tributary backwater areas.
    c. Missouri River main channel as determined by the boundary of the August 50% duration flow extent.

6. Modeling efforts and assessment should strive towards the following (repeated from above RPA IX):
   a. Floodplain inundation and connectivity is essential in order to maximize the production of the forage base for pallid sturgeon. The forage base production must occur at a time that coincides with larval sturgeon becoming active, free swimming feeders. Floodplains are highly productive habitats in the late spring and early summer when warm, shallow water floods over the area and produces a bloom of forage that is of appropriate size for larval fish to eat. Additionally, low-lying lands are an extremely important source for other floodplain spawning fish which subsequently support the forage base for adult pallid sturgeon. Highly productive floodplains are necessary on a frequent annual basis to provide necessary life requisites for pallid sturgeon survival.

SHALLOW WATER HABITAT PARAMETERS

1. Add shallow water habitat (SWH) to the HEC-RAS models based on the 2003 Amendments to the 2000 Biological Opinion (BiOp) and in accordance with subsequent discussions between the U.S. Army Corps of Engineers and U.S. Fish and Wildlife Service.
2. Future habitat will be modeled, to the extent possible, by selecting locations along the river with reasonable characteristics for habitat construction and that do not interfere with existing human infrastructure.
3. Total SWH to be placed in models downstream of Gavins equals 11,265 acres. This is equal to the amount required by the BiOp to achieve 30 acres/mile (753 miles x 30 ac/mi = 22,590 acres) minus the existing acres of SWH as reported by USACE in the 2014 SWH Accounting Report (11,325 acres).
4. Distribute SWH acreage based on the table below.

Reach	Segment	Required Acres of SWH (30 ac/mi)	Existing Acres of SWH (2014 SWH accounting report)	Additional acres of SWH to add to HEC-RAS model
Ponca to Sioux City	Segment 11	540	120	420
Sioux City to Platte River	Segment 12	4,200	1,682	2,518
Platte River to Kansas River	Segment 13	6,840	2,560	4,280
Kansas River to Osage River	Segment 14	7,110	3,710	3,400
Osage River to Mouth	Segment 15	3,900	3,253	647
Total		22,590	11,325	11,265

* Platte River to Kansas City reach will be pro-rated between the two districts by river length, 57% will be accomplished by NWK and 43% by NWO.

5. SWH will be some combination of in-channel habitat and off-channel habitat. Diversity is important, however, added habitat will favor in-channel widening to the extent possible.
6. New in-channel SWH will be modeled to function at three different flow levels. The mean river flows for these calendar periods will be added to the Gavins Point discharge to account for increasing river flows downstream from Gavins Point.

    a. 1/3 of the new SWH will be placed to provide 0-5 feet of depth at low summer flow. Low summer flow is defined as 21-kcfs release from Gavins Point, plus July incremental flows downstream.
    b. 1/3 of the new SWH will be placed to provide 0-5 feet of depth at mid-August. Mid-August is defined as the median August release from Gavins point, plus August incremental flows downstream.
    c. 1/3 of the new SWH will be placed to provide 0-5 feet of depth at the spring pulse. Spring pulse is defined as the median May release plus 20-kcfs from Gavins Point, plus May incremental flows downstream.
    d. In order to simplify HEC-RAS model construction, the width of each new SWH area will be determined as roughly 1/3 for each of the above flow profiles with side slope to attain the desired total top width of the widened area
    e. SWH already in the system through 2012 was placed to provide 0-5 feet of depth at mid-August. Mid-August is defined as the August 50% duration flow based on gauge statistics.
7. Incremental flows will be from the USACE Missouri River Basin Water Management Division report titled Missouri River Incremental Flows Below Gavins Point (2014). Flow changes will be made at major tributary locations, portioned by tributary basin area.
8. Model all new in-channel and off-channel SWH based on the projected channel degradation expected for the future without project condition, making the assumption that constructed habitat will be modified as necessary in the future to avoid loss of habitat to channel degradation.
9. New in-channel SWH is to be represented as channel widening. SWH will be modeled as 250-ft wide in the reach from Gavins to Rulo and 300-ft wide from Rulo to St. Louis. Habitat will be placed as sloping from the elevation of water surface indicated by the model by the reference flows (for the three different flow levels described above).
10. New off-channel SWH will be represented as chutes in the Kansas City District, and chutes and backwaters in the Omaha district. Chutes will be represented with a fully developed top width of 300-ft.
11. Existing chutes that are currently represented in the model will be modified to represent an anticipated fully developed width of 300-ft with inverts modified for projected degradation.

FORT PECK FLOW ENHANCEMENTS AND WATER TEMPRERATURE CONTROL DEVICE FEASIBILITY

The BiOp recognized water temperatures and flows as controlling factors for spawning cues, larval pallid sturgeon development as well as supporting forage in the Missouri River below Fort Peck Dam. The BiOp called for mini- and full-test of Fort Peck flow enhancements in addition to a study of the feasibility of temperature control device at Fort Peck.

Because of a drought followed by damages to the Fort Peck spillway during the 2011 high release events, the mini- and full-tests have not been completed. Unlike the Gavins Point release scenarios in which flow parameters were articulated in the BiOp, the BiOp relied heavily upon results from the Fort Peck flow tests to ultimately determine the long term flow implementation plan from Fort Peck. Therefore, it would be speculative at this time to determine modeling parameters for a long term flow implementation plan from Fort Peck.

Our understanding of the current science indicates larval drift distances are thought to be the leading factor in the lack of natural recruitment in the pallid sturgeon population below Fort Peck. Options to increase drift distances could include modifying infrastructure and operations at Fort Peck Dam to improve release timing and duration and to increase water temperature have been evaluated. We understand that your analysis of these options results in unacceptable dam safety risks and threatens compliance with congressionally authorized project purposes including flood control. Recent modeling for the effects analysis indicated that even if these issues could be overcome, actively managing the hydrology below Fort Peck Dam to provide the appropriate volume and temperature at the correct time would be a significant challenge containing hydrological, physical and biological uncertainty with a small probability of success. Additionally, for necessary larval drift distance to be achieved in this reach, the pool elevation of Lake Sakakawea would need to be lowered to historically low levels.

EMERGENT SANDBAR HABITAT PARAMETERS

1. The BiOp has a goal of 11,886 acres of ESH, which was further subdivided into acreage goals by river reach to be achieved by the year 2015Existing Habitat/Existing Conditions
    a. Below Gavins Point Dam – 80 acres of habitat per river mile;
    b. Below Garrison Dam - 50 acres of habitat per river mile;
    c. Below Fort Randall Dam - 20 acres per river mile;
    d. Lewis & Clark Lake - 80 acres per river mile;
    e. The USFWS 2003 BiOp Projected Actions Alternative modeling effort should focus on the above acreage goals. How those acreage goals are achieved is at USACE's discretion. Fledge ratios were included within the BiOP to reduce incidental take.

    f. Acreages should be measured in late July and consist of 60 percent dry sand.

2. The Corps will assume construction or maintenance activities to perpetuate the acreages determined.
3. Due to a lack of tern or plover presence in the Ft. Peck reach, no habitat would be included or modeled for the Ft. Peck reach.

Please contact Wayne Nelson-Stastny at (605) 660-5349 for further questions and clarification regarding the modeling of this alternative. The Service looks forward to our continuing collaboration with the Corps and other conservation partners in support of this important effort.

Sincerely yours,

Casey D. Kruse

cc: USFWS, Region 6 ARD/ES, Lakewood, CO (Thabault)
USFWS, Region 3 ARD/ES, Bloomington, MN (Lewis)
State F&W Directors: MT, ND, SD, NE, IA, MO, KS
Dave Ponganis, USACE
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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Mountain-Prairie Region
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IN REPLY REFER TO:
FWS/R6/ES

November 13, 2015

Ms. April Fitzner
Missouri River Recovery Program
Senior Program Manager
U.S. Army Corps of Engineers
601 E 12th Street
Kansas City, Missouri 64106

RE: Planning Aid Letter Regarding Task B3 in the Missouri River Recovery Program FWCA Scope or Work – FY 2015

Dear Ms. Fitzner:

The U.S. Fish and Wildlife Service (Service or USFWS) provides this planning aid letter (PAL) to assist in the development of the U.S. Army Corps of Engineers' (Corps or USACE) Missouri River Recovery Management Plan and associated Environmental Impact Statement (MRRMP-EIS) in accordance with the Fiscal Year 2015 Fish and Wildlife Coordination Act (FWCA) scope of work agreed to by our agencies. This letter fulfills Task B3 contained in the scope of work. As a cooperating agency on the MRRMP-EIS, the Service provides the following comments pursuant to the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 et seq.), the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321-4347), and the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 et seq.). Appendix 1 of this letter contains a list of definitions that will help to clarify the terms used in this letter.

The purpose of the MRRMP-EIS is to develop a suite of actions to meet the Corps ESA responsibilities regarding the threatened Northern Great Plains (NGP) population of the piping plover (*Charadrius melodus*), and the endangered interior least tern (*Sternula antillarum*) (ILT) and the pallid sturgeon (*Scaphirhynchus albus*), and the authorized purposes of the operations of the dams using Corps authorities. The geographic scope of the MRRMP-EIS encompasses the main stem portions of the Missouri River from Fort Peck, Montana to St. Louis, Missouri. The MRRMP-EIS will assess the current Corps programmatic impacts, cumulative effects and a range of potential alternatives. The MRRMP-EIS will include an adaptive management process for all Missouri River Recovery Program (MRRP) activities to ensure management decisions and actions are continuously improved by the learning that takes place from research and regular monitoring of the river.

This PAL does not constitute the final report of the Secretary of the Interior as required by Section 2 (b) of the FWCA for the MRRMP-EIS, nor does it constitute reconsultation of the 2000 and 2003 Amended Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and

Navigation Project (BSNP), and Operation of the Kansas River Reservoir System (BiOp) under section 7 of the ESA.

In 2011, the Independent Science Advisory Panel (ISAP) provided a report per the request of Missouri River Recovery Implementation Committee (MRRIC) on the efficacy of the managed Spring Pulse and Adaptive Management. In its final report the ISAP recommended that the Service should specify the species objectives and targets for jeopardy avoidance, survival, and recovery in relation to Missouri River project impact and that the species objectives should be consistent with the findings of the ongoing Effects Analysis (EA) (Buenau et al. 2014, Fischenich et al. 2014).

This letter transmits the quantitative population and habitat targets for the Missouri River piping plover sub-population to assure that each management action and alternative in the MRRMP-EIS is working towards meeting the agreed upon species objectives during implementation. We are pleased to provide these targets using the best available information to help the Corps in their efforts to better define management actions on the Missouri River to avoid jeopardizing these species due to the operation of the main stem dams and the operation, and maintenance of the BSNP. These targets are subject to change as necessary within the adaptive management process depending on monitoring and research information obtained during the implementation phase.

The Service greatly appreciates the ongoing effort of the EA team in supporting the development of these quantitative targets. This effort, led by Dr. Kate Buenau and Dr. Craig Fischenich, has resulted in the creation of cutting edge population and habitat models that were vital to our analysis and establishment of these targets. Advancing this effort and continued refinement of these models will be imperative to a successful adaptive management program and to the implementation of effective management actions. The Service fully supports the utility and further development of these important analytical and predictive capabilities.

Jeopardy Versus Targets

The determination of jeopardy or adverse modification is based on the effects of the action on the continued existence of the entire population of the listed species or on a listed population, and/or the effect on critical habitat as designated in a final rulemaking. (USFWS Consultation Handbook, page 4-34)

The Service does not define jeopardy as a particular number, target, or a particular threshold. Rather, under the ESA, jeopardy occurs when there is an action that reasonably would be expected, directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species. If a species population starts declining, jeopardy may be occurring.

Jeopardy of a species is a determination the Service makes after going through a process under the ESA of accessing the suite of alternative actions for a proposed federal project. Through that process the Service will determine what actions a federal agency needs to implement in relationship to where the species needs to be to remove any negative impacts to the species due to the agency proposed actions. A "jeopardy" determination is based on four factors: 1) status of the species, 2) environmental baseline, 3) effects of the Federal action, and 4) cumulative actions. These quantitative population and habitat targets of themselves do not constitute a jeopardy determination; rather it is our intent to provide these targets to assist in the development of alternatives that achieve the fundamental objectives. The Service will be making a draft jeopardy determination after a preferred alternative has been identified. The final jeopardy determination will be made when a alternative has been selected in the Final EIS.

Use of the Piping Plover Targets for the Interior Least Tern and the Delisting Process

As part of the ILT delisting process, under the conservation mandate of section 7(a)1 of the ESA, there are efforts under way to develop conservation plans throughout the least tern population range. Section 7(a)1 of the ESA requires Federal agencies to use their authorities to develop and carry out conservation programs for listed species. The Corps Mississippi Valley Division on the lower Mississippi River, the Louisville District for the lower Ohio River, and the Southwestern Division for the Red and Arkansas rivers are developing 7(a)1 plans with post-delisting management commitments. After the Corps management strategies are drafted, there will be a 7(a)1 consultation with the relevant Service office. When these management plans are finalized, nearly all of the ILT population will be covered under post-delisting management commitments.

As previously discussed, we are anticipating that the MRRMP-EIS will serve as the conservation plan that will meet this ILT delisting requirement for the Missouri River. The MRRMP-EIS should discuss how the management practices contained therein are beneficial to ILT conservation, as well as demonstrate monitoring commitments which will continue post-delisting.

Much effort has been expended in the last year to develop objectives, metrics, and targets for the NGP piping plover for the MRRMP-EIS. We believe that managing for sufficient nesting habitat to sustain a NGP piping plover population in the Missouri River will also provide sufficient nesting habitat for the ILT in the Missouri River. Piping plovers and least terns are sympatric nesters, often using the same breeding sites throughout the Missouri River basin. Therefore, the efforts listed in this document will be referring to the needs of the piping plover only from here on. However, as mentioned above, to serve as the conservation plan required for delisting of the ILT, it will be important to include an assessment of how the management actions contained within the MRRMP-EIS may affect the ILT.

Piping Plover Fundamental Objective, Sub-Objectives, Metrics and Targets

The following is a summary of the Fundamental Objectives for both bird species and the Sub-Objectives, Metrics and Targets for the piping plover. In order to facilitate a clear understanding of the Service's determination of the piping plover objectives, metrics, and targets, the definitions of these terms can be found in Appendix 1. A more detailed description of the methods that were used to determine these targets will be provided in a future document.

After considering all the comments and input from species experts in two workshops the Service conducted in the summer of 2013, external reviewers, the MRRIC Science and Adaptive Management (SAM) Work Group, the MRRIC Strategic Programmatic Assessment (SPA) Task Group, and ISAP; the Service and the Corps developed the following **Fundamental Objectives** for the two listed bird species:

- Avoid jeopardizing the continued existence of the threatened Northern Great Plains population of the piping plover due to the US Army Corps of Engineers actions on the Missouri River.
- Avoid jeopardizing the continued existence of the endangered Interior Least Tern due to the US Army Corps of Engineers actions on the Missouri River.

While these fundamental objectives are consistent with the Service's current established recovery goals for the piping plover and least tern, they are prepared specifically to avoid and prevent jeopardy to the species due to Corps' operation and maintenance of the Missouri River System. These fundamental objectives and subsequent sub-objectives described below are the desired outcomes from the Corps' actions as part of the MRRMP-EIS. We believe that if the targets for the sub-objectives described below are attained it will result in the achievement of the stated fundamental objectives. The Service anticipates regular assessment and refinement of the sub-objectives, mean objectives, performance metrics and target levels through the adaptive management process. For this to occur, monitoring must be designed to measure metrics and assess whether targets are achieving the anticipated outcomes. This data would then be used to make any necessary adjustments to the Corps actions to meet the fundamental objectives. The Service looks forward to working with the Corps as development of these monitoring plans is progressed.

The following sub-objectives, means objectives, metrics, and targets are based on the following documents and events:

- information in the 2000 and 2003 amended Biological Opinion
- recent studies and research
- conceptual ecological models (CEMs) developed by both agencies with the help of internal and external species experts
- June 11, 2013 memo from ISAP to the SAM Work Group and MRRIC
- June 27, 2013 memo from ISAP to the Strategic Programmatic Assessment (SPA) Task Group
- discussions at the Species Objectives Workshops in July 2013
- interagency charrette in September 2014
- Corps' January 10, 2014 "Sideboards" document, and the geographic scope of the main stem of the Missouri River from the upper end of Fort Peck reservoir to the confluence with the Mississippi River
- Draft Interim Effects Analysis Integrated Report: Piping Plovers and Least Terns October 2014 (EA) (Buenau et al. 2014)
- Modeling to Support the Development of Habitat Targets for Piping Plovers on the Missouri River (Buenau 2015)
- Preliminary draft NGP Piping Plover Recovery Plan (in review)
- 2015 Draft Science and Adaptive Management Plan: Missouri River Recovery Program. Version 3. (Fischenich et al. 2015)

The EA (Buenau et al. 2014, Fischenich et al. 2014), including the hydraulic, emergent sandbar habitat (ESH) and population models, provided an empirical relationship linking hydrology, habitat, and bird populations. These models, created specifically for the Missouri River, consider the dynamic river processes and variable amounts of nesting habitat from year to year along with density dependent reproductive rates to calculate the acres of ESH necessary for a resilient population of piping plovers. Population resiliency is primarily determined by habitat availability rather than an initial population size (Buenau 2015). As a result and as indicated in the targets below, we propose using acres of ESH as a target to ensure a resilient population of birds on the Missouri River for the adaptive management process. Acres of ESH are calculated in two ways:

Standardized ESH: The area above water when releases from Gavins Point Dam are 31.6 kcfs, Fort Randall Dam are 30.5 kcfs, and Garrison Dam are 23.9 kcfs. Used to track the amount of ESH structure in the river independent of flows.

Available ESH: The area above water during maximum July release for a specified year. Estimate of usable habitat for the birds during the nesting season. Reported as acreage of ESH exceeded during a percentage of years, e.g. 10, 25, 50, 75%.

Geographic distribution of the Missouri River piping plover population (sub-population of the NGP population) is described by two distinct geographic regions:

Northern Rivers Region: Missouri River from Fort Peck Lake Montana to Fort Randall Dam, South Dakota.

Southern Rivers region: Missouri River from Fort Randall Dam, South Dakota to Ponca, Nebraska.

- **Sub-objective 1 (Population):** Maintain a total population number of Missouri River piping plovers that keeps the population resilient on the Missouri River in the long term.

  Means Objective: Provide enough ESH habitat on the Missouri River to maintain a 95% probability (resiliency) that a population of at least 50 individuals will persist for at least 50 years on the Missouri River.

  Metric: Number of standardized and available ESH acres measured annually.

  Target:

		Acres Of Sandbar Habitat		
		Lower 95% CI	**Median**	**Upper 95% CI**
Standardized ESH Acres		*675*	*1433*	*6033*
Percent Exceedance of Available ESH Acres	**75%**	510	710	1330
	50%	930	1430	2675
	25%	1580	2880	5070
	10%	2420	4550	8470

- **Sub-objective 2 (Reproduction):** Maintain a long-term trend in population growth rate (λ) that is at least stable.

  Means Objective: Maintain a stable or increasing population.

  Metric: Population growth rate: the change in population size between years; calculate annually.

Target: (lambda) $\lambda \geq 1$

- **Sub-objective 3 (Chick Survival/Reproduction):** Increase and maintain the success of breeding pairs on Missouri River.

  Means Objective: Increase nest success and chick survival to fledge.

  Metric: Fledge Ratio: Number of fledglings observed/(number of adults/2).

  Target Range: $\geq$ 1.25 chicks fledged per breeding pair (Catlin et.al. 2015).

- **Sub-objective 4 (Distribution):** Maintain a geographic distribution of plovers in the river and reservoirs in which they currently occur in both the Northern and Southern River Regions.

  Means Objective: Provide enough ESH habitat on the Missouri River to maintain a 95% probability (resiliency) that a population of at least 50 individuals will persist for at least 50 years in each region.

  Metric: Number of standardized and available ESH acres measured annually.

  Target:

		Acres of Sandbar Habitat					
		Northern Rivers Region			Southern Rivers Region		
		2.5%ile	Median	97.5%ile	2.5%ile	Median	97.5%ile
Standardized ESH Acres		200	428	1996	264	782	3907
Percent	0.75	140	210	470	280	370	700
Exceedance	0.5	380	630	1000	460	720	1580
of Available	0.25	770	1420	2010	780	1370	3285
ESH Acres	0.1	1340	2230	3625	1130	2320	5275

The Service looks forward to continuing to work collaboratively in support of this important effort, ensuring the success and ultimate implementation of the MRRMP-EIS for the conservation of Missouri River fish and wildlife resource. If you have any questions, please feel free to contact me at (605) 665-4856.

Sincerely yours,

Casey D. Kruse

Casey D. Kruse
Missouri River Coordinator

Enclosures

cc: Service, Region 6 ARD/ES, Lakewood, CO (Thabault)
Service, Region 3 ARD/ES, Bloomington, MN (Lewis)ARD
State F&W Directors: MT, ND, SD, NE, IA, MO, KS
Dave Ponganis, USACE
Mark Harberg, USACE

Literature Citations

Buenau, K.E., V. Cullinan, C.J. Huber, and C.R. Vernon. 2014. Draft Interim Effects Analysis Integrated Report: Piping Plovers and Least Terns. Pacific Northwest National Laboratory, Richland, Washington. Prepared for the U.S. Department of Energy.

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USFWS. 2003. U.S. Fish and Wildlife Service 2003 amendment to the 2000 biological opinion on the operation of the Missouri River main stem reservoir system, operation and maintenance of the Missouri River bank stabilization and navigation project, and operation of the Kansas River reservoir system.

Correspondence

Independent Science Advisory Panel memorandum to the MRRIC SAM Work Group and MRRIC. 11 June 2013.

Independent Science Advisory Panel memorandum to the MRRIC SPA Task Group. 27 June 2013.

Independent Science Advisory Panel memorandum to the Missouri River Recovery Management Plan and Effects Analysis Teams. 26 February 2014.

Kate Buenau (Personal Email Communication) December 7, 2014

Kate Buenau (Personal Email Communication) December 9, 2014

Kate Buenau (Personal Email Communication) March 31, 2015

United States Department of the Interior

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IN REPLY REFER TO:
FWS/R6/ES

December 4, 2015

Ms. April Fitzner
Missouri River Recovery Program
Senior Program Manager
U.S. Army Corps of Engineers
601 E 12th Street
Kansas City, Missouri 64106

RE: Planning Aid Letter regarding development of the Missouri River Recovery Management Plan/EIS

Dear Ms. Fitzner:

The U.S. Fish and Wildlife Service (Service or USFWS) provides this planning aid letter (PAL) to assist in the development of the U.S. Army Corps of Engineers' (Corps or USACE) Missouri River Recovery Management Plan and associated Environmental Impact Statement (MRRMP-EIS). The Service provides the following comments pursuant to the Fish and Wildlife Coordination Act (FWCA) of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 et seq.), the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321-4347), and the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 et seq.).

This PAL does not constitute the final report of the Secretary of the Interior as required by Section 2(b) of the FWCA for the MRRMP-EIS, nor does it constitute reconsultation of the 2000 and 2003 Amended Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project (BSNP), and Operation of the Kansas River Reservoir System (BiOp) under section 7 of the ESA.

The purpose of the MRRMP-EIS is to develop a suite of actions to meet ESA responsibilities for the threatened Northern Great Plains (NGP) population of the piping plover (*Charadrius melodus*), and the endangered interior least tern (*Sternula antillarum*) and pallid sturgeon (*Scaphirhynchus albus*), and the authorized purposes of the operations of the dams using Corps authorities. The geographic scope of the MRRMP-EIS encompasses the main stem portions of the Missouri River from Fort Peck, Montana to St. Louis, Missouri. The MRRMP-EIS will assess the current Corps programmatic impacts, cumulative effects and a range of potential alternatives. The MRRMP-EIS will include an adaptive management process for all Missouri River Recovery Program (MRRP) activities to ensure management decisions and actions are improved by the learning that takes place from research and monitoring of the river.

After discussions with the Missouri River Recovery Implementation Committee (MRRIC) and our review of recent additions to the available scientific information, the Service provides this letter to clarify and further define our recommendations regarding development of management actions intended to provide habitat for the piping plover and interior least tern as part of the development of the MRRMP-EIS. The information provided herein should be considered in concert with previous statements provided in our letter to Corps dated November 10, 2010.

For clarity of this letter, the Service defines off-channel habitat as areas that are not connected to the main channel hydrologically, energetically, and/or through sediment degradation/aggradation processes. In-channel habitat is defined as areas within or adjacent to and connected with the main channel hydrologically, energetically, and/or to the sediment transport processes; and suitable for productive nesting as defined in the 2011 Final Programmatic Environmental Impact Statement for the Mechanical and Artificial Creation and Maintenance of Emergent Sandbar Habitat in the Riverine Segments of the Upper Missouri River. (USACE 2011)

As you know, the Effects Analysis (EA) lead by Dr. Kate Buenau and Dr. Craig Fischenich and being conducted as part of the MRRMP-EIS planning process has significantly advanced our analytical and predictive capabilities. This effort has utilized more than 20 years of Corps piping plover demographic data and linked it with habitat availability to create predictive models that estimate the extent and temporal availability of habitat necessary for persistence of piping plovers on the Missouri River. This relationship between species persistence and habitat availability relies on our understanding of piping plover reproductive ecology on riverine portions of the Missouri River particularly below Garrison, Fort Randall and Gavins Point Dams. While the relationship between habitat availability and piping plover reproductive success is less certain for reservoir habitat, the model does account for those birds and their contribution to population persistence.

It is from these predictive models that we have been able to provide numerical bird targets in terms of available habitat acres (see Planning Aid Letter dated November 13, 2015). To meet these targets and maintain least terns and piping plovers on the Missouri River, the Service recommends at this time that the Corps develop management actions for the MRRMP-EIS that prioritize creation and maintenance of habitat within the unchannelized river below Garrison, Fort Randall (including the sediment delta of Lewis and Clark Lake) and Gavins Point Dams. The Service encourages continued assessment and model development that considers all potential bird habitat associations within the MRRMP-EIS planning area, concurrent with implementation of adaptive management in continued efforts to better understand and meet species and human considerations needs on the Missouri River.

The MRRP Independent Science Advisory Panel's (ISAP) evaluation of the Draft Bird Adaptive Management Cycle Example (ISAP 2015) contained recommendations to consider "off-channel" habitat for the birds as a management action in the MRRMP-EIS. Additionally on several occasions since 2010, MRRIC has recommended the Service consider "off-channel" nesting habitat as a MRRP management action. These discussions have included habitat within reservoir pools, off-channel habitat similar to sandpits adjacent to the central Platte River and habitat creation in the navigation channel below Ponca, Nebraska. While the Service considers only the sandpit habitat to be off-channel, we do not recommend the development of management actions within the MRRMP-EIS that include the purposeful creation of tern and plover habitat in any of these habitat associations at this time. However, as our knowledge of these habitat associations increases and in the case that it is demonstrated that these habitat associations can function successfully as tern and plover reproductive habitat, the Service will revisit its current position regarding nesting habitat within the MRRP at that time.

In certain years, Lake Sakakawea and Lake Oahe are important nesting areas particularly for piping plovers. The nesting habitat on these reservoirs is currently maintained by the inter-annual regulation of storing and releasing river basin runoff. Reproductive success is typically highest during drier basin conditions that follow periods of higher reservoir pool levels. Declining reservoir pools expose the newly scoured substrates preferred by the plovers. However, tern and plover nests are frequently at risk of being flooded in the reservoirs with storage of seasonal uncontrolled run-off and the Corps regulation of water levels to meet the Master Manual (USACE 2006) requirements. Since MRRP monitoring of the tern and plover populations within the Missouri River began in 1986, approximately 80 percent of the total incidental take of piping plover eggs and chicks and 58 percent of least tern eggs and chicks were due to rising pool levels in reservoirs. Until we better understand reservoir habitat dynamics in relation to bird densities and reproductive output, and until we develop sustainable habitat-creation techniques on reservoirs that can demonstrate desired levels of reproduction, and because it is necessary to allow the reservoirs to fluctuate in order to protect the reproductively high value habitats below the dams; the Service does not recommend purposefully developing habitat on reservoirs as a management action in the MRRMP-EIS at this time. However, all birds produced and supported on habitat associated with the reservoirs contribute towards meeting MRRMP-EIS species objectives as conferred by the Service in the planning aid letter dated November 13, 2015.

Developing off-channel habitat similar to what occurs adjacent to the central Platte River is frequently referred to as a management strategy that should be considered for piping plover and least tern habitat on the Missouri River. While similarities provide the opportunity for extrapolation of ideas, the Missouri River is different from the central Platte River both ecologically and in regards to its water resource development. The two rivers do not have the same sedimentation or hydrological processes, or predator regime (Jenniges and Plettner 2008). The 90-mile reach of the central Platte River used by the birds is hydrologically limited regarding in-channel flows to isolate nesting colonies and habitat forming and maintenance flows to scour and redistribute habitat within the river channel. This region of the Platte River has a long history of active commercial sand and gravel mining sites, which most of the terns and plovers on the central Platte use for nesting. These off-channel habitat areas on the central Platte River provide better nesting conditions than the marginal habitat occurring on the river itself. Uncertainties regarding the potential contributions of this habitat type on the Missouri River to piping plover and least tern persistence remain. Reproductive potential, habitat preferences and dispersal, land acquisition, feasibility of creation and maintenance would all need to be resolved. As such the Service does not recommend including sand pit habitat management as a management action in the MRRMP-EIS at this time.

The reach of the Missouri River below Ponca, Nebraska is defined by the Bank Stabilization and Navigation Project. Nesting of least terns on this reach has only recently been recorded. This has occurred on sand splays resulting from dike ruptures during the 2011 flood and on sediment aggradation areas within the shallow water habitat project at Deer Island. No piping plover nesting activity has been recorded on this reach of the Missouri River since the species was listed. Many of the same uncertainties existing for reservoir and sandpit habitats exist for habitat in this geographic extent. The value of this habitat to piping plover and least reproduction is unknown. Habitat preferences and dispersal, forage availability, land acquisition, feasibility of creation and maintenance would all need to be resolved. Considering these uncertainties, the Service does not recommend purposefully developing habitat below Ponca, Nebraska as a management action in the MRRMP-EIS at this time.

Once again, the Service is looking forward to continuing to work collaboratively with you and the MRRIC in support of this important effort to ensure the success and ultimate implementation of a management plan for the recovery of the fish and wildlife resources of the Missouri River, while also taking into consideration the human resources. If you have any questions, please feel free to contact me at (605) 665-4856.

Sincerely yours,

v/r *Casey D. Kruse*

Casey D. Kruse
Missouri River Coordinator
US Fish and Wildlife Service
Yankton, SD

Enclosures

cc: Service, Region 6 ARD/ES, Lakewood, CO (Thabault)
Service, Region 3 ARD/ES, Bloomington, MN (Lewis)ARD
State F&W Directors: MT, ND, SD, NE, IA, MO, KS
Dave Ponganis, USACE
Mark Harberg, USACE

Related Correspondence

MRRIC letter to General McMahon & Director Guertin, Approved October 19, 2010 and dated November 18, 2010.

USFWS letter dated November 10, 2010 to the Corps in response to the MRRIC recommendation.

USACE letter to MRRIC dated January 21, 2011.

October 27, 2011 Letter from MRRIC Chairman Mike Mac to the Corps.

January 11, 2012 Letter from the Corps to Chairman Mike Mac.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Mountain-Prairie Region
31247 436th Avenue
Yankton, SD 57078

IN REPLY REFER TO:
FWS/R6/ES

December 4, 2015

Ms. April Fitzner
Missouri River Recovery Program
Senior Program Manager
U.S. Army Corps of Engineers
601 E 12th Street
Kansas City, Missouri 64106

RE: Planning Aid Letter Regarding the Missouri River Recovery Management Plan and Environmental Impact Statement (MRRMP-EIS) fish and wildlife proxy

Dear Ms. Fitzner:

The U.S. Fish and Wildlife Service (Service or USFWS) provides this planning aid letter (PAL) regarding the development of the U.S. Army Corps of Engineers' (Corps or USACE) Missouri River Recovery Management Plan (Management Plan) and associated Environmental Impact Statement (EIS) in accordance with the Fiscal Year 2015 Fish and Wildlife Coordination Act (FWCA) scope of work, task B4. As a cooperating agency on the Management Plan and EIS, the Service provides the following comments in coordination with the seven Missouri River Mainstem state fish and wildlife agencies pursuant to the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 et seq.), the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321-4347), and the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 et seq.). Enclosures include letters and emails with comments and suggestions we received from five state fish & wildlife agencies.

This PAL does not constitute the final report of the Secretary of the Interior as required by Section 2 (b) of the FWCA, nor does it constitute reconsultation of the 2000 and 2003 Amended Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project (BSNP), and Operation of the Kansas River Reservoir System (BiOp) under section 7 of the ESA.

The following comments are specifically in regards to the draft human consideration objective developed for the environmental conservation/fish and wildlife topic. They are a compilation of comments provided by state agencies and Service staff.

Comments

The current methodology uses flows at the 50th percentile over the period of record to determine benefits/impacts to fish and wildlife. Analyzing those flows provides some insight into the effects of the alternatives on fish and wildlife; however the 50th percentile may overly focus on impacts to species that are generalists. Because more extreme events play a more significant role in benefiting species adapted to extremes, we recommend analyzing the effects of upper/lower decile percentile flows and upper/lower quartile percentile flows to better understand the full range of potential biologic responses.

We recommend that open water habitat be broken into a range of depth and velocity classes. With many native Missouri River fish species in decline, it is important to consider the quantity of each habitat type and its associated functionality to more accurately estimate effects on native fish species. Depth, velocity and seasonality of inundation all play critical roles in determining impacts to floodplain and riverine fish and wildlife species. Classification of aquatic habitats based on water depth and velocity, and analyzing the acreage or percentage of each class/category would provide an index to habitat diversity within the open water category. This will be especially useful since the diverse assemblage of native Missouri River fishes have a wide range of habitat requirements, but may have particular requirements for different life stages. One category that has not normally been considered before is deeper slow water. This habitat appears to be important as a haven for many species and life stages as well as in many different seasons. We propose the Corps include a matrix of the following depth and velocity categories recognizing at this point that velocity analysis may be difficult to complete:

- Velocities: 0-1 ft/sec, 1-2 ft/sec, 2-3 ft/sec, >3 ft/sec
- Depths: 0-3 ft., 3-6 ft., 6-12 ft., 12-20 ft., and >20 ft.

Seasonality of inundation or lack thereof plays an important role in determining fish and wildlife benefits. Currently, the proxy averages inundation over a growing season generally spanning April-October. To better determine the impacts to fish and wildlife, including various life stages, we recommend the year be separated into the following five periods for the length of the Missouri River being analyzed:

- Overwintering late: January 1 – February 28/29
- Early spawning: March 1 – May 14
- Late spawning: May 15 – June 30
- Summer rearing and growth: July 1 – September 30
- Overwintering early: October 1 – December 31

Floodplain habitats can and do support a wide array of fish, wildlife and plants. Through the BSNP, degradation and construction of levees have combined to reduce aquatic habitat diversity and connectivity within the Missouri River floodplain. It is important to ensure that the fish and wildlife proxy has the ability to discriminate between alternatives in regards to habitat diversity and connectivity. Currently, much of the effects analysis appears focused between river levees. There is a large portion of the floodplain behind levees, especially in the lower river, that may have impacts that are not being assessed for the various alternatives. This could come about through groundwater connections of various flows and tributary backwater at high Missouri River stages. Thus, we strongly recommend adding an additional metric that measures public fish and wildlife conservation lands to determine the effects of the various alternatives on fish and wildlife via changes in terrestrial as well as aquatic habitats, and their intersection. This metric should also include a measure of potential connectivity for Missouri River fishes with an examination as to whether or not connectivity provides fish access. Finally, a helpful addition to better understanding the impact of different alternatives on floodplain and wetland habitats may be to consider different assemblages of plant communities in the floodplain and wetland habitats. With regards to the floodplain habitat types and inundation definitions provided, they appear legitimate for the analysis.

The Service, in coordination with Missouri River mainstem state fish and wildlife agencies, is looking forward to continuing to work collaboratively in support of this important effort to ensure the success and ultimate implementation of the Management Plan for the recovery of the fish and wildlife resources of the Missouri River, while also taking into consideration the human resources. Please contact me at (605)665-4856 or Wayne Nelson-Stastny at (605)660-5349 for further questions and clarification.

Sincerely yours,

v/r *Casey D. Kruse*

Casey D. Kruse
USFWS Missouri River Coordinator
Yankton, SD

Enclosures

cc: USFWS, Region 6 ARD/ES, Lakewood, CO (Thabault)
USFWS, Region 3 ARD/ES, Bloomington, MN (Lewis)ARD
State F&W Directors: MT, ND, SD, NE, IA, MO, KS
Dave Ponganis, USACE
Mark Harberg, USACE

Enclosure 1

DEPARTMENT OF GAME, FISH, AND PARKS
Foss Building
523 East Capitol
Pierre, South Dakota 57501-3182

July 8, 2015

Wayne Nelson-Stastny
USFWS
PO Box 710
Yankton, SD 57078

Dear Mr. Nelson-Stastny,

Thank you for allowing us to provide comments on the Missouri River Recovery Management Plan (MRRMP) and Environmental Impact Statement (EIS) Fish and Wildlife Proxy under the guidance of the Fish and Wildlife Coordination Act. The South Dakota Department of Game, Fish, and Parks (SDGFP) is charged with managing the fish and wildlife resources of the State of South Dakota and their associated habitats for the benefit of the public. The opportunity to comment on the Fish and Wildlife proxy allows SDGFP to actively participate in the fish and wildlife management process for this inter-jurisdictional river so important to our State.

The United States Army Corps of Engineers (USACE) has decided to use the HEC-RAS modeling to classify acres of multiple habitat types based on the amount of time land is inundated or wetted. While there are many factors that can influence which successional plant community will be present, utilizing the HEC-RAS modeling may provide a good estimate of changes that could occur due to USACE actions. We generally believe that this is a reasonable approach and that the terrestrial habitat classifications are adequate, however, we have some concerns about the current state of aquatic habitat classifications within the proxy.

We believe that there needs to be more consideration given to aquatic habitat types. Under the proposed proxy, all aquatic habitat is classified as "open water." With 51 of 67 fish species native to the Missouri River in decline, it is important to consider the quantity of each habitat type and its associated functionality in order to estimate effects on native fish species. There are two approaches that could help improve the aquatic aspect of the fish and wildlife proxy. Aquatic habitats could be classified as lakes, ponds, scour holes, main channel, side channels and tributaries, however this method may prove difficult and time consuming. An alternative method would be to classify habitats based on water depth and velocity. Analyzing either the acreage or percentage in each level of water depth and velocity could give an index to habitat diversity within the open water category. This may be a more appropriate method, since not all species have the same habitat requirements.

We were informed during the briefing webinar that there is a tool being developed by another USACE office that will facilitate the classification of aquatic habitats. Unfortunately there is great uncertainty about when the tool will be available and if the data will be available for the round 2 tradeoff discussions or the draft EIS. Due to the importance of the aquatic habitats in the Missouri River, we recommend that the USACE coordinate within its agency to provide a timeline of when more detailed aquatic habitat classifications will be included in the fish and wildlife proxy.

Another component that appears to be missing from the proxy is the seasonality of inundation, and more specific to the aquatic habitats, depth and velocity. The list of current alternatives that are being discussed includes alternatives with both spring and fall releases for habitat creation. Each alternative will likely have different seasonal patterns in regards to inundation, depth, and velocity and could have varying effects on fish and wildlife.

The Bank Stabilization and Navigation Project along with degradation below the dams have reduced aquatic habitat diversity and connectivity within the Missouri River floodplain. Thus it is important to ensure that the fish and wildlife proxy has the ability to discriminate between alternatives in regards to habitat diversity and connectivity. The acreage or percentage of the three wetland types (emergent wetland, scrub-shrub wetland, and riparian woodland/forested wetland) may provide the best indication of differences in floodplain connectivity between the alternatives. Additionally, early alternative discussions included the effects of degradation on human consideration proxies. Does the current fish and wildlife proxy include effects of degradation? Also, how does the model account for reduced sediment availability over the next 50 years?

During the briefing webinar, we were told that we would be provided with information about the length of the cross sections which ultimately define the scope of the habitat modeling. We look forward to receiving this information in a timely matter.

We appreciate the extended comment period and briefing webinars provided as requested. For future input requests, we suggest a similar process that includes a briefing webinar and adequate time to gather input from staff so the states can provide a comprehensive review of materials.

Thank you for this opportunity to provide comments on the fish and wildlife proxy to be used in developing the Missouri River Recovery Management Plan and EIS through the Fish and Wildlife Coordination Act. If you have questions regarding these comments or are in need of additional input please contact our Aquatics Section Chief John Lott 605.773.4508 or Senior Fisheries Biologist Chris Longhenry 605.734.4548.

Sincerely,

Kelly Hepler,
Department Secretary

KH:da

cc: Tony Leif, John Lott, Chris Longhenry

Enclosure 2

Office of the Secretary
1020 S Kansas Ave., Suite 200
Topeka, KS 66612-1327

Kansas
Department of Wildlife, Parks and Tourism

Phone: 785-296-2281
Fax: 785-296-6953
www.kdwp.state.ks.us

Robin Jennison, Secretary

Sam Brownback, Governor

June 30, 2015

Wayne Nelson-Stastny
U.S. Fish and Wildlife Service
55245 NE Highway 121
Crofton, NE 68730

Dear Wayne;

RE: Fish and Wildlife Coordination Act Comments

Thank you for the opportunity to review and discuss the draft model. First, we appreciate the difficulty of the task to develop a metric or measure to describe biological response to various management actions in a system as vast as the Missouri River. Further, we are confining our comments to how we see the proposal describing a response in the river segment adjacent to the Kansas border.

It appears that what has been presented is an attempt to use a single quantitative measure (water level or stage only) to make a qualitative assessment. The assumption being that more or less is better or worse for fish and wildlife. This approach lacks any qualitative measure. There is no assessment of the varying types of habitat available at a given water level stage. The very basic measures of depth, substrate and velocity and refinements of those typically used to assess habitat suitability are not included.

As an example, slide 10 of the presentation illustrates a "typical" cross section of the system. Within that "typical" cross section there is a wide range of flows or depths in which it appears there is no apparent change in available habitats or diversity of habitats. The apparent implication of the model is that conditions for the pallid sturgeon may be better or worse with more or less flow when the "typical" cross section only indicates vertical movement within a confined channel over a wide range of flows or stages, vertical movement within a confined channel. Similarly, the seasonal habitat needs or habitat needs for various life stages of a target species, such as the pallid sturgeon, appear to be lost with this model. There are differences in the habitat and food source requirements of many species at different stages of their life history. Larval, juvenile, adult and spawning habitat and food needs are not the same. It is not apparent to us the model captures either those needs or how changes affect those needs.

Also, as stated in slide 8 the 50^{th} percentile flow (median flow) is used as the basis for the model. Median flows appear to favor those species which would be considered generalists. Those species which have their needs met over a wide variety of conditions. In this situation the goal is recovery of a species, and other declining species, that do not appear to have their needs met by median conditions in the systems as it exists. The model should assess effects on the target species using a metric (or metrics) that address the specific needs of that species. It is not apparent to us that median flows will accomplish this.

Thank you for the opportunity to provide comments. We look forward to working with you as this effort progresses.

Sincerely,

Steve Adams,
Chief of Planning

Enclosure 3

MDC FWCA input on FW Human Consideration received July 6, 2015

Jennifer Campbell <Jennifer.Campbell@mdc.mo.gov>

Jul 6, 2015

Wayne,

Thanks for the opportunity to review the U.S. Army Corps of Engineers (USACE) fish and wildlife proxies, objectives and metrics for native species other than the three federally listed species. From the conference call, our understanding of the purpose of these fish and wildlife proxies is to conceptualize how a range of river management alternatives, primarily related to flow, would affect native fish and wildlife species. We further understand that the proxies will be used in a trade-offs analysis (Round 1 and 2) and impacts assessment for the Missouri River Recovery Management Plan Environmental Impact Statement (EIS). The trade-offs analysis will seek to balance how management actions are likely to affect different interests on the river, including native species, to help guide future USACE river management efforts. The EIS will seek to demonstrate that a preferred alternative, among the suite of alternatives considered, is the least environmentally damaging practical alternative.

Through a paired Hydrologic River Engineering Center-River Analysis System (HEC-RAS) and Hydrologic Engineering Center -Ecological Function Model (HEC-EFM) modeling approach, the USACE will estimate available habitat acres from the given alternative flow regime by estimating water depths longitudinally along the Missouri River and laterally within the navigation channel, as well as duration of inundation. Some river segments will also estimate water depths within portions of the floodplain. The approach assumes that water depth predicted by the model will meet the needs of native species. The reference dataset of flows is 1933 – 2012, and the 50th percentile flow will be used to estimate the median potential habitat acreage. USACE estimates that the 50th percentile flow represents the typical flow.

Predicting impacts of river management alternatives to native fish and wildlife is a complex undertaking. While Department staff are not experts in these models, there do appear to be some fundamental limitations to the approach that should be addressed. We offer the following technical comments:

1. Potentially available habitats (suitable water depth) could more likely predict functional habitats with a measure of accuracy if the prescribed inundation depth and duration were to occur:

A. At a biologically useful time (“correct season”);

B. Along with suitable flow velocity;

C. On a bank slope conducive to vegetation that supports various life stages and feeding guilds;

D. In areas that are hydrologically connected to the River such that native fish and wildlife can access these areas.

2. How will results from the modeling effort be verified? Levees and ditches with drainage tube structures can be expected to prevent areas of suitable elevation from inundation at the corresponding river elevation in some areas. Modeled inundation may not always translate to fish access. Perhaps a combination of LiDAR and field observations could help to develop the fine scale inundation maps that could accurately predict habitat availability.

3. Will using a median (50th percentile flows) approach to reference flows capture the needs of those native, non-endangered species that may be in decline? Such species are rarely generalists. It would seem that a median approach for the period of record (since river modifications began) might be biased towards benefiting the species capable of exploiting the modified river conditions.

4. Defining fish and wildlife habitat by water depth and inundation alone could overestimate the number of acres of habitat capable of supporting fish and wildlife. It is not clear what a result of this model might measure or how it might be interpreted. How would the results provide insight into effects of different alternatives on fish and wildlife species?

5. How will the model account for the effect of soil types on sites that require a longer or shorter hydroperiod to develop the desired plant community? For example, very sandy wetland sites require longer duration of inundation (longer hydroperiod) to develop the desired wetland plant community. Conversely, wetland sites with heavy clay content would need a shorter hydroperiod to achieve the same result. Soil maps are themselves not of sufficient resolution or recent revision to reflect variable hydroperiod needs.

6. Habitat Classes should include a class dominated by annual herbaceous plant species found during short hydroperiods, such as 20-30 days of inundation during the growing season. This would be a wetland habitat class dominated by annual plants with some mix of perennials and share the same Quantitative Hydroperiod as the terrestrial habitat class listed as Forest.

7. Hydroperiods may warrant reconsideration. By observation, there are times during the year when certain habitats are inundated for shorter or longer periods of time than listed in the document.

8. The five fish growing seasons (late overwintering, early spawning, late spawning, summer rearing and growth, and early overwintering) described by Nebraska look consistent with what is observed in Missouri.

9. The effort could consider establishing the life cycle of plants in these wetland habitats.

Thanks for your coordination and for the opportunity to comment. Please contact me with any questions about these comments.

Jennifer

Enclosure 4

NEGPC FWCA input on Fish and Wildlife Human Considerations.   Received June 26, 2015

Zuerlein, Gene <gene.zuerlein@nebraska.gov>

Jun 26, 2015

Wayne,

In regards to the fish growing season comments, NGPC used 5 timeframes in the MesoHABSIM study on the Niobrara River. They can be found in the final report by Parasiewicz et al. 2014 located on the NGPC web site (www.outdoornebraska.ne.gov), clicking on conservation, then clicking on water, and then scrolling down to the Niobrara River. In brief the timeframes are as follows:

Overwintering late – Jan1 – Febr 28/29

Early spawning – March 1 – May 14

Late spawning – May 15 – June 30

Summer rearing and growth – Jul 1 – Sept 30

Overwintering early – October 1 – Dec 31

In the report the periods (Table 20) are switched around a bit, but I put them in calendar order sequence for a normal calendar year.

Gene

Enclosure 5

Longhenry, Chris
Aug 11, 2015
to me, Adams, Chris, dfryda, Don, Gene, Kasey, jennifer.campb., Sam, Gerald.Mestl, John
All,
Today during the MRRIC fish and wildlife proxy webinar, the issue was brought up again that the open water habitat category should be spilt in to multiple classifications based on depth and velocity. The facilitators asked me to provide the parameters for the different depth and velocity classes. Since this has been discussed among this group in the past, I wanted to get your input on what depth/ velocity classes you feel would be most useful for comparing alternatives. I have included a draft set of classifications to get us started. I am open to any suggestions. Also, I would like input on how each of you thinks the year should be split to evaluate seasonal changes. Right now the proxy only includes a April- October growing season. I believe previous discussions indicated the importance of estimating the acreage of each habitat type during each of four seasons, but I can't remember the specific months suggested.
I apologize for the short turnaround, but I would like to send them this information by the end of next week.

Depth	velocity
0-2 ft.	0-0.5 ft./sec
2-5 ft.	0.5-1.5 ft./sec
5-10 ft.	1.5-3 ft./sec
10-20 ft.	>3 ft./sec
>20	

Thanks for your help
Chris

Chris Longhenry
Senior Fisheries Biologist
Game, Fish and Parks
Chamberlain, SD 57325
605-734-4548
chris.longhenry@state.sd.us

Enclosure 6

Larson, Chris J [DNR] <Chris.Larson@dnr.iowa.gov>
Aug 11, 2015
to Chris, me, Adams, dfryda, Don, Gene, Kasey, jennifer.campb., Sam, Gerald.Mestl
One of the mitigation issues Iowa staff has been discussing on the lower river is the lack of deep slow velocity habitat (overwintering habitat). We believe this is also beneficial habitat during the growing season as well.

CHRIS LARSON, Southern Iowa Regional Fisheries Supervisor

Iowa Department of Natural Resources
P (712) 769-2587 | F (712) 769-2440 | chris.larson@dnr.iowa.gov
57744 Lewis Rd | Lewis, IA 51544

Enclosure 7

Zuerlein, Gene <gene.zuerlein@nebraska.gov>
Aug 12, 2015
to Chris, me, Adams, Chris, dfryda, Don, Kasey, jennifer.campb., Sam, Gerald.Mestl, John
Chris,
Different seasons for a fish life cycle. The one we used for an instream flow study was for many warm and cool season species inhabiting the Niobrara River and generally covers most species as follows:
Overwintering Late – Jan 1 – Feb 28
Early Spawning – Mar 1 – May 14
Late Spawning – May 15 – Jun 30
Summer Rearing and Growth – Jul 1 – Sept 30
Overwintering Early – Oct 1 – Dec 31

Normally spawning is on the upswing or downswing slope of a spring runoff event. If you consolidated over wintering into one, there would be 4 seasons, but in terms of water management on a calendar basis, we (Fish Division staff and Piotri-contractor) thought the above timeframes fit most species based on experience and literature.
Gene

Enclosure 8

Stukel, Sam
Aug 14 (6 days ago)

to Chris, Chris, me, Adams, dfryda, Don, Gene, Kasey, jennifer.campb., Gerald.Mestl
I agree with Chris that a deep and slow habitat should be considered as an additional category. Here in the unchannelized MNRR that would cover the #1 type of habitat we go to when we are in search of sturgeon – at any time of year. These would be the slow-water pools behind sandbars. In this reach, such a habitat might be characterized by a depth of 6 – 12' and a velocity of 1 - 2 ft./sec. They are a haven for many species. It seems to me that this type of habitat would be an important part of a diverse river reach.

Otherwise, I think the categories you listed would be helpful in comparing alternatives.

The seasonal component seems like an obvious need. I support using the periods listed by Gene.

Sam Stukel
Fisheries Biologist
South Dakota Dept. of Game, Fish and Parks
31297 496th Ave
Yankton, SD 57078
605-668-5464
sam.stukel@state.sd.us

Enclosure 9

Jennifer Campbell <Jennifer.Campbell@mdc.mo.gov>
8/20/2015

to Chris, me, Adams, Chris, dfryda, Don, Gene, Kasey, Sam, Gerald.Mestl, John
Chris,

MDC data collected through annual HAMP studies lend weight to the need for deep, slow velocity habitat. Some of the highest catch rates of YOY sturgeon species occur in river depths of 2-3 meters that had velocities of 0.5-0.7m/s. Staff suspect velocity could be more important than depth for this life stage.

More frequently staff observe greater depth water in the river correlates to higher velocities, so the results are of interest. Is there a model that defines the relationship between depth and velocity? For example, at point A with a velocity of 0.5 m/s would we get depth X. If we increase velocity to 1.0m/s at the same point would we get depth Y?

MDC staff agree with the habitat categories proposed by Nebraska for spawning times, rearing times, overwintering and migration. Note that these life stages are not limited to April – October, the period considered by USACE for a range of management alternatives, based on the navigation season. Each season and the habitat available during it has an effect on the life stages of pallids and other fish.

Thanks,
Jennifer

Jennifer K. Campbell
Policy Coordinator
Missouri Department of Conservation
(573) 522-4115x3159
Jennifer.Campbell@mdc.mo.gov

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Mountain-Prairie Region
31247 436th Avenue
Yankton, SD 57078

April 28, 2016

Ms. April Fitzner
Missouri River Recovery Program
Senior Program Manager
U.S. Army Corps of Engineers
601 E 12th Street
Kansas City, Missouri 64106

RE: Missouri River Recovery Management Plan and Environmental Impact Statement (MRRMP-EIS) Preliminary Draft Chapter 2: Alternatives

Dear Ms. Fitzner:

As a cooperating agency in the development of the U.S. Army Corps of Engineers' (Corps or USACE) draft Missouri River Recovery Management Plan and associated Environmental Impact Statement (MRRMP-EIS), the U.S. Fish and Wildlife Service (Service) provides the following overarching comments regarding the preliminary draft Chapter 2. We provide these comments in partial completion of Task B3 contained in the draft Fiscal Year 2016 scope of work for the Service pursuant to the Fish and Wildlife Coordination Act (FWCA) of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 et seq.), the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321-4347), and the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 et seq.). Enclosed is a list of specific comments regarding the draft Chapters 1 and 2.

This letter does not constitute the final report of the Secretary of the Interior as required by Section 2(b) of the FWCA for the MRRMP-EIS, nor does it constitute reconsultation of the 2000 and 2003 Amended Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project (BSNP), and Operation of the Kansas River Reservoir System (BiOp) under section 7 of the ESA.

The Service appreciates the close coordination during the development of the MRRMP-EIS process and the opportunity to review early drafts of the MRRMP-EIS chapters. Continuing to work together in this effort will allow any significant issues that may impede accomplishing the objectives of the plan to be resolved early in the process and prevent delays in the schedule.

Range of Alternatives

It is the Service's understanding that the alternatives as structured in the MRRMP-EIS were developed to singularly analyze the effects of individual actions because of the difficulty of portraying a multi-faceted alternative with adaptive management to the public. As such, any one of the alternatives disparately displayed may not meet the purpose and need of the MRRMP-EIS.

Alternative 2, which represents the existing BiOp as projected, has a suite of actions that can be implemented to address the needs of the listed species, the endangered interior least tern (*Sternula antillarum*) and pallid sturgeon (*Scaphirhynchus albus*), and the threatened Northern Great Plains (NGP) population of the piping plover (*Charadrius melodus*); therefore, meeting the objectives of the MRRMP-EIS. It is our anticipation that a final selected alternative will likely require a combination of actions from several of the analyzed alternatives at some frequency, duration, or scale. While the current suite of alternatives may not fully meet the purpose and need of the MRRMP-EIS at this time, the analysis should provide sufficient information on the scope, scale and duration of actions that can be combined to meet the objectives. As the Service and the Corps have discussed, we recommend that the Corps include language in the alternatives chapter and cumulative effects section that discusses the possibility of this approach.

Importance of the BSNP Missouri River Fish and Wildlife Mitigation Project

The 2003 Amended Biological Opinion (BiOP) considered the BSNP Missouri River Fish and Wildlife Mitigation Project (MRFWP) as an important interrelated and interdependent action during past consultations regarding actions on the Missouri River.

The goal of BSNP MRFWP is to restore fish and wildlife lands that were lost or damaged due to the channelization and bank stabilization of the Missouri River below Sioux City, Iowa. The legislation authorizes the purchase of 166,750 acres of land along the river from willing sellers. These lands are then restored with native vegetation, wetlands and water features that connect to the river. While the overarching focus of the BSNP MRFWP is on mitigating losses to the wide range of fish, wildlife, plants and associated habitats that comprise the Missouri River ecosystem, a vital component of the overall effort also provides benefits to the listed species.

The Service will be looking for a clear articulation of how the BSNP MRFWP will be utilized to enhance and enable actions to be completed, to achieve the objectives of this MRRMP-EIS.

Adaptive Management

The Service continues to be supportive and applauds the Corps' efforts in developing the Adaptive Management Plan (AM Plan) in concert with the MRRMP-EIS. While the Service recognizes that this review is focused on the proposed alternatives, we remain keenly interested in how adaptive management will be integrated within the alternatives. How the AM Plan will guide and adapt the implementation of actions through the decision space defined in this EIS; how decision criteria, thresholds, triggers and time frames will be used to initiate meaningful actions and/or subsequent regulatory requirements; and defining a clear commitment to change will be paramount to successfully achieving the objectives contained in the MRRMP-EIS.

The Service is looking forward to continuing to work collaboratively in support of this important effort to ensure the success and ultimate implementation of the MRRMP for the recovery of the fish and wildlife resources of the Missouri River, while also taking into consideration the human resources. Please contact me at (605) 665-4856 for further questions and clarification.

Sincerely yours,

Casey D. Kruse
USFWS Missouri River Coordinator
Yankton, SD

Enclosures

cc: USFWS, Region 6 ARD/ES, Lakewood, CO (Thabault)
USFWS, Region 3 ARD/ES, Bloomington, MN (Lewis)ARD
Dave Ponganis, USACE
Mark Harberg, USACE

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Mountain-Prairie Region
31247 436th Avenue
Yankton, SD 57078

September 14, 2016

Ms. April Fitzner
Senior Program Manager
Missouri River Recovery Program
U.S. Army Corps of Engineers
601 E 12th Street
Kansas City, Missouri 64106

RE: Interception Rearing Complex Targets

Dear Ms. Fitzner:

As a cooperating agency in the development of the U.S. Army Corps of Engineers' (Corps or USACE) draft Missouri River Recovery Management Plan and associated Environmental Impact Statement (MRRMP-EIS), the U.S. Fish and Wildlife Service (Service) provides the following *recommended targets for Interception and Rearing Complexes*. We provide these comments in partial completion of the draft Fiscal Year 2016 scope of work for the Service pursuant to the Fish and Wildlife Coordination Act (FWCA) of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 et seq.), the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321-4347), and pursuant to the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 et seq.).

This letter does not constitute the final report of the Secretary of the Interior as required by Section 2(b) of the FWCA for the MRRMP-EIS, nor does it constitute reconsultation of the 2000 and 2003 Amended Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project (BSNP), and Operation of the Kansas River Reservoir System (BiOp) under section 7 of the ESA.

Interception Rearing Complex Targets in an Adaptive Management Context

The Service is providing the following recommendations to the Corps with regard to Interception Rearing Complexes (IRCs) Targets in an Adaptive Management context.

The Service supports the Adaptive Management process with regards to learning, modifying, and testing the IRC hypotheses and implementation of this habitat component. Our recommendations reflect a progression of implementation based upon learning and improving IRC's provided the hypotheses remains valid for the duration of the temporal scope of this EIS. Ultimately these efforts would lead to determination of a Level 4 implementation target within the temporal scope of the EIS.

These recommendations emanate from the June 2016 In Progress Review during which a request was made of the Service to provide recommendations on three components making up the level of implementation of IRCs:

- Study phase equivalent to 2 sites/year totaling 12 sites within 6 years
- Refurbishing existing Shallow Water Habitat sites
- Define additional IRC's needed to achieve the EIS objectives

These recommendations are intended as a step-wise progression of implementation for each of the above components within an Adaptive Management context.

While the functionality of IRC habitat has been only in part defined, we recognize that further refinement of IRC habitat will continue within the AM process. We recommend inclusion of the following to aide in computation of successfully implemented IRC habitats:

- I = Interception as a binary response, interception of particles (drifting larval pallid larvae) is or isn't occurring. In the future this component could be parsed out further based upon the relative rate of interception occurring.
- RC = Rearing Complex consisting of newly produced Food Producing and Foraging Habitat. Acre-days / year is the metric that will be utilized to define the amount of Rearing Complex habitat produced. Further discussion regarding the associated hypotheses can be found within the Missouri River *Scaphirynchus albus* (pallid sturgeon) effects analysis-Integrative Report 2016 - pages 112-120 (Jacobson *et al.* 2016). We anticipate improvements in determining the effectiveness of this metric in the near future.
- For computational purposes the amount of IRC's constructed in a given year will equal the sum of I(RC). We also recommend continuation of ongoing efforts to determine the biological significance of IRC's to the pallid sturgeon and refinement of a metric(s) measuring IRC's relationship to pallid sturgeon survival.

Flows play an important role in the function of IRC habitat and provide a means for producing IRC habitat. Although the Service is not requesting that flows be manipulated to implement IRC habitat during the study phase, the role of ambient flows should be included in all assessments should the need arise to utilize flows to help achieve IRC implementation targets in the future.

Following is a series of stages of IRC implementation recommendations:

Stage 1 – Begin study phase:

- Duration three years.
- At least two IRC sites constructed per year paired with control sites.
- Amount of functional IRC habitat added each year is equivalent or greater than 33,000 acre-days/year.
- Assess existing SWH habitat sites and determine potential for refurbishing as IRC sites.

<u>Assessment:</u>

- Assess IRC complexes.
- If results are positive or equivocal proceed to Stage 2 (decision criteria TBD).
- If hypotheses are no longer valid, discontinue efforts (decision criteria TBD).

Stage 2 – Continuation of study phase, refurbishing of SWH sites, and determination of level 3 implementation.

- Duration three years.
- At least two IRC sites constructed per year paired with control sites.

- Amount of functional IRC habitat added each year is equivalent to or greater than 33,000 acre-days/year.
- Refurbish SWH habitat sites in addition to study sites (rate TBD).

<u>Assessment:</u>
- Assess IRC complexes and refurbishment.
- If results are positive or equivocal proceed to Stage 3 (decision criteria TBD).
- If hypotheses are no longer valid, discontinue efforts (decision criteria TBD).

.Stage 3 – Level 3 implementation and determination of level 4 implementation.
- Duration four years.
- Continue assessing study sites and refurbished sites.
- Culminate refurbishing existing SWH sites as warranted.
- At least 66,000 acre-days/year of functional IRC habitat added each year. The ultimate rate of level 3 implementation needed to determine level 4 implementation rates within four years will be informed by Stages 1 & 2.

<u>Assessment:</u>
- If the hypotheses are no longer valid, discontinue efforts (decision criteria TBD).
- Based on results determine Level 4 IRC target and implementation rate.

Stage 4 – Level 4 implementation to ultimately remove paucity of IRC habitat as an issue to pallid sturgeon survival.
- Implement IRC habitats at level 4

The Service appreciates the opportunity to provide these recommendations to realize recovery of the listed species on the Missouri River. The Service is looking forward to continuing to work collaboratively in support of this important effort to ensure the success and ultimate implementation of the MRRMP for the recovery of the fish and wildlife resources of the Missouri River, while also taking into consideration the human resources. Please contact me at (605) 665-4856 for further questions and/or clarification.

Sincerely yours,

Casey D. Kruse
USFWS Missouri River Coordinator
Yankton, SD

cc: USFWS, Region 6 ARD/ES, Lakewood, CO (Thabault)

USFWS, Region 3 ARD/ES, Bloomington, MN (Lewis)ARD
Dave Ponganis, USACE
Mark Harberg, USACE

Citation

Jacobson, R.B., Annis, M.L., Colvin, M.E., James, D.A., Welker, T.L., and Parsley, M.J., 2016, Missouri River *Scaphirhynchus albus* (pallid sturgeon) effects analysis—Integrative report 2016: U.S. Geological Survey Scientific Investigations Report 2016–5064, 154 p., http://dx.doi.org/10.3133/sir20165064.

APPENDIX C: CUMULATIVE ACTIONS DESCRIPTIONS

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Appendix C: Cumulative Actions Descriptions

This section presents the cumulative actions that were identified and a description of each action.

Missouri River Mainstem Reservoir System Construction: The 1944 Flood Control Act (FCA) authorized the construction and operation of five large dams on the Missouri River mainstem. The projects authorized by the FCA, along with their reservoirs, are Garrison Dam (Lake Sakakawea) in North Dakota; and Oahe Dam (Lake Oahe), Big Bend Dam (Lake Sharpe), Fort Randall Dam (Lake Francis Case) and Gavins Point Dam (Lewis and Clark Lake) in South Dakota. The construction of Fort Peck Dam (Fort Peck Lake) in Montana was authorized in the Rivers and Harbors Act of 1935; however, the 1944 FCA incorporated the Fort Peck Dam along with the other five dams and reservoirs to form the System. Construction of the dams was completed in 1964. Section 9 of the 1944 FCA authorized the system to be operated for the purposes of flood control, navigation, irrigation, power, water supply, water quality control, recreation, and fish and wildlife (USACE 2006). The Missouri River Mainstem Reservoir System Master Water Control Manual, Missouri River Basin (Master Manual) serves as a guide to the USACE in meeting the operational objectives of the system when regulating the six mainstem system reservoirs.

Bank Stabilization and Navigation Project Construction: The BSNP consists mainly of rock pile structures and revetments along the outsides of bends and transverse dikes along the insides of bends to force the river into a single active channel that is self-maintaining. As authorized, the BSNP provides a 9-foot-deep channel with a minimum width of 300 feet during the navigation season from April 1 to November 30 between Sioux City, Iowa, and the mouth of the Missouri River near St. Louis, Missouri.

Missouri River Depletions for Agriculture, Municipal, and Industrial Use: This action includes water withdrawals directly from the river channel and associated return flows (if any). Irrigation, agriculture, and municipal/industrial use take place on the floodplain or adjacent uplands, supplied by pumping directly from the river.

Oil and Natural Gas Production: This action includes water withdrawals for use in hydraulic fracturing technologies for oil and gas wells. Return flows of treated wastewater from these activities is possible. Hydraulic fracturing is a key element in the development of natural “shale gas” fields, of which several are under development or forecast for development in the basin. Oil and Natural Gas Production also includes construction of infrastructure such as pipelines, roads, utilities, well pads, and staging areas.

Groundwater Withdrawal Practices: This action includes groundwater pumping for a wide range of uses, from both shallow and deep aquifers, both along the floodplain of the mainstem and tributaries and across the uplands of the basin.

Floodplain Animal Pasturing/Grazing: This action includes the use, alteration, or conversion of land in the floodplain of the mainstem Missouri River to grassland for pasturing animals.

Floodplain Development (Urban, Residential, Commercial, Industrial): This action includes a wide range of development that converts natural lands to a wide range of urban, residential, commercial, and industrial uses.

Crop Production: This action includes the conversion of land from native habitat to crop production. Extensive acreage within the floodplain of the Missouri River and its tributaries, as well as the surrounding uplands, has been converted for crop production (Bragg and Tatschl 1977; Hesse et al. 1988; National Research Council 2002).

Levee Construction (federal and private): This action includes the placement, design, and management of structures intended to prevent or control floodplain inundation.

Fishery Stocking and Management: This action includes the stocking and management of native or non-native fish that can alter the natural fish composition in an area. This includes stocking of sport-fish in reservoirs. This action also includes past, present, and reasonably foreseeable commercial fishing that has occurred on the Missouri and Mississippi Rivers.

Snag Removal: This action includes the historic removal of large woody debris from the river channel and banks. This includes removal of floating, stranded, and buried snags.

Transportation and Utility Corridor Development: This action includes the construction and maintenance of bridges, highways, local roads, railways and electrical and gas rights of way.

USACE Continuing Authority Programs (i.e., Section 514, 206, 1135): USACE has several Continuing Authority Program (CAP) ecosystem restoration authorities that have been used to restore fish and wildlife habitat in the Missouri River floodplain and could be used to fund the restoration of additional habitat in the future. These include Section 514 (Missouri and Middle Mississippi Rivers Enhancement Projects), Section 1135 (Environmental Restoration Projects), and Section 206 (Aquatic Ecosystem Restoration). The habitat created by these programs on the Missouri River has historically been minor in scope compared to the MRRP.

Management of USACE Project Properties: Missouri River project lands managed by the USACE represent a significant amount of designated fish and wildlife habitat in the study area. Project lands are divided into land classifications that govern the land uses, management activities, and level of development that are allowed. The Environmentally Sensitive, Wildlife Management, and Vegetation Management classifications are managed predominantly for fish and wildlife habitat; accordingly, the majority of restoration activities on project lands take place on these land classifications.

USACE Regulating Works Project: The USACE is responsible for providing a 9-feet-deep and not less than 300-feet-wide navigation channel on the Middle Mississippi River. This is achieved through the Regulating Works Project. The Regulating Works Project consists of bank stabilization and sediment management to ensure adequate width and depth. Project improvements are achieved through the construction of river training structures, revetment, rock removal, and construction dredging. A supplemental EIS (SEIS) is currently being prepared by the USACE to examine new circumstances and information on the potential impacts of the Regulating Works Project that were not considered in the original 1976 EIS. A draft of the SEIS will be available for public review in January of 2017 with a final expected in August of 2017. The Regulating Works Project is maintained through dredging and any needed maintenance to already constructed features. These present activities would continue into the future.

USFWS National Wildlife Refuge (NWR) System Lands Management: The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats. Seven national wildlife refuges are located along the mainstem Missouri River encompassing a total of 1,192,891 acres:

- Charles M. Russell NWR in north-central Montana;
- Audubon NWR in central North Dakota;
- Karl E. Mundt NWR in southeastern South Dakota;
- Desoto NWR and Boyer NWR on the Iowa/Nebraska border;
- Squaw Creek NWR in northwestern Missouri; and,
- Big Muddy NWR, which consists of several land units in the Missouri River floodplain between Kansas City and St. Louis, Missouri.

There are 40,319 acres remaining in acquisition authority for the Big Muddy NWR and 7,607 acres for Boyer Chute NWR (USACE, USFWS, 2010).

USFWS Aquatic Invasive Species Program: The USFWS Aquatic Invasive Species Program contributes to the conservation of federal trust species and their habitats by preventing the introduction and spread of aquatic invasive species, monitoring habitats to determine the distribution of invasive species, rapidly responding to new invasions, and controlling established populations. The Aquatic Invasive Species Program is made up of three elements: state plans / National Invasive Species Act of 1996 implementation, prevention, and control and management. Through the Aquatic Invasive Species Program, the USFWS provides grants for state and tribal aquatic nuisance species management plans. With approval of a state or Tribe's plan, matching funds for activities detailed in the management plan are available. Annual funding for the Aquatic Invasive Species Program nationwide is estimated at $6.3 million.

NRCS Easement Programs (WRP and EWPP-FPE): As of 2010, a total of 67,707 acres of private lands, including Tribal lands, within the bluff-to-bluff Missouri River floodplain were enrolled in some form of NRCS easement program. These acres are primarily Wetland Reserve Program (WRP) acres (49,572 acres or 73 percent), but also include 6,527 acres enrolled in Emergency Watershed Protection Program - Floodplain Easements (EWPP-FPE), and 11,084 acres in the Emergency Wetland Reserve Program (EWRP). The EWRP was established in response to 1993 flooding in the upper Mississippi and lower Missouri River basins and is not currently active although current acreages remain in the program.

NRCS Technical and Financial Assistance Programs (e.g., CSP, EQIP, WHIP):

- **Conservation Stewardship Program (CSP)**: The CSP is a conservation assistance program that supports stewardship of private agricultural lands by providing payments for maintaining and enhancing natural resources. The annual payment is based on the level of conservation stewardship achieved. The seven Missouri River basin states averaged a total of $1 million in CSP funding annually from 2005 to 2010.
- **Environmental Quality Incentives Program (EQIP)**: The EQIP program provides technical, financial, and educational assistance to farmers and other private landowners to help plan and implement conservation practices that address natural resources concerns and for opportunities to improve soil, water, plant, animal, air, and related resources on agricultural land and non-industrial private land. The seven Missouri River basin states averaged a total of $199.7 million annually in EQIP funding from 2005 to 2010.

- **Wildlife Habitat Incentive Program (WHIP)**: The WHIP is a voluntary program that assists private landowners in developing and improving wildlife habitat on agricultural land, nonindustrial private forest land, and Tribal lands. The seven Missouri River basin states averaged a total of $17.5 million annually in WHIP funding from 2005 to 2010.

NPS Missouri National Recreational River Management Actions: The MNRR, located on the border between Nebraska and South Dakota, represents the majority of land managed by the NPS on the Missouri River. Although there has been development along the Missouri River within the national park, it is one of the few remaining segments that still exhibit some characteristics of a natural undammed and unchannelized river. To ensure this in the future, NPS staff continually monitor changes in environmental factors and implement plans and actions to preserve and protect natural resources. A general management plan and environmental impact statement for the lower 59-mile reach was issued in 1999, and for the upper 39-mile stretch was issued in 1997, which was meant to provide guidance for 10–15 years. Approximately 70,000 acres are included between the two reaches. MNRR management includes active preservation and restoration of native vegetation on roughly 300 acres. Habitat creation within the Missouri River floodplain includes two cottonwood regeneration projects near Bow Creek. Wetland creation along the MNRR is primarily through the NRCS Wetlands Reserve Enhancement Program and WRP. The MNRR includes management strategies to directly benefit both the endangered least tern and piping plover.

EPA Section 319 Non-Point Source Grant Program: The mission of the EPA is to protect human health and the environment. EPA administers regulatory and voluntary grant programs under the Clean Water Act (CWA) that contribute to mitigation, recovery, and restoration on the landscape/watershed scale. The passage and implementation of the CWA established a regulatory framework that resulted in considerable improvement in the nation's water quality. The Section 319 Non-Point Source Grant Program under the CWA provides grant money to states and Tribes to support nonpoint source control projects. A wide variety of support is provided under this program including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, watershed planning, implementation of best management practices and monitoring. Specific project actions include:

- Total Maximum Daily Load establishment and monitoring
- Best Management Practice design and implementation
- Wetland restoration/protection
- Nutrient runoff management
- Water quality assessment and monitoring
- Stormwater discharge control
- Vegetation management
- Erosion control
- Streambank stabilization

From 2007 to 2011 the seven mainstem states received a total yearly average of $14.1 million in Section 319(h) grant funding.

Tribal Programs and Actions: The Tribes along the Missouri River are involved with natural resources management and several tribes are involved with the management of federally listed species. As an example, the Cheyenne River Sioux Tribe is involved with the management of federally listed species through their involvement with monitoring terns and plovers on the Missouri and Cheyenne Rivers (USFWS 2000). The Cheyenne River Sioux Tribe and the Lower Brule Sioux Tribe have also developed terrestrial mitigation projects under Title VI – Cheyenne River Sioux Tribe, Lower Brule Sioux Tribe, and State of South Dakota Terrestrial Wildlife Habitat Restoration (PL 105-277) and WRDA of 1999 (PL 106-53). The Cheyenne River Sioux and Lower Brule Sioux Tribes have designed their mitigation efforts to restore riparian, ecological, and cultural significance to their land adjacent to the Missouri River. Example projects on the Cheyenne River reservation include planting cottonwood saplings along the shoreline to mitigate for loss of cottonwood forests due to the impoundment of Lake Oahe, wetland restoration along Medicine Creek, and construction of an island to protect a cultural site and to provide an area for native tree, shrub, and prairie grass plantings.

Comprehensive Wildlife Conservation Plans and Protected Natural Areas (all states): Each state along the Mainstem Missouri River implements a comprehensive fish and wildlife habitat management plan (CWMP) that, at a programmatic level, serves to synthesize information on wildlife species, habitats, threats, conservation priorities and opportunities (Storms et al. 2008). The plans emphasize ecosystems and species of greatest conservation need. In the majority of states, the CWMPs represent an increased emphasis on conserving non-game species. The CWMPs also serve to identify priority conservation areas; each mainstem state identifies portions of the Missouri River as a high priority for conservation.

Yellowstone Intake Diversion Dam Modification: The goal of the Yellowstone Intake Diversion Dam modification is to improve passage for the endangered pallid sturgeon and other native fish and to reduce entrainment of fish into the main channel of the Lower Yellowstone Project.

APPENDIX D: HYDROLOGIC PERIOD OF RECORD ANALYSIS OF ALTERNATIVES

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Appendix D: Hydrologic Period of Record Analysis of Alternatives

This appendix provides the graphics of the overall long-term hydrology in the river and reservoirs based on the period of record (POR). The POR consists of average measurements of stage (or elevation) and flow for each day over 82 years between 1931 and 2012[1]. The analysis evaluates key locations along the Missouri River, as well as for St. Louis at the Mississippi River downstream of the confluence with the Missouri River (Figure D-1).

General hydrologic conditions in the river and its reservoirs were analyzed using the statistical 90th, 50th, and 10th percentiles simulated for flow conditions of the 82-year POR for the six alternatives[2]. Specifically, a percentile is a statistical measure indicating the value below which a given percentage of observations in a group of observations falls. For example, the 90th percentile of a reservoir elevation reflects the elevation below which 90 percent of the elevations may be found; only 10 percent of the elevations would be higher. Thus, the 90th percentile may be indicative of “wet period” conditions. A “period” could be a year or several years long, affecting storage and flow conditions. Similarly, the 10th percentile is the reservoir elevation below which 10 percent of the elevations may be found; 90 percent of the elevations would be higher. Thus, the 10th percentile may be indicative of “dry period” conditions. Finally, the 50th percentile is the reservoir elevation may be indicative of “average” conditions, where 50 percent of the elevations are higher and 50 percent of the elevations are lower. Similar definitions also apply to percentiles used for flow and stage in the river.

Impacts under wet, average, and dry period conditions (90th, 50th, and 10th percentile, respectively) are presented together for the six alternatives to demonstrate similarities and differences. However, hydrological conditions during individual years can result in specific changes under individual alternatives. For example, during extreme droughts such as in the 1930s and during peak flow events such as the spring and summer of 2011, rules would prevent flow releases under Alternatives 1, 2, 4, 5, and 6 to avoid a potential worsening of the effects of these extreme conditions.

Specifically, the figures superimpose all six alternatives; they include the following:

- Percentiles of the elevations for the upper four reservoirs (Figures D-2 to D-5).
- Percentiles of stage and flow, as well as maximum flows, at Bismarck, ND (Figures D-6 to D-8).

[1] It is noted that the analysis is limited to an 82-year period of record. Consequently, the number of years with flow conditions that would trigger releases under the various action alternatives is limited and statistically small. The limited data set necessitates monitoring of impacts under any implemented action alternative, as well as adaptive management.

[2] It is noted that flows and stages presented in this analysis are not observed data. All simulated results are corrected to reflect the 2012 level of water development, commonly referred to as depletions. Depletions to streamflow result from evaporation on System and tributary reservoirs, irrigation, implementation of Tribal water rights, conservation practices in the basin, and development of the multitude of stock and farm ponds. Reservoir stages and releases are from model simulations using the depletion corrected inflow. Therefore, while the flows and stages determined for alternatives can be compared to each other, it is not possible to compare to observed data.

- Percentiles of flow at Gavins Point Dam, SD; Sioux City, IA; Omaha, NE; Nebraska City, NE; and Kansas City, MO (Figures D-9 to D-13).
- Percentiles of stage at Sioux City, IA; Omaha, NE; Nebraska City, NE; and Kansas City, MO (Figures D-14 to D-17).
- Percentiles of flow, as well as maximum and minimum flow at St. Louis, MO, downstream of the confluence with the Missouri River.

It is noted that flows and stages presented in this analysis are not observed data. All results are corrected to reflect the 2012 level of water development, commonly referred to as depletions. Reservoir stages and releases are from model simulations using the depletion corrected inflow. Therefore, while the flow and stage determined for alternatives can be compared to each other, it is not possible to compare to observed data.

For the Missouri River, the analysis of Figure D-2 to D-17 is provided in section “Impacts to Hydrology from All Alternatives” within EIS Section 3.2.2.2. For the Mississippi River (St. Louis Station), the analysis of Figure D-18 and D-19 is provided in Chapter 3.0, Section 3.24.

None of the proposed management actions would change the total volume of water transported through the river System over the long term. However, the timing of flow releases and flow rates would be altered and some dominant peak flows may be introduced by high releases, which would affect geomorphological processes in the river, groundwater elevations, and riverine infrastructure. Similarly, the overall fluctuations in elevation in the upper three reservoirs are dominated by natural precipitation and snow melt patterns. However, flow releases under the proposed action would add fluctuations in the reservoir elevations; these added fluctuations could increase shoreline erosion as a result of the wetting and drying cycle.

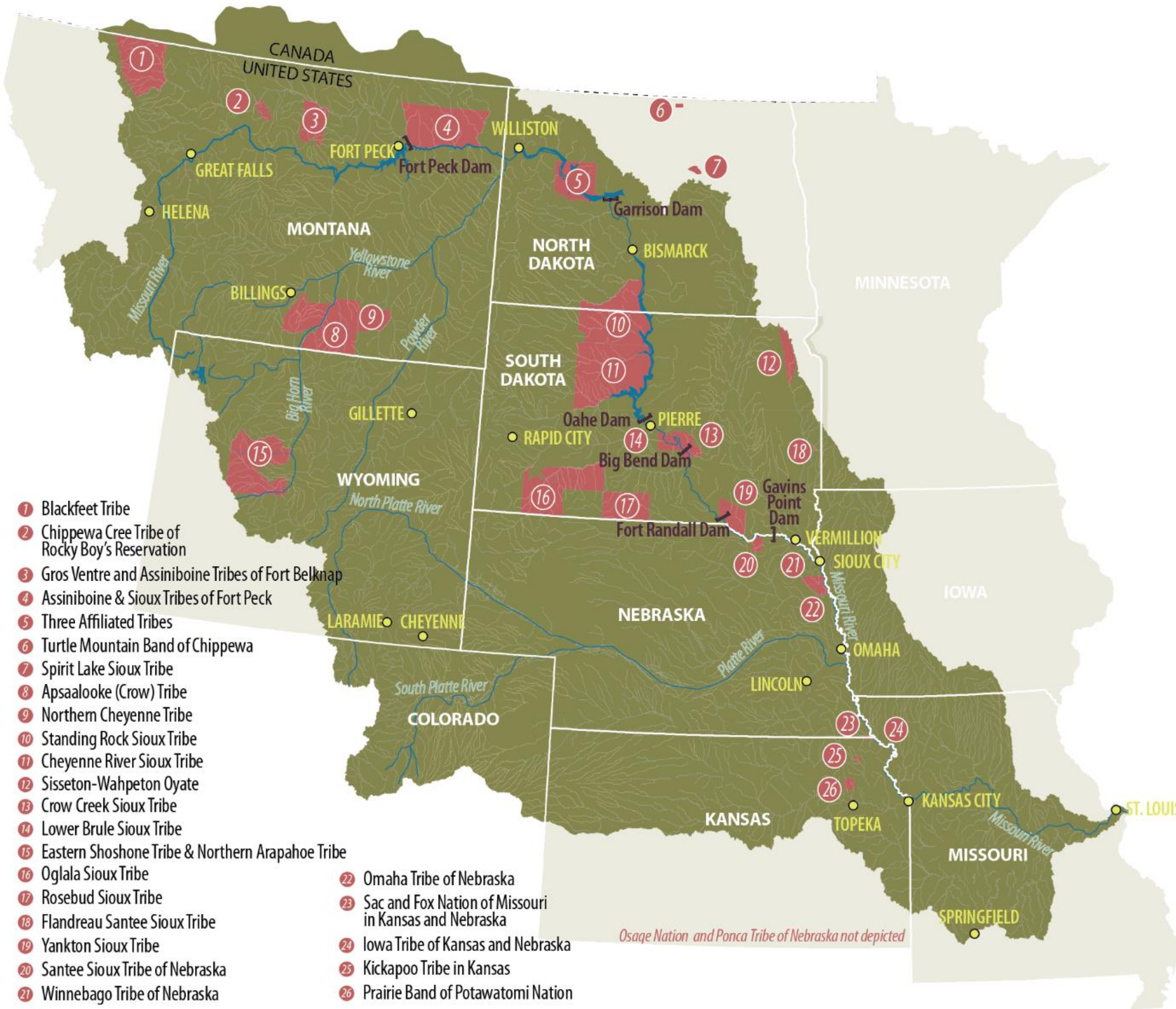


Figure D-1. Missouri River Basin, including Mainstem System Dams and Reservoirs, Tributaries, and Larger Communities

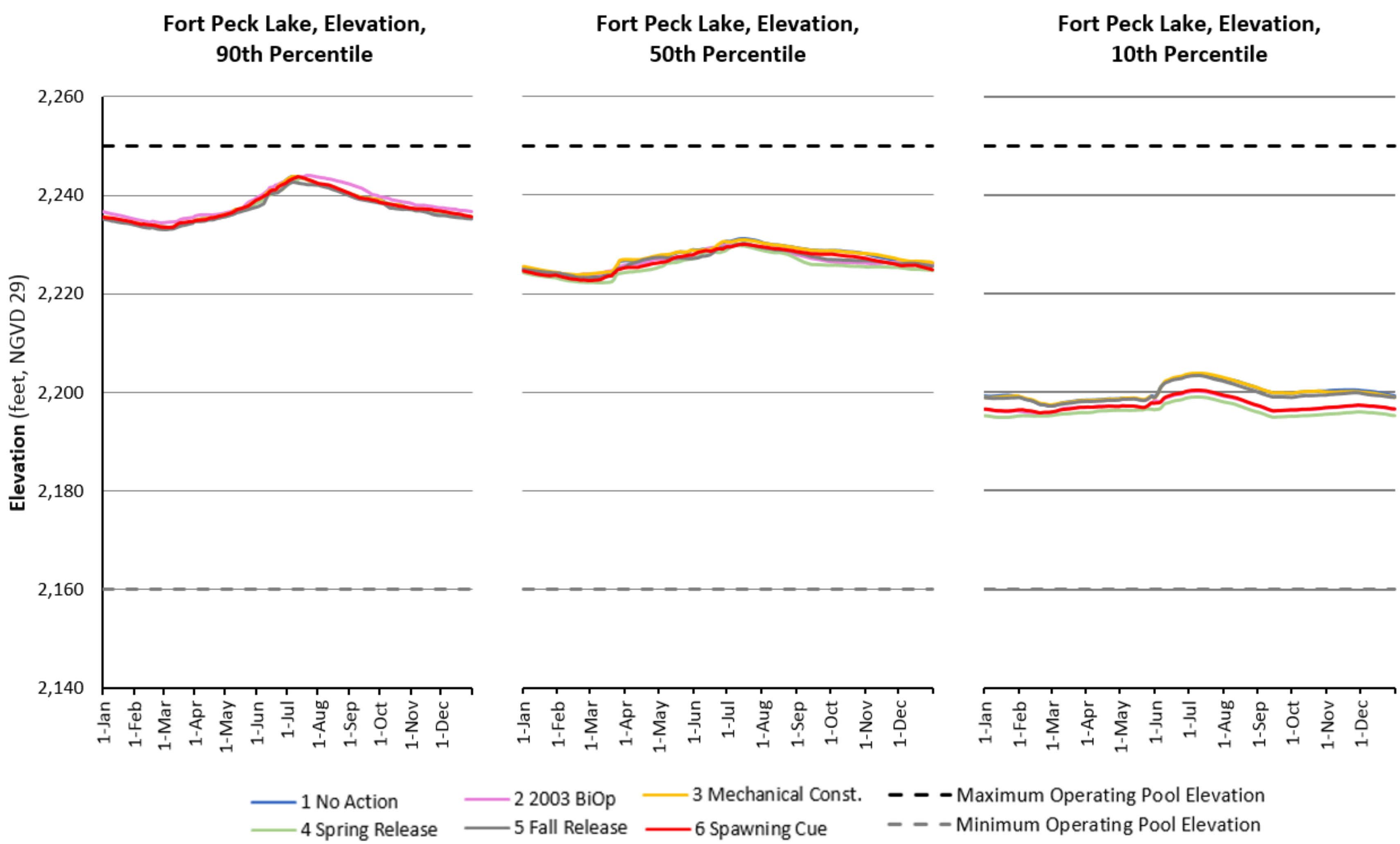


Figure D-2. Elevations in Fort Peck Lake under Alternatives 1 to 6 over the Period of Record (90th, 50th, and 10th percentiles)

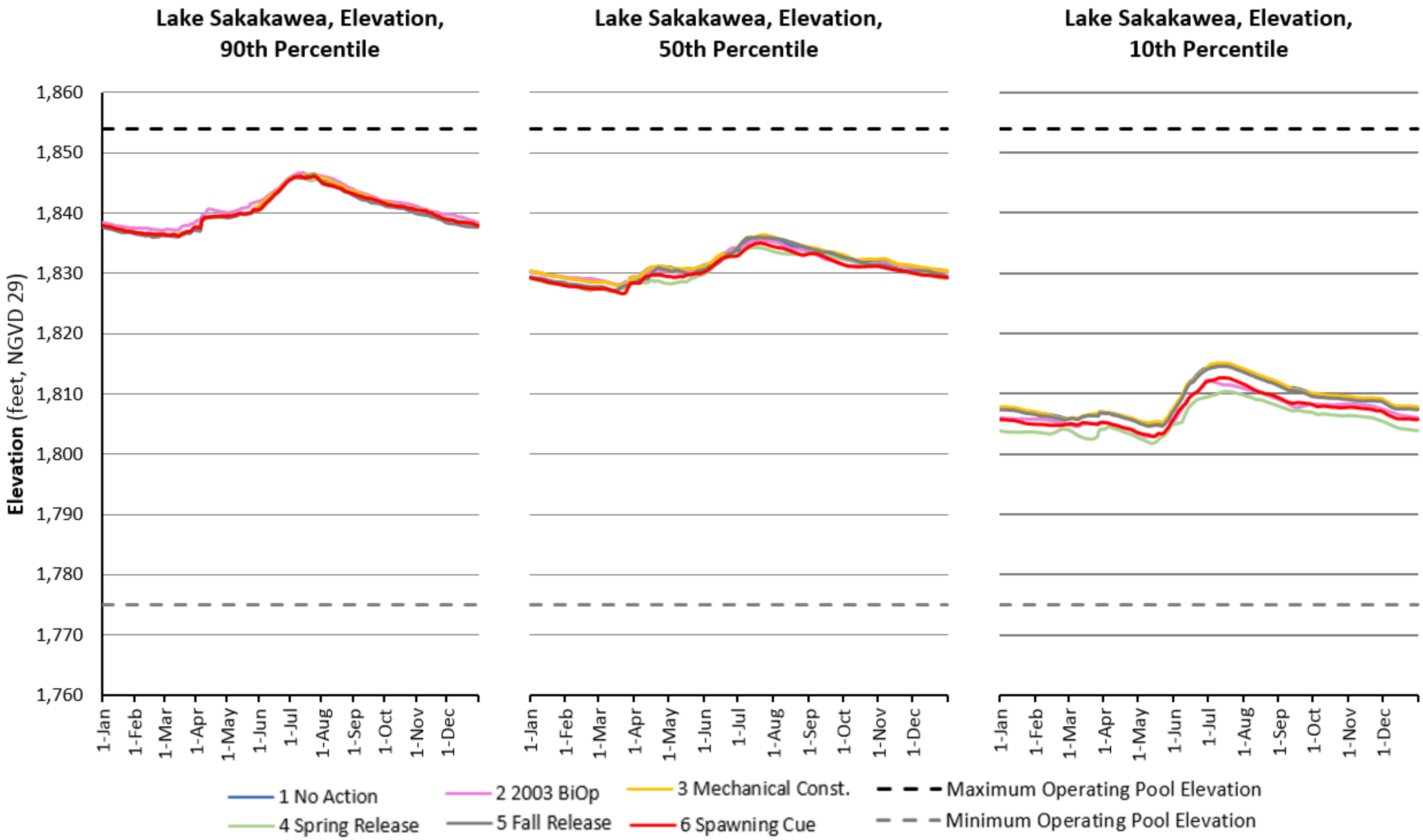


Figure D-3. Elevations in Lake Sakakawea under Alternatives 1 to 6 over the Period of Record (90th, 50th, and 10th percentiles)

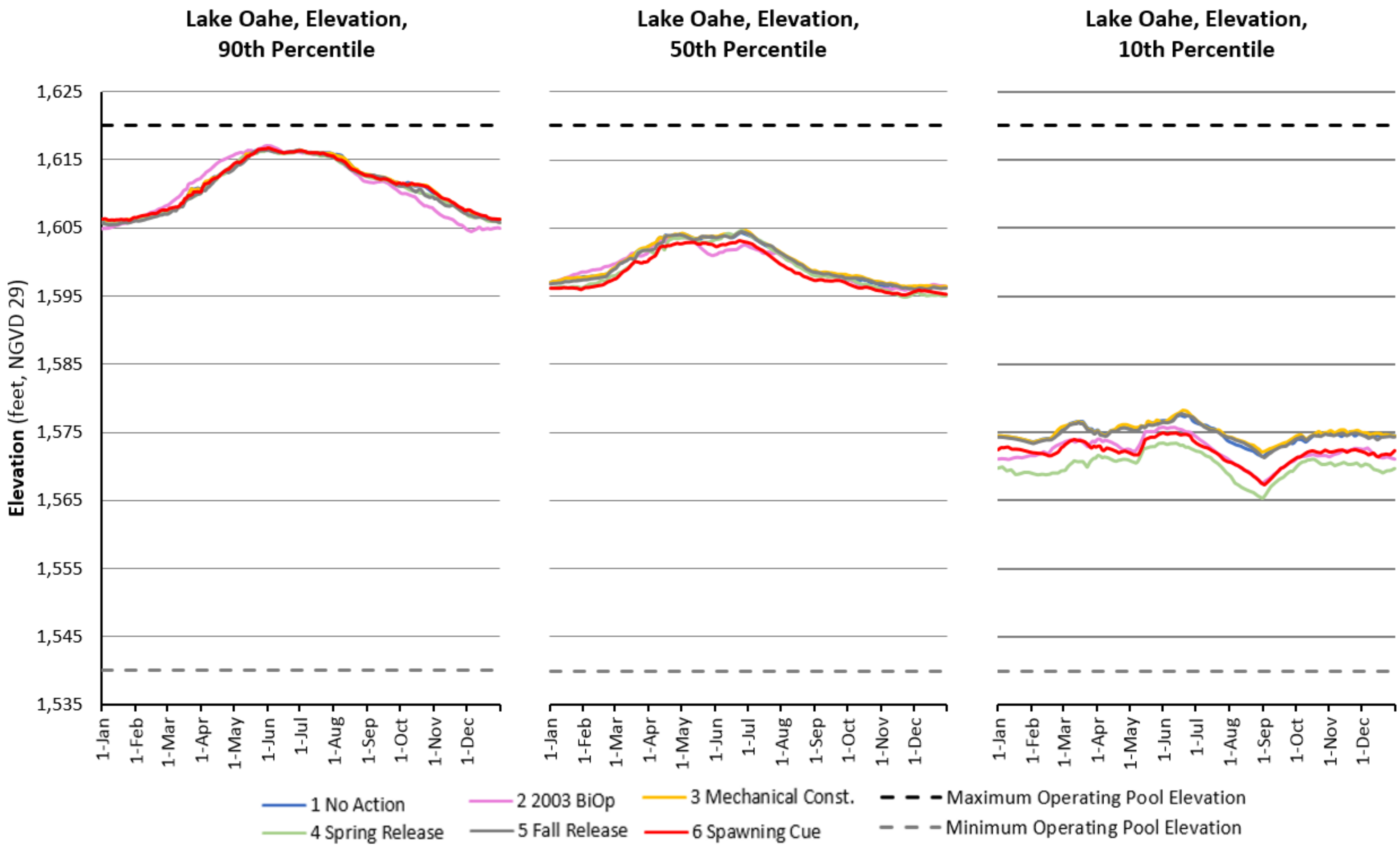


Figure D-4. Elevations in Lake Oahe under Alternatives 1 to 6 over the Period of Record (90th, 50th, and 10th percentiles)

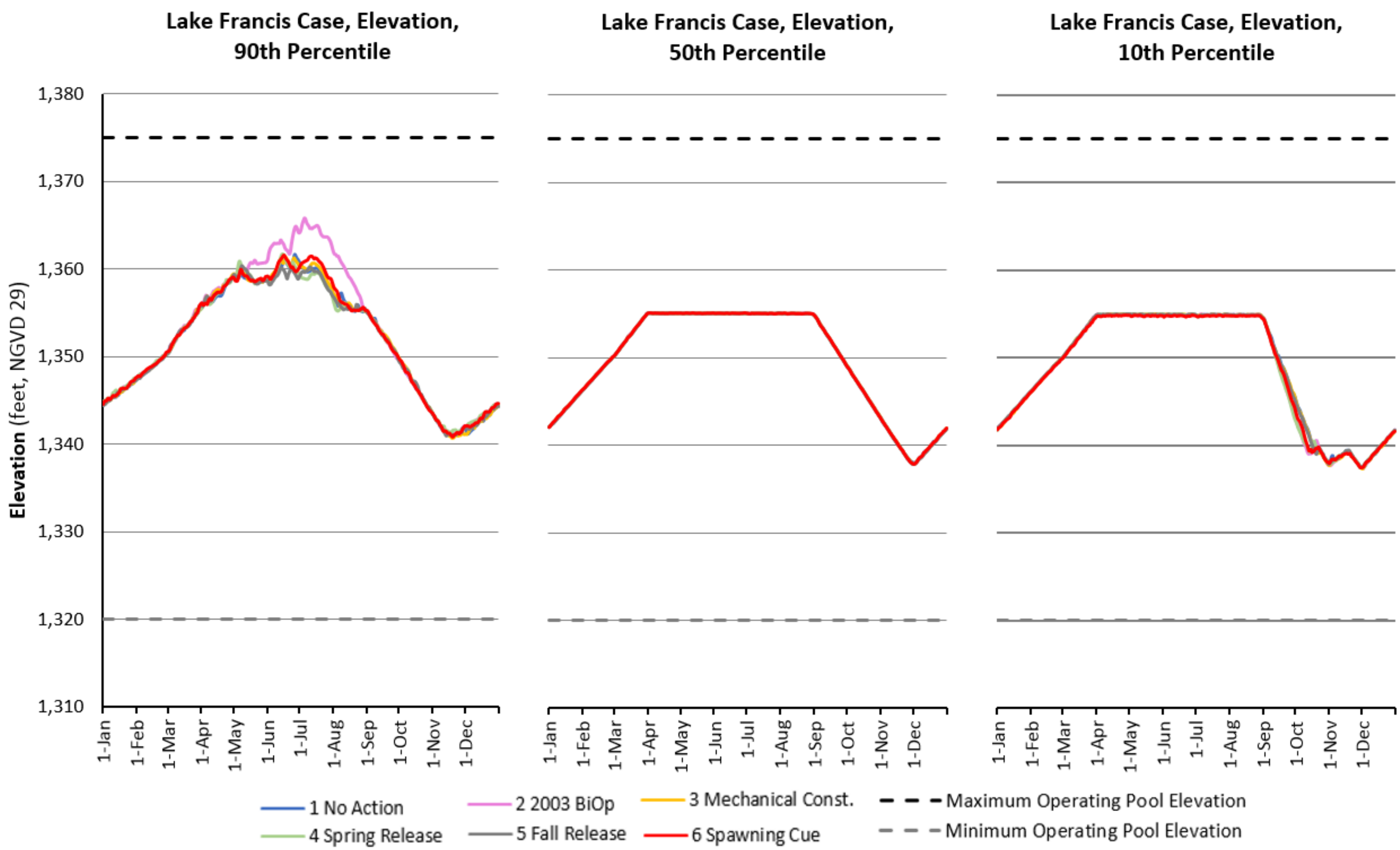


Figure D-5. Elevations in Lake Francis Case under Alternatives 1 to 6 over the Period of Record (90th, 50th, and 10th percentiles)

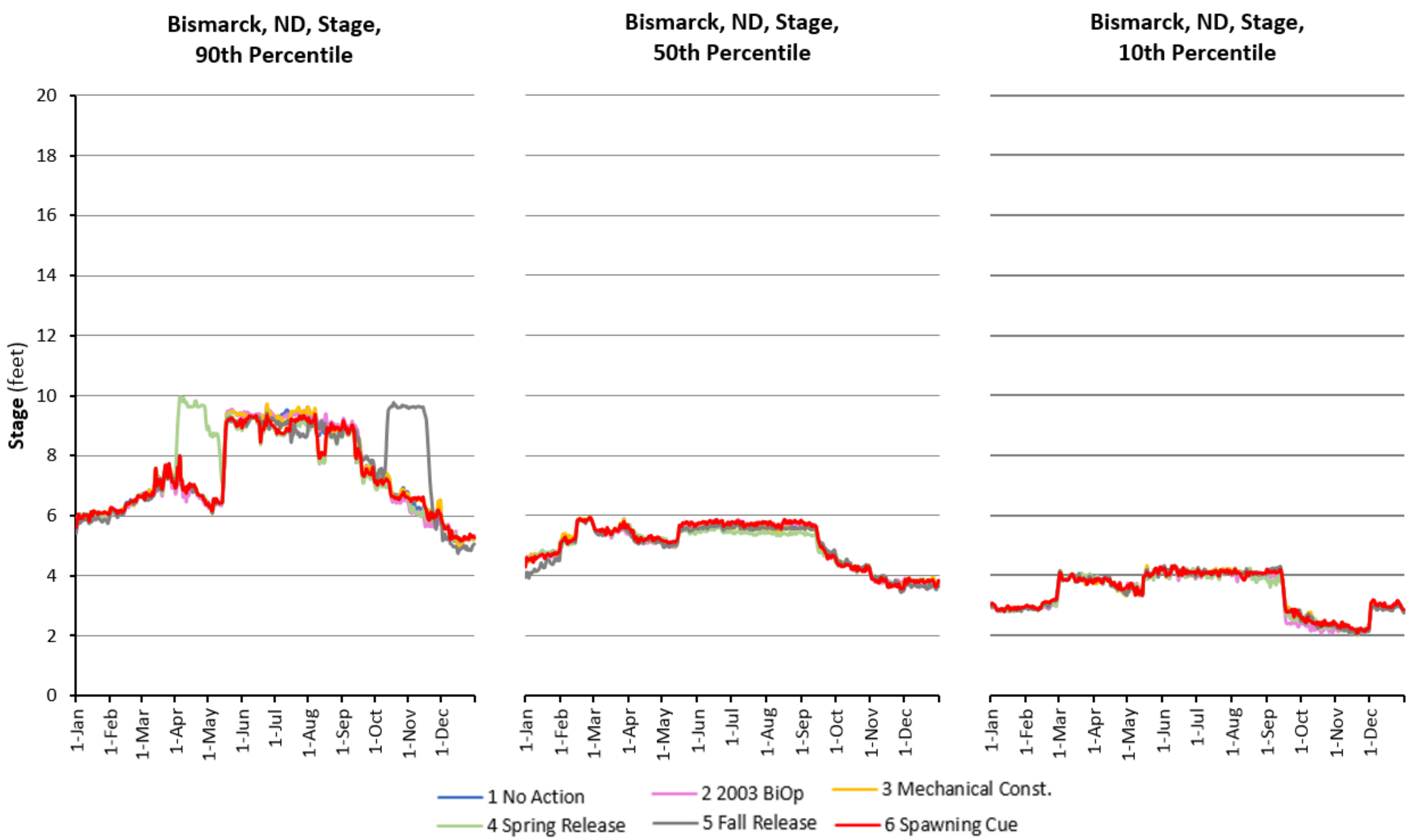


Figure D-6. Stage of the Missouri River at Bismarck, North Dakota, under Alternatives 1 to 6 over the Period of Record (90th, 50th, and 10th percentiles)

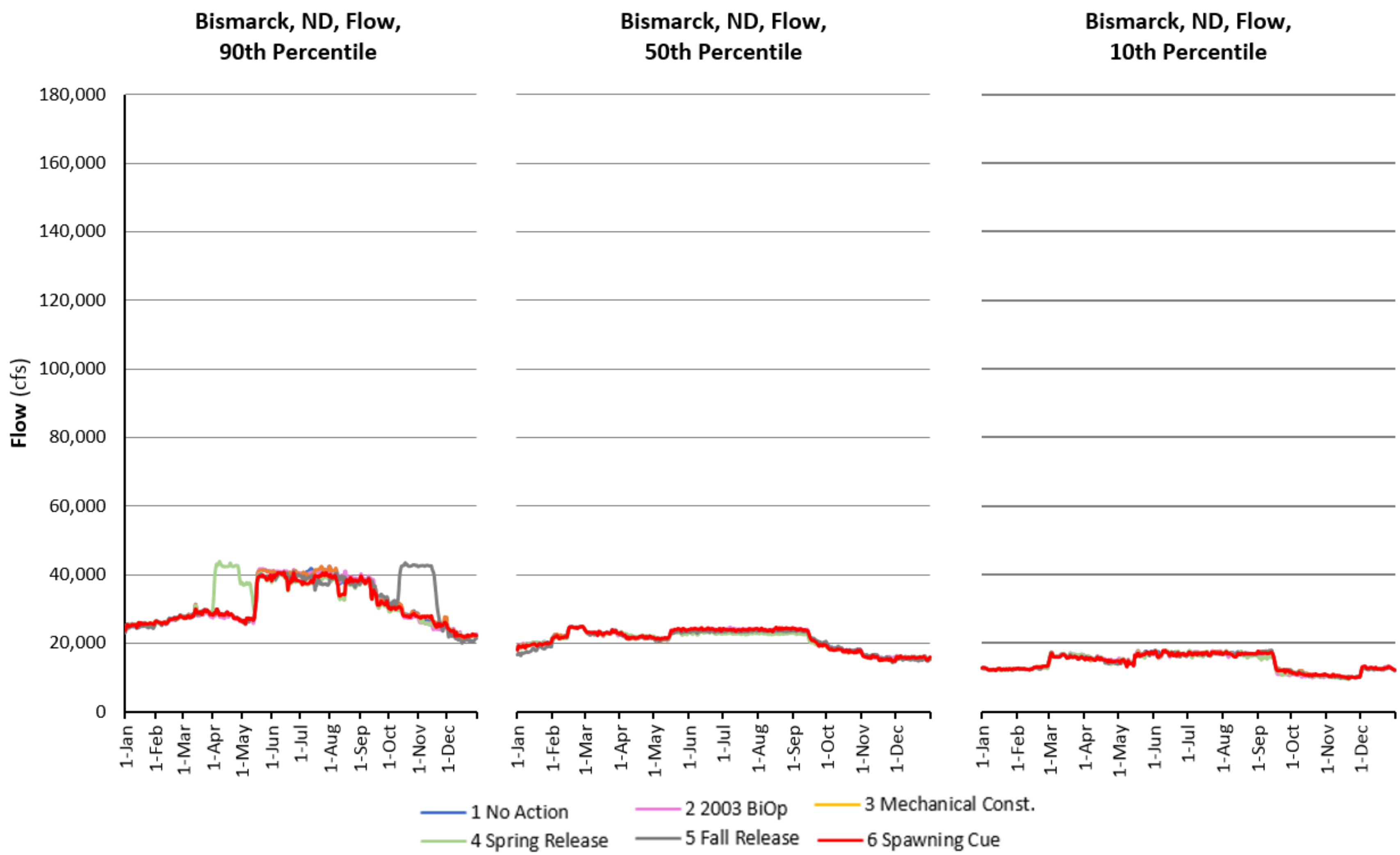
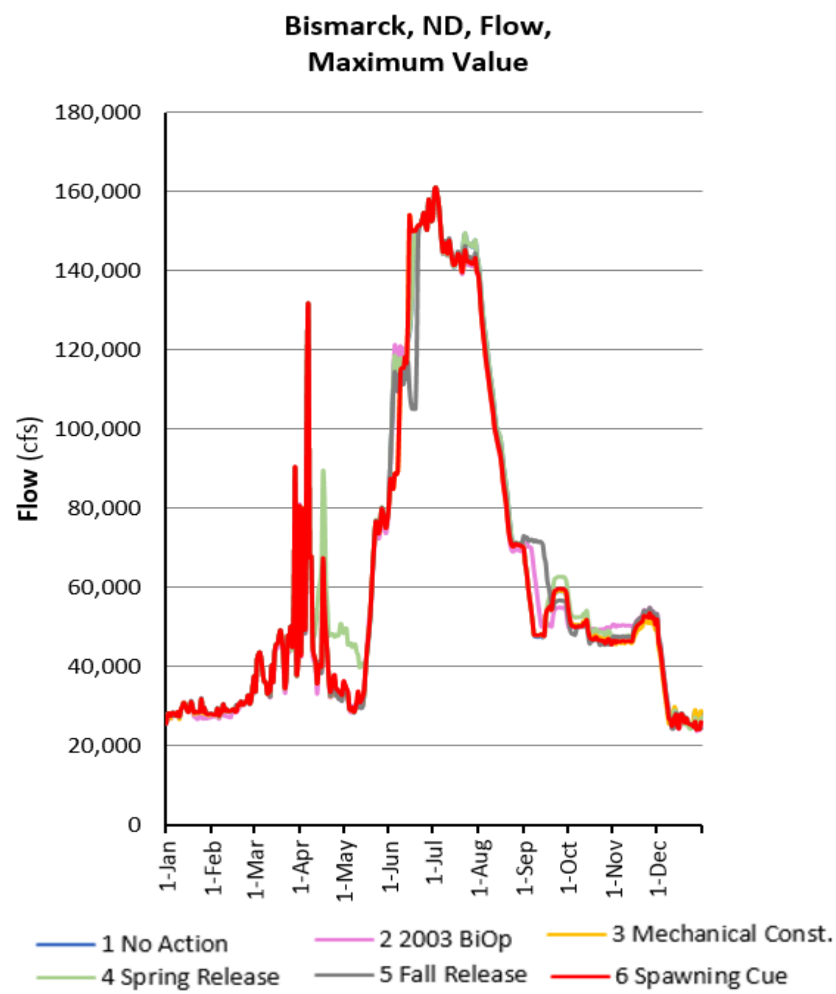


Figure D-7. Flows of the Missouri River at Bismarck, North Dakota, under Alternatives 1 to 6 over the Period of Record (90th, 50th, and 10th percentiles)

1 

2 Note: The peak flows from late spring to summer are a result of the flood of 2011.

3 **Figure D-8. Maximum Flows of the Missouri River at Bismarck, North Dakota, under Alternatives 1 to 6 over the Period of Record**

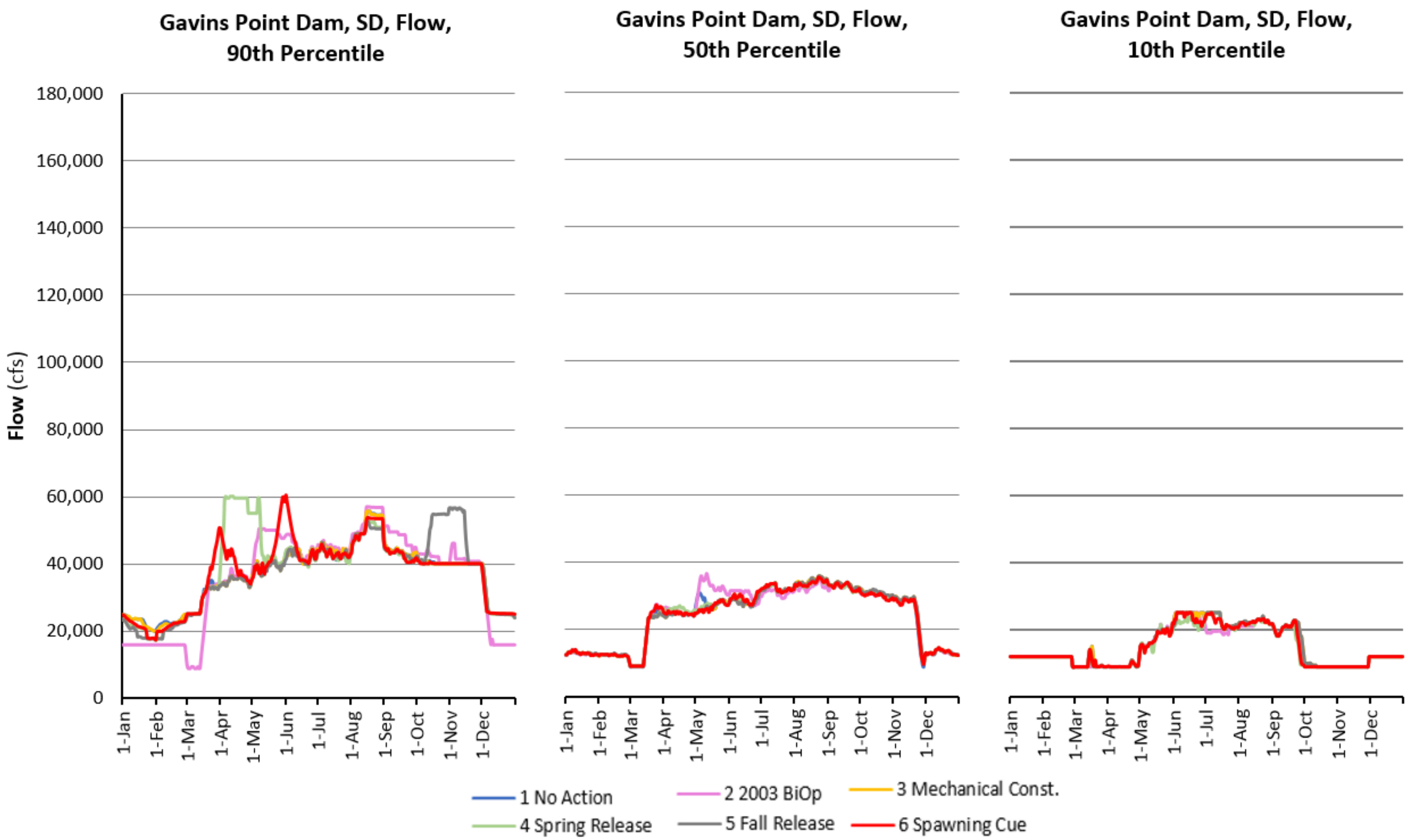
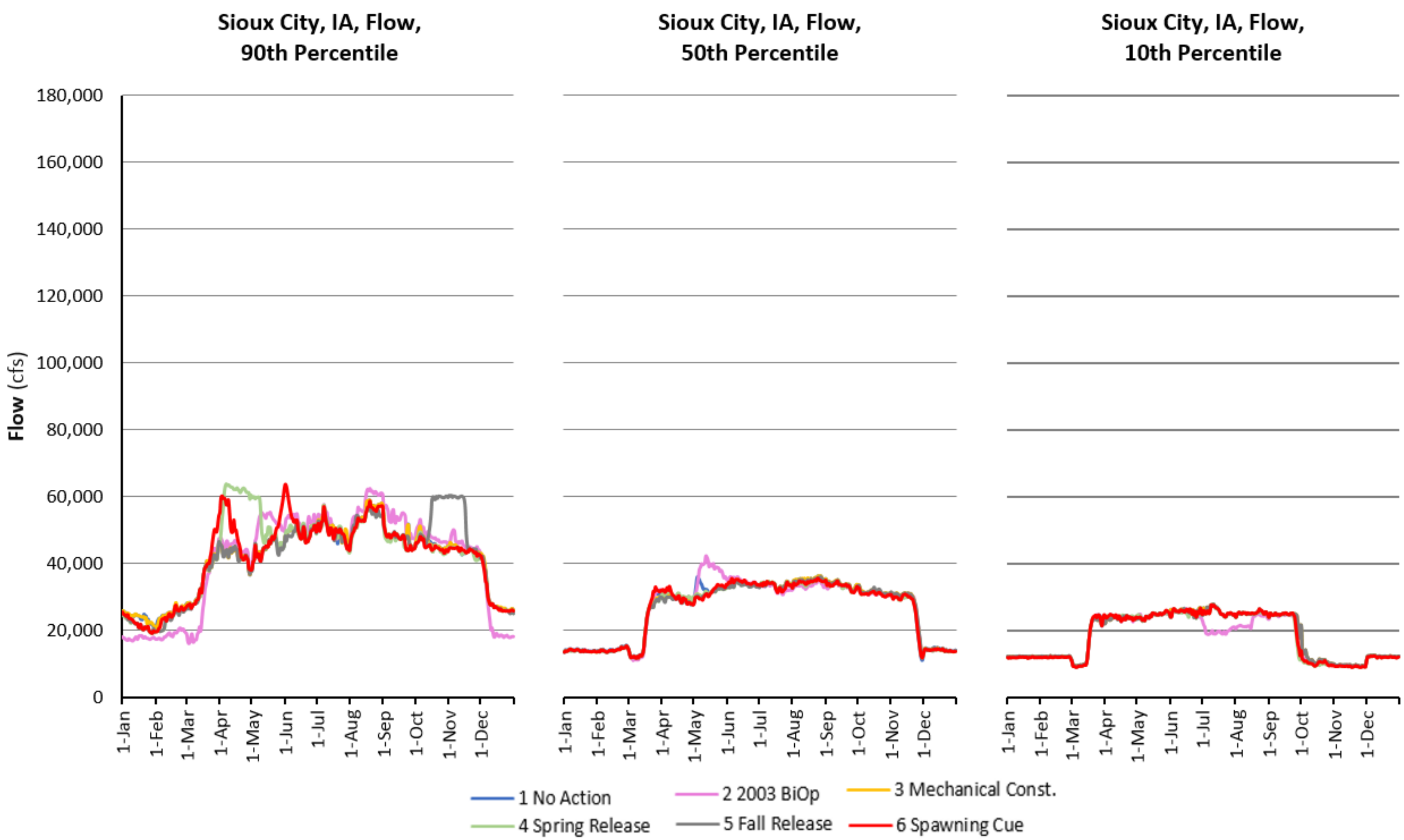


Figure D-9. Flows of the Missouri River at Gavins Point Dam under Alternatives 1 to 6 over the Period of Record (90th, 50th, and 10th percentiles)



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2 **Figure D-10. Flows of the Missouri River at Sioux City, Iowa, under Alternatives 1 to 6 over the Period of Record**
3 **(90th, 50th, and 10th percentiles)**

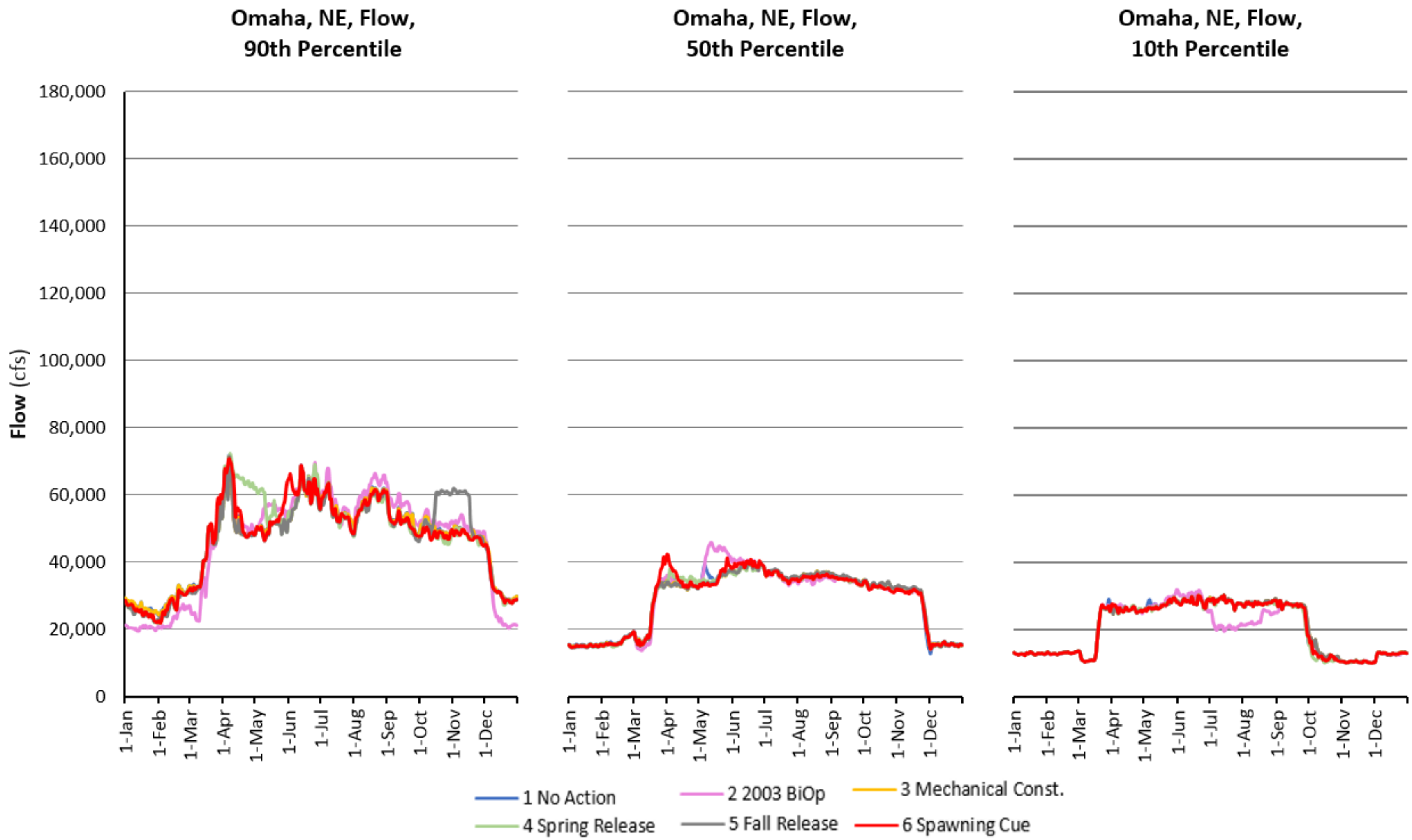
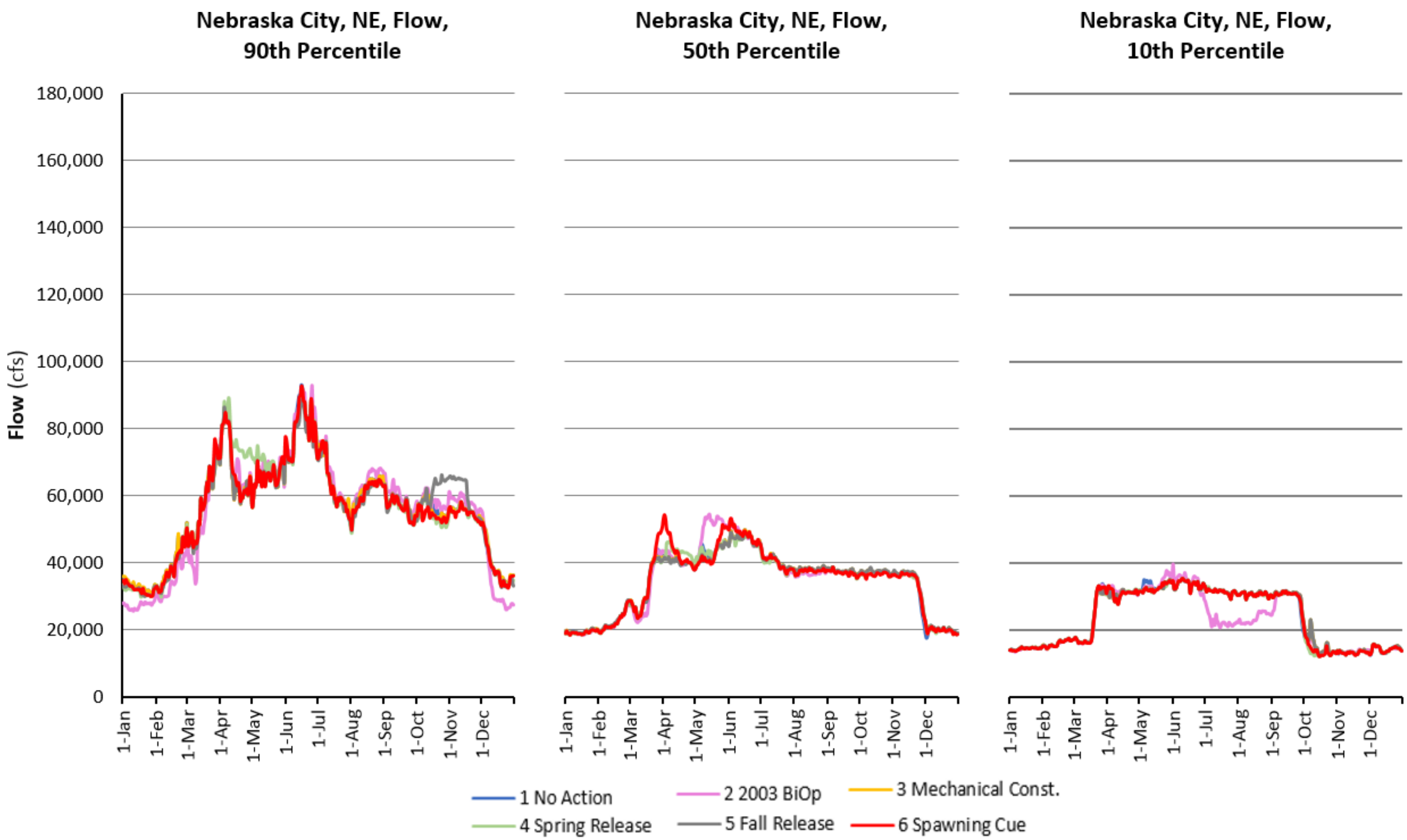


Figure D-11. Flows of the Missouri River at Omaha, Nebraska, under Alternatives 1 to 6 over the Period of Record (90th, 50th, and 10th percentiles)



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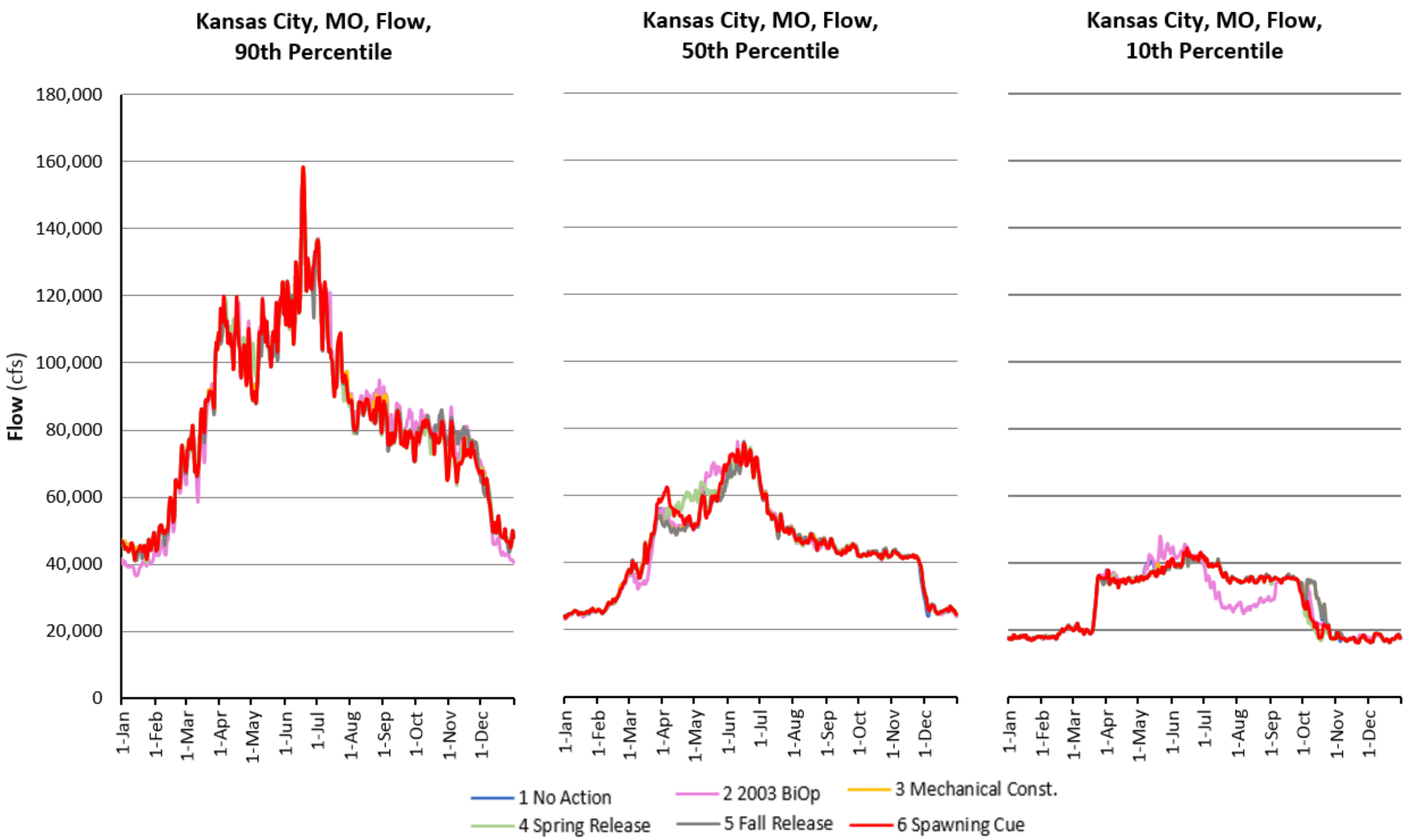
2 **Figure D-12. Flows of the Missouri River at Nebraska City, Nebraska, under Alternatives 1 to 6 over the Period of Record**
3 **(90th, 50th, and 10th percentiles)**



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2 **Figure D-13. Flows of the Missouri River at Kansas City, Missouri, under Alternatives 1 to 6 over the Period of Record**
3 **(90th, 50th, and 10th percentiles)**

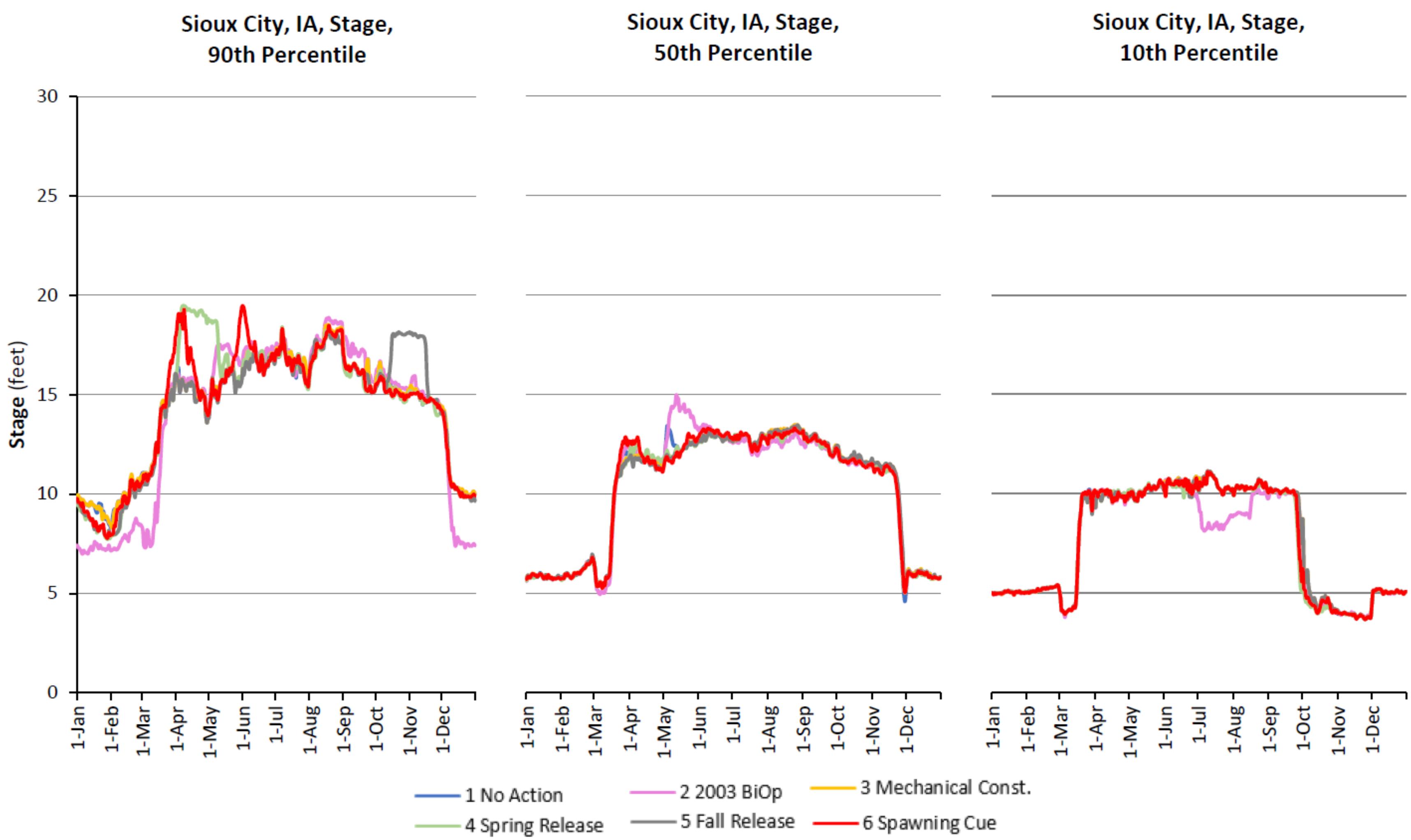


Figure D-14. Stage of the Missouri River at Sioux City, Iowa, under Alternatives 1 to 6 over the Period of Record (90th, 50th, and 10th percentiles)

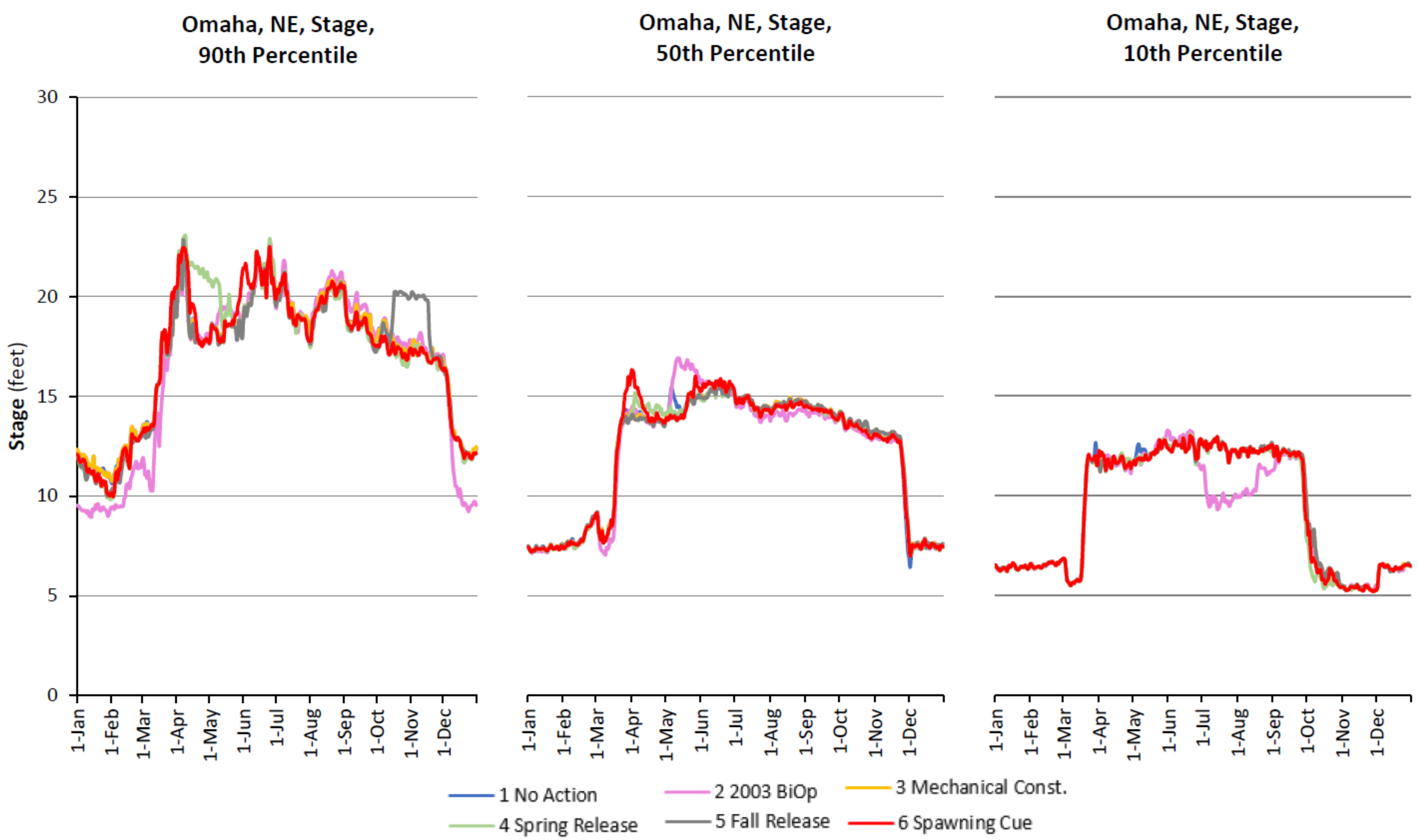


Figure D-15. Stage of the Missouri River at Omaha, Nebraska, under Alternatives 1 to 6 over the Period of Record (90th, 50th, and 10th percentiles)

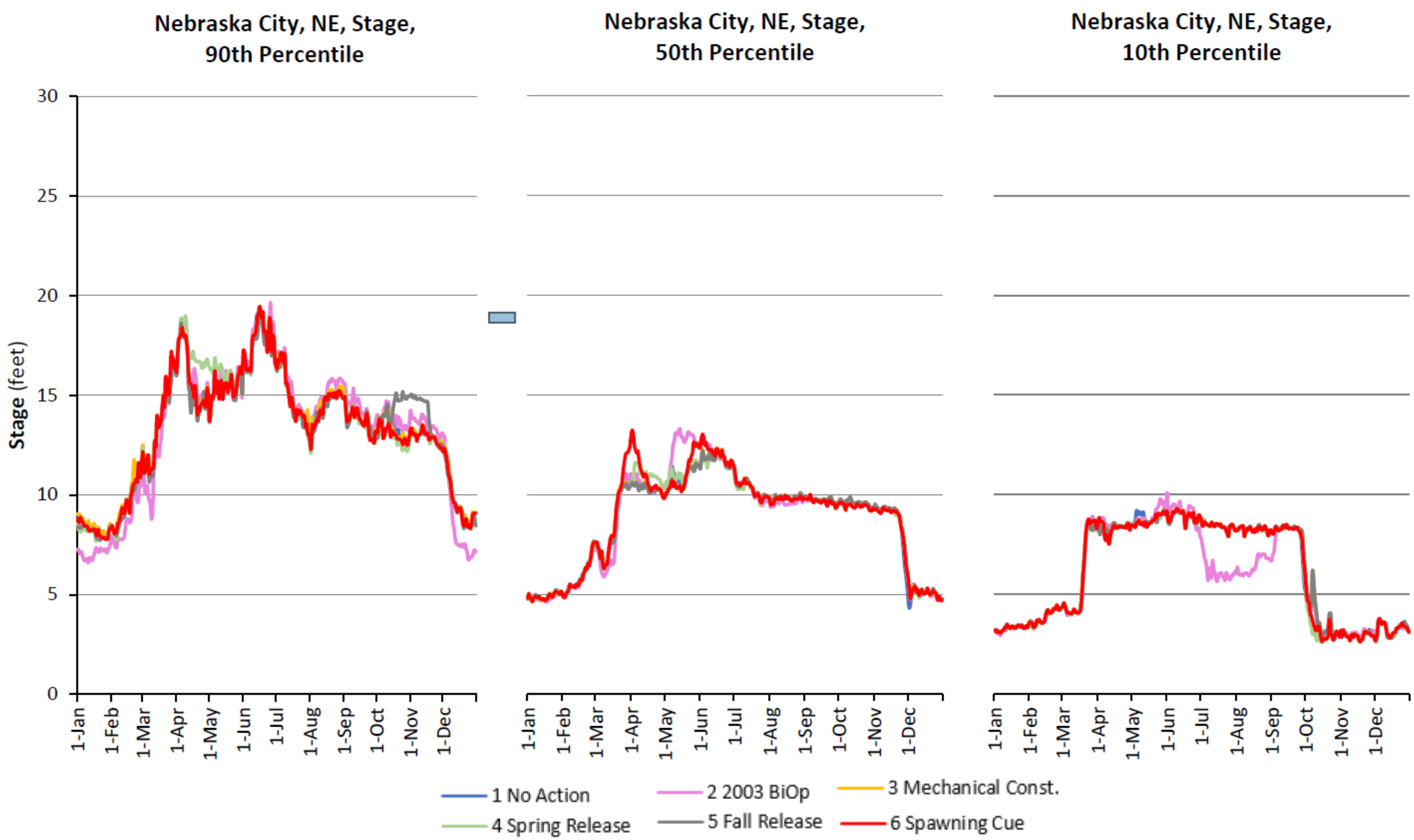


Figure D-16. Stage of the Missouri River at Nebraska City, Nebraska, under Alternatives 1 to 6 over the Period of Record (90th, 50th, and 10th percentiles)

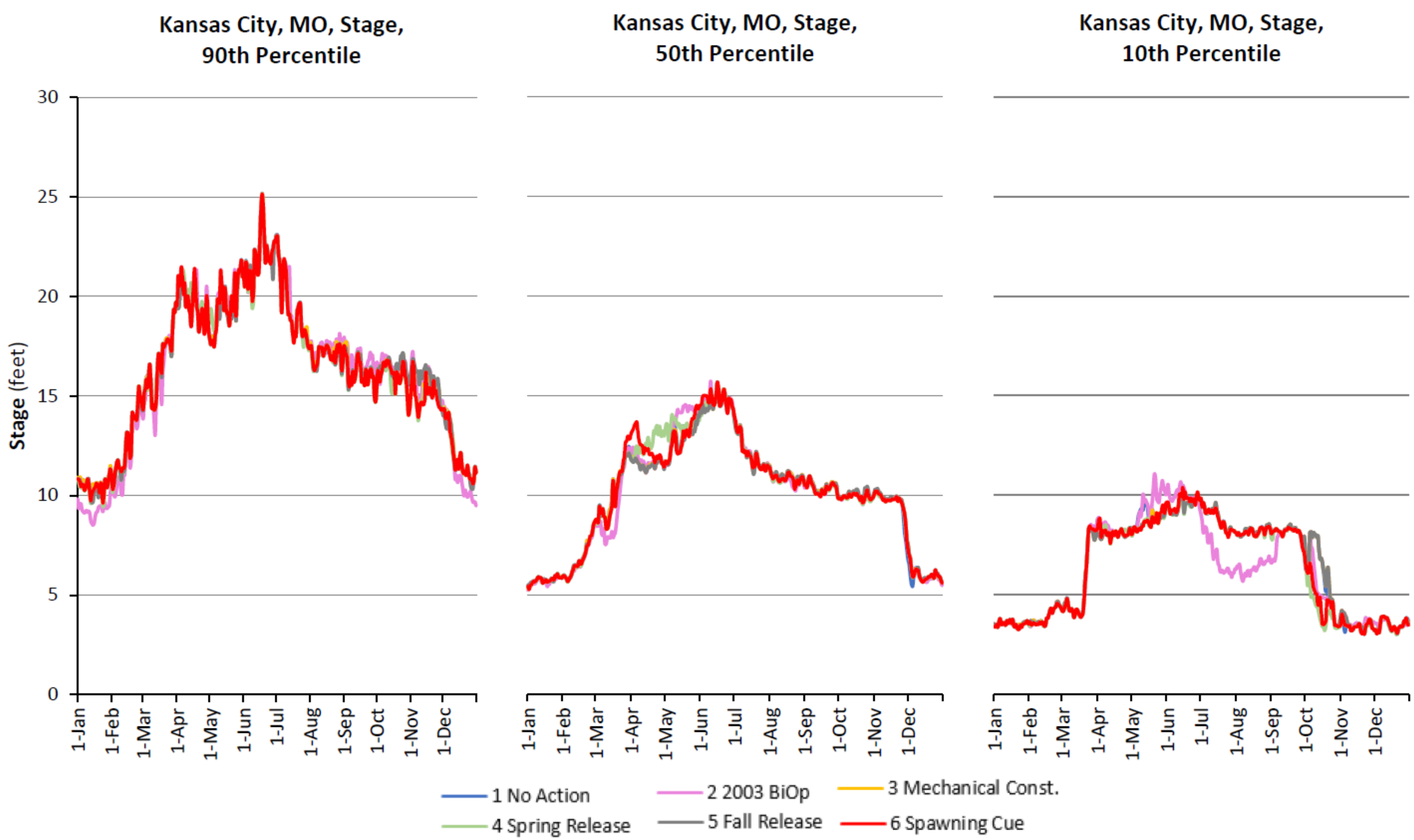
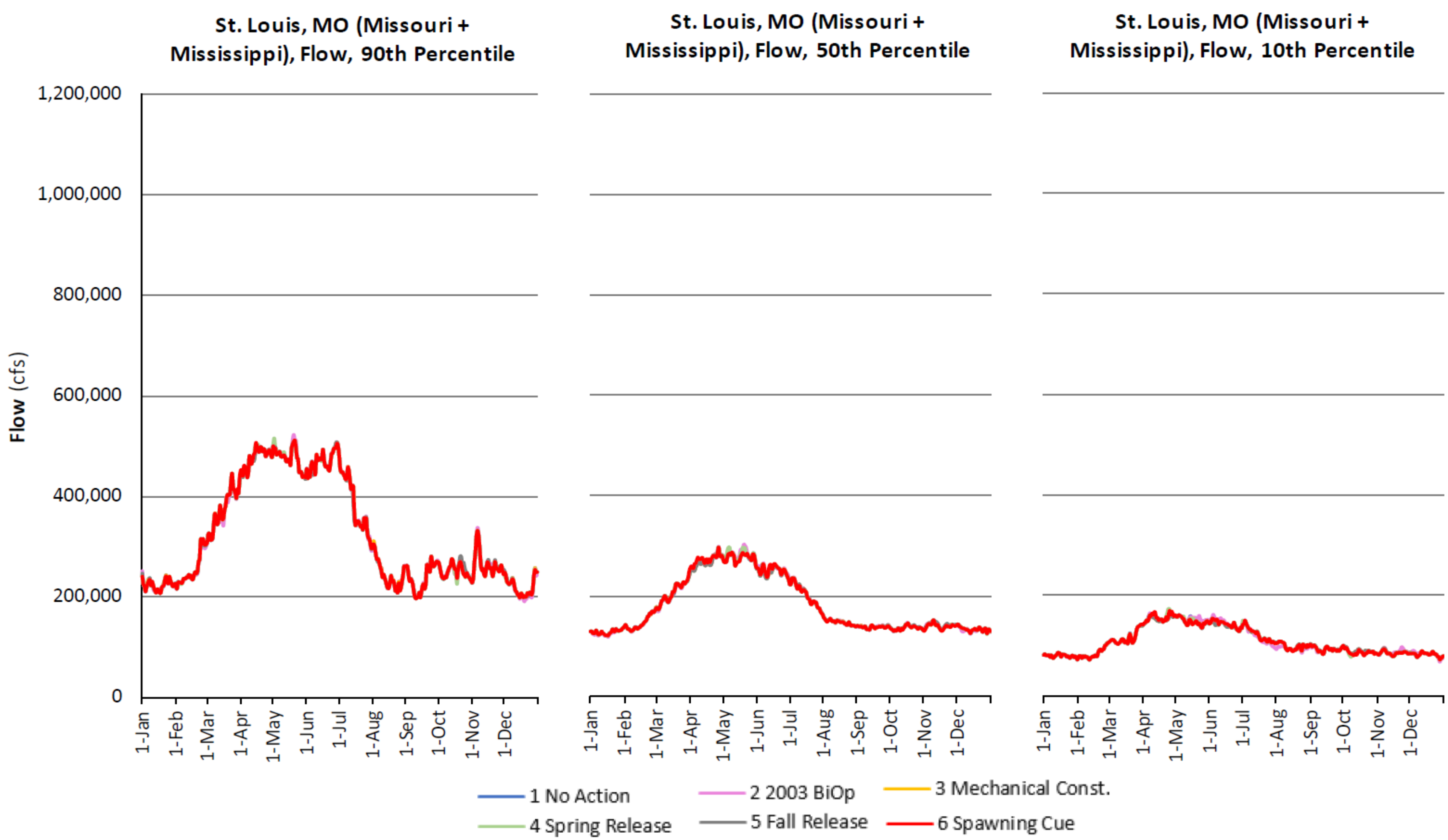


Figure D-17. Stage of the Missouri River at Kansas City, Missouri, under Alternatives 1 to 6 over the Period of Record (90th, 50th, and 10th percentiles)



1

2 **Figure D-18. Flows of the Mississippi River (downstream of the confluence with the Missouri River) at St. Louis, Missouri, under**
3 **Alternatives 1 to 6 over the Period of Record**
4 **(90th, 50th, and 10th percentiles)**

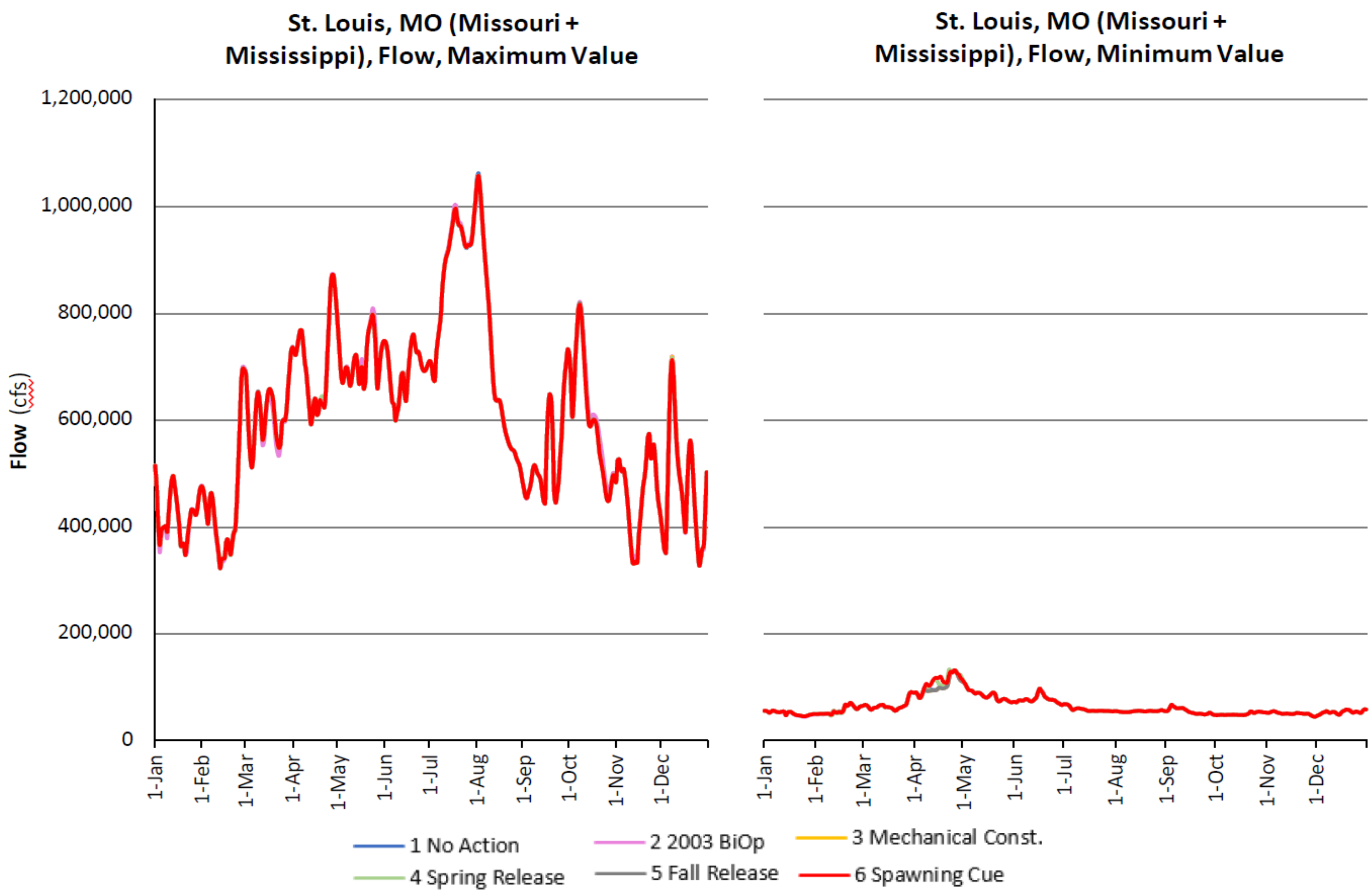


Figure D-19. Flows of the Mississippi River (downstream of the confluence with the Missouri River) at St. Louis City, Missouri, under Alternatives 1 to 6 over the Period of Record for Maximum and Minimum Conditions

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APPENDIX E: OTHER SPECIAL-STATUS SPECIES

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Appendix E: Other Special-Status Species

Table E-1 lists other special status species known to occur or may occur within the geographic scope of the EIS. Each species is listed by common name and scientific name along with their federal and state statuses. Habitat associations and river reaches in which each species holds a special status designation are provided along with anticipated impacts under each alternative. Impacts are not expected to differ significantly among alternatives. All of the alternatives are expected to have long-term beneficial impacts on fish and wildlife from the addition of lost terrestrial and aquatic habitat. Adverse impacts would primarily consist of short-term construction related impacts. Additional environmental analyses will be completed for site-specific management actions before they are implemented.

The criteria for identifying species and how these species are organized vary from state to state. A description of how each state designates and classifies special status species is provided below.

Montana

Montana does not have a state endangered or threatened species list. However, the Montana Natural Heritage Program maintains a list of Species of Concern for native animals and plants that are considered to be "at risk" due to declining population trends, threats to their habitats, and/or restricted distribution (MTNHP 2016a, 2016b). Designation as a Species of Concern is not a statutory or regulatory classification. Conservation measures for many Montana species of concern are outlined in the State Wildlife Action Plan (MDFWP 2015).

Montana uses a standardized ranking system employed by the international network of natural heritage programs to denote state status for Species of Concern. Species are assigned numeric ranks ranging from 1 (highest risk, greatest concern) to 5 (demonstrably secure, least concern), reflecting the relative degree of risk to the species viability, based upon available information (MTNHP 2016b). “S” indicates that the ranking is at the state level (as opposed to global rankings), “B” indicates that the ranking applies only to breeding populations, “M” indicates that the species is only present in Montana during migrations, and “H” denotes historical populations. One species (red knot) has a ranking of “SNA,” which indicates that a state rank is not applicable, because of a lack of information on its migratory stopover use of Montana wetlands. However it is still considered a special status species in Montana due its federal status under ESA.

North Dakota

North Dakota does not have a state endangered or threatened species list. Only those species listed by the ESA are considered threatened or endangered in North Dakota. North Dakota has a Wildlife Action Plan that focuses on species that are considered species of conservation priority. Information relating to the distribution, abundance, habitat requirements, threats, management goals and monitoring techniques for each of these species is included in the Wildlife Action Plan (NDGF 2012). The species are categorized into three levels as described below.

- **Level I**: These species are in decline and receive little or no monetary support or conservation efforts. North Dakota Game and Fish Department has a clear obligation to use state wildlife grants funding to implement conservation actions that directly benefit these species. Level I species have a high level of conservation priority because of declining status across their range or high rate of occurrence in North Dakota constituting the core of the species breeding range.

- **Level II**: North Dakota Game and Fish Department will use state wildlife grants to implement conservation actions to benefit these species if funding for Level I species is sufficient or conservation needs have been met. Level II species have a moderate level of conservation priority or high level of conservation priority but a substantial level of non-state funding available to them
- **Level III**: These are North Dakota species having a moderate level of conservation priority but are believed to be peripheral or nonbreeding in North Dakota (NDGF 2012).

South Dakota

The South Dakota Game, Fish and Parks maintains a list of state-designated threatened and endangered species which are separate from federally-listed species. This list is reviewed and updated biannually. State-level designations for threatened and endangered species are also used to identify species in need of state wildlife grants funding (SDFGP 2016). Conservation measures for South Dakota state-listed species are outlined in the state wildlife action plan (SDDGFP 2014).

Nebraska

Nebraska Game and Parks maintains a list of state-designated threatened and endangered species in accordance with the Nebraska Nongame and Endangered Species Conservation Act (NGPC 2015). These species are separate from federally-listed species and represent a subset of species determined to be “at-risk” in Nebraska. Animals and plants are designated as endangered or threatened when their continued existence in Nebraska is in jeopardy. The Nebraska Game and Parks Commission develops state recovery plans which set forth measures to restore populations of these animals and plants to a more secure status (NGPC 2015). Conservation measures for state-listed species are also outlined in the Nebraska state wildlife action plan, developed in partnership with the Nebraska Natural Legacy Program (Schneider et al. 2011).

Iowa

Iowa maintains a list of state-designated threatened and endangered species, which are separate from federally listed species. Species are designated by the Iowa Department of Natural Resources, in accordance with Chapter 481B of the Iowa Administrative Code: Endangered Plants and Wildlife. The designation of endangered is given to any species of fish, plant life, or wildlife in danger of extinction throughout all or a significant part of its range. The designation of threatened is given to any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, and both designations are protected by law (IAC 2009). Additionally, the Iowa Wildlife Action Plan is a 25-year proactive strategy designed to facilitate recovery of listed species and conserve other wildlife species in Iowa, before special status designations become necessary (IDNR 2015).

Kansas

The Kansas Department of Wildlife, Parks and Tourism maintains a list of state-level threatened and endangered species in accordance with the Kansas Nongame and Endangered Species Conservation Act of 1975 (KWPT 2015). State-designated threatened and endangered species statuses are reviewed on five-year intervals and recovery plans are developed to facilitate recovery of listed species. The Kansas Wildlife Action Plan also outlines measures to conserve state-listed species and is used to appropriately allocate conservation funding (Rohweder 2015).

Missouri

The Missouri Department of Conservation maintains a list of state-designated threatened and endangered species in accordance with the Missouri State Endangered Species Law 252.240 (MDC 2016). Conservation measures for state-listed species are also outlined in the Missouri State Wildlife Action Plan (MDC 2015).

Table E-1. Adverse Impacts of Alternatives 1–6 on Other Special Status Species

R1 = Fort Peck Lake to Garrison Dam; R2 = Garrison Dam to Oahe Lake; R3 = Fort Randall Dame to Gavins Point Dam; R4 = Gavins Point Dam to Rulo; R5 = Rulo to Kansas River; R6 = Kansas River to Grand River; R7 = Grand River to Osage River; R8 = Osage River to Mississippi River

Common Name	Scientific Name	Federal Status	State Rank							Habitat Association(s)	Reach	Adverse Impacts from Alternatives 1–6
			MT	ND	SD	NE	IA	KS	MO			
Plants												
American Ginseng	*Panax quinquefolius*					T				Forest	R3, R4	No impact
Annual Skeletonweed	*Shinnersoseris rostrata*						E			Upland grassland/prairie	R4	No impact
Black Chokeberry	*Aronia melanocarpa*						E			Scrub shrub wetland; Riparian wetland/forested wetland	R4	negligible short-term adverse impacts
Bog Clubmoss	*Lycopodium inundatum*						E			Emergent wetland; Forested wetland	R4	negligible short-term adverse impacts
Cordroot Sedge	*Carex chordorrhiza*						E			Emergent wetland; Forested wetland	R4	negligible short-term adverse impacts
Decurrent False Aster	*Boltonia decurrens*	T								Emergent wetland; Upland grassland/prairies	R8	negligible short-term adverse impacts
Eastern Prairie Fringed Orchid	*Platanthera leucophaea*	T					E		E	Emergent wetland; Upland grassland/prairie	R4, R5, R6, R7, R8	negligible short-term adverse impacts
Geyer's Milkvetch	*Astragalus geyeri*		S2							Upland grassland/prairie	R1	negligible short-term adverse impacts
Heavy Sedge	*Carex gravida*		S3							Upland grassland/prairie	R1	negligible short-term adverse impacts

Common Name	Scientific Name	Federal Status	State Rank							Habitat Association(s)	Reach	Adverse Impacts from Alternatives 1–6
			MT	ND	SD	NE	IA	KS	MO			
Nannyberry	*Viburnum lentago*		S2S3							Upland grassland/prairie; Forest	R1	negligible short-term adverse impacts
Persistent-Sepal Yellow-cress	*Rorippa calycina*		SH							Emergent wetland; Riparian wetland; Upland grassland/prairie	R1	No impact
Prairie Bush-Clover	*Lespedeza leptostachya*	T					T			Upland grassland/prairie	R4	No impact
Roundleaf Water hyssop	*Bacopa rotundifolia*		S3							Emergent wetland; Riparian wetland	R1	No impact
Scarlet Ammannia	*Ammannia robusta*		S2							Emergent wetland	R1	No impact
Small White Lady's Slipper	*Cypripedium candidum*					T				Upland grassland/prairie; Emergent wetland	R3, R4	negligible short-term adverse impacts
Water-willow	*Justicia americana*						E			Emergent wetland; Open water;	R4	negligible short-term adverse impacts
Western Prairie Fringed Orchid	*Platanthera praeclara*	T				T			E	Upland grassland/prairie; Emergent wetland	R3, R4, R5, R6, R7, R8	negligible short-term adverse impacts
Whiskbroom Parsley	*Harbouria trachypleura*						E			Upland grassland/prairie	R4	No impact
Birds												
American Avocet	*Recurvirostra americana*			Level II						Open water; Emergent wetland	R1, R2	negligible short-term adverse impacts
American Bittern	*Botaurus lentiginosus*		S3B	Level I					E	Open water; Emergent wetland; Upland grassland/prairies	R1, R2, R4, R5, R6, R7, R8	negligible short-term adverse impacts

Common Name	Scientific Name	Federal Status	State Rank							Habitat Association(s)	Reach	Adverse Impacts from Alternatives 1–6
			MT	ND	SD	NE	IA	KS	MO			
American Dipper	*Cinclus mexicanus*				T					Open water; Riparian wetland/forested wetland	R2, R3, R4	negligible short-term adverse impacts
Bald Eagle	*Haliaeetus leucocephalus*			Level II						Forest; Riparian wetland; Open water	R1, R2	negligible short-term adverse impacts
Black Tern	*Chlidonias niger*		S3B	Level I						Open water; Emergent wetland; Upland grassland/prairie	R1, R2	negligible short-term adverse impacts
Bobolink	*Dolichonyx oryzivorus*		S3B	Level II						Upland grassland/prairies; emergent wetland	R1, R2	negligible short-term adverse impacts
Common Tern	*Sterna hirundo*		S3B							Emergent wetland; Open water; Upland grassland/prairie; Forest	R1	negligible short-term adverse impacts
Eskimo Curlew	*Numenius borealis*	E			E	E				Upland grassland/prairie; Emergent wetland	R2, R3, R4	negligible short-term adverse impacts
Forster's Tern	*Sterna forsteri*		S3B							Emergent wetland;	R1	No impact
Franklin's Gull	*Leucophaeus pipixcan*		S3B	Level I						Emergent wetland; Open water	R1, R2	negligible short-term adverse impacts
Golden Eagle	*Aquila chrysaetos*		S3	Level I						Upland grassland/prairie; Emergent wetland; Riparian wetland	R1, R2	negligible short-term adverse impacts
Henslow's Sparrow	*Ammodramus henslowii*						T			Upland grassland/prairies; Emergent wetland	R4	negligible short-term adverse impacts

Common Name	Scientific Name	Federal Status	State Rank							Habitat Association(s)	Reach	Adverse Impacts from Alternatives 1–6
			MT	ND	SD	NE	IA	KS	MO			
Horned Grebe	*Podiceps auritus*			Level I						Emergent wetland; Riparian wetland; Open water	R1, R2	negligible short-term adverse impacts
King Rail	*Rallus elegans*								E	Emergent wetland; Open water	R4, R5, R6, R7, R8	negligible short-term adverse impacts
Le Conte's Sparrow	*Ammodramus leconteii*			Level II						Emergent wetland; Upland grassland/prairies;	R1, R2	negligible short-term adverse impacts
Long-billed Curlew	*Numenius americanus*			Level I						Upland grassland/prairies; Emergent wetland	R1, R2	negligible short-term adverse impacts
Long-eared Owl	*Asio otus*						T			Forest; Upland grassland/prairie	R4	No impact
Marbled Godwit	*Limosa fedoa*			Level I						Upland grassland/prairie; emergent wetland	R1, R2	negligible short-term adverse impacts
Nelson’s Sparrow	*Ammodramus nelsoni*		S3B	Level I						Emergent wetland; Upland grassland/prairie	R1, R2	negligible short-term adverse impacts
Northern Harrier	*Circus cyaneus*						E		E	Upland grassland/prairie; Emergent wetland; Riparian wetland	R4, R5, R6, R7, R8	negligible short-term adverse impacts
Osprey	*Pandion haliaetus*				T					Emergent wetland; Open water; Riparian wetland	R2, R3	negligible short-term adverse impacts
Red Knot	*Calidris canutus rufa*	T	SNA	level III		T				Emergent wetland	R1, R2, R3	negligible short-term adverse impacts
Red-shouldered Hawk	*Buteo lineatus*						E			Forest; Riparian/forested wetland	R4	negligible short-term adverse impacts

Common Name	Scientific Name	Federal Status	State Rank							Habitat Association(s)	Reach	Adverse Impacts from Alternatives 1–6
			MT	ND	SD	NE	IA	KS	MO			
Sedge Wren	*Cistothorus platensis*		S3B							Upland grassland/prairie; Emergent wetland	R1	negligible short-term adverse impacts
Short-eared Owl	*Asio flammeus*			level II			E			Upland grassland/prairie; Emergent wetland	R1, R2, R4	negligible short-term adverse impacts
Snowy Egret	*Egretta thula*								E	Emergent wetland; Riparian wetland; Open water; Upland grassland/prairie	R4, R5, R6, R7, R8	negligible short-term adverse impacts
White-faced Ibis	*Plegadis chihi*		S3B							Emergent wetland; Upland grassland/prairie	R1	negligible short-term adverse impacts
Whooping Crane	*Grus americana*	E	S1M	Level III	E	E				Emergent wetland; Upland grassland/prairie	R1, R2, R3, R4	negligible short-term adverse impacts
Willet	*Tringa semipalmata*			level II						Emergent wetland; Upland grassland/prairie	R1, R2	negligible short-term adverse impacts
Wilson's Phalarope	*Phalaropus tricolor*			Level I						Emergent wetland; Upland grassland/prairie; Open water	R1, R2	negligible short-term adverse impacts
Yellow Rail	*Coturnicops noveboracensis*		S3B	Level I						Emergent wetland; Scrub shrub wetland	R1, R2	negligible short-term adverse impacts

Common Name	Scientific Name	Federal Status	State Rank MT	ND	SD	NE	IA	KS	MO	Habitat Association(s)	Reach	Adverse Impacts from Alternatives 1–6
Mammals												
Arctic Shrew	*Sorex arcticus*			Level III						Emergent wetland; Riparian/forested wetland; Upland grassland/prairie; Forest	R1, R2	negligible short-term adverse impacts
Gray Bat	*Myotis grisescens*	E						E	E	Forest	R5, R6, R7, R8	No impact
Hispid Pocket Mouse	*Chaetodipus hispidus*			Level III						Upland grassland/prairie	R1, R2	negligible short-term adverse impacts
Indiana Bat	*Myotis sodalis*	E					E		E	Forest; Upland grassland/prairie	R1, R2, R4, R5, R6, R7, R8	negligible short-term adverse impacts
Least Shrew	*Cryptotis parva*						T			Upland grassland/prairie; Forest; Emergent wetland	R4	negligible short-term adverse impacts
Northern Long-eared Bat	*Myotis septentrionalis*	T								Forest	R1, R2, R4, R5, R6, R7, R8	negligible short-term adverse impacts
Plains Pocket Mouse	*Perognathus flavenscens*			Level III			E			Upland grassland/prairie	R1, R2, R4, R5, R6, R7, R8	negligible short-term adverse impacts
Pygmy Shrew	*Sorex hoyi*			Level II						Forest	R1, R2	negligible short-term adverse impacts
Red-backed Vole	*Clethrionomys gapperi*						E			Forest; Emergent wetland	R4, R5, R6, R7, R8	negligible short-term adverse impacts

Common Name	Scientific Name	Federal Status	State Rank MT	ND	SD	NE	IA	KS	MO	Habitat Association(s)	Reach	Adverse Impacts from Alternatives 1–6
River Otter	*Lontra canadensis*			Level II	T	T				Open water, Riparian/forested wetland; Emergent wetland; Scrub shrub wetlands	R1, R2, R3, R4	negligible short-term adverse impacts
Southern Bog Lemming	*Synaptomys cooperi*						T			Forest; Emergent wetland; Upland grassland/prairie	R4, R5, R6, R7, R8	negligible short-term adverse impacts
Reptiles and Amphibians												
Blanding's Turtle	*Emydoidea blandingii*								E	Emergent wetland; Riparian/forested wetland; Scrub shrub wetland; Open water; Upland grassland/prairie; Forest	R4, R5, R6, R7, R8	negligible short-term adverse impacts
Canadian Toad	*Anaxyrus hemiophrys*			Level I						Emergent wetlands; Riparian/forested wetland; Scrub shrub wetland; Upland grassland/prairie; Forest	R1, R2	negligible short-term adverse impacts
Common Musk Turtle	*Sternotherus odoratus*						T			Emergent wetland; Riparian/forested wetland; Open water	R4	negligible short-term adverse impacts
False Map Turtle	*Graptemys pseudogeographica*			Level III	T					Open water; Riparian/forested wetland; Emergent wetland	R1, R2, R3, R4	negligible short-term adverse impacts

Common Name	Scientific Name	Federal Status	State Rank MT	ND	SD	NE	IA	KS	MO	Habitat Association(s)	Reach	Adverse Impacts from Alternatives 1–6
Great Plains Skink	*Eumeces obsoletus*						E			Upland grassland/prairie; Forest	R4	No impact
Massasauga	*Sistrurus catenatus*					T	E		E	Emergent wetland; Upland grassland/prairie; Riparian/forested wetland; Scrub shrub wetland	R3, R4, R5, R6, R7, R8	negligible short-term adverse impacts
Ornate Box Turtle	*Terrapene ornata*						T			Upland grassland/prairie	R4	No impact
Plains Spadefoot	*Spea bombifrons*			Level I						Upland grassland/prairie; Emergent wetland	R1, R2	negligible short-term adverse impacts
Prairie Rattlesnake	*Crotalus viridis*						E			Upland grassland/prairie	R4	No impact
Slender Walker Snake	*Pomatiopsis lapidaria*							E		Emergent wetland; Riparian wetland	R4	negligible short-term adverse impacts
Smooth Green Snake	*Opheodrys vernalis*		S2	Level I						Upland grassland/prairie; Emergent wetland; riparian wetland; Forest	R1, R2	negligible short-term adverse impacts
Smooth Softshell	*Apalone mutica*			Level III						Open water; Emergent wetland;	R1, R2	negligible short-term adverse impacts
Speckled Kingsnake	*Lampropeltis getula holbrooki*						T			Riparian/forested wetland; Forest; Upland grassland/prairie	R4	negligible short-term adverse impacts

Common Name	Scientific Name	Federal Status	State Rank							Habitat Association(s)	Reach	Adverse Impacts from Alternatives 1–6
			MT	ND	SD	NE	IA	KS	MO			
Spiny Softshell	*Apalone spinifera*		S3	Level III						Open water; Emergent wetland;	R1, R2	negligible short-term adverse impacts
Western Chicken Turtle	*Deirochelys reticularia miaria*								E	Emergent wetland; Riparian/forested wetland	R4, R5, R6, R7, R8	negligible short-term adverse impacts
Western Hognose Snake	*Heterodon nasicus*						E			Upland grassland/prairie	R4	No impact
Wood Turtle	*Glyptemys inscul pta*						E			Open water; Forest; emergent wetland	R4	negligible short-term adverse impacts
Yellow Mud Turtle	*Kinosternon flavescens*						E		E	Open water; Emergent wetland; Upland grassland/prairie; Riparian/forested wetland	R4, R5, R6, R7, R8	negligible short-term adverse impacts
Fishes												
Blue Sucker	*Cycleptus elongatus*		S2S3	Level I						Open water	R1, R2	negligible short-term adverse impacts
Burbot	*Lota lota*			Level II			T			Open water	R2, R2, R4	negligible short-term adverse impacts
Carmine Shiner	*Notropis percobromis*			Level III						Open water	R1, R2	negligible short-term adverse impacts
Central Mudminnow	*Umbra limi*								E	Open water; Emergent wetland	R4, R5, R6, R7, R8	negligible short-term adverse impacts
Chestnut Lamprey	*Ichthyomyzon castaneus*			Level III			T			Open water	R1, R2, R4	negligible short-term adverse impacts

Common Name	Scientific Name	Federal Status	State Rank							Habitat Association(s)	Reach	Adverse Impacts from Alternatives 1–6
			MT	ND	SD	NE	IA	KS	MO			
Crystal Darter	*Crystallaria asprella*								E	Open water	R4, R5, R6, R7, R8	negligible short-term adverse impacts
Flathead Chub	*Platygobio gracilis*			Level II				T	E	Open water	R1, R2, R4, R5, R6, R7, R8	negligible short-term adverse impacts
Lake Sturgeon	*Acipenser fulvescens*						E		E	Open water	R4, R5, R6, R7, R8	negligible short-term adverse impacts
Logperch	*Percina caprodes*			Level III						Open water	R1, R2	negligible short-term adverse impacts
Northern Pearl Dace	*Margariscus nachtriebi*			Level I						Open water	R1, R2	negligible short-term adverse impacts
Paddlefish	*Polyodon spathula*		S2							Open water	R1, R2	negligible short-term adverse impacts
Pearl Dace	*Margariscus margarita*						E			Open water	R4	negligible short-term adverse impacts
Plains Minnow	*Hybognathus placitus*							T		Open water	R5	negligible short-term adverse impacts
River Darter	*Percina shumardi*			Level III						Open water	R1, R2	negligible short-term adverse impacts
Sauger	*Sander canadensis*		S2							Open water	R1	negligible short-term adverse impacts
Shoal Chub	*Macrhybopsis hyostoma*							T		Open water	R5	negligible short-term adverse impacts

Common Name	Scientific Name	Federal Status	State Rank							Habitat Association(s)	Reach	Adverse Impacts from Alternatives 1–6
			MT	ND	SD	NE	IA	KS	MO			
Shortnose Gar	*Lepisosteus platostomus*		S1							Open water; Riparian/forested wetland	R1	negligible short-term adverse impacts
Sicklefin Chub	*Macrhybopsis meeki*		S1	Level I	E			E		Open water	R1, R2, R3, R4, R5	negligible short-term adverse impacts
Silver Chub	*Macrhybopsis storeriana*			Level II				E		Open water	R1, R2, R5	negligible short-term adverse impacts
Silver Lamprey	*Ichthyomyzon unicuspis*			Level III						Open water	R1, R2	negligible short-term adverse impacts
Sturgeon Chub	*Macrhybopsis gelida*			Level I	T			T		Open water	R1, R2, R3, R4, R5	negligible short-term adverse impacts
Trout-perch	*Percopsis omiscomaycus*			Level II						Open water	R1, R2	negligible short-term adverse impacts
Western Silvery Minnow	*Hybognathus argyritis*							T		Open water	R5	negligible short-term adverse impacts
Mussels												
Black Sandshell	*Ligumia recta*			Level II						Open water	R1, R2	negligible short-term adverse impacts
Buckhorn	*Tritogonia verrucosa*						E			Open water	R4	negligible short-term adverse impacts
Creeper	*Strophitus undulatus*			Level III			T			Open water	R1, R2, R4	negligible short-term adverse impacts

Common Name	Scientific Name	Federal Status	State Rank MT	ND	SD	NE	IA	KS	MO	Habitat Association(s)	Reach	Adverse Impacts from Alternatives 1–6
Deertoe	*Truncilla truncata*			Level III						Open water	R1, R2	negligible short-term adverse impacts
Ebonyshell	*Fusconaia ebena*								E	Open water	R4, R5, R6, R7, R8	negligible short-term adverse impacts
Elephant Ear	*Elliptio crassidens*								E	Open water	R4, R5, R6, R7, R8	negligible short-term adverse impacts
Fragile Papershell	*Leptodea fragilis*			Level III						Open water	R1, R2	negligible short-term adverse impacts
Higgins Eye	*Lampsilis higginsii*	E							E	Open water	R4, R5, R6, R7, R8	negligible short-term adverse impacts
Mapleleaf	*Quadrula quadrula*			Level III						Open water	R1, R2	negligible short-term adverse impacts
Mucket Mussel	*Actinonaias ligamentina*						E			Open water	R4	negligible short-term adverse impacts
Ohio River Pigtoe	*Pleurobema cordatum*						E			Open water	R4	negligible short-term adverse impacts
Pink Heelsplitter	*Potamilus alatus*			Level II						Open water	R1, R2	negligible short-term adverse impacts
Pink Mucket	*Lampsilis abrupta*	E							E	Open water	R4, R5, R6, R7, R8	negligible short-term adverse impacts
Pink Papershell	*Potamilus ohiensis*			Level I						Open water	R1, R2	negligible short-term adverse impacts

Common Name	Scientific Name	Federal Status	State Rank							Habitat Association(s)	Reach	Adverse Impacts from Alternatives 1–6
			MT	ND	SD	NE	IA	KS	MO			
Scaleshell	*Leptodea leptodon*	E				E			E	Open water	R3, R4, R5, R6, R7, R8	negligible short-term adverse impacts
Sheepnose	*Plethobasus cyphyus*	E							E	Open water	R4, R5, R6, R7, R8	negligible short-term adverse impacts
Slough Sandshell	*Lampsilis teres teres*						E			Open water	R4	negligible short-term adverse impacts
Threeridge	*Amblema plicata*			Level II						Open water	R1, R2	negligible short-term adverse impacts
Wabash Pigtoe	*Fusconaia flava*			Level II						Open water	R1, R2	negligible short-term adverse impacts
Yellow Sandshell	*Lampsilis teres anodontoides*						E			Open water	R4	negligible short-term adverse impacts
Insects												
Brimstone Clubtail	*Stylurus intricatus*		S1							Open water; Emergent wetland;	R1	negligible short-term adverse impacts
Gray Comma	*Polygonia progne*		S2							Forest	R1	negligible short-term adverse impacts
Homoeoneuria alleni	*Homoeoneuria alleni*		S2							Open water	R1	negligible short-term adverse impacts
Lachlania saskatchewanensis	*Lachlania saskatchewanensis*		S1							Open water; Riparian wetland	R1	negligible short-term adverse impacts

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APPENDIX F: MISSOURI RIVER RECOVERY MANAGEMENT PLAN-EIS ALTERNATIVES – COST ESTIMATES

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Project Summary Management Actions	Alternative 1 - No Action		Alternative 2 - USFWS 2003 BiOp Projected Actions		Alternative 3 - Pallid Habitat Construction & ESH Mechanical		Alternative 4 - Pallid Habitat Construction and ESH Spring Release		Alternative 5 - Pallid Habitat Construction and ESH Fall Release		Alternative 6 - Pallid Habitat Construction and ESH Mechanical w/Spawning Cue	
	TOTAL	Annual cost	TOTAL	Annual cost	TOTAL	Annual cost	TOTAL	Annual cost	TOTAL	Annual cost	TOTAL	Annual cost
Program Management, Integration & Coordination	284,500,000	5,690,000	284,500,000	5,690,000	284,500,000	5,690,000	284,500,000	5,690,000	284,500,000	5,690,000	284,500,000	5,690,000
MRRIC	75,000,000	1,500,000	75,000,000	1,500,000	75,000,000	1,500,000	75,000,000	1,500,000	75,000,000	1,500,000	75,000,000	1,500,000
Lower River Pallid Sturgeon												
Propagation and Augmentation Program	22,758,350	455,167	22,758,350	455,167	22,758,350	455,167	22,758,350	455,167	22,758,350	455,167	22,758,350	455,167
Spawning Habitat Construction	N/A	N/A	N/A	N/A	1,109,735	123,304	1,109,735	123,304	1,109,735	123,304	1,109,735	123,304
Spawning Habitat OMRRR	N/A	N/A	N/A	N/A	1,233,039	24,661	1,233,039	24,661	1,233,039	24,661	1,233,039	24,661
Early Life History Habitat Construction:												
Existing SWH operations & maintenance	369,176,850	7,383,537	369,176,850	7,383,537	369,176,850	7,383,537	369,176,850	7,383,537	369,176,850	7,383,537	369,176,850	7,383,537
Backwater - construction	65,529,009	4,368,601	122,866,891	8,191,126	Not required	N/A	Not required	N/A	Not required	N/A	Not required	N/A
Backwater - OMRRR	76,416,000	1,528,320	143,280,000	2,865,600	Not required	N/A	Not required	N/A	Not required	N/A	Not required	N/A
Channel Widening - total	1,836,033,033		5,233,847,824		1,367,532,501		1,367,532,501		1,367,532,501		1,367,532,501	
- Omaha reaches construction	244,309,782	16,287,319	602,451,444	40,163,430	144,769,940	9,651,329	144,769,940	9,651,329	144,769,940	9,651,329	144,769,940	9,651,329
- Omaha reaches O&M costs	355,476,450	7,109,529	876,580,950	17,531,619	210,643,650	4,212,873	210,643,650	4,212,873	210,643,650	4,212,873	210,643,650	4,212,873
- Kansas City reaches construction	730,799,901	48,719,993	2,219,636,680	147,975,779	602,721,411	40,181,427	602,721,411	40,181,427	602,721,411	40,181,427	602,721,411	40,181,427
- Kansas City reaches O&M costs	505,446,900	10,108,938	1,535,178,750	30,703,575	409,397,500	8,187,950	409,397,500	8,187,950	409,397,500	8,187,950	409,397,500	8,187,950
Real Estate Acquisition	39,021,444	3,902,144	251,948,331	25,194,833	9,977,069	997,707	9,977,069	997,707	9,977,069	997,707	9,977,069	997,707
Habitat Development	7,900,800	526,720	50,191,800	3,346,120	2,125,200	141,680	2,125,200	141,680	2,125,200	141,680	2,125,200	141,680
Land Management	7,467,558	152,399	48,449,604	988,767	1,876,938	38,305	1,876,938	38,305	1,876,938	38,305	1,876,938	38,305
Spawning Cue Flow	No implementation cost	N/A	No implementation cost	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Low Summer Flow	N/A	N/A	No implementation cost	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Floodplain Connectivity	N/A	N/A	No implementation cost	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Monitoring, Evaluation and Research:												
PSPAP	125,000,000	2,500,000	125,000,000	2,500,000	125,000,000	2,500,000	125,000,000	2,500,000	125,000,000	2,500,000	125,000,000	2,500,000
HAMP	27,905,000	1,860,333	27,905,000	1,860,333	27,905,000	1,860,333	27,905,000	1,860,333	27,905,000	1,860,333	27,905,000	1,860,333
Focused Research	48,000,000	3,200,000	48,000,000	3,200,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Level 1 and 2 studies	N/A	N/A	N/A	N/A	27,021,250	1,422,171	27,021,250	1,422,171	27,021,250	1,422,171	27,021,250	1,422,171
Upper River Pallid Sturgeon												
Propagation and Augmentation Program	Included above	Included above	Included above	Included above	Included above	Included above	Included above	Included above	Included above	Included above	Included above	Included above
Monitoring, Evaluation and Research:												
PSPAP	Included above	Included above	Included above	Included above	Included above	Included above	Included above	Included above	Included above	Included above	Included above	Included above
HAMP	Included above	Included above	Included above	Included above	Included above	Included above	Included above	Included above	Included above	Included above	Included above	Included above
Focused Research	Included above	Included above	Included above	Included above	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Level 1 and 2 studies	N/A	N/A	N/A	N/A	13,995,400	933,027	13,995,400	933,027	13,995,400	933,027	13,995,400	933,027
Piping Plover and Least Tern												
Mechanical ESH Creation	221,375,000	4,427,500	8,862,500,000	177,250,000	735,125,000	14,702,500	291,400,000	5,828,000	485,650,000	9,713,000	540,225,000	10,804,500
Vegetation Management	3,400,000	68,000	3,400,000	68,000	3,400,000	68,000	3,400,000	68,000	3,400,000	68,000	3,400,000	68,000
Predator Management	1,000,000	20,000	1,000,000	20,000	1,000,000	20,000	1,000,000	20,000	1,000,000	20,000	1,000,000	20,000
Human Restrictions Measures	250,000	5,000	250,000	5,000	250,000	5,000	250,000	5,000	250,000	5,000	250,000	5,000
Spring Reservoir Release for ESH Creation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No implementation cost	N/A	N/A	N/A
Fall Reservoir Release for ESH Creation	N/A	N/A	N/A	N/A	N/A	N/A	No implementation cost	N/A	N/A	N/A	N/A	N/A
Monitoring, Evaluation and Research:												
Monitoring	60,000,000	1,200,000	60,000,000	1,200,000	60,000,000	1,200,000	60,000,000	1,200,000	60,000,000	1,200,000	60,000,000	1,200,000
Focused Research	25,000,000	500,000	25,000,000	500,000	Included below	N/A	Included below	N/A	Included below	N/A	Included below	N/A
Level 1 and 2 Studies	N/A	N/A	N/A	N/A	27,800,000	1,853,333	27,800,000	1,853,333	27,800,000	1,853,333	27,800,000	1,853,333
ESTIMATED COST	**$3,295,733,044**	**$121,513,501**	**$15,755,074,651**	**$478,592,886**	**$3,156,786,331**	**$103,152,304**	**$2,713,061,331**	**$94,277,804**	**$2,907,311,331**	**$98,162,804**	**$2,961,886,331**	**$99,254,304**

Assumptions applicable to all Management Actions

1. All costs and benefits are in FY2016 (October 2015) dollars, are unescalated beyond that and are not discounted to generate a Net Present Value.
2. Where cost data was dated before the 4th quarter of 2015, it was escalated using the Engineering Manual on the Civil Works Construction Cost Index System (CWCCIS). The indices for Line 06 Fish & Wildlife Facilities were used to escalate costs as necessary.
3. Various "soft costs" have been added to the construction costs to arrive at a total project cost, where applicable. These are typically as follows:
   - a) Project Management (PM) 5%
   - b) Pre-construction Engineering & Design (PED) 10%
   - c) Supervision & Administration (S&A) 6%
   - d) Operations, Maintenance, Repair, Rehabilitation & Replacement (OMRRR) 20% Note - doesn't apply to sandbar projects.
   - e) Operations & Maintenance (O&M) - only applies to channel widening and backwater construction projects and was developed on a cost/acre basis from information provided by USACE.
   - f) Engineering during construction (EDC) 10%
   - g) Contingency 20%
4. As construction durations are presently unknown, no allowance has been included for interest costs incurred during construction.

Alternative Summary Management Actions	Alternative 1 - No Action TOTAL	Assumptions for estimates
Program Management, Integration & Coordination	284,500,000	$5,690,000 annually (per USACE), for 50 years.
MRRIC	75,000,000	$1,500,000 annually (per USACE), for 50 years.
Lower River Pallid Sturgeon		
Propagation and Augmentation Program	22,758,350	Annual budget of $455,167 for 50 years
Spawning Habitat Construction	N/A	
Early Life History Habitat Construction:		
Existing SWH operations & maintenance	369,176,850	O&M cost of $4,903/acre for existing 1,509 acres (744 acres of chutes and 366 acres of backwaters for Omaha; 399 acres of chutes for Kansas City) - assumes same cost as top width O&M
Backwater - construction	65,529,009	Cost of 480 acres at $86,844 plus applicable mark-ups, spread over 15 years
Backwater - OMRRR	76,416,000	OMRRR spread over 50 years (at $3,184/acre for 480 acres)
Channel Widening - total	1,836,033,033	
- Omaha reaches construction	244,309,782	Construction - cost of 3,519 acres at $115,800 for Omaha acreage; $243,614 for Kansas City acreage (average cost data escalated to 10/15) plus applicable mark-ups, assuming **100%** material removal, spread over 15 years. Costs/acre include PED.
- Omaha reaches O&M costs	355,476,450	
- Kansas City reaches construction	730,799,901	O&M - cost for O&M spread over 50 years (at $4,893/acre).
- Kansas City reaches O&M costs	505,446,900	
Real Estate Acquisition	39,021,444	Acquisition cost of 915 acres x 7.7 = 7,046 acres. Acquisition cost based on a weighted average of costs of agricultural land and recreational land. For Omaha Reach, using ag. land price of $6,000/acre and rec. land at $2,000/acre, with a 60/40 split, resulting in an average of $4,400/acre. For KC Reach ag. land at $5,050 and rec. land at $3,261, with an 80/20 split, resulting in an average cost of $4,692/acre. Assumed to be purchased over a 10-year period, with a 20% contingency applied.
Habitat Development	7,900,800	5,267 acres of agricultural land developed over 15 years at a cost of $1,500 per acre.
Land Management	7,467,558	6,131 acres managed over a 50-year period at an annual cost of $29/acre
Spawning Cue Flow	No implementation cost	
Low Summer Flow	N/A	
Floodplain Connectivity	N/A	
Monitoring, Evaluation and Research:		
PSPAP	125,000,000	$2,500,000 annually for 50 years
HAMP	27,905,000	$1,860,333 annually for 15 years
Focused Research	48,000,000	$3,200,000 annually for 15 years
Upper River Pallid Sturgeon		
Propagation and Augmentation Program	Included above	
Monitoring, Evaluation and Research:		
PSPAP	Included above	
HAMP	Included above	
Focused Research	Included above	
Piping Plover and Least Tern		
Mechanical ESH Creation	221,375,000	Cost of 88.55 acres being constructed annually at a cost of $50,000 per acre, for 50 years
Vegetation Management	3,400,000	$136,490 annually (incurred on average every other year), for 50 years
Predator Management	1,000,000	$60,000 annually (incurred on average once every 3 years), for 50 years
Human Restrictions Measures	250,000	Annual signage costs of $5,000 (rounded), for 50 years
Spring Reservoir Release for ESH Creation	N/A	
Fall Reservoir Release for ESH Creation	N/A	
Monitoring, Evaluation and Research:		
Monitoring	60,000,000	$1,200,000 annually for monitoring, for 50 years
Focused Research	25,000,000	$500,000 annually for research, for 50 years
Level 1 and 2 Studies	N/A	
ESTIMATED COST	**$3,295,733,044**	

Program Management, Integration & Coordination

Costs provided by USACE:

Program management, integration & coordination	$	1,500,000
ISP Labor	$	1,590,000
AM Costs	$	1,700,000
Strategic annual process review	$	40,000
Communication support	$	80,000
Information management	$	600,000
FWCA	$	100,000
Tribal business	$	80,000
Average cost per year:	$	5,690,000

Study years: **50** **Total:** **$ 284,500,000**

MRRIC

Costs provided by USACE:

MRRIC	$	1,500,000
Average cost per year:	$	1,500,000

Study years: **50** **Total:** **$ 75,000,000**

Lower River Pallid Sturgeon

1 Propagation & Augmentation Program

Average cost per year: $ 455,167
(spread over 50 years)

Study years: **50** **Total:** **$ 22,758,350**

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2 Operations & Maintenance of Existing SWH

Total area included: 1,509 acres

Average cost per year: $ 7,383,537 at $4,893/acre
(spread over 50 years)

Study years: **50** **Total:** **$ 369,176,850**

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3 Backwaters

Acres included	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
480	$ 86,844	5%	10%	6%	0%	0%	10%	$ 54,607,507	20%	$ 65,529,009

		Construction:	Average cost per year: (spread over 15 years)	$ 4,368,601
Study years:	**15**		**Total:**	**$ 65,529,009**
		O&M: Cost/acre: $ 3,184	Average cost per year: (spread over 50 years)	$ 1,528,320
Study years:	**50**		**Total:**	**$ 76,416,000**

4 Channel widening

	Acres included	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
Omaha	1,453	$ 115,800	5%	0%	6%	0%	0%	10%	$ 203,591,485	20%	$ 244,309,782
KC	2,066	$ 243,614	5%	0%	6%	0%	0%	10%	$ 608,999,918	20%	$ 730,799,901

				Omaha	KC
		Construction:	Average costs per year: (spread over 15 years)	$ 16,287,319	$ 48,719,993
Study years:	**15**		**Total:**	**$ 244,309,782**	**$ 730,799,901**
		O&M: Cost/acre: $ 4,893	Average cost per year: (spread over 50 years)	$ 7,109,529	$ 10,108,938
Study years:	**50**		**Total:**	**$ 355,476,450**	**$ 505,446,900**

5 Real Estate Acquisition

	Lands reqd	Acres purchased (x 7.7)	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
Omaha	240	1,848	$ 4,400	0%	0%	0%	0%	0%	0%	$ 8,131,200	20%	**$ 9,757,440**
KC	675	5,198	$ 4,692	0%	0%	0%	0%	0%	0%	$ 24,386,670	20%	**$ 29,264,004**

6 Monitoring, Evaluation & Research

PSPAP:

Average cost per year: $ 2,500,000
(spread over 50 years)

Study years: **50** **Total:** **$ 125,000,000**

HAMP:

Average cost per year: $ 1,860,333
(spread over 15 years)

Study years: **15** **Total:** **$ 27,905,000**

Focused Research:

Average cost per year: $ 3,200,000
(spread over 15 years)

Study years: **15** **Total:** **$ 48,000,000**

Piping Plover and Least Tern

7 Mechanical ESH Construction

Acres/year	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
88.55	$ 50,000	0%	0%	0%	0%	0%	0%	$ 4,427,500	0%	$ 4,427,500

Construction: Average cost per year: (spread over 50 years) $ 4,427,500

Study years: **50**

Total: **$ 221,375,000**

8 Vegetation Management

Annual cost	$	136,491
Occurs in 1/2 of years - reduce:	$	(68,246)
Annual average cost, rounded (spread over 50 years)	$	68,000

Study years: **50**

Total: **$ 3,400,000**

9 Predator Management

Annual cost	$	60,000
Occurs in 1/3rd of years - reduce:	$	(40,000)
Annual average cost, rounded (spread over 50 years)	$	20,000

Study years: **50**

Total: **$ 1,000,000**

10 Human Restriction Measures

		Signage material	$	1,036
		Signage labor	$	3,062
		Average cost per year:	$	4,098
		Add contingency (20%)	$	820
Study years:	**50**	Annual average cost, rounded	$	5,000
		(spread over 50 years)		
		Total:	**$**	**250,000**

11 Monitoring

		Monitoring cost	$	1,200,000
		Average cost per year:	$	1,200,000
		(spread over 50 years)		
Study years:	**50**	**Total:**	**$**	**60,000,000**

12 Focused Research

		Research cost	$	500,000
		Average cost per year:	$	500,000
		(spread over 50 years)		
Study years:	**50**	**Total:**	**$**	**25,000,000**

Alternative Summary Management Actions	Alternative 2 - USFWS 2003 BiOp Projected Actions TOTAL	Assumptions for estimates
Program Management, Integration & Coordination	284,500,000	$5,690,000 annually (per USACE), for 50 years.
MRRIC	75,000,000	$1,500,000 annually (per USACE), for 50 years.
Lower River Pallid Sturgeon		
Propagation and Augmentation Program	22,758,350	Annual budget of $455,167 for 50 years
Spawning Habitat Construction	N/A	
Early Life History Habitat Construction:		
Existing SWH operations & maintenance	369,176,850	O&M cost of $4,903/acre for existing 1,509 acres (744 acres of chutes and 366 acres of backwaters for Omaha; 399 acres of chutes for Kansas City) - assumes same cost as top width O&M
Backwater - construction	122,866,891	Cost of 900 acres at $86,844 plus applicable mark-ups, spread over 15 years
Backwater - OMRRR	143,280,000	Cost for OMRRR spread over 50 years (at $3,184/acre for 900 acres)
Channel Widening - total	5,233,847,824	
- Omaha reaches construction	602,451,444	Construction - cost of 9,858 acres at $115,800 for Omaha acreage; $243,614 for Kansas City acreage plus applicable mark-ups, assuming **100%** material removal, spread over 15 years. Costs/acre include PED.
- Omaha reaches O&M costs	876,580,950	
- Kansas City reaches construction	2,219,636,680	O&M - cost for O&M spread over 50 years (at $4,893/acre).
- Kansas City reaches O&M costs	1,535,178,750	
Real Estate Acquisition	251,948,331	##
Habitat Development	50,191,800	33,461 acres of agricultural land developed over 15 years at a cost of $1,500 per acre.
Land Management	48,449,604	39,778 acres managed over a 50-year period at an annual cost of $29/acre
Spawning Cue Flow	No implementation cost	
Low Summer Flow	No implementation cost	
Floodplain Connectivity	No implementation cost	
Monitoring, Evaluation and Research:		
PSPAP	125,000,000	$2,500,000 annually for 50 years
HAMP	27,905,000	$1,860,333 annually for 15 years
Focused Research	48,000,000	$3,200,000 annually for 15 years
Upper River Pallid Sturgeon		
Propagation and Augmentation Program	Included above	
Monitoring, Evaluation and Research:		
PSPAP	Included above	
HAMP	Included above	
Focused Research	Included above	
Piping Plover and Least Tern		
Mechanical ESH Creation	8,862,500,000	Cost of 3,545 acres being constructed annually at a cost of $50,000 per acre, for 50 years
Vegetation Management	3,400,000	$136,490 annually (incurred on average every other year), for 50 years
Predator Management	1,000,000	$60,000 annually (incurred on average once every 3 years), for 50 years
Human Restrictions Measures	250,000	Annual signage costs of $5,000 (rounded), for 50 years
Spring Reservoir Release for ESH Creation	N/A	
Fall Reservoir Release for ESH Creation	N/A	
Monitoring, Evaluation and Research:		
Monitoring	60,000,000	$1,200,000 annually for monitoring, for 50 years
Focused Research	25,000,000	$500,000 annually for research, for 50 years
Level 1 and 2 Studies	N/A	
ESTIMATED COST	**$15,755,074,651**	

Program Management, Integration & Coordination

Costs provided by USACE:

Program management, integration & coordination	$	1,500,000
ISP Labor	$	1,590,000
AM Costs	$	1,700,000
Strategic annual process review	$	40,000
Communication support	$	80,000
Information management	$	600,000
FWCA	$	100,000
Tribal business	$	80,000
Average cost per year:	$	5,690,000

Study years: **50** **Total:** **$ 284,500,000**

MRRIC

Costs provided by USACE:

MRRIC	$	1,500,000
Average cost per year:	$	1,500,000

Study years: **50** **Total:** **$ 75,000,000**

Lower River Pallid Sturgeon

1 Propagation & Augmentation Program

Average cost per year: $ 455,167
(spread over 50 years)

Study years: **50** **Total:** **$ 22,758,350**

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2 Operations & Maintenance of Existing SWH

Total area included: 1,509 acres

Average cost per year: $ 7,383,537 at $4,893/acre
(spread over 50 years)

Study years: **50**

Total: **$ 369,176,850**

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3 Backwaters

Acres included	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
900	$ 86,844	5%	10%	6%	0%	0%	10%	$ 102,389,076	20%	$ 122,866,891

Construction:

Average cost per year: $ 8,191,126
(spread over 15 years)

Study years: **15**

Total: **$ 122,866,891**

O&M:
Cost/acre:
$ 3,184

Average cost per year: $ 2,865,600
(spread over 50 years)

Study years: **50**

Total: **$ 143,280,000**

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4 Channel widening

	Acres included	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
Omaha	3,583	$ 115,800	5%	0%	6%	0%	0%	10%	$ 502,042,870	20%	$ 602,451,444
KC	6,275	$ 243,614	5%	0%	6%	0%	0%	10%	$ 1,849,697,233	20%	$ 2,219,636,680

			Omaha	KC
	Construction:	Average cost per year: (spread over 15 years)	$ 40,163,430	$ 147,975,779
Study years: **15**		**Total:**	**$ 602,451,444**	**$ 2,219,636,680**

			Omaha	KC
	O&M: Cost/acre: $ 4,893	Average cost per year: (spread over 50 years)	$ 17,531,619	$ 30,703,575
Study years: **50**		**Total:**	**$ 876,580,950**	**$ 1,535,178,750**

5 Real Estate Acquisition

	Lands reqd	Acres purchased (x 7.7)	Cost/acre	PM	PED	S&A	OMRRR	O&M	Sub-total	Contingency	Total
Omaha	2,020	15,555	$ 4,400	0%	0%	0%	0%	0%	$ 68,442,000	20%	**$ 82,130,400**
KC	3,917	30,161	$ 4,692	0%	0%	0%	0%	0%	$ 141,514,943	20%	**$ 169,817,931**

6 Monitoring, Evaluation & Research

PSPAP:

		Average cost per year: (spread over 50 years)	$	2,500,000
Study years:	**50**	**Total:**	**$**	**125,000,000**

HAMP:

		Average cost per year: (spread over 15 years)	$	1,860,333
Study years:	**15**	**Total:**	**$**	**27,905,000**

Focused Research:

		Average cost per year: (spread over 15 years)	$	3,200,000
Study years:	**15**	**Total:**	**$**	**48,000,000**

7 Mechanical ESH Construction

Acres/year	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
3,545	$ 50,000	0%	0%	0%	0%	0%	0%	$ 177,250,000	0%	$ 177,250,000

Construction: Average cost per year: $ 177,250,000
(spread over 50 years)

Study years: **50**

Total: **$ 8,862,500,000**

8 Vegetation Management

Annual cost	$	136,491
Occurs in 1/2 of years - reduce:	$	(68,246)
Annual average cost, rounded (spread over 50 years)	$	68,000

Study years: **50**

Total: **$ 3,400,000**

9 Predator Management

Annual cost	$	60,000
Occurs in 1/3rd of years - reduce:	$	(40,000)
Annual average cost, rounded (spread over 50 years)	$	20,000

Study years: **50**

Total: **$ 1,000,000**

10 Human Restriction Measures

	Signage material	$	1,036
	Signage labor	$	3,062
	Average cost per year:	$	4,098
	Add contingency (20%)	$	820
Study years: **50**	Annual average cost, rounded	$	5,000
	(spread over 50 years)		

Total: $ 250,000

11 Monitoring

	Monitoring cost	$	1,200,000
	Average cost per year:	$	1,200,000
	(spread over 50 years)		
Study years: **50**			

Total: $ 60,000,000

12 Focused Research

	Research cost	$	500,000
	Average cost per year:	$	500,000
	(spread over 50 years)		
Study years: **50**			

Total: $ 25,000,000

Alternative Summary Management Actions	Alternative 3 - Pallid Habitat Construction & ESH Mechanical TOTAL	Assumptions for estimates
Program Management, Integration & Coordination	284,500,000	$5,690,000 annually (per USACE), for 50 years.
MRRIC	75,000,000	$1,500,000 annually (per USACE), for 50 years.
Lower River Pallid Sturgeon		
Propagation and Augmentation Program	22,758,350	Annual budget of $455,167 for 50 years
Spawning Habitat Construction	2,342,773	Cost of creation of 6.6 acres (3 sites at 2.2 acres each), starting in year 3 and spread over 9 years, using the Omaha cost/acre for channel widening of $115,800; plus cost of OMRRR at 20% of construction cost, annually for 50 years
Early Life History Habitat Construction:		
Existing SWH operations & maintenance	369,176,850	O&M cost of $4,903/acre for existing 1,509 acres (744 acres of chutes and 366 acres of backwaters for Omaha; 399 acres of chutes for Kansas City) - assumes same cost as top width O&M
Backwater	Not required	
Channel Widening - total	1,367,532,501	
- Omaha reaches construction	144,769,940	##
- Omaha reaches O&M costs	210,643,650	
- Kansas City reaches construction	602,721,411	O&M - cost for O&M spread over 50 years (at $4,893/acre); for the 10 structure modifications projects in KC reaches, $114,500 is included
- Kansas City reaches O&M costs	409,397,500	per year.
Real Estate Acquisition	9,977,069	##
Habitat Development	2,125,200	1,417 acres of agricultural land developed over 15 years at a cost of $1,500 per acre.
Land Management	1,876,938	1,541 acres managed over a 50-year period at an annual cost of $29/acre
Spawning Cue Flow	N/A	
Low Summer Flow	N/A	
Floodplain Connectivity	N/A	
Monitoring, Evaluation and Research:		
PSPAP	125,000,000	$2,500,000 annually for 50 years
HAMP	27,905,000	$1,860,333 annually for 15 years
Focused Research	N/A	
Level 1 and 2 studies	27,021,250	Annual cost of $1,422,171 for 19 years - based on total cost of $27,021,250 for years 2014 - 2032, converted to an average annual cost.
Upper River Pallid Sturgeon		
Propagation and Augmentation Program	Included above	
Monitoring, Evaluation and Research:		
PSPAP	Included above	
HAMP	N/A	
Focused Research	N/A	
Level 1 and 2 studies	13,995,400	Annual cost of $933,027 for 15 years - based on total cost of $13,995,400 for years 2014 - 2028, converted to an average annual cost.
Piping Plover and Least Tern		
Mechanical ESH Creation	735,125,000	NPV of 294.05 acres being constructed annually at a cost of $50,000 per acre, for 50 years
Vegetation Management	3,400,000	$136,490 annually (incurred on average every other year), for 50 years
Predator Management	1,000,000	$60,000 annually (incurred on average once every 3 years), for 50 years
Human Restrictions Measures	250,000	Annual signage costs of $5,000 (rounded), for 50 years
Spring Reservoir Release for ESH Creation	N/A	
Fall Reservoir Release for ESH Creation	N/A	
Monitoring, Evaluation and Research:		
Monitoring	60,000,000	$1,200,000 annually for monitoring, for 50 years
Focused Research	0	Included below
Level 1 and 2 Studies	27,800,000	Engineered log jams and multiple stabilization methods, plus focused research cost of $25,000,000, spread over 15 years.
ESTIMATED COST	**$3,156,786,331**	

Program Management, Integration & Coordination

Costs provided by USACE:

Program management, integration & coordination	$	1,500,000
ISP Labor	$	1,590,000
AM Costs	$	1,700,000
Strategic annual process review	$	40,000
Communication support	$	80,000
Information management	$	600,000
FWCA	$	100,000
Tribal business	$	80,000
Average cost per year:	$	5,690,000

Study years: **50** **Total:** **$ 284,500,000**

MRRIC

Costs provided by USACE:

MRRIC	$	1,500,000
Average cost per year:	$	1,500,000

Study years: **50** **Total:** **$ 75,000,000**

Lower River Pallid Sturgeon

1 Propagation & Augmentation Program

Average cost per year: $ 455,167
(spread over 50 years)

Study years: **50** **Total:** **$ 22,758,350**

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2 Spawning Habitat Construction

Acres included	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
6.6	$ 115,800	5%	0%	6%	0%	0%	10%	$ 924,779	20%	$ 1,109,735

Construction: Average cost per year: $ 123,304
(spread over 9 years)

Study years: **9** **Total:** **$ 1,109,735**

OMRRR: 20% Average cost per year: $ 24,661
(spread over 50 years)

Study years: **50** **Total:** **$ 1,233,039**

3 Operations & Maintenance of Existing SWH

Total area included: 1,509 acres

Average cost per year: $ 7,383,537 at $4,893/acre
(spread over 50 years)

Study years: **50** **Total:** **$ 369,176,850**

4 Channel widening

	Acres included	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
Omaha	861	$ 115,800	5%	0%	6%	0%	0%	10%	$ 120,641,616	20%	$ 144,769,940
KC	1,650	$ 243,614	5%	0%	6%	0%	0%	10%	$ 486,374,571	20%	$ 583,649,486
KC *(structure mod projects)*	869	$ 15,115	5%	0%	6%	0%	0%	10%	$ 15,893,271	20%	$ 19,071,926

	Omaha	KC
Total:	**$ 144,769,940**	**$ 602,721,411**

OMRRR (KC structure mods):
Cost/project: $ 11,450

O&M:
Cost/acre:
$ 4,893

	Omaha	KC
Average cost per year: (spread over 50 years)	$ 4,212,873	$ 8,187,950

Study years: **50**

	Omaha	KC
Total:	**$ 210,643,650**	**$ 409,397,500**

5 Real Estate Acquisition

	Lands reqd	Acres purchased (x 7.7)	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
KC	230	1,772	$ 4,692	0%	0%	0%	0%	0%	0%	$ 8,314,224	20%	**$ 9,977,069**

6 Monitoring, Evaluation & Research

PSPAP:

Average cost per year: $ 2,500,000
(spread over 50 years)

Study years: **50** **Total:** **$ 125,000,000**

HAMP:

Average cost per year: $ 1,860,333
(spread over 15 years)

Study years: **15** **Total:** **$ 27,905,000**

Level 1 & 2 studies - lower river:

Average cost per year: $ 1,422,171
(spread over 19 years)

Study years: **19** **Total:** **$ 27,021,250**

Level 1 & 2 studies - upper river:

Average cost per year: $ 933,027
(spread over 15 years)

Study years: **15** **Total:** **$ 13,995,400**

7 Mechanical ESH Construction

Acres/year	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
294.05	$ 50,000	0%	0%	0%	0%	0%	0%	$ 14,702,500	0%	$ 14,702,500

Construction: Average cost per year: $ 14,702,500
(spread over 50 years)

Study years: **50** **Total:** **$ 735,125,000**

8 Vegetation Management

		Annual cost	$	136,491
		Occurs in 1/2 of years - reduce:	$	(68,246)
Study years:	**50**	Annual average cost, rounded	$	68,000
		(spread over 50 years)		

Total: $ 3,400,000

9 Predator Management

		Annual cost	$	60,000
		Occurs in 1/3rd of years - reduce:	$	(40,000)
Study years:	**50**	Annual average cost, rounded	$	20,000
		(spread over 50 years)		

Total: $ 1,000,000

10 Human Restriction Measures

		Signage material	$	1,036
		Signage labor	$	3,062
		Average cost per year:	$	4,098
		Add contingency (20%)	$	820
Study years:	**50**	Annual average cost, rounded	$	5,000
		(spread over 50 years)		

Total: $ 250,000

11 Monitoring

Monitoring cost	$	1,200,000
Average cost per year:	$	1,200,000
(spread over 50 years)		

Study years: **50**

Total: **$ 60,000,000**

12 Focused Research

Research cost	incl. below	
Average cost per year:	$	-
(spread over 50 years)		

Study years: **50**

Total: **$ -**

13 Level 1 and 2 Studies

Focused research	$	25,000,000
Engineered log jams	$	1,500,000
Stabilization using biopolymers	$	500,000
Stabilization using biotechnical methods:		
Construction	$	500,000
Monitoring	$	100,000
Stabilization using sub-optimal sediments	$	200,000
Total cost:	$	27,800,000
(spread over 15 years)		

Study years: **15**

Total: **$ 27,800,000**

Alternative Summary Management Actions	Alternative 4 - Pallid Habitat Construction and ESH Spring Release TOTAL	Assumptions for estimates
Program Management, Integration & Coordination	284,500,000	$5,690,000 annually (per USACE), for 50 years.
MRRIC	75,000,000	$1,500,000 annually (per USACE), for 50 years.
Lower River Pallid Sturgeon		
Propagation and Augmentation Program	22,758,350	Annual budget of $455,167 for 50 years
Spawning Habitat Construction	2,342,773	Cost of creation of 6.6 acres (3 sites at 2.2 acres each), starting in year 3 and spread over 9 years, using the Omaha cost/acre for channel widening of $115,800; plus cost of OMRRR at 20% of construction cost, annually for 50 years
Early Life History Habitat Construction:		
Existing SWH operations & maintenance	369,176,850	O&M cost of $4,903/acre for existing 1,509 acres (744 acres of chutes and 366 acres of backwaters for Omaha; 399 acres of chutes for Kansas City) - assumes same cost as top width O&M
Backwater	Not required	
Channel Widening - total	1,367,532,501	
- Omaha reaches construction	144,769,940	##
- Omaha reaches O&M costs	210,643,650	
- Kansas City reaches construction	602,721,411	O&M - cost for O&M spread over 50 years (at $4,893/acre); for the 10 structure modifications projects in KC reaches, $114,500 is included per year.
- Kansas City reaches O&M costs	409,397,500	
Real Estate Acquisition	9,977,069	##
Habitat Development	2,125,200	1,417 acres of agricultural land developed over 15 years at a cost of $1,500 per acre.
Land Management	1,876,938	1,541 acres managed over a 50-year period at an annual cost of $29/acre
Spawning Cue Flow	N/A	
Low Summer Flow	N/A	
Floodplain Connectivity	N/A	
Monitoring, Evaluation and Research:		
PSPAP	125,000,000	$2,500,000 annually for 50 years
HAMP	27,905,000	$1,860,333 annually for 15 years
Focused Research	N/A	
Level 1 and 2 studies	27,021,250	Annual cost of $1,422,171 for 19 years - based on total cost of $27,021,250 for years 2014 - 2032, converted to an average annual cost.
Upper River Pallid Sturgeon		
Propagation and Augmentation Program	Included above	
Monitoring, Evaluation and Research:		
PSPAP	Included above	
HAMP	N/A	
Focused Research	N/A	
Level 1 and 2 studies	13,995,400	Annual cost of $933,027 for 15 years - based on total cost of $13,995,400 for years 2014 - 2028, converted to an average annual cost.
Piping Plover and Least Tern		
Mechanical ESH Creation	291,400,000	Cost of 116.56 acres being constructed annually at a cost of $50,000 per acre, for 50 years
Vegetation Management	3,400,000	$136,490 annually (incurred on average every other year), for 50 years
Predator Management	1,000,000	$60,000 annually (incurred on average once every 3 years), for 50 years
Human Restrictions Measures	250,000	Annual signage costs of $5,000 (rounded), for 50 years
Spring Reservoir Release for ESH Creation	N/A	
Fall Reservoir Release for ESH Creation	No implementation cost	
Monitoring, Evaluation and Research:		
Monitoring	60,000,000	$1,200,000 annually for monitoring, for 50 years
Focused Research	0	Included below
Level 1 and 2 Studies	27,800,000	Engineered log jams and multiple stabilization methods, plus focused research cost of $25,000,000, spread over 15 years.
ESTIMATED COST	**$2,713,061,331**	

Program Management, Integration & Coordination

Costs provided by USACE:

Program management, integration & coordination	$	1,500,000
ISP Labor	$	1,590,000
AM Costs	$	1,700,000
Strategic annual process review	$	40,000
Communication support	$	80,000
Information management	$	600,000
FWCA	$	100,000
Tribal business	$	80,000
Average cost per year:	$	5,690,000

Study years: **50**

Total: **$ 284,500,000**

MRRIC

Costs provided by USACE:

MRRIC	$	1,500,000
Average cost per year:	$	1,500,000

Study years: **50**

Total: **$ 75,000,000**

Lower River Pallid Sturgeon

1 Propagation & Augmentation Program

Average cost per year: $ 455,167
(spread over 50 years)

Study years: **50**

Total: **$ 22,758,350**

2 Spawning Habitat Construction

Acres included	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
6.6	$ 115,800	5%	0%	6%	0%	0%	10%	$ 924,779	20%	$ 1,109,735

Construction: Average cost per year: $ 123,304
(spread over 9 years)

Study years: **9** **Total:** **$ 1,109,735**

OMRRR: 20% Average cost per year: $ 24,660.77
(spread over 50 years)

Study years: **50** **Total:** **$ 1,233,039**

3 Operations & Maintenance of Existing SWH

Total area included: 1,509 acres

Average cost per year: $ 7,383,537 at $4,893/acre
(spread over 50 years)

Study years: **50** **Total:** **$ 369,176,850**

4 Channel widening

	Acres included	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
Omaha	861	$ 115,800	5%	0%	6%	0%	0%	10%	$ 120,641,616	20%	$ 144,769,940
KC	1,650	$ 243,614	5%	0%	6%	0%	0%	10%	$ 486,374,571	20%	$ 583,649,486
KC *(structure mod projects)*	869	$ 15,115	5%	0%	6%	0%	0%	10%	$ 15,893,271	20%	$ 19,071,926

	Omaha	KC
Total:	**$ 144,769,940**	**$ 602,721,411**

OMRRR (KC structure mods):
Cost/project: $ 11,450

O&M:
Cost/acre:
$ 4,893

Study years: **50**

	Omaha	KC
Average cost per year: (spread over 50 years)	$ 4,212,873	$ 8,187,950
Total:	**$ 210,643,650**	**$ 409,397,500**

5 Real Estate Acquisition

	Lands reqd	Acres purchased (x 7.7)	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
KC	230	1,772	$ 4,692	0%	0%	0%	0%	0%	0%	$ 8,314,224	20%	**$ 9,977,069**

6 Monitoring, Evaluation & Research

PSPAP:

Average cost per year: $ 2,500,000
(spread over 50 years)

Study years: **50** **Total:** **$ 125,000,000**

HAMP:

Average cost per year: $ 1,860,333
(spread over 15 years)

Study years: **15** **Total:** **$ 27,905,000**

Level 1 & 2 studies - lower river:

Average cost per year: $ 1,422,171
(spread over 19 years)

Study years: **19** **Total:** **$ 27,021,250**

Level 1 & 2 studies - upper river:

Average cost per year: $ 933,027
(spread over 15 years)

Study years: **15** **Total:** **$ 13,995,400**

7 Mechanical ESH Construction

Acres/year	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
116.56	$ 50,000	0%	0%	0%	0%	0%	0%	$ 5,828,000	0%	$ 5,828,000

Construction: Average cost per year: $ 5,828,000
(spread over 50 years)

Study years: **50** **Total:** **$ 291,400,000**

8 Vegetation Management

		Annual cost	$	136,491
		Occurs in 1/2 of years - reduce:	$	(68,246)
Study years:	**50**	Annual average cost, rounded (spread over 50 years)	$	68,000
		Total:	**$**	**3,400,000**

9 Predator Management

		Annual cost	$	60,000
		Occurs in 1/3rd of years - reduce:	$	(40,000)
Study years:	**50**	Annual average cost, rounded (spread over 50 years)	$	20,000
		Total:	**$**	**1,000,000**

10 Human Restriction Measures

		Signage material	$	1,036
		Signage labor	$	3,062
		Average cost per year:	$	4,098
		Add contingency (20%)	$	820
Study years:	**50**	Annual average cost, rounded (spread over 50 years)	$	5,000
		Total:	**$**	**250,000**

11 Monitoring

		Monitoring cost	$ 1,200,000
		Average cost per year:	$ 1,200,000
		(spread over 50 years)	
Study years:	**50**		
		Total:	**$ 60,000,000**

12 Focused Research

		Research cost	incl. below
		Average cost per year:	$ -
		(spread over 50 years)	
Study years:	**50**		
		Total:	**$ -**

13 Level 1 and 2 Studies

		Focused research	$ 25,000,000
		Engineered log jams	$ 1,500,000
		Stabilization using biopolymers	$ 500,000
		Stabilization using biotechnical methods:	$ -
		Construction	$ 500,000
		Monitoring	$ 100,000
		Stabilization using sub-optimal sediments	$ 200,000
		Total cost:	$ 27,800,000
		(spread over 15 years)	
Study years:	**15**		
		Total:	**$ 27,800,000**

Alternative Summary Management Actions	Alternative 5 - Pallid Habitat Construction and ESH Fall Release TOTAL	Assumptions for estimates
Program Management, Integration & Coordination	284,500,000	$5,690,000 annually (per USACE), for 50 years.
MRRIC	75,000,000	$1,500,000 annually (per USACE), for 50 years.
Lower River Pallid Sturgeon		
Propagation and Augmentation Program	22,758,350	Annual budget of $455,167 for 50 years
Spawning Habitat Construction	2,342,773	Cost of creation of 6.6 acres (3 sites at 2.2 acres each), starting in year 3 and spread over 9 years, using the Omaha cost/acre for channel widening of $115,800; plus cost of OMRRR at 20% of construction cost, annually for 50 years
Early Life History Habitat Construction:		
Existing SWH operations & maintenance	369,176,850	O&M cost of $4,903/acre for existing 1,509 acres (744 acres of chutes and 366 acres of backwaters for Omaha; 399 acres of chutes for Kansas City) - assumes same cost as top width O&M
Backwater	Not required	
Channel Widening - total	1,367,532,501	
- Omaha reaches construction	144,769,940	##
- Omaha reaches O&M costs	210,643,650	
- Kansas City reaches construction	602,721,411	O&M - cost for O&M spread over 50 years (at $4,893/acre); for the 10 structure modifications projects in KC reaches, $114,500 is included per year.
- Kansas City reaches O&M costs	409,397,500	
Real Estate Acquisition	9,977,069	##
Habitat Development	2,125,200	1,417 acres of agricultural land developed over 15 years at a cost of $1,500 per acre.
Land Management	1,876,938	1,541 acres managed over a 50-year period at an annual cost of $29/acre
Spawning Cue Flow	N/A	
Low Summer Flow	N/A	
Floodplain Connectivity	N/A	
Monitoring, Evaluation and Research:		
PSPAP	125,000,000	$2,500,000 annually for 50 years
HAMP	27,905,000	$1,860,333 annually for 15 years
Focused Research	N/A	
Level 1 and 2 studies	27,021,250	Annual cost of $1,422,171 for 19 years - based on total cost of $27,021,250 for years 2014 - 2032, converted to an average annual cost.
Upper River Pallid Sturgeon		
Propagation and Augmentation Program	Included above	
Monitoring, Evaluation and Research:		
PSPAP	Included above	
HAMP	N/A	
Focused Research	N/A	
Level 1 and 2 studies	13,995,400	Annual cost of $933,027 for 15 years - based on total cost of $13,995,400 for years 2014 - 2028, converted to an average annual cost.
Piping Plover and Least Tern		
Mechanical ESH Creation	485,650,000	Cost of 194.26 acres being constructed annually at a cost of $50,000 per acre, for 50 years
Vegetation Management	3,400,000	$136,490 annually (incurred on average every other year), for 50 years
Predator Management	1,000,000	$60,000 annually (incurred on average once every 3 years), for 50 years
Human Restrictions Measures	250,000	Annual signage costs of $5,000 (rounded), for 50 years
Spring Reservoir Release for ESH Creation	No implementation cost	
Fall Reservoir Release for ESH Creation	N/A	
Monitoring, Evaluation and Research:		
Monitoring	60,000,000	$1,200,000 annually for monitoring, for 50 years
Focused Research	0	Included below
Level 1 and 2 Studies	27,800,000	Engineered log jams and multiple stabilization methods, plus focused research cost of $25,000,000, spread over 15 years.
ESTIMATED COST	**$2,907,311,331**	

Program Management, Integration & Coordination

Costs provided by USACE:

Program management, integration & coordination		$	1,500,000
ISP Labor		$	1,590,000
AM Costs		$	1,700,000
Strategic annual process review		$	40,000
Communication support		$	80,000
Information management		$	600,000
FWCA		$	100,000
Tribal business		$	80,000
	Average cost per year:	$	5,690,000

Study years: **50** **Total:** **$ 284,500,000**

MRRIC

Costs provided by USACE:

MRRIC		$	1,500,000
	Average cost per year:	$	1,500,000

Study years: **50** **Total:** **$ 75,000,000**

Lower River Pallid Sturgeon

1 Propagation & Augmentation Program

Average cost per year: $ 455,167
(spread over 50 years)

Study years: **50** **Total:** **$ 22,758,350**

2 Spawning Habitat Construction

Acres included	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
6.6	$ 115,800	5%	0%	6%	0%	0%	10%	$ 924,779	20%	$ 1,109,735

	Construction:	Average cost per year: (spread over 9 years)		$ 123,304
Study years:	9		**Total:**	**$ 1,109,735**
	OMRRR: 20%	Average cost per year: (spread over 50 years)		$ 24,661
Study years:	50		**Total:**	**$ 1,233,039**

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3 Operations & Maintenance of Existing SWH

Total area included:	1,509 acres			
		Average cost per year: (spread over 50 years)	$ 7,383,537	at $4,893/acre
Study years:	50	**Total:**	**$ 369,176,850**	

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4 Channel widening

	Acres included	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
Omaha	861	$ 115,800	5%	0%	6%	0%	0%	10%	$ 120,641,616	20%	$ 144,769,940
KC	1,650	$ 243,614	5%	0%	6%	0%	0%	10%	$ 486,374,571	20%	$ 583,649,486
KC *(structure mod projects)*	869	$ 15,115	5%	0%	6%	0%	0%	10%	$ 15,893,271	20%	$ 19,071,926

	Omaha	KC
Total:	**$ 144,769,940**	**$ 602,721,411**

OMRRR (KC structure mods):
Cost/project: $ 11,450

O&M:
Cost/acre: $ 4,893

Study years: **50**

	Omaha	KC
Average cost per year: (spread over 50 years)	$ 4,212,873	$ 8,187,950
Total:	**$ 210,643,650**	**$ 409,397,500**

5 Real Estate Acquisition

	Lands reqd	Acres purchased (x 7.7)	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
KC	230	1,772	$ 4,692	0%	0%	0%	0%	0%	0%	$ 8,314,224	20%	**$ 9,977,069**

6 Monitoring, Evaluation & Research

PSPAP:

		Average cost per year: (spread over 50 years)		$ 2,500,000
Study years:	**50**	**Total:**	**$ 125,000,000**	

HAMP:

		Average cost per year: (spread over 15 years)		$ 1,860,333
Study years:	**15**	**Total:**	**$ 27,905,000**	

Level 1 & 2 studies - lower river:

		Average cost per year: (spread over 19 years)		$ 1,422,171
Study years:	**19**	**Total:**	**$ 27,021,250**	

Level 1 & 2 studies - upper river:

		Average cost per year: (spread over 15 years)		$ 933,027
Study years:	**15**	**Total:**	**$ 13,995,400**	

7 Mechanical ESH Construction

Acres/year	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
194.26	$ 50,000	0%	0%	0%	0%	0%	0%	$ 9,713,000	0%	$ 9,713,000

Construction: Average cost per year: $ 9,713,000
(spread over 50 years)

Study years: **50**

Total: $ 485,650,000

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8 Vegetation Management

Annual cost $ 136,491
Occurs in 1/2 of years - reduce: $ (68,246)

Study years: **50**

Annual average cost, rounded $ 68,000
(spread over 50 years)

Total: $ 3,400,000

---

9 Predator Management

Annual cost $ 60,000
Occurs in 1/3rd of years - reduce: $ (40,000)

Study years: **50**

Annual average cost, rounded $ 20,000
(spread over 50 years)

Total: $ 1,000,000

---

10 Human Restriction Measures

		Signage material	$ 1,036
		Signage labor	$ 3,062
		Average cost per year:	$ 4,098
		Add contingency (20%)	$ 820
Study years:	**50**	Annual average cost, rounded	$ 5,000
		(spread over 50 years)	
		Total:	**$ 250,000**

11 Monitoring

		Monitoring cost	$ 1,200,000
		Average cost per year:	$ 1,200,000
		(spread over 50 years)	
Study years:	**50**		
		Total:	**$ 60,000,000**

12 Focused Research

		Research cost	incl. below
		Average cost per year:	$ -
		(spread over 50 years)	
Study years:	**50**		
		Total:	**$ -**

13 <u>Level 1 and 2 Studies</u>

Focused research	$	25,000,000
Engineered log jams	$	1,500,000
Stabilization using biopolymers	$	500,000
Stabilization using biotechnical methods:	$	-
Construction	$	500,000
Monitoring	$	100,000
Stabilization using sub-optimal sediments	$	200,000
Total cost:	$	27,800,000
(spread over 15 years)		

Study years: **15**

Total: **$ 27,800,000**

Alternative Summary / Management Actions	Alternative 6 - Pallid Habitat Construction and ESH Mechanical w/Spawning Cue TOTAL	Assumptions for estimates
Program Management, Integration & Coordination	284,500,000	$5,690,000 annually (per USACE), for 50 years.
MRRIC	75,000,000	$1,500,000 annually (per USACE), for 50 years.
Lower River Pallid Sturgeon		
Propagation and Augmentation Program	22,758,350	Annual budget of $455,167 for 50 years
Spawning Habitat Construction	2,342,773	Cost of creation of 6.6 acres (3 sites at 2.2 acres each), starting in year 3 and spread over 9 years, using the Omaha cost/acre for channel widening of $115,800; plus cost of OMRRR at 20% of construction cost, annually for 50 years
Early Life History Habitat Construction:		
Existing SWH operations & maintenance	369,176,850	O&M cost of $4,903/acre for existing 1,509 acres (744 acres of chutes and 366 acres of backwaters for Omaha; 399 acres of chutes for Kansas City) - assumes same cost as top width O&M
Backwater	Not required	
Channel Widening - total	1,367,532,501	
- Omaha reaches construction	144,769,940	##
- Omaha reaches O&M costs	210,643,650	
- Kansas City reaches construction	602,721,411	O&M - cost for O&M spread over 50 years (at $4,893/acre); for the 10 structure modifications projects in KC reaches, $114,500 is included per year.
- Kansas City reaches O&M costs	409,397,500	
Real Estate Acquisition	9,977,069	##
Habitat Development	2,125,200	1,417 acres of agricultural land developed over 15 years at a cost of $1,500 per acre.
Land Management	1,876,938	1,541 acres managed over a 50-year period at an annual cost of $29/acre
Spawning Cue Flow	N/A	
Low Summer Flow	N/A	
Floodplain Connectivity	N/A	
Monitoring, Evaluation and Research:		
PSPAP	125,000,000	$2,500,000 annually for 50 years
HAMP	27,905,000	$1,860,333 annually for 15 years
Focused Research	N/A	
Level 1 and 2 studies	27,021,250	Annual cost of $1,422,171 for 19 years - based on total cost of $27,021,250 for years 2014 - 2032, converted to an average annual cost.
Upper River Pallid Sturgeon		
Propagation and Augmentation Program	Included above	
Monitoring, Evaluation and Research:		
PSPAP	Included above	
HAMP	N/A	
Focused Research	N/A	
Level 1 and 2 studies	13,995,400	Annual cost of $933,027 for 15 years - based on total cost of $13,995,400 for years 2014 - 2028, converted to an average annual cost.
Piping Plover and Least Tern		
Mechanical ESH Creation	540,225,000	Cost of 216.09 acres being constructed annually at a cost of $50,000 per acre, for 50 years
Vegetation Management	3,400,000	$136,490 annually (incurred on average every other year), for 50 years
Predator Management	1,000,000	$60,000 annually (incurred on average once every 3 years), for 50 years
Human Restrictions Measures	250,000	Annual signage costs of $5,000 (rounded), for 50 years
Spring Reservoir Release for ESH Creation	N/A	
Fall Reservoir Release for ESH Creation	N/A	
Monitoring, Evaluation and Research:		
Monitoring	60,000,000	$1,200,000 annually for monitoring, for 50 years
Focused Research	0	Included below
Level 1 and 2 Studies	27,800,000	Engineered log jams and multiple stabilization methods, plus focused research cost of $25,000,000, spread over 15 years.
ESTIMATED COST	**$2,961,886,331**	

Program Management, Integration & Coordination

Costs provided by USACE:

Program management, integration & coordination	$	1,500,000
ISP Labor	$	1,590,000
AM Costs	$	1,700,000
Strategic annual process review	$	40,000
Communication support	$	80,000
Information management	$	600,000
FWCA	$	100,000
Tribal business	$	80,000
Average cost per year:	$	5,690,000

Study years: **50** **Total:** **$ 284,500,000**

MRRIC

Costs provided by USACE:

MRRIC	$	1,500,000
Average cost per year:	$	1,500,000

Study years: **50** **Total:** **$ 75,000,000**

Lower River Pallid Sturgeon

1 Propagation & Augmentation Program

Average cost per year: $ 455,167
(spread over 50 years)

Study years: **50** **Total:** **$ 22,758,350**

2 Spawning Habitat Construction

Acres included	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
6.6	$ 115,800	5%	0%	6%	0%	0%	10%	$ 924,779	20%	$ 1,109,735

Construction: Average cost per year: (spread over 9 years) $ 123,304

Study years: **9** **Total:** **$ 1,109,735**

OMRRR: 20% Average cost per year: (spread over 50 years) $ 24,661

Study years: **50** **Total:** **$ 1,233,039**

---

3 Operations & Maintenance of Existing SWH

Total area included: 1,509 acres

Average cost per year: (spread over 50 years) $ 7,383,537 at $4,893/acre

Study years: **50** **Total:** **$ 369,176,850**

---

4 Channel widening

	Acres included	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
Omaha	861	$ 115,800	5%	0%	6%	0%	0%	10%	$ 120,641,616	20%	$ 144,769,940
KC	1,650	$ 243,614	5%	0%	6%	0%	0%	10%	$ 486,374,571	20%	$ 583,649,486
KC	869	$ 15,115	5%	0%	6%	0%	0%	10%	$ 15,893,271	20%	$ 19,071,926
(structure mod projects)											

	Omaha	KC
Total:	**$ 144,769,940**	**$ 602,721,411**

OMRRR (KC structure mods):
Cost/project: $ 11,450

Study years: **50**

O&M:
Cost/acre:
$ 4,893

	Omaha	KC
Average cost per year: (spread over 50 years)	$ 4,212,873	$ 8,187,950
Total:	**$ 210,643,650**	**$ 409,397,500**

5 Real Estate Acquisition

	Lands reqd	Acres purchased (x 7.7)	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
KC	230	1,772	$ 4,692	0%	0%	0%	0%	0%	0%	$ 8,314,224	20%	**$ 9,977,069**

6 Monitoring, Evaluation & Research

PSPAP:

Average cost per year: $ 2,500,000
(spread over 50 years)

Study years: **50** **Total:** **$ 125,000,000**

HAMP:

Average cost per year: $ 1,860,333
(spread over 15 years)

Study years: **15** **Total:** **$ 27,905,000**

Level 1 & 2 studies - lower river:

Average cost per year: $ 1,422,171
(spread over 19 years)

Study years: **19** **Total:** **$ 27,021,250**

Level 1 & 2 studies - upper river:

Average cost per year: $ 933,027
(spread over 15 years)

Study years: **15** **Total:** **$ 13,995,400**

7 Mechanical ESH Construction

Acres/year	Cost/acre	PM	PED	S&A	OMRRR	O&M	EDC	Sub-total	Contingency	Total
216.09	$ 50,000	0%	0%	0%	0%	0%	0%	$ 10,804,500	0%	$ 10,804,500

Construction: Average cost per year: $ 10,804,500
(spread over 50 years)

Study years: **50** **Total:** **$ 540,225,000**

8 Vegetation Management

		Annual cost	$	136,491
		Occurs in 1/2 of years - reduce:	$	(68,246)
Study years:	**50**	Annual average cost, rounded (spread over 50 years)	$	68,000

Total: $ 3,400,000

9 Predator Management

		Annual cost	$	60,000
		Occurs in 1/3rd of years - reduce:	$	(40,000)
Study years:	**50**	Annual average cost, rounded (spread over 50 years)	$	20,000

Total: $ 1,000,000

10 Human Restriction Measures

		Signage material	$	1,036
		Signage labor	$	3,062
		Average cost per year:	$	4,098
		Add contingency (20%)	$	820
Study years:	**50**	Annual average cost, rounded (spread over 50 years)	$	5,000

Total: $ 250,000

11 Monitoring

Monitoring cost	$ 1,200,000
Average cost per year:	$ 1,200,000
(spread over 50 years)	

Study years: **50**

Total: **$ 60,000,000**

12 Focused Research

Research cost	incl. below
Average cost per year:	$ -
(spread over 50 years)	

Study years: **50**

Total: **$ -**

13 Level 1 and 2 Studies

Focused research	$ 25,000,000
Engineered log jams	$ 1,500,000
Stabilization using biopolymers	$ 500,000
Stabilization using biotechnical methods:	$ -
Construction	$ 500,000
Monitoring	$ 100,000
Stabilization using sub-optimal sediments	$ 200,000
Total cost:	$ 27,800,000
(spread over 15 years)	

Study years: **15**

Total: **$ 27,800,000**

Habitat development costs

December 5, 2016

Alt.	Reach	Acreage acquired	Agricultural land portion		Cost/acre	Total cost	Annual cost
			Omaha (60%)	Kansas City (80%)			
1	Omaha	1,848	1,109		$ 1,500	$ 1,663,200	$ 110,880
	Kansas City	5,198		4,158	$ 1,500	$ 6,237,600	$ 415,840
2	Omaha	15,554	9,332		$ 1,500	$ 13,998,600	$ 933,240
	Kansas City	30,161		24,129	$ 1,500	$ 36,193,200	$ 2,412,880
3	Omaha	-	-		$ 1,500	$ -	$ -
	Kansas City	1,771		1,417	$ 1,500	$ 2,125,200	$ 141,680
4	Omaha	-	-		$ 1,500	$ -	$ -
	Kansas City	1,771		1,417	$ 1,500	$ 2,125,200	$ 141,680
5	Omaha	-	-		$ 1,500	$ -	$ -
	Kansas City	1,771		1,417	$ 1,500	$ 2,125,200	$ 141,680
6	Omaha	-	-		$ 1,500	$ -	$ -
	Kansas City	1,771		1,417	$ 1,500	$ 2,125,200	$ 141,680

Land management costs **December 5, 2016**

Annual cost/acre: $ 29.00

Alt.	Reach	Acreage acquired	Deduct SWH acreage	Total acreage	Year 2 acreage	Cost year 2	Years 3 - 16 acreage	Cost years 3 - 16	Years 17 - 50 acreage	Cost years 17 - 50	Total cost	Average annual cost
1	Omaha	1,848	240	1,608	107	$ 3,109	1,501	$ 369,947	1,608	$ 1,585,488	$ 1,958,544	$ 39,970
	Kansas City	5,198	675	4,523	302	$ 8,744	4,221	$ 1,040,592	4,523	$ 4,459,678	$ 5,509,014	$ 112,429
2	Omaha	15,554	2,020	13,534	902	$ 26,166	12,632	$ 3,113,722	13,534	$ 13,344,524	$ 16,484,412	$ 336,417
	Kansas City	30,161	3,917	26,244	1,750	$ 50,738	24,494	$ 6,037,870	26,244	$ 25,876,584	$ 31,965,192	$ 652,351
3	Omaha	-	0	0	0	$ -	0	$ -	0	$ -	$ -	$ -
	Kansas City	1,771	230	1,541	103	$ 2,979	1,438	$ 354,533	1,541	$ 1,519,426	$ 1,876,938	$ 38,305
4	Omaha	-	-	0	0	$ -	0	$ -	0	$ -	$ -	$ -
	Kansas City	1,771	230	1,541	103	$ 2,979	1,438	$ 354,533	1,541	$ 1,519,426	$ 1,876,938	$ 38,305
5	Omaha	-	-	0	0	$ -	0	$ -	0	$ -	$ -	$ -
	Kansas City	1,771	230	1,541	103	$ 2,979	1,438	$ 354,533	1,541	$ 1,519,426	$ 1,876,938	$ 38,305
6	Omaha	-	-	0	0	$ -	0	$ -	0	$ -	$ -	$ -
	Kansas City	1,771	230	1,541	103	$ 2,979	1,438	$ 354,533	1,541	$ 1,519,426	$ 1,876,938	$ 38,305

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APPENDIX G: MRRIC RECOMMENDATIONS

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Missouri
River
Recovery
Implementation
Committee

Approved February 7, 2012
Transmitted February 21, 2012

Mr. David Ponganis
Acting Director of Programs
US Army Corps of Engineers
Northwestern Division
P.O. Box 2870
Portland, OR 97208-2870

Mr. Stephen Guertin
Regional Director
U.S. Fish and Wildlife Service, Region 6
P.O. Box 25486 – DFC
Denver, CO 80225-0486

Dear Mr. Ponganis & Director Guertin

I am writing you on behalf of the Missouri River Recovery Implementation Committee (MRRIC or the Committee). The MRRIC has nearly 70 members comprised of States, Tribes, Federal Agencies, and Stakeholders associated with Missouri River resources. It was authorized by Congress in Section 5018 of the Water Resources Development Act of 2007 and established in 2008 by the Assistant Secretary of the Army for Civil Works (Secretary). The duties of this committee include providing guidance to the Secretary regarding the existing Missouri River recovery and mitigation plans, including recommendations on the annual work plan and budget.

I am pleased to provide you with MRRIC's initial recommendation on the Final Report provided by the Independent Science Advisory Panel (ISAP) on Spring Pulses and Adaptive Management reached by consensus of MRRIC members present during our meeting in Kansas City, MO, on February 7-9, 2012. The recommendation is as follows:

> Following a collaborative effort, between the SAM Work Group and the lead agencies, to review the ISAP Final Report #1 and consider next steps – the Lead Agencies will provide a written response(s) to MRRIC regarding the findings/recommendations in the ISAP Final Report on Topic #1. The SAM Work Group will review the agency response(s) and ISAP Final Report on Topic #1, and assess whether to develop additional recommendations for MRRIC consideration.

Thank you for your consideration of this recommendation. Please contact me if you have any questions.

Sincerely,

Michael J. Mac
Chair, MRRIC
(573) 808-0288
mikejmac11@gmail.com

Missouri River Recovery Implementation Committee

Mr. David Ponganis
Director of Programs
Northwestern Division
US Army Corps of Engineers

Subject: MRRIC Recommendations for Proposed Actions to Move Forward Fulfillment of the ISAP Final Report on Spring Pulses and Adaptive Management

Dear Mr. Ponganis:

I am writing you on behalf of the Missouri River Recovery Implementation Committee (MRRIC or the Committee). The MRRIC has nearly 70 members comprised of States, Tribes, Federal Agencies, and Stakeholders associated with Missouri River. It was authorized by Congress in Section 5018 of the Water Resources Development Act of 2007 and established in 2008 by the Assistant Secretary of the Army for Civil Works (Secretary).

MRRIC recommends the USACE, in concert with the USFWS, proceed with a series of seven proposed actions (see below) for moving forward on fulfillment of the ISAP Final Report recommendations. These proposed actions are consistent with the ISAP recommendations; however they include some additional clarifications, based on MRRIC exchanges with the ISAP, which the Committee believes will be beneficial.

The Committee is providing these proposed actions based on: 1) review of the ISAP report;[1] 2) the clarifications from the ISAP in response to questions raised;[2] and 3) building on MRRIC's understanding of the conceptual process for moving forward as laid out by the agencies to the SAM Work Group in mid-April.[3]

As you consider the Committee's recommendations, please consider the following quote from the ISAP's Final Report, which provides useful context for MRRIC's role as efforts to move forward with the ISAP's recommendations are undertaken.

> "The ISAP views our role as providing interpretations of available science and preparing scientific findings to inform the decision-making process of the MRRIC. Further, we identify

[1] ISAP Final Report on Spring Pulses and Adaptive Management, November 30, 2011

[2] See clarification communications from the ISAP (December 12, 2011; summary of January 26, 2012 SPA Task Group call with ISAP and follow-on clarification; April 9, 2012)

[3] This conceptual framework will be shared with the full MRRIC in preparation for the May meeting and presented prior to MRRIC reaching closure on this recommendation.

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gaps in information that, if filled, could enhance the knowledge upon which river management decisions can be made. We expect MRRIC to use the ISAP findings and interpretations to assess what actions are actually feasible, possible, and/or practicable given other constraints, including social constraints and existing Authorized Purposes, on the system."

The Committee further supports the ISAP's further definition of the term "social constraints" as intended to refer to non-scientific factors including social, cultural, economic, legal, or other considerations.[4]

Proposed Actions

1. An effects analysis should be developed that incorporates new knowledge that has accrued since the 2003 Amended Biological Opinion. As part of this analysis:
   - The effects of the Missouri and Kansas River Operations on the listed species should be reviewed and analyzed in the context of other stressors on the listed species;
   - The quantitative effects of potential management actions on the listed species should be documented to the extent possible; and
   - These potential management actions should be incorporated into the CEMs.

2. Conceptual ecological models should be developed for each of the three listed species and these models should articulate the effects of stressors and mitigative actions (including but not limited to flow management, habitat restoration actions, and artificial propagation) on species performance.

3. Other managed flow programs and adaptive management plans should be evaluated as guidance in development of the CEMs and AM strategy for the Missouri River Recovery Program.

4. An overarching adaptive management strategy should be developed that anticipates implementation of combined flow management actions and mechanical habitat construction, and this strategy should be used to guide future management actions, monitoring, research, and assessment activities within the context of regulatory and legal constraints.

5. Monitoring programs along the Missouri River should be designed so as to determine if hypothesized outcomes are occurring and the extent to which they are attributable to specific management actions.

6. The agencies should identify decision criteria (trigger points) that will lead to continuing a management action or selecting a different management action. A formal[5] process should be designed and implemented to regularly compare incoming monitoring results with the decision criteria.

---

[4] See April 9, 2012 ISAP Response to 3/22/12 SPA TG Clarification Questions
[5] See April 9, 2012 ISAP Response to 3/22/12 SPA TG Clarification Questions

7. Aspects of how the entire hydrograph influences the three listed species should be evaluated when assessing the range of potential management actions.

We look forward to working with you on efforts to implement the proposed actions as defined in the SAM Work Group charge. The Committee thanks you for the opportunity to provide input on the efforts to implement the recommendations included in the ISAP's Final Report and hopes you thoughtfully consider our recommendations.

Respectfully,

Michael Mac

Dr. Michael Mac
Chair
Missouri River Recovery Implementation Committee

Cc: Steve Guertin, Regional Director, Mountain Prairie Region, US Fish and Wildlife Service

Missouri River Recovery Implementation Committee

August 28, 2014

Mr. David Ponganis
Director of Programs
U.S. Army Corps of Engineers

Subject: Transmittal of MRRIC Human Considerations Objectives and Metrics and accompanying Prologue

The attached file contains the MRRIC recommended set of Human Considerations objectives and metrics agreed upon by the Committee at the August 2014 plenary meeting. This document represents significant effort by MRRIC members and Agency staff which began in January 2013 and evolved into this consensus recommendation.

Although divided into two sections, the Prologue and the Objectives and Metrics, it is critical to point out that the recommendation package is the combination of the two. The Prologue sets out specific caveats by which the human considerations objectives and metrics can be used and interpreted.

Among the limitations set forward in the Prologue is that these objectives are only valid for alternatives that are within the sideboards articulated in the January 10, 2014 memorandum (attached to the Prologue). It is also important to understand that while each member does not endorse every objective and performance metric included, as a group MRRIC agrees that this set of objectives and metrics will assist efforts to evaluate Management Plan alternatives and future consideration of these alternatives.

Please feel free to contact me with any questions.

Michael J Mac

Michael J Mac, Ph.D.
Chair
Missouri River Recovery Implementation Committee

Cc: Michael Thabault, Assistant Regional Director-Ecological Services, Mountain Prairie Region, U.S. Fish and Wildlife Service.

1616 Capitol Avenue · Omaha, Nebraska 68102-4901 · (402) 995-2919 · info@MRRIC.org · www.MRRIC.org

APPENDIX H: TRIBAL ENGAGEMENT

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APPENDIX H

Missouri River Recovery Management Plan-EIS (MRRMP-EIS) Tribal Correspondence

Annotated Table of Contents:

- List of the 29 Missouri River Basin Tribes
- Example Tribal Scoping Letter: Scoping Letters were sent out to the identified 29 Tribes in July, 2013, informing them of the MRRMP-EIS. Providing face-to-face scoping is part of the Federal Trust responsibility and helped identify Tribal concerns and comments. Additionally the letter offered Formal Government-to-Government Consultation at any time it is requested by Tribal leaders.
- Management Plan Tribal Input Meeting Invite Letters: A series of meetings were conducted during the summer of 2015. These meetings were requested by MRRIC Tribal representatives for further explanation of the MRRMP-EIS and to gather additional information.
- DEIS Release Example Letter: In October 2016, a letter from General Spellmon was sent to the 29 identified Tribes, informing leaders of the release of the DEIS in December 2016 and how we will conduct Consultation after its release.
- Table of Management Plan Tribal Meetings
- DRAFT Tribal Consultation Plan

Missouri River Basin Tribes

Apsaalooke (Crow) Nation

Assiniboine and Sioux Tribe of Fort Peck

Blackfeet Tribe

Cheyenne River Sioux Tribe

Chippewa Cree Tribe of Rocky Boy's

Crow Creek Sioux Tribe

Eastern Shoshone Tribe

Flandreau Santee Sioux Tribe

Gros Ventre and Assiniboine Tribes of Fort Belknap

Iowa Tribe of Kansas and Nebraska

Kickapoo Tribe of Kansas

Lower Brule Sioux Tribe

Northern Arapaho Tribe

Northern Cheyenne Tribe

Oglala Sioux Tribe

Omaha Tribe of Nebraska

Osage Nation

Ponca Tribe of Nebraska

Prairie Band Potawatomi Nation

Rosebud Sioux Tribe

Sac and Fox Nation of Missouri in Kansas

Santee Sioux Tribe of Nebraska

Sisseton-Wahpeton Oyate

Spirit Lake Sioux Tribe

Standing Rock Sioux Tribe

Three Affiliated Tribes

Turtle Mountain Band of Chippewa Indians

Winnebago Tribe of Nebraska

Yankton Sioux Tribe

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NORTHWESTERN DIVISION
PO BOX 2870
PORTLAND OR 97208-2870

April 7, 2015

Planning, Environmental Resources,
Fish Policy and Support Division

The U.S. Army Corps of Engineers (Corps) is committed to working closely with sovereign tribal nations, along with other governmental and non-governmental stakeholders in the Missouri River Basin (Basin), to develop a Missouri River Recovery Management Plan and Environmental Impact Statement (Management Plan/EIS). The Management Plan/EIS will identify a set of actions for the Corps to implement to ensure that our operation of the Missouri River mainstem reservoirs and the Bank Stabilization and Navigation Project does not jeopardize the continued existence of three Federally-listed species: the pallid sturgeon, the interior least tern, and the piping plover.

The Management Plan/EIS is being developed collaboratively with the Missouri River Recovery Implementation Committee (MRRIC). I strongly encourage you and your tribe to participate in MRRIC to improve your understanding of the effort and to take advantage of every opportunity to ensure your voice is heard as the plan comes together. All Basin tribes are members of MRRIC and my staff will be happy to provide more information to you about MRRIC.

The Corps understands and respects the unique relationship the tribes have with the Missouri River and wants to ensure that you have the opportunity outside of MRRIC to communicate directly with the Corps and provide input to the Management Plan. The Corps will hold a special, day-long meeting for the Basin tribes on May 6, 2015, 0800-1600, at the Oglala Sioux Rural Water Supply System (OSRWSS) Mni Wiconi - Water Treatment Plant at 28542 Trails End Road, Ft. Pierre, SD (Conference Room). All tribes within or connected to the Basin are invited to attend and participate. A draft agenda for the meeting is enclosed to this letter and we welcome your feedback on that, as well.

The Corps recognizes its responsibilities and reiterates its commitment to conduct formal government-to-government consultation with the tribes in the Basin as outlined in Executive Order 13084. Participation in MRRIC and at the tribes-only meeting is not meant to replace this government-to-government consultation. Government-to-government consultation can be requested at any time.

Again, we want to ensure that Basin tribes are knowledgeable about the Management Plan and are aware of the various ways they can participate. Ms. Cathi Warren, Native American Consultation Specialist, will be contacting you in the next two weeks to follow up on this letter. You may also contact Ms. Warren directly at 402-995-2684 or by email at catherine.j.warren@usace.army.mil for questions or clarifications. Your input and participation are important and we look forward to working with you.

Sincerely,

John S. Kem
Brigadier General, US Army
Division Commander

Enclosure

Missouri River Management Plan Tribal Meeting

May 6th Pierre, SD 8:00-4:00

8:00-8:30	Prayer and Introductions - Cathi Warren
8:30-9:00	Overview of Management Plan and Proact. Probably want to briefly cover MRRIC here and the connection with the Management Plan and why the Management Plan is "going" through MRRIC - Mark Harberg
9:00-10:00	Overview of Effects Analysis and results, i.e. management hypotheses and actions - Joe Bonneau
10:00-10:45	Status of "Alternative plans" - Mark Harberg
10:45-12:00	Overview of Hydrologic and Hydraulic Modeling, explain what this is- Use visualization tool to show "Exisiting Operation" and example of a Round 1 alternative - Jeff Tripe
12:00-1:00	LUNCH
1:00-2:30	Human Considerations and Human Consideration Proxy Measures, what are they and how they work - Use visualization tool to show HC proxy results for "Existing Operation" and example Round 1 alternative - Thomas Topi
2:30-3:00	Adaptive Management, how does/will this work - Joe Bonneau
3:00-3:30	What is happening next? At what point will we engage the tribes outside of MRRIC again - Mark Harberg
3:30-4:00	Wrap up and additional questions -- Cathi Warren

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
1616 CAPITOL AVENUE
OMAHA NE 68102-4901

Planning, Programs, and Project Management Division

«Prefix» «FirstMiddle_Name» «Last_Name», «Suffix»«Title»
«Organization»
«Address1»
«Address2»
«City», «State» «Zip»

Dear «Salutation» «Last_Name»:

The U.S. Army Corps of Engineers (Corps) is committed to working closely with sovereign tribal nations, along with other governmental and non-governmental stakeholders in the Missouri River Basin (Basin), to develop a Missouri River Recovery Management Plan (Management Plan). The Management Plan will identify a set of actions for the Corps to implement to ensure that our operation of the Missouri River mainstem reservoirs and the Bank Stabilization and Navigation Project does not jeopardize the continued existence of three Federally-listed species: the pallid sturgeon, the interior least tern, and the piping plover.

The Corps understands and respects the unique relationship the tribes have with the Missouri River and is holding a second meeting the first of which was held on May 6th, to provide input to the Management Plan. The Corps will hold a day-long meeting for the Basin tribes on July 14th, 2015, 8:00 a.m. to 4:00 p.m., at the Royal River Casino and Hotel, 607 Veterans St, Flandreau, SD. All tribes within or connected to the Basin are invited to attend and participate. A draft agenda for the meeting is attached to this letter and we welcome your feedback on it, as well. A block of rooms are being held under the name Great Plains Tribal Water Alliance, please call (877) 912-5825 for reservations.

The Management Plan is being developed collaboratively with the Missouri River Recovery Implementation Committee (MRRIC). I strongly encourage you and your tribe to participate in MRRIC to improve your understanding of the effort and to take advantage of every opportunity to ensure your voice is heard as the plan comes together. All Basin tribes are members of MRRIC and my staff will be happy to provide you with more information about MRRIC.

The Corps recognizes its responsibilities and reiterates its commitment to conduct formal government-to-government consultation with the tribes in the Basin as outlined in Executive Order 13084. Participation in MRRIC and the tribes-only meeting is not meant to replace this government-to-government consultation. Government-to-government consultation can be requested at any time.

Again, we want to ensure that Basin tribes are knowledgeable about the Management Plan and are aware of the various ways they can participate. Ms. Cathi Warren, Native American Consultation Specialist, will be contacting you in the next two weeks to follow up on this letter. You may also contact Ms. Warren directly at (402) 995-2684 or by email at catherine.j.warren@usace.army.mil for questions or clarifications. Your input and participation are important and we look forward to working with you.

Sincerely,

April Fitzner, PMP
Senior Program Manager
Missouri River Recovery Program
US Army Corps of Engineers

Enclosure

Copy Furnished: (Electronic Distribution)

CENWD-PDR (Jodi Farhat)
CENWD-PDD (G. Paul Cloutier)
CECC-NWD (Jennifer Richman)
CENWO-DD (LTC Martinez)
CENWO-OC (Richard Totten)
CENWO-SA-NA (Joel Ames)
CENWO-OD-T (Larry Janis)
CENWO-OD-T (Harold M. Key)
CENWO-OD-T (Chris Wiehl)
CENWO-OD-TN (Jeremy Szynskie)
CENWO-OD-GP (Jeff Cook)
CENWO-OD-GP (Gary Ledbetter)
CENWO-OD-FR (Cody Wilson)
CENWO-OD-FR (Thomas Curran)
CENWO-OD-BB (Keith Fink)
CENWO-OD-BB (Jackie Bultsma)
CENWO-OD-BB (Jennifer Winter)
CENWO-OD-OA (Rick Harnois)
CENWO-OD-OA (Megan Maier)
CENWO-OD-OA (Phil Sheffield)
CENWO-OD-OA (Eric Stasch)
CENWO-OD-GA (Todd Lindquist)
CENWO-OD-GA (Ryan Newman)
CENWO-OD-GA (Casey Buechler)
CENWO-OD-GA (Dave Cain)
CENWO-OD-LP (John Daggett)
CENWO-OD-LP (Darin McMurry)
CENWO-PM-AE (Julie Price)
CENWO-PM-AE (Sandra Barnum)
CENWO-PM-AE (Amy McClean)
State of SD - Dan.Shaffer@state.sd.us

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NORTHWESTERN DIVISION
PO BOX 2870
PORTLAND OR 97208-2870

OCT 20 2016

Chairman Dave Archambault, II
Standing Rock Sioux Tribe
P.O. Box D
Fort Yates, ND 58538

Dear Chairman Archambault:

The Missouri River Recovery Management Plan, Draft Environmental Impact Statement (MRRMP-DEIS) is an effort that will evaluate the effectiveness of current Missouri River Recovery Program management activities and recommend any needed modifications to more effectively create habitat and avoid jeopardy to the following threatened and endangered species: the least tern, piping plover and pallid sturgeon.

This effort is led by the U.S. Army Corps of Engineers' (USACE) Kansas City (NWK) and Omaha (NWO) Districts in partnership with the U.S. Fish and Wildlife Service (USFWS). The geographic scope of the federal action includes the Missouri River within its meander belt from the headwaters of Fort Peck Lake in Montana to its confluence with the Mississippi River near St. Louis, Missouri.

At this time, we would like to offer you the opportunity to meet and discuss the DEIS development and review process and share your thoughts and concerns with regard to the project. The MRRMP-DEIS will be released in December 2016 and a copy of the document will be sent for your review. At that time we will invite you to meet or consult on the DEIS and the preferred alternative.

We appreciate your attention regarding this matter and we look forward to working with you on this important effort. In closing, Ms. Cathi Warren, Missouri River Programs Tribal Consultation Specialist, will be contacting you to identify appropriate tribal points of contact, and schedule meetings as requested. In the interim, should you have any questions, please feel free to contact Mr. Mark Harberg, Program Manager, at (402-995-2554), or Ms. Warren at (402-995-2684).

Sincerely,

Scott A. Spellmon
Brigadier General, US Army
Division Commander

Noreen Walsh
Regional Director
Mountain Prairie Region
U.S. Fish and Wildlife Service

MANAGEMENT PLAN TRIBAL ENGAGEMENT MEETINGS

Scoping Meetings:

8/8/2013 – Billings, Mt: Crow Nation, Gros Ventre and Assiniboine Tribes of Ft. Belknap
8/20/2013 – Bismarck, ND: Three Affiliated Tribes
8/27/2013 – Pawhuska, OK: Osage Nation
8/29/2013 – Lawrence, KS: Kickapoo Tribe

Alternatives Development Meetings:

7/30/2013 - Osage - (MRRIC & Mgmt Plan)
10/2013 - Tribal & Cultural Webinar
2/25/2014 – Iowa Tribe of Kansas and Nebraska
2/26/2014 - Kickapoo & Pottawatomie
3/26/2014 - Osage
4/7/2014 – Standing Rock Sioux Tribe
4/8/2014 – Three Affiliated
4/9/2014 – Cheyenne River Sioux Tribe
4/15/2014 – United Tribes Technical College, Environmental Training
4/22/2014 – Ponca Tribe of Nebraska
5/14/2014 Lower Brule Sioux Tribe
5/15/2014 – Crow Creek Sioux Tribe
5/29/2014 – Winnebago Tribe of Nebraska
7/14/2014 – Ponca Tribe of Nebraska
10/1/2014 – Rosebud and Oglala Sioux Tribes
3/10/2015 – Crow Nation
4/14/2015 – Three Affiliated
5/6/2015 - Fort Pierre, SD; Oglala, Rosebud, Standing Rock, Flandreau, Fort Peck, Iowa, Osage, Crow.
6/23/2015 - Crow Creek Sioux Tribe
6/30/2015 – Osage Nation
7/14/2015 – Flandreau. SD: Flandreau, Winnebago, Omaha, Standing Rock, Rosebud, Oglala
8/2015 - Cultural Resources Proxy Webinar
9/2/2015 - Crow Agency, MT: Crow Nation, Northern Cheyenne, Rocky Boy Chippewa Cree
9/15/2015 – Osage Nation
10/21/2015 – Bismarck, ND: Standing Rock & Three Affiliated Tribes
1/20/2015 Standing Rock Sioux Tribe
2/17/2015 - Standing Rock, ND
4/13/2016 – Red Lodge Montana: Native American Fish and Wild life Society
7/11/2016 – Oglala Sioux Tribe9/15/2016 – Osage Nation

MoRAST:

- March 2014 – Pierre, SD
- October 2014 – Denver

MRRIC Meetings:

- Quarterly Plenary Meetings (2012-2016 related to Mgt. Plan)

- Tribal Interest Work Group Meetings (2012-2016 related to Mgt. Plan)

I. Identification of Parties for Consultation

All Federally Recognized Tribes geographically located within the Missouri River Basin or that have historical ties within the basin have been identified as potential consulting parties. For this process, the term “Tribe(s)” refers to Federally Recognized Tribes. These Tribes are acknowledged to have all the immunities and privileges available to all Federally Recognized Tribes, as well as, the responsibilities, powers, limitations and obligations by virtue of their Government-to-Government relationship with the United States. The Department of Interior, Bureau of Indian Affairs (BIA), maintains a list of all Federally Recognized Tribes. Updates to this list are posted in the Federal Register (81 FR 26826).

Tribal points of contact will be asked to identify other potentially interested Tribes, Tribal affiliates and Tribal grassroots organizations that may have an interest in the Missouri River Recovery Management Plan (MRRMP) via letter, phone, and/or in person. If additional interested parties are identified during Consultation with Federally Recognized Tribes, they will be brought into the Consultation Process.

The U.S. Fish and Wildlife Service (Service) Native American Liaison will assist as the interface for logistics, communication, scheduling, tracking actions items relevant to the and attendance decisions for Service Region 6 leadership. The Service will jointly offer Consultation in conjunction with the USACE. This strategy will help to efficiently engage Tribal and agency leaderships’ time and reduce confusion that could be created with multiple agencies engaging separately.

Regional Director, Noreen Walsh will delegate Consultation authority for the MRRP EIS to Michael Thabault, Assistant Regional Director for Ecological Services and Missouri River Coordinator Casey Kruse. The letters offering consultation should be signed jointly by agency Regional Directors. The Service will be responsible for Endangered Species Act Section 7 during the Consultations.

II. Communications

Coordination and communication with the Tribes will occur and continue throughout the Consultation Process. Open and honest communication is the foundation of Government-to-Government Consultation. Consulting parties are encouraged to take advantage of opportunities to exchange information and discuss issues during both informal forums and the formal Consultation Process. Forms of communication to be used during the Consultation Process include face-to-face meetings when possible, letters, email and telephone. It is important to remember that informal meetings/forums are not considered “Government-to-Government Consultation” and should be made clear to all that attend. A list of informal Tribal engagement so far is included in Appendix A.

III. Consultation Process

Any time a Tribal leader and/or their designee requests formal Consultation, the Missouri River Recovery Programs Tribal Consultation Specialist (MRRP Consultation Specialist) will be the lead. The Consultation will take place with the appropriate District, NWK or NWO, based upon the Tribe's location and/or area of interest. The appropriate District Tribal Liaison and Program and Project Managers will support the MRRP Consultation Specialist with planning and executing the Consultation to ensure compliance with the requirements of all applicable statutes, executive orders, or other applicable laws.

The Corps' MRRP Consultation Specialist will ensure that the Service Regional Native American Liaison is aware of all meeting times, locations, agendas, correspondence, and other pertinent information. It is the responsibility of the Service Region Leadership to participate according to their requirements. The Service Native American Liaison will ensure their agency is aware of those requirements and pertinent Consultation meeting information.

The guidelines below are not intended to replace specifically mandated Consultation requirements, such as those identified in the National Historic Preservation Act (NHPA) or the Native American Graves Protection and Repatriation Act (NAGPRA) implementing regulations. Rather, they would provide a framework for implementation of these and any other requirements.

IV. Consultation Guidelines

The steps in the Government-to-Government Consultation Process for the MRRMP-EIS are:

- Initiation of Government-to-Government Consultation is the responsibility of the both the Corps and Service as required by statute. By written correspondence, the appropriate District Commander will offer to engage in Government-to-Government Consultation with all Federally Recognized Tribes, geographically located within the Missouri River Basin or that have historical ties within the basin, on the MRRMP EIS. This letter will be sent as early in the Process as is reasonable. The purpose of this letter will be to define the MRRMP-EIS and to indicate that this letter is the first step in the formal Government-to-Government Consultation Process.

- After the initial letter is mailed the MRRP Consultation Specialist will follow up by telephone. Information from these telephone calls will be documented and follow-up actions requested by the Tribe will be noted, incorporated as appropriate, and reported to appropriate Corps staff for any necessary follow up. If a Tribe elects not to respond to the initial Consultation letter or the subsequent telephone call, the MRRP Consultation Specialist will periodically, throughout the Consultation Process, attempt to initiate Consultation with the Tribes in the manner described above.

- Tribes may accept the Corps' offer of Government-to-Government Consultation by any form of communication. It is incumbent on the MRRP Consultation Specialist to verify that the decision to consult reflects the wishes of the Tribal Leader or their designee. Though written confirmation is not required, it is preferred.

- In cooperation with the Tribal Leader or their designee, arrangements for an initial Consultation meeting will be made as soon as possible after the Tribe accepts the Corps' offer of Consultation. Consultation meetings will take place at mutually agreed upon intervals and locations. Agendas for the Consultation meetings will be mutually developed by the Consulting Parties and should reflect Consultation issues that are of primary importance to all parties. Some Consultation discussions may also focus on Tribal participation during official National Environmental Policy Act (NEPA) efforts.

- In addition to the Consultation meetings described above, to ensure that there is meaningful Government-to-Government Consultation occurring at critical points during the Study process, the Corps will offer face-to-face meetings with both Consulting and non-Consulting Tribal Leaders or their designees and the appropriate District Commander or his designee. These meetings will be offered at a minimum during the following points in the process:
    - Following the release of the Draft EIS (December 2016)
    - Following the identification of a Preferred Alternative/Proposed Action for initiation of Section 7, ESA consultation, if one is not included in the DEIS
    - Prior to a Record of Decision (ROD)

V. <u>Resolution of Issues</u>

The intent of Government-to-Government Consultation is to provide for identification and resolution of issues related to the management actions being evaluated by the Corps' for ESA compliance regarding the Corps' operation of the Missouri River Mainstem Reservoir System, operation and maintenance of the Bank Stabilization and Navigation Project, and operation of the Kansas River Reservoir System with the respective Corps District; however, resolutions of some issues may be beyond the scope and authority of the District Commanders. Unresolved issues identified in formal Government-to-Government Consultation may be elevated to higher levels within the Corps beginning with the Northwestern Division, Headquarters USACE, and then to the Office of the Assistant Secretary of the Army for Civil Works. Consulting parties will develop joint procedures for elevation and ultimate disposition of unresolved issues. This may include annual meetings to maintain relationships and provide relevant information. Tribal resolutions or other Tribal procedures may also serve as tools for unresolved Tribal issues.

The Service will work with Tribes to elevate an ultimate disposition of unresolved issues using Consultation options such as: putting an emphasis on co-management and collaborative management of natural and cultural resources, in which the Service and tribes share decision-making to the extent permitted by law. These actions can include placing an added emphasis on implementation and accountability, engage tribal knowledge in the Service's decision-making, and provide a consistent national framework flexible enough to accommodate regional and local variations in culture and perspectives.

VI. References:

a. Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, 06 Nov 2000.

b. White House Memorandum, Government-to-Government Relations, 29 April 1994.

c. U.S. Army Corps of Engineers (USACE) Tribal Policy Principles, 18 Feb 1998 and 10 May 2010.

d. DOD American Indian and Alaska Native Policy, 20 Oct 1998.

e. Presidential Memorandum, Tribal Consultation, 05 Nov 2009.

f. Department of the Army American Indian and Alaskan Native Policy, 24 Oct 2012.

g. USACE Memorandum for Commanders, Directors and Chiefs of Separate Offices, U.S. Army Corps of Engineers, Subject: Tribal Consultation Policy, 01 Nov 2012.

h. Planning, Environmental Resources, Fish Policy and Support Division: Native American Policy CENWD-PDD Policy Memorandum, No. NWDOM 2.

i. Secretarial Order 3206, American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act.

j. Department of the Interior Policy on Consultation with Indian Tribes.

k. U.S. Fish and Wildlife Service Native American Policy.

APPENDIX A Tribal Engagements So Far

Scoping Meetings:

Alternatives Development Meetings:

- Osage – July 2013 (MRRIC & Mgmt Plan)
- Tribal & Cultural Webinar – October 2013
- Kickapoo & Potowatomie – February 2014
- Osage – March 2014
- Multiple Tribes, Fort Pierre, SD – May 2015
- Crow Creek – June 2015
- Multiple Tribes, Flandreau, SD – July 2015
- Cultural Resources Proxy Webinar – August 2015
- Winnebago, NE – August 2015
- Crow Agency, MT – September 2015
- Standing Rock & Three Affiliated Tribes, ND – October 2015
- Standing Rock, ND – January 2016
- Standing Rock, ND – February 2016

MoRAST:

- March 2014 – Pierre, SD
- October 2014 – Denver

MRRIC Meetings:

- Quarterly Plenary Meetings
- Tribal Interest Work Group Meetings

APPENDIX I: ENDANGERED SPECIES ACT CORRESPONDENCE

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Mountain-Prairie Region

IN REPLY REFER TO:
FWS/R6/ES/MORC

MAILING ADDRESS:
P.O. Box 25486, DFC
Denver, Colorado 80225-0486

STREET LOCATION:
134 Union Boulevard
Lakewood, Colorado 80228-1807

OCT 10 2012

David Ponganis, Director of Programs
U.S. Army Corps of Engineers
1125 NW Couch Street, Suite 500
Portland, Oregon 97209

Dear Mr. Ponganis:

The U.S. Fish and Wildlife Service (USFWS) has received and reviewed the Missouri River Recovery Program Independent Science Advisory Panel's (ISAP) *Final Report on Spring Pulses and Adaptive Management*, dated November 30, 2011. This report, commissioned by the Missouri River Recovery Implementation Committee (MRRIC), evaluated the pulses that have been implemented to date and how they have achieved the biological outcomes the USFWS sought in the 2003 Amendment to the 2000 Biological Opinion (2003 Amended BiOp), dated December 23, 2003. The ISAP confirmed that spring pulses, as currently implemented, are not accomplishing their intended outcomes and provided recommendations towards achieving a new management paradigm for the Missouri River.

Based on the final report, we have determined that aggressive pursuit of completing the recommendations laid out by the ISAP is the best path forward to ensure we are using the available scientific data to achieve the intent of the 2003 Amended BiOp and species recovery. Accordingly, while completion of the ISAP recommendations is being pursued, the USFWS believes it is appropriate to forego a spring pulse, under the currently established criteria, during the 2013 Missouri River operating season and that not providing a spring pulse is not likely to have an adverse effect on the listed species addressed in the 2003 Amended BiOp.

To ensure timely implementation of the ISAP recommendations, it will be imperative that the U.S. Army Corps of Engineers (USACE) continue its collaboration with the USFWS to quickly develop a schedule, process, and check in points, to ensure the agencies are on track to fully evaluate the needs of Missouri River endangered species and the role hydrology may play in their recovery and long-term sustainability. This process needs to evaluate the complete hydrograph, consider a full range of alternatives to meet species requirements, and result in a sustainable and adaptable management strategy for the Missouri River.

We should all turn our efforts to quickly and efficiently implementing the ISAP recommendations. We also hope that our two agencies will continue working together with Missouri River stakeholders to fully implement all these recommendations. It is possible, even likely, that as the ISAP recommendations are implemented, a new management strategy for flows and habitat restoration will develop, leading to more effective species recovery actions on the Missouri River. We envision that a new management strategy coming off the ISAP effort could be implemented by spring 2014, or during 2015 at the latest, thus replacing the current spring pulse operation with a more comprehensive management plan. We look forward to our first two planned USFWS – USACE check-in points (November 2012 and February 2013) on the progress of implementing the ISAP recommendations.

My staff stands ready to assist in any way they can. If you have any questions, please feel free to contact Casey Kruse, Missouri River Coordinator at (605) 760-7471.

Sincerely,

Regional Director

Cc: Jody Farhat
U.S. Army Corps of Engineers
1616 Capitol Avenue
Omaha, NE 68102-4909

Cc: Steve Fischer, USACE, Kansas City, MO
Casey Kruse, USFWS, Yankton, SD

Draft Pallid Sturgeon Objectives (Upper and Lower Basin) for the Missouri River Recovery Program

As part of the effort to develop a comprehensive adaptive management plan for implementation of the U.S. Army Corps of Engineers (USACE) Missouri River Recovery Program (MRRP), the U.S. Fish and Wildlife Service (USFWS) provides the following species objective for the endangered pallid sturgeon.

While this objective is consistent with USFWS established recovery goals for the pallid sturgeon, it is prepared specifically as a fundamental objective to avoid and prevent jeopardy to the species from the USACE action of operating and maintaining the Missouri River System. This fundamental objective and subsequent sub-objectives describe the desired outcomes from the USACE actions as part of the MRRP.

These objectives are prepared with the following tenants. They should:

- Be consistent with Endangered Species Act required Pallid Sturgeon Recovery Plan recovery goals and strategies,
- Reflect the latest knowledge of the species life history needs and their current status relative to the form and function of the contemporary Missouri River System,
- Have a direct relationship with the USACE's effect on the species from their operations of the Missouri River System, and
- Be sensitive to actionable threat remediation.

Fundamental Objective: Avoid jeopardizing the continued existence of the pallid sturgeon from the US Army Corps of Engineers actions on the Missouri River.

Sub-objective 1: Increase pallid sturgeon recruitment to age 1.

Sub-objective 2: Maintain or increase numbers of pallid sturgeon as an interim measure until sufficient and sustained natural recruitment occurs.

Sub-objectives track progress towards achieving the fundamental objective. They can also help determine which factors contribute most to achieving the fundamental objective. Note that the fundamental and sub-objectives are not independent of each other, and should be considered **together** rather than separately when assessing the state of the system and choosing management actions.

The following sub-objectives are those objectives which must be attained to ultimately allow us to achieve the stated "fundamental objective". The intent of the sub-objectives is to provide direction in the short term, provide objectives meaningful for adaptive management, and focus efforts on the desired short term outcomes while keeping the fundamental objective in mind. Although attaining a self sustaining population is ultimately the desired outcome, we are likely decades away from such an objective being very meaningful. Even if we achieved natural recruitment in the next 10 years, it would be another 20 to 30 years before we could assess progress toward the self-sustaining population objective.

Sub-objective 1: **Increase pallid sturgeon recruitment to age 1.**

Metric: catch rates of naturally-produced age 2 and 3 pallid sturgeon
This metric is used because pallid sturgeons are susceptible to sampling gears at these ages AND are still young enough to be accurately aged. If older fish can be accurately aged, their catch rates should be used as well. Close coordination will need to occur with scientists on the Mississippi River to determine if Missouri River fish are recruiting in the Mississippi and eventually returning to Missouri River to spawn. This will require cooperative microchemistry work on young fish.

Target: TBD. Short-term measurable recruitment, long-term informed by the effects analysis and population models. Target values for recruitment (i.e. necessary levels and frequency of recruitment over time) will be informed by population models as part of the effects analysis. Defining this target is not critical right now given that we are not currently concerned with levels or frequency of recruitment given we first need to see measurable recruitment.

Sub-objective 2: **Maintain or increase numbers of pallid sturgeon as an interim measure until sufficient and sustained natural recruitment occurs.**

This sub-objective really focuses on artificial propagation since it is the only means to achieve this intermediate objective. Monitoring and assessment will be directed at refining the artificial propagation approach and maximizing the utility of the artificial propagation program.

Metric: catch rates of all pallid sturgeon by size class. This metric is in accordance with the recovery guidance provided in the Pallid Sturgeon Recovery Plan and Genetics Plans for the Upper Basin and Lower Basin.

Target: TBD. The target values, by reach, will be informed by the effect analysis.

Means Objectives specify the way and degree to which the fundamental and sub-objectives can be achieved. The MRRP Means Objectives will be defined at a later date after the Effect Analysis is completed.

Note: Following are explanations regarding the above objectives:

These refinements to the objectives are consistent with the discussions at the workshops and incorporate many of the points made at the workshops.

- It is suggested that refining the strategic objective wording to focus on jeopardy avoidance (while including the 'contributing to recovery') will avoid ambiguity and confusion. The role of the USACE is to address the impacts of the USACE actions on the species (i.e., jeopardy avoidance). This is the manner in which the USACE contributes to the broader recovery efforts.
- The "Sub–objectives" as previously drafted contained redundancy (e.g., <u>Increase self-sustaining population</u> with a metric of length frequency and <u>Improve population size structure</u> with a metric of length frequency) and are basically synonymous with the stated fundamental objective. Some rewording of these objectives was done to help distinguish between sub-objectives and the fundamental objective.
- The sub-objectives should be viewed in terms of timeframes or immediate relevancy. The sub-objectives in sum ultimately allow us to achieve the fundamental objective in the long-term.
- The objectives as previously stated weren't particularly responsive to management actions or of utility for adaptive management (i.e., it would take many years to decades to link success back to a management action if our objectives and metrics relate to overall population size or desired population size structure). Adaptive management will require the opportunity to observe responses to management actions in a shorter time frame and an ability to link the response to an action or suite of actions.
- It is clear from the Conceptual Ecological Models (CEMs) and current understanding that without attaining some level of natural recruitment to age 1, it will not be possible to meet other objectives. Lack of recruitment is currently limiting pallid population growth. This is where attention must focus. Doing so shows that we have broken down and understand the problem and will provide some meaning to plan formulation exercises. It may be decades before anything else matters to us (or the pallid population).
- **There are several hypotheses regarding the lack of recruitment to age 1 (especially in the lower basin). These are partially identified in the CEMs, will be further evaluated in the Effects Analysis, and can be addressed in the formulation of alternatives and active adaptive management to come. For example, it could be that we have too few adults to successfully spawn, it could be that there is high egg mortality, it could be that drifting embryos suffer high mortality, it could be that habitat and food availability are limiting, etc., so the problem may actually be occurring prior to recruitment of larval sturgeon to age 1. Although there are multiple hypotheses, the bottom line is that we know fish survive well once they reach age 1 and an objective of getting fish to that point (i.e., recruitment to age 1) is the objective we need to achieve regardless of the early life history problem which is most limiting. In addition,**

the performance metric which can actually be measured is catch of fish once they get to age 2, 3, and 4.

- The CEMs make the link between USACE operation of the river and the loss of recruitment and place high importance on that linkage in both the Upper and Lower Basins. It is important to make that connection between the CEMs and our objectives. We need to show how our objectives are linked to addressing the effects of USACE operations on the species.
- It is important for future reviewers and contributors to understand the origin of and our needs for these objectives, for example:
    - The objectives stem from the effect of USACE actions and operations on the species and the legal mandate to avoid jeopardizing continued existence of the species;
    - The objectives will be used in an Effects Analysis;
    - Assessments of progress toward achieving objectives will be the basis for Adaptive Management efforts moving forward; and
    - For Adaptive Management purposes, objectives must be responsive within a reasonable time frame (i.e., we can't use monitoring results to affect management change if we must wait 30 to 40 year to interpret the results).

Draft Piping Plover Objective for the Missouri River Recovery Program

As part of the effort to develop a comprehensive adaptive management plan for implementation of the U.S. Army Corps of Engineers (USACE) Missouri River Recovery Program (MRRP), the U.S. Fish and Wildlife Service (USFWS) provides the following species objective for the threatened piping plover.

While this objective is consistent with USFWS established recovery goals for the piping plover, it is prepared specifically as a fundamental objective to avoid and prevent jeopardy to the species from the USACE action of operating and maintaining the Missouri River System. This fundamental objective and subsequent sub-objectives describe the desired outcomes from the USACE actions as part of the MRRP.

These objectives are prepared with the following tenants. They should:

- Be consistent with Endangered Species Act required Piping Plover Recovery Plan recovery goals and strategies,
- Reflect the latest knowledge of the plover's life history needs and their current status relative to the form and function of the contemporary Missouri River System,
- Have a direct relationship with the USACE's effect on the species from their operations of the Missouri River System, and
- Be sensitive to actionable threat remediation.

Fundamental Objective: Avoid jeopardizing the continued existence of the piping plover from the US Army Corps of Engineers actions on the Missouri River.

Sub-objective 1: Maintain a total population number of Missouri River birds that keep the population resilient on the Missouri River in the long term.

Sub-objective 2: Maintain a long-term trend in population growth that is at least stable.

Sub-objective 3: Increase and maintain the success of breeding pairs on Missouri River.

Sub-objective 4: Maintain a geographic distribution of plovers in the river and reservoirs in which they currently occur.

Sub-objectives track progress towards achieving the fundamental objective. They can also help determine which factors are contributing to an inability to reach the fundamental objective. Note that the fundamental and sub-objectives are not independent of each other, and should be considered **together** rather than separately when assessing the state of the system and choosing management actions.

The following sub-objectives are those objectives which must be attained to ultimately allow us to achieve the stated “fundamental objective”. The intent of the sub-objectives is to provide direction in the short term, provide objectives meaningful for adaptive management, and focus efforts on the desired short term outcomes while keeping the fundamental objective in mind.

Sub-objective 1: **Maintain a total population number of Missouri River birds that keep the population resilient on the Missouri River in the long term.**

Metric: Total Missouri River population size, frequency of years that population size is above target.

Target: TBD and informed by Effects Analysis.

Resilient can be defined by a population size that is large enough to withstand and recover from system shocks. Resiliency of the Missouri River population is interdependent of the population range-wide considering that the birds are known to sometimes use habitat elsewhere. Targets can be estimated with population viability analysis (PVA) models once an acceptable level of risk is specified, e.g. a 5% risk of extirpation over the next 50 years.

Population targets may also be specified as frequencies (e.g. populations should be above target 2 years out of 3; a 3-year running average of the population should be above target) to reflect the natural variability of plover habitat and population sizes. While this does not support the resiliency of the population, it can be used as part of adaptive management to determine when actions should be triggered in response to population sizes falling below the target.

Sub-objective 2: **Maintain a long-term trend in population growth that is at least stable.**

Metric: population growth rate (lambda; λ).

Target: $\lambda \geq 1$.

Population growth rate is nothing more than the change in population size over time. In other words, it is the trend in the fundamental objective. Growth rates (lambda) larger than one lead to an increase in population size, while growth rates less than one lead to a decrease in population size. This metric is used to determine whether population sizes below target are on track to reach the target, and whether population sizes above target are likely to remain there.

This metric is also important because there are biological constraints on population growth, and thus time lags before small populations can respond to improved conditions and reach the target. This metric allows for determination of whether management is successful in the short term.

<u>Sub-objective 3:</u> Increase and maintain the success of breeding pairs on Missouri River.

Metric: number of fledglings/breeding pair, or survival to fledge.

Target: TBD, informed by Effects Analysis.

An assessment of productivity is critical to determining the extent to which plover population trends are dependent upon conditions on the Missouri River rather than to conditions at wintering habitat outside of the basin, and therefore whether they can be affected by the MRRP. A decrease in population growth rate and size may be due to reduced productivity or decreased overwinter survival. Conversely, decreases in productivity may be masked in the short term if overwinter survival improves. Rates of fledgling production alone do not determine the health of the population (a very small population may have high fledge ratios), but instead must be considered together with population size and growth rate. Reduced productivity can be tolerated and, for plovers, expected when population sizes are large; however, small populations with low productivity will not recover in the absence of sufficient immigration from other populations. One downside of using fledglings/breeding pair is that the calculation amplifies the error inherent in survey data. Another issue with fledge ratio is the ability to accurately count fledglings without marking them, fledglings fly and can therefore easily be counted multiple times if they are not uniquely marked. Survival to fledge will require bird banding but will provide more accurate tracking of fledglings.

<u>Sub-objective 4:</u> Maintain a geographic distribution of plovers in the river and reservoirs in which they currently occur.

Metric: population size by reach, or proportion of population within each reach.

Target: TBD, informed by Effects Analysis

This sub-objective could be considered separately rather than as part of the fundamental objective, depending on emphasis desired. The geographic distribution of birds throughout the river supports population resilience by reducing the likelihood of local disturbances having catastrophic effects on the population. It will also likely support a larger population of plovers, as there is potential for more habitat when larger parts of the river are considered, and increased habitat supports increases in population sizes.

Means Objectives specify the way and degree to which the fundamental and sub-objectives can be achieved. The MRRP Means Objectives will be defined at a later date after the Effect Analysis is completed.

Note: Following are explanations regarding the above objectives:

These objectives are consistent with the discussions at the workshops and incorporate many of the points made at the workshops.

- It is suggested that refining the strategic objective wording to focus on jeopardy avoidance (while including the 'contributing to recovery') will avoid ambiguity and confusion. The role of the USACE is to address the impacts of the USACE's actions on the species (i.e., jeopardy avoidance). This is the manner in which the USACE contributes to the broader recovery efforts, but that point is regularly confused or lost as this debate has consumed many hours over the past two years. The wording should be as concise and unambiguous as possible.
- The "Sub–objectives" as previously drafted contained redundancy and were basically synonymous with the stated fundamental objective. Some rewording of these objectives was done to help distinguish between sub-objectives and the fundamental objective.
- The sub-objectives should be viewed in terms of timeframes or immediate relevancy. The sub-objectives in sum ultimately allow us to achieve the fundamental objective in the long-term.
- The objectives as previously stated weren't particularly responsive to management actions or of utility for adaptive management (i.e., it would take many years to decades to link success back to a management action if our objectives and metrics relate to overall population size or desired population size structure). Adaptive management will require the opportunity to observe responses to management actions in a shorter time frame and an ability to link the response to an action.
- The Conceptual Ecological Models (CEM) makes the link between USACE operations of the river and meeting the Fundamental Piping Plover Objectives. We need to show how our objectives are linked to addressing the effects of USACE operations on the species.
- It is important for future reviewers and contributors to understand the origin of and our needs for these objectives, for example:
    - The objectives stem from the effect of USACE actions and operations on the species and the legal mandate to avoid jeopardizing continued existence of the species;
    - The objectives will be used in an Effects Analysis;
    - Assessments of progress toward achieving objectives will be the basis for Adaptive Management efforts moving forward; and
    - For Adaptive Management purposes, objectives must be responsive within a reasonable time frame (i.e., we can't use monitoring results to affect management change if we must wait 30 to 40 year to interpret the results).

Draft Least Tern Objective for the Missouri River Recovery Program

As part of the effort to develop a comprehensive adaptive management plan for implementation of the U.S. Army Corps of Engineers (USACE) Missouri River Recovery Program (MRRP), the U.S. Fish and Wildlife Service (USFWS) provides the following species objective for the endangered least tern.

While this objective is consistent with USFWS established recovery goals for the least tern, it is prepared specifically as a fundamental objective to avoid and prevent jeopardy to the species from the USACE action of operating and maintaining the Missouri River System. This fundamental objective and subsequent sub-objectives describe the desired outcomes from the USACE actions as part of the MRRP.

These objectives are prepared with the following tenants. They should:

- Be consistent with Endangered Species Act required Least Tern Recovery Plan recovery goals and strategies,
- Reflect the latest knowledge of the species life history needs and their current status relative to the form and function of the contemporary Missouri River System,
- Have a direct relationship with the USACE's effect on the tern from their operations of the Missouri River System, and
- Be sensitive to actionable threat remediation.

Fundamental Objective: Avoid jeopardizing the continued existence of the least tern from the US Army Corps of Engineers actions on the Missouri River.

Sub-objective 1: Maintain a total population number of Missouri River birds that keep the population resilient on the Missouri River in the long term.

Sub-objective 2: Maintain a long-term trend in population growth that is at least stable.

Sub-objective 3: Increase and maintain the success of breeding pairs on Missouri River.

Sub-objective 4: Maintain a geographic distribution of terns in the river and reservoirs in which they currently occur.

Sub-objectives track progress towards achieving the fundamental objective. They can also help determine which factors are contributing to an inability to reach the fundamental objective. Note that the fundamental and sub-objectives are not independent of each other, and should be considered **together** rather than separately when assessing the state of the system and choosing management actions.

The following sub-objectives are those objectives which must be attained to ultimately allow us to achieve the stated "fundamental objective". The intent of the sub-objectives is to provide direction in the short term, provide objectives meaningful for adaptive management, and focus efforts on the desired short term outcomes while keeping the fundamental objective in mind.

Sub-objective 1: **Maintain a total population number of Missouri River birds that keep the population resilient on the Missouri River in the long term.**

Metric: Total Missouri River population size, frequency of years that population size is above target.

Target: TBD and informed by Effects Analysis.

Resilient can be defined by a population size that is large enough to withstand and recover from system shocks. Resiliency of the Missouri River population is interdependent of the population range-wide considering that the birds are known to sometimes use habitat elsewhere. Targets can be estimated with population viability analysis (PVA) models once an acceptable level of risk is specified, e.g. a 5% risk of extirpation over the next 50 years.

Population targets may also be specified as frequencies (e.g. populations should be above target 2 years out of 3; a 3-year running average of the population should be above target) to reflect the natural variability of tern habitat and population sizes. While this does not support the resiliency of the population, it can be used as part of adaptive management to determine when actions should be triggered in response to population sizes falling below the target.

Sub-objective 2: **Maintain a long-term trend in population growth that is at least stable.**

Metric: population growth rate (lambda; λ).

Target: $\lambda \geq 1$.

Population growth rate is nothing more than the change in population size over time. In other words, it is the trend in the fundamental objective. Growth rates (lambda) larger than one lead to an increase in population size, while growth rates less than one lead to a decrease in population size. This metric is used to determine whether population sizes below target are on track to reach the target, and whether population sizes above target are likely to remain there.

This metric is also important because there are biological constraints on population growth, and thus time lags before small populations can respond to improved conditions and reach the target. This metric allows for determination of whether management is successful in the short term.

Sub-objective 3: **Increase and maintain the success of breeding pairs on Missouri River.**

Metric: number of fledglings/breeding pair, or survival to fledge.

Target: TBD, informed by Effects Analysis.

An assessment of productivity is critical to determining the extent to which tern population trends are dependent upon conditions on the Missouri River rather than to conditions at wintering habitat outside of the basin, and therefore whether they can be affected by the MRRP. A decrease in population growth rate and size may be due to reduced productivity or decreased overwinter survival. Conversely, decreases in productivity may be masked in the short term if overwinter survival improves. Rates of fledgling production alone do not determine the health of the population (a very small population may have high fledge ratios), but instead must be considered together with population size and growth rate. Reduced productivity can be tolerated and, for terns, expected when population sizes are large; however, small populations with low productivity will not recover in the absence of sufficient immigration from other populations. One downside of using fledglings/breeding pair is that the calculation amplifies the error inherent in survey data. Another issue with fledge ratio is the ability to accurately count fledglings without marking them, fledglings fly and can therefore easily be counted multiple times if they are not uniquely marked. Survival to fledge will require bird banding but will provide more accurate tracking of fledglings.

Sub-objective 4: **Maintain a geographic distribution of terns in the river and reservoirs in which they currently occur.**

Metric: population size by reach, or proportion of population within each reach.

Target: TBD, informed by Effects Analysis

This sub-objective could be considered separately rather than as part of the fundamental objective, depending on emphasis desired. The geographic distribution of birds throughout the river supports population resilience by reducing the likelihood of local disturbances having catastrophic effects on the population. It will also likely support a larger population of terns, as there is potential for more habitat when larger parts of the river are considered, and increased habitat supports increases in population sizes.

Means Objectives specify the way and degree to which the fundamental and sub-objectives can be achieved. The MRRP Means Objectives will be defined at a later date after the Effect Analysis is completed.

Note: Following are explanations regarding the above objectives:

These objectives are consistent with the discussions at the workshops and incorporate many of the points made at the workshops.

- It is suggested that refining the strategic objective wording to focus on jeopardy avoidance (while including the 'contributing to recovery') will avoid ambiguity and confusion. The role of the USACE is to address the impacts of the USACE actions on the species (i.e., jeopardy avoidance). This is the manner in which the USACE contributes to the broader recovery efforts, but that point is regularly confused or lost as this debate has consumed many hours over the past two years. The wording should be as concise and unambiguous as possible.
- The "Sub–objectives" as previously drafted contained redundancy and were basically synonymous with the stated fundamental objective. Some rewording of these objectives was done to help distinguish between sub-objectives and the fundamental objective.
- The sub-objectives should be viewed in terms of timeframes or immediate relevancy. The sub-objectives in sum ultimately allow us to achieve the fundamental objective in the long-term.
- The objectives as previously stated weren't particularly responsive to management actions or of utility for adaptive management (i.e., it would take many years to decades to link success back to a management action if our objectives and metrics relate to overall population size or desired population size structure). Adaptive management will require the opportunity to observe responses to management actions in a shorter time frame and an ability to link the response to an action.
- The CEMs makes the link between USACE's operation of the river and meeting the Fundamental Least tern Objectives. We need to show how our objectives are linked to addressing the effects of USACE operations on the species.
- It is important for future reviewers and contributors to understand the origin of and our needs for these objectives, for example:
  - The objectives stem from the effect of USACE actions and operations on the species and the legal mandate to avoid jeopardizing continued existence of the species;
  - The objectives will be used in an Effects Analysis;
  - Assessments of progress toward achieving objectives will be the basis for Adaptive Management efforts moving forward; and
  - For Adaptive Management purposes, objectives must be responsive within a reasonable time frame (i.e., we can't use monitoring results to affect management change if we must wait 30 to 40 year to interpret the results).

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NORTHWESTERN DIVISION
PO BOX 2870
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REPLY TO
ATTENTION OF

Programs Directorate

3 1 JUL 2015

Noreen Walsh
U.S. Fish and Wildlife Services
134 Union Blvd
Lakewood, CO 80228

Dear Noreen:

As we have discussed, this letter confirms our mutual understanding that the U.S. Army Corps of Engineers (Corps) and the U.S. Fish and Wildlife Service (Service) are engaged in consultation on the 2003 Amended Biological Opinion on the Operation and Maintenance of the Mainstem Missouri River Reservoir System, the Missouri River Bank Stabilization and Navigation Project, and the Kansas Reservoir System (2003 Amended BiOp). The Missouri River Recovery Management Plan and Environmental Impact Statement (MRRMP/EIS), which is currently being developed jointly by our agencies in collaboration with the Missouri River Recovery Implementation Committee (MRRIC), serves as the on-going medium for this consultation. Following release of the draft MRRMP/EIS for public review and comment in 2016, this document will provide the foundation for a revised Biological Assessment (BA) and proposed action for our operation of the Missouri River System. Subject to the conclusions of the revised BA, we anticipate the Service may amend the current BiOp or issue a new BiOp pursuant to regulations governing section 7 of the Endangered Species Act (ESA). Based on this process and public input, the Corps will then be poised to make any appropriate revisions to the draft MRRMP/EIS, issue a final decision, and begin implementation.

The Missouri River Recovery Program's Independent Science Advisory Panel (ISAP), tasked by MRRIC, released a report (Final Report on Spring Pulses and Adaptive Management) on November 30, 2011 that analyzed the efficacy of the managed spring pulse releases from Gavins Point Dam as implemented by the Corps in response to the 2003 Amended BiOp. The ISAP's report identified the need to review the current management actions being taken to benefit the listed species in light of the current state of the science, concluding that there was "substantial new knowledge regarding pallid sturgeon, least tern, and piping plover, their habitats, and management opportunities on the lower Missouri River" since the 2003 Amended BiOp was published (pg 57). The ISAP recommended a "new management agenda using hydrological manipulations and habitat construction activities, implemented in an adaptive management framework" to replace the current action plan (pg 4). To achieve that goal, the panel provided a set of specific guidance and suggestions for the agencies to pursue (pg 4-5). The report also provided recommendations for developing an overarching Adaptive Management (AM) program to systematically address uncertainties involved with implementation of the management actions. As you know, development of an AM plan is also a component of the 2003 Amended BiOp.

On February 21, 2012, the MRRIC supported that guidance and provided our agencies with a formal consensus recommendation, in accordance with their Charter, proposing seven specific actions for the agencies to implement to fulfill the ISAP recommendations. On May 8, 2012, the Corps and Service provided a joint response to the MRRIC's recommendation, endorsing the ISAP's report and expressing our agencies' joint commitment to working closely with the MRRIC to implement the recommended actions.

To implement the ISAP report's recommendations, and in coordination with and building on the corresponding set of recommendations from the MRRIC, our two agencies have been applying a structured scientific process, employing teams of nationally recognized experts, to:

- Complete an Effects Analysis (EA) that includes review and compilation of the best available scientific information,
- Develop Conceptual Ecological Models (CEMs) for the three listed species to articulate the stressors and mitigative actions on species performance ,
- Identify the factors that might be limiting species' success,
- Evaluate a suite of management actions with the potential to remove those limiting factors, including any impacts that may accrue to human considerations,
- Design an overarching AM plan with clear decision criteria and robust and integrated research, monitoring and assessment activities,
- Assess and make appropriate changes to management actions through a management plan for continued compliance with ESA requirements, and
- Demonstrate commitment to implementing that management plan by completing all necessary components to its development, including National Environmental Policy Act (NEPA), Corps' Independent External Peer Review (IEPR), and Fish and Wildlife Coordination Act (FWCA).

Over the past three years, our agencies have invested significant time and resources toward implementing the recommendations and have made tremendous progress.

- The Notice of Intent for the MRRMP/EIS was published in January 2013 following extensive collaboration between our agencies on the study's Purpose and Need.
- The Request for Proposals for the Effects Analyses work was developed jointly by our agencies, reviewed by the ISAP and the MRRIC, and issued in March 2013. Nationally respected experts from the U.S. Geological Survey (pallid sturgeon), Pacific Northwest National Laboratories (least tern and piping plover), and the Corps' Engineer Research

and Development Center (river geomorphology) were selected to lead the EA teams and began work immediately.

- At the suggestion of the Service, a group of key team members, including the Corps, Service, and the Chair of the MRRIC, attended a Structured Decision Making Workshop at the National Conservation Training Center in June 2013 to strengthen our ability to conduct such a complex undertaking as the MRRMP/EIS with such a large and diverse group as the MRRIC.

- Evolving through a series of interim products that were guided by ISAP reviews and feedback, the CEMs for the three species were completed in February 2014.

- At the MRRIC's request, and with our agencies' concurrence, an independent socio-economic panel of experts was selected in April 2014 to provide review and feedback on the economic evaluation of potential MRRMP/EIS alternatives. The three-member Independent Social Economic Technical Review (ISETR) panel supplements the scientific expertise of the ISAP.

- Draft EAs for the species were completed in October 2014; the documents are currently undergoing pre-publication quality reviews.

Key elements that have been developed as part of the EA process include predictive species models, comprehensive hypotheses sets, evidence-based assessments of those hypotheses, and identification of potential management actions. It is safe to say that the breathtaking amount of state-of-the-science information that has been produced as part of this effort is unprecedented.

We appreciate the Service's continued efforts to utilize the EA results to identify objectives and metrics for the species. As you are aware, the species objectives and metrics are critical to development of appropriate management actions. The clear connection of species objectives and metrics to the rigorous scientific processes being followed by the EA teams (and reviewed by the ISAP and the MRRIC) will ensure success in reaching the goals described above.

Our agencies have been working with stakeholders to evaluate potential management action alternatives that achieve species objectives. This includes analyzing the potential impacts of those management actions on a suite of socioeconomic and other human considerations. We are also working with the EA team leads to draft the AM strategies that will systematically address uncertainties involved with implementation of management actions. And all of this has been accomplished with and improved by continuous review and feedback from the ISAP, ISETR, and the MRRIC.

While there is no doubt that our two agencies, working with the MRRIC, EA teams, and review panels, have accomplished much, there is still work to be done. As our agencies continue to refine management actions, assemble and evaluate alternative plans and potential impacts, develop AM strategies, and select a new management plan, we are committed to maintaining continuous engagement with the Service.

As we jointly work to complete the MRRMP/EIS, the Corps continues to implement the Reasonable and Prudent Alternative (RPA) provisions in the 2003 Amended BiOp, working closely with the Service to adaptively manage the RPA elements as appropriate, and as envisioned by the 2003 Amended BiOp. For example, over the past several years, based on new information or changing environmental conditions, our agencies have convened a plenary process with basin stakeholders to develop technical criteria for the spring pulse, worked collaboratively to modify the definition and parameters of Shallow Water Habitat (SWH), and explored modifications to criteria for unbalancing the upper three reservoirs that will benefit the species without adversely affecting the flood control purpose. All of these adjustments to management actions are based on evaluation of habitat, flow, climate, species response and other information as it becomes available, as contemplated in the 2003 Amended BiOp (pg 221).

Our agencies continue to meet regularly through the established Agency Coordination Team (now known as the CORE team) which allows us to evaluate implementation of management actions alongside the status of the species to ensure sufficient progress is always being made toward avoiding jeopardy and that course corrections are made as needed (pg 223). This is nowhere more evident than in the continuous improvements being made in the design, location, and construction of SWH to benefit the pallid sturgeon. The Corps' implementation teams are incorporating the best available pallid sturgeon science into engineering designs to address the factors thought to be limiting sturgeon success. We will also continue to make use of the quarterly MRRMP/EIS In-Progress Review meetings to jointly resolve management decisions as needed.

As we have agreed, and shared publicly on many occasions, the Corps fully recognizes the need to expeditiously complete the path to a new management plan as agreed to above in order to continue fulfilling our obligations under the ESA.

We look forward to our continued collaboration over the next year to achieve that goal.

David J. Ponganis, SES
Director, Programs

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Mountain-Prairie Region

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FWS/R6/ES

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SEP 29 2015

David J. Ponganis, Director
Department of the Army
Corps of Engineers, Northwest Division
P.O. Box 2870
Portland, Oregon 97208-2870

Dear Mr. Ponganis:

Thank you for your July 31, 2015 letter concerning the status of consultation regarding the U.S. Army Corps of Engineers (Corps) operation and maintenance of the mainstem Missouri River reservoir system, the Missouri River Bank Stabilization and Navigation Project, and the Kansas Reservoir System. As you point out, our two agencies have been working very closely on a path forward. That path includes the development of a Missouri River Recovery Management Plan and Environmental Impact Statement (MRRMP/EIS). This is being conducted in a highly transparent and public forum through the Missouri River Recovery Implementation Committee (MRRIC). Your letter goes into great detail about the level of scientific and policy involvement that has been ongoing between our agencies and the MRRIC for the last several years. I will not reiterate those efforts here.

It is reasonable to expect that a logical outcome of all of our work will be a Biological Assessment and a new, revised, or amended biological opinion based on the Service's current 2003 Amended Biological Opinion. I concur in your understanding of the status of consultation described in your letter. We will continue to assist the Corps in implementing the current biological opinion, and will continue to support the current process on the MRRMP/EIS. Your letter accurately reflects our understanding about the sequencing or scheduling of these steps. It is imperative that we coordinate the MRRMP/EIS and section 7 consultation obligations, as this coordination is critical to the success of our respective obligations under NEPA and the ESA.

Lastly, I agree with you that time is of the essence. Both from a conservation perspective for the species, as well as administratively, it is in our collective best interest to have a scientifically sound and legally defensible strategy to meet our agency challenges. The work at hand is extensive, requiring both human capital and financial resources from both of our agencies. You have my commitment to assist the Corps in finding efficiencies that do not sacrifice quality as we move forward.

I appreciate all the excellent working relationship that the U.S. Fish and Wildlife Service has with the Corps on the Missouri River. If you have additional questions, please feel free to contact Michael Thabault, Assistant Regional Director at (303) 236-4210.

Sincerely,

Deputy Regional Director

cc: USFWS Regional Directors, Reg. 6 & 3
USFWS ARDs, Reg. 6 & 3
State F&W Directors: MT, ND, SD, NE, IA, MO, KS
Missouri River Coordinator – Casey Kruse
April Fitzner, USACE
Mark Harberg, USACE