



DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, NORTHWESTERN DIVISION
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OCT 03 2019

Ms. Gail Bingham
Chair, Missouri River Recovery Implementation Committee
c/o U.S. Army Corps of Engineers
601 East 12th Street
Kansas City, Missouri 64106-2896

Dear Ms. Bingham:

Thank you for your letter dated July 3, 2019, transmitting the Missouri River Recovery Implementation Committee's (MRRIC) consensus recommendations for the U.S. Army Corps of Engineers (USACE) and the U.S. Fish and Wildlife Service (USFWS) concerning implementation of the Missouri River Recovery Program (MRRP) 2019 Spring Strategic Plan and Science and Adaptive Management Plan (SAMP).

The Lead Agencies appreciate the time and effort put forth by MRRIC's members to develop these recommendations. We want to recognize the hard work many members have invested to assist the agencies in meeting the objectives of the MRRP.

This letter constitutes the Lead Agencies' joint response, in accordance with the MRRIC Charter. The response to each recommendation is provided in the attachment, to allow for better understanding.

MRRIC's timely consensus recommendations on the Program's Strategic Plan can influence USACE's implementation of the SAMP by contributing to MRRP's budget request which is submitted two years in advance of the current Fiscal Year (FY). Section 2.2.3 of the SAMP explains the federal Civil Works budget process and why strategic recommendations for FY+2 have the best potential to guide Program direction. We offer the following suggestions to help MRRIC in providing future strategic recommendations.

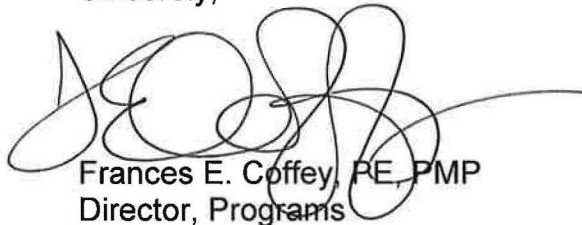
1. Recommendations that involve issues other than MRRIC's priorities for the FY+2 budget process can be brought forward for consensus determination at any time during the year. Focusing on recommendations specific to FY+2 through FY+4 in May could result in fewer but more strategically substantive recommendations. Reducing the number of recommendations and focusing on substantive topics may help alleviate concerns some MRRIC members have expressed of feeling rushed to address the number of recommendations that have lately come up during the May Plenary.

2. Recommendations that help USACE and USFWS staff better prioritize MRRP tasks within sub-programs as well as across sub-programs would be helpful. When crafting recommendations regarding research, it would be a help to the Program if

MRRIC could address the priority of the recommendation relative to other research activities.

We look forward to continuing to work with MRRIC. If you have additional questions, please contact Mark Harberg at 402-995-2554 or Lisa Rabbe at 816-389-3837 for USACE or Casey Kruse at 605-665-4856 for USFWS.

Sincerely,

A handwritten signature in black ink, appearing to read 'Frances E. Coffey', with a long horizontal line extending to the right.

Frances E. Coffey, PE, PMP
Director, Programs
Northwestern Division
U.S. Army Corps of Engineers

A handwritten signature in blue ink, appearing to read 'Noreen E. Walsh'.

Noreen Walsh
Regional Director
Ecological Services
Mountain-Prairie Region
U.S. Fish & Wildlife Service

ENCLOSURE
USACE and USFWS Joint Response to
MRRIC Recommendations to USACE on the
MRRP Strategic Plan and SAMP Implementation
Final Consensus reached by MRRIC on June 26, 2019

MRRIC appreciates the opportunity to work collaboratively with USACE in development of the five-year strategic plan for implementing the Missouri River Recovery Program (MRRP) and Science and Adaptive Management Plan (AM Plan). These recommendations are organized into three categories: management actions for the pallid sturgeon, the Integrated Science Program for the pallid sturgeon, and piping plovers.

Some recommendations emphasize the Committee's support for USACE's current plans and others convey additional ideas that MRRIC recommends. The wording of the former would become "recommend" if USACE's plans change. Where the agencies have questions about a recommendation, MRRIC invites the agencies to raise these questions on work group calls and to clarify the Committee's intent as part of the agencies' formulation of a response.

I. Recommendations on Management Actions Concerning the Pallid Sturgeon

A. Regarding Ft. Peck Test Flows:

1. MRRIC recommends that USACE incorporate the following analyses in the preparation of the draft EIS for potential Ft. Peck test flows.

a. A complete survey of the number and location of pump sites on the Upper Missouri as to functionality at the full range of flows contemplated in the NEPA alternatives under consideration. This survey is important since previous surveys were for pumps at a more limited set of flows and since flows in recent water years have changed the river bed and, therefore, the location of pumps. This data is important for planning potential pump retrofit and relocation needs. A statistically significant number of pump sites should be utilized for impact

b. An analysis of river channel morphology at a sufficient level of resolution to provide a three dimensional picture of the river bed. This is important to form an understanding of the flows needed for slowing larval drift and for potential pump retrofit and relocation needs.

c. A power reliability analysis, with various flows through the turbines at Ft. Peck during the test.

Stakeholders in the region have been in contact and wish to work together to accommodate a flow test by the USACE for the Pallid Sturgeon Recovery efforts. For example, irrigators (over 150 private pumps and two federal recognized projects

including Ft. Peck and the Buford Trenton Irrigation Projects) seek to maintain the ability to irrigate during the test flow. Montana Fish Wildlife and Parks seeks to determine the best river flows for larval drift success; and hydro power representatives have highlighted the importance of power system reliability maintained to North American Electric Reliability Corp (NERC) Reliability Standards. These entities and others feel a compromise can be reached that will serve their needs as well as serve the needs of a flow test. But, to accomplish this compromise, the analyses above are important.

Thus, MRRIC also recommends USACE work closely with relevant stakeholders (e.g., Tribes, Montana Fish, Wildlife, and Parks, hydropower, conservation districts irrigation projects, private irrigation projects owners, and community water supply systems) in designing these analyses and evaluating the results.

Finally, MRRIC supports USACE providing information about whether these studies can be accommodated in the FY'19 and FY'20 budgets for the NEPA analysis and, if not, how much additional funding would be needed.

USACE RESPONSE: USACE concurs that additional information on pump sites is needed as part of the impact analysis. The Corps will reach out to a statistically significant number of irrigation pump and water intake owners and operators to collect data on a representative number of sites. The Corps will use this data in the draft Ft. Peck Test Flow EIS to analyze and compare the modeled impacts to irrigation and water supply from the alternatives. The Corps does not intend to do a detailed survey of every pump site on the Upper Missouri but rather will use the interviews mentioned above to represent pump sites throughout the reach.

USACE does not agree that a three dimensional look at the river bed is necessary in order to assess impacts to irrigation intakes. The Corps will use existing channel cross sections and HEC-RAS modeling to provide data for analysis of the impacts of the alternative hydrographs. There were concerns that very low flows would isolate drifting larvae from the channel margins and reduce the possibility of surviving the drift. Based on discussions with pallid scientists, review of the channel shape, and limitations of current modeling with lower flows, all alternatives will have a summer minimum of 8,000 cfs.

USACE concurs that an assessment of power reliability would be beneficial. Power reliability is under the purview of the Western Area Power Administration (WAPA), therefore USACE will work with WAPA to assess impacts to power reliability. The Corps will complete an analysis of impacts to hydropower from the alternative hydrographs. The Corps is working with hydropower stakeholders to coordinate the analysis.

USACE concurs that an effective analysis of Ft. Peck flows requires USACE to work closely with stakeholders and has been conducting extensive outreach to date. The Corps will continue to work with stakeholders to ensure there is an adequate opportunity for input prior to making any decisions on implementation.

2. MRRIC recommends USACE establish flood control and low flow constraints/criteria to minimize potential for flooding during the Ft. Peck test flows, including specific criteria related to minimizing flooding and/or impacts from high flows and low flows to irrigation and drinking water needs in the Ft. Peck reach, such as: Williston, Wolf Point, and Culbertson.

USACE RESPONSE: The Corps will set low and high flow criteria to minimize potential adverse impacts that may be caused by the variation in releases as part of the implementation criteria for the alternatives.

3. MRRIC recommends that USACE engage in regular, proactive communication with the Tribes, Montana Fish Wildlife and Parks, ND State Water Commission, hydropower representatives, conservation districts, organized irrigation projects, private irrigation project owners, and community water supply systems downstream of Ft. Peck into western North Dakota during the NEPA process for potential Ft. Peck test flows. Direct communication with each of these entities will ensure that outreach in the basin is extensive (beyond just MRRIC and traditional scoping meetings) during preparation of the DEIS and during other steps in the process. Important times for both information and discussion with local stakeholders include but are not limited to the points of engagement currently envisioned with MRRIC: 1) summarizing what was heard during the scoping meetings (April) and 2) reporting on and discussing the results of analyses conducted about the alternatives and the potential tradeoffs (Fall).

USACE RESPONSE: The Corps will continue to work with stakeholders to ensure there is an adequate opportunity for input prior to making any decisions on implementation, both through MRRIC engagements and outreach to Tribes and stakeholders in the Basin. These engagements will continue to be briefed at MRRIC.

4. MRRIC recommends USACE have the ISAP review the Ft. Peck AM Framework now and draft EIS when it is ready, including a review of the assessment of potential impacts to the system (e.g., impacts to pallid sturgeon on the Yellowstone). MRRIC further recommends USACE consider opportunities for how the ISAP can be engaged and involved as early as possible (e.g., reviewing the alternatives being evaluated and proposed actions being considered).

USACE RESPONSE: The ISAP is in the process of reviewing the Ft Peck AM Framework. This will give them the opportunity to review the conceptual hydrographs developed as part of the framework which form the basis for the alternatives being considered in the EIS. The Draft EIS will be reviewed by the ISAP in early 2020 concurrent with public review of the document.

5. MRRIC recommends USACE establish standards for the Ft. Peck test flow to maintain compliance for the electric system in accordance to North American Electric Reliability Corporation (NERC) Reliability Standards. These standards established by USACE should include the ability to halt the test flow to maintain hourly generation if these NERC Reliability Standards threaten compliance requirements.

USACE RESPONSE: USACE will ensure the test flows as implemented complies with all applicable law. The Corps is working with WAPA to evaluate impacts to NERC reliability standards and will continue to work with hydropower stakeholders to ensure that concerns are understood, impacts to stakeholders are minimized as much as possible, and the appropriate standards are considered in developing the hydrograph.

6. MRRIC supports USACE conducting the dam safety review and inspection of the Ft. Peck Dam spillway for any compromising damages caused from a test release for pallid sturgeon. Further MRRIC supports USACE plans to communicate any risks to stakeholders and the public associated with operating the spillway for the purpose of endangered species recovery. MRRIC recommends USACE make all necessary repairs before the following runoff season begins.

USACE RESPONSE: USACE concurs that an assessment of needed repairs will need to be completed following implementation of any test flows. The timing of those repairs will be evaluated as part of the process. Public safety is the primary focus of the Corps' dam safety program. Continuous and periodic inspections and assessments of all Corps dams is a part of the program, as well as accurate, timely, and clear communication of risks and related information. An analysis of dam safety will be included in the EIS, including considerations of potential changes in risks and costs from the existing condition.

7. When evaluating alternative hydrographs in the Ft. Peck EIS, MRRIC recommends USACE evaluate alternatives with higher low flow portions and lower high flow pulses to the extent supported by the best available science for optimum fish response, in order to reduce potential impacts to human considerations (irrigation, water supply, etc.) and to minimize flooding and bank erosion.

USACE RESPONSE: The Corps has worked with pallid experts to formulate the alternatives using the best available science. The alternatives have been formulated with as much flexibility as possible (to provide decision space within an AM framework), while still allowing the Agency to adequately disclose the impacts of the action pursuant to NEPA. A discussion with MRRIC of the preliminary impact analysis will occur in October and alternatives may be revised based on the discussion.

B. Regarding Intake:

8. MRRIC recommends USACE and BOR work with MTFWP to share with MRRIC pre- and -post Intake Monitoring Plans to assess whether the bypass is working correctly (according to the design criteria) and to evaluate use by spawning pallid sturgeon.

USACE RESPONSE: USACE will continue to share monitoring plans with MRRIC and we will work with our partners (e.g. BOR, USFWS, MTFWP, USGS) to ensure all related monitoring and research efforts are well coordinated and shared with MRRIC as well. We will also share monitoring results annually.

9. MRRIC recommends USFWS coordinate with BOR, USACE, and MTFWP, following construction of the Intake Bypass. If there is evidence of pallid sturgeon using the bypass, MRRIC recommends continuing research on the Yellowstone and Powder Rivers' hydrology and geomorphology above Intake Dam (as it relates to the pallid's successful natural recruitment) to understand if further actions above the Intake Dam should be considered as part of adaptive management.

USFWS RESPONSE: USFWS met with USACE, BOR, MTFWP, and USGS staff in June of 2019 to discuss pallid sturgeon monitoring efforts and the need for coordination and assistance on the Yellowstone River and other upper basin tributaries. We will continue coordination of these efforts so that needed and comparable monitoring occurs throughout the upper basin.

C. Regarding IRCs:

10. MRRIC supports USACE and USFWS efforts to implement the revision clause of the SAMP (Section 2.5.2; pgs. 132-134) to review during FY2019 the hypothesis, function, design and performance criteria for IRCs to assess if adjustments are needed to enhance the likelihood of MRRP success relative to its fundamental objectives. Specifically, MRRIC supports reviewing the relative importance of interception, food production and foraging, and retention aspects of IRCs. For food production and foraging, MRRIC supports examination of the food limitation hypothesis, food-producing and foraging habitat definitions, and creation of food and foraging habitat to date in relation to the targets.

USACE RESPONSE: We appreciate the support for this effort. We are preparing a white paper covering these topics in accordance with procedures in the SAMP and we will discuss results during the Fall Science Meeting.

11. MRRIC supports USACE continuing to work closely with relevant stakeholders (including state governments, navigators, and dredgers) on IRCs site selection, design, monitoring and modeling impacts and regulatory structure, and partner with MRRIC to identify opportunities for members and agency staff to assess the ongoing engagement and propose adjustments as needed.

USACE RESPONSE: We appreciate the continued support for this effort. We plan to continue to work closely with relevant stakeholders on the implementation and assessment of IRC projects.

12. MRRIC recommends USACE keep MRRIC informed about future consultations with ISAP, Engineer Research and Development Center (ERDC), and, if appropriate, other peer review entities to assess impacts IRCs may have on navigation safety and efficiency, flood control, fish and wildlife, other authorized purposes, as well as commercial sand dredging and bank erosion. MRRIC also supports letting the SAMP process control the IRC construction schedule.

USACE RESPONSE: We will inform MRRIC on any future consultations with ISAP, ERDC, or any other peer review entities regarding the assessment of impacts of IRC projects on Missouri River authorized purposes as well as commercial sand dredging and bank erosion. We appreciate the continued support for the SAMP process.

13. MRRIC supports USACE conducting pre- and post- construction modeling of channel reconfigurations to create functional IRCs (e.g., comprehensive modeling of the following actions, either independently or in combination: modification of existing structures, placement of new structures, manipulation of existing off-channel habitats (chutes), and mainstem channel widening to assess potential impacts to the navigation channel and flood control) with similar rigor for HCs as for the species.

USACE RESPONSE: We appreciate the continued support for the modeling and monitoring assessments of IRC projects as laid out in the SAMP.

14. MRRIC recommends USACE undertake a basic bioenergetics investigation of age-0 pallid sturgeon to inform the design of IRCs by bounding the likely production of pallid sturgeon prey.

USACE RESPONSE: The Interception Food and Foraging Habitat white paper being prepared for discussion at the Fall Science Meeting will include an assessment of food limitations of age-0 sturgeon. Some basic bioenergetics analyses will likely be possible in this timeframe and results discussed during the Fall Science Meeting. Additional needs can be discussed as well.

15. MRRIC supports USACE's inclusion of assessment of age-0 concentration hotspots in the Lower River and export from Missouri River to the Mississippi River along with constructed IRCs as complimentary alternative hypotheses, to collectively evaluate age-0 pallid recruitment.

USACE RESPONSE: We appreciate the support for these efforts. We do not believe that IRC-related hypotheses can be evaluated effectively without evaluating the corresponding alternative hypotheses or without taking advantage of other opportunities to increase understanding of larval drift and dispersion.

D. Regarding Spring Rise/High Flow Situations:

16. MRRIC supports USACE and USFWS efforts to gather and share information obtained about pallid response to natural spring rise or high flow situations. MRRIC recommends USACE communicate to MRRIC and other stakeholders what ranges of river stage and duration at USGS gages in the lower river are representative of historical bi-modal pulses.

USACE RESPONSE: We will continue to share results of ongoing research and monitoring efforts related to the effects of flows on pallid sturgeon reproduction and recruitment. Each spring will provide conditions which can provide valuable information. It is critical to evaluate sturgeon response in years with minimal spring flow variation as

well as years with natural spring rises. Although the Effects Analysis describes the natural, bimodal spring rise, the actual flow regime which most benefits pallid sturgeon is unknown.

17. MRRIC supports USACE conducting the Missouri River Risk analysis for the whole river to better inform the discussion of possible flood risk and interior drainage impacts from any flow actions, including a possible one-time spawning cue release from Gavins Point. MRRIC further recommends USACE communicate to MRRIC what the Missouri River Risk analysis entails (including the anticipated timeline) as well as any potential limitations and cost implications for conducting this analysis.

USACE RESPONSE: USACE concurs that engagement with MRRIC on the risk analysis and what it entails would be beneficial. We will work with the LA-LFT to set up appropriate engagements regarding the risk analysis that is currently an ongoing effort.

II. Recommendations on Integrated Science Program Pallid Sturgeon Activities

A. Regarding Activities in Both the Upper Basin and Lower Basin

18. MRRIC recommends USACE identify clear learning objectives for unpredictable or purposeful flows in both the upper and lower Missouri River. Considerations should be given to the following: 1) What opportunistic measurements are needed? 2) What, if any, are the alternative means of tracking sturgeon should telemetry technologies not be effective or insufficient resources are available to implement the proposed network of passive stations with multiple receivers? 3) What, if anything, should be measured in addition to routine monitoring (i.e., temperature, turbidity, etc.)? 4) What level of learning would trigger changes in management actions?

USACE RESPONSE: We agree with the need identified in this recommendation. We have drafted monitoring plans for evaluating flows and those plans will be reviewed by the ISAP. We will take a look at those monitoring plans and the SAMP to determine what clarifications and/or additions may be helpful in identifying important opportunistic measurements. We will continue to clarify how information will be used to make decisions. With regard to telemetry, we have started improving and upgrading telemetry systems. We will evaluate effectiveness and report progress and results annually. If telemetry is not meeting our needs, we will discuss alternatives.

19. MRRIC recommends USACE explicitly include, in their sampling protocols related to high flows, intensive monitoring for age-0 pallids in the Missouri River above the confluence with the YSR and in the LMOR above the confluence with the MSR during periods when larvae might be present and each river is backed up due to high discharges in the other river.

USACE RESPONSE: We agree that the effect of “back up” water on larval drift at both of these locations is important to understand. There is evidence from the upper Missouri River, for example, that such conditions may have resulted in slowing of drift and increased catches of age-0 shovelnose sturgeon. We will assess whether this

need can be incorporated in the PSPAP v.2 monitoring efforts or whether it is better accomplished by other means.

20. MRRIC recommends USFWS, with the support of USACE, assess PSPAP and HAMP results for captures for each year and size class of stocked pallids from Neosho NFH, Gavins Point NFH, and Garrison NFH between 2000-2018 to evaluate returns by hatchery, size class, location stocked, and other relevant variables for which information is available.

USFWS RESPONSE: The USFWS concurs with this recommendation and anticipates that the pallid sturgeon technical lead position currently being filled at the USFWS will lead this effort.

21. MRRIC supports USACE working with USFWS and other partners to collect and analyze samples from emaciated pallid sturgeon (if they continue to show up in sampling) and healthy fish, through non-lethal sampling, to investigate the presence of parasites (as possible), contaminants and trace elements - and their possible link/causation to health problems, and their effect towards disease development, inability to thrive, and other water quality constraints on pallid sturgeon survival and recruitment.

USACE RESPONSE: We appreciate the support for this work. The research is underway and is a cooperative effort between MT State University, USFWS, NGPC, MDC, and USACE. We will share results as they become available.

22. MRRIC recommends that USACE and USFWS use the Basin-wide Contaminants Assessment Report and Water Quality Webinar to interact with EPA, state agencies, and tribes with water quality jurisdiction. Collectively, identify informational data gaps and participate in regional workshops with subject matter specialists. Further, evaluate contaminants and water quality parameters most likely to affect pallid sturgeon health and the ecosystem.

USACE RESPONSE: USACE has collected substantial water quality information over the years related to pallid sturgeon and other needs. We also contributed to the Basin-wide Contaminants Report and will continue to provide information and contribute to discussions led by agencies with technical lead responsibilities.

23. MRRIC recommends USACE incorporate recruitment into the 'full implementation version' of Pallid Sturgeon Population Assessment Project (PSPAP) v. 2.0 Draft Final Report (Fall 2019) and apply this version to available pallid sturgeon population results by 2021. MRRIC recommends an independent science review of the 'full implementation version' of PSPAP v. 2.0 when the Draft final report is completed (estimated to be Fall 2019, Section D.1.4., SAMP Appendix D) relative to its quality and utility for evaluating existing pallid sturgeon management actions and potential management options that contribute to achieving pallid sturgeon objectives. Upon completion of the independent science review, host a webinar where the quality and

utility of PSPAP v2.0 relative to its cost are explained to MRRIC in understandable terms.

USACE RESPONSE: USACE concurs with this recommendation. The focus of the revised monitoring effort is on assessing reproduction and recruitment as well as providing reliable population estimates. The PSPAP v.2 Plan is on schedule to be reviewed by the ISAP next FY. The ISAP has contributed to the development so far through technical discussions and input. Monitoring crews have begun implementation of portions of the new PSPAP v.2 protocols and we anticipate lessons learned being included in the final monitoring plan. We look forward to input from the ISAP and opportunities to discuss this important monitoring effort with MRRIC.

24. MRRIC supports USFWS working together with the USACE, state agencies throughout the range of the pallid sturgeon, and other federal agencies with pallid responsibilities to evaluate ways to collaborate and integrate information from ongoing programs in systems connected to the main-stem Missouri River to more fully understand each system's contemporary contribution to the pallid sturgeon life history and how that affects pallid population objectives in the Missouri River.

USFWS RESPONSE: The USFWS appreciates the support on this important topic and are working through the pallid sturgeon recovery coordinator and will work with the pallid sturgeon tech lead currently being hired by the USFWS to assure this recommendation is properly coordinated. The USACE will continue to assist USFWS in collaborating with other agencies to ensure comparable monitoring efforts occur in critical areas such as the Yellowstone and Mississippi River. We participated in recent meetings hosted by USFWS with partners from both the Mississippi and Yellowstone Rivers to discuss additional monitoring needs.

B. Regarding Upper Basin Activities

25. MRRIC supports USFWS efforts to collaborate with USACE, BOR, and MTFWP to see what options (if any) there are to implement all or some portions of PSPAP 2.0 on the Yellowstone River. These efforts would ensure aspects of the AM Plan are being adequately evaluated in progressing towards meeting the fundamental sub-objectives and options should be explored.

USFWS RESPONSE: The USFWS appreciates the support for this important topic. We participated in a meeting with other partners in the upper basin to discuss current monitoring efforts on the Yellowstone River and potential to implement PSPAP v.2 protocols. We will be providing information and assistance to all collaborating partners to assist them in implementing these monitoring efforts on the Yellowstone River.

26. MRRIC recommends USACE and USFWS, and BOR, collaborate with MTFWP and USGS to implement the telemetry system upgrades in the Upper River as proposed by the USGS. The upgraded system is necessary to provide improved consistency and

coverage of all fish that move between the Missouri and Yellowstone Rivers and complements aspects of numerous Big Questions.

USACE RESPONSE: USACE, working with the upper basin pallid sturgeon work group, has already started implementation of the recommended telemetry upgrades and we will continue to work with partners in the upper basin to fully implement and evaluate the recommended upgrades.

27. MRRIC supports continuing USACE efforts to work with USGS, USFWS, ERDC, BOR, and MFWP to reconcile differences between competing model predictions for larval dispersal and drift duration in the Missouri River from below Ft. Peck Dam to Lake Sakakawea. Further, MRRIC recommends that additional aspects be included into the 2019 larval drift study design to help further understand potential differences between competing model predictions (e.g., inclusion of sampling for potential "stallers" in slower velocity habitats, support for reach-scale comparative analyses). MRRIC recommends results from the 2019 larval drift study be presented to the FWG (and make available to MRRIC) along with how the results specifically influence competing model predictions. Further, MRRIC recommends additional technical discussion between modelers, the FWG, and ISAP is undertaken to ensure ongoing communication and resolution between competing model predictions are understood. This additional technical discussion may be most appropriate to take place during the Fall Science Meeting.

USACE RESPONSE: The USACE agrees with the importance of continually refining drift models and better understanding advection and dispersion dynamics and we therefore concur with the need to validate models and determine which are most useful and best reflect the drift dynamics of actual fish. The 2019 larval drift study was designed specifically to contribute to refinement of models, help assess differing predictions, and ensure the models are validated and refined based on **observed drift of pallid embryos**. In other words, it is the drift of the embryos that is important and any model must be validated with actual observations. Results will be shared as they become available beginning at the Fall Science Meeting where initial results and next steps will be discussed.

C. Regarding Lower Basin Activities

28. MRRIC recommends USACE address: 1) if and how results from constructing spawning sites will inform the pallid population model and ultimately the population growth rate (i.e., λ : the ratio of population size N between the current year and previous year calculated annually); and 2) how success of constructed spawning sites will be evaluated relative to the hypothesis that pallid sturgeon spawning habitat is limiting?

USACE RESPONSE: The monitoring plan for Spawning Habitat creation has been drafted and will be reviewed by the ISAP next FY. We will be as explicit as possible regarding relation to the pallid population model and how success is determined and look forward to discussion with the ISAP, Technical Team, and others on these topics.

29. MRRIC recommends USACE statistically analyze Lower Missouri River pallid sturgeon population and condition trends by relevant spatial and temporal scales in addition to any larger scale analyses.

USACE RESPONSE: We agree. We will be explicit about statistical tests used, spatial and temporal scales of analysis, and significance of any reported trends.

30. MRRIC recommends USACE determine if sampling efforts can be implemented to reliably measure survival of age-0 and age-1 pallid sturgeon, given the inherent difficulty in measuring these parameters. Further, MRRIC recommends USACE determine the potential constraints posed by variance in time and space, which may overwhelm feasible sampling efforts. (ISAP pg. 17)

USACE RESPONSE: We agree. These analyses are inherent in the approach we are taking to design monitoring efforts. As initial monitoring data become available, we will assess and make additional adjustments to monitoring if needed. If determined the level of effort needed is unrealistic we will discuss implications and any alternative approaches.

31. MRRIC recommends USACE add sampling for drifting free embryos downstream from known spawning locations in the Lower River to current age-0 sturgeon monitoring protocols. The Spring Strategic Plan currently indicates USACE "may" implement this sampling into the protocols and that should change to "will" implement.

USACE RESPONSE: We agree with the importance of this sampling but we cannot ensure this monitoring will become a high enough priority to occur annually. In order to include free embryo monitoring on a routine basis we would need to scale back or cut other monitoring which is high priority and MRRIC also supports. The relative priority of drift monitoring should be discussed at the AM Workshop before a decision about priorities is made. In 2019, however, sampling for drifting embryos was conducted opportunistically by monitoring crews on the lower river, partly because high water precluded some of the planned monitoring. We will continue to adapt monitoring efforts based on the lessons learned, resources available, and identified priorities.

III. Recommendations Regarding Piping Plover Related Activities

A. Regarding Planning, Engineering, and Design Work for Plover Habitat Creation

32. MRRIC supports USACE plans (SP 2 .3.2 and 3.3.3) to engage with the Bird Team/BWG for early exploration into expanding the planning, engineering, and design (PED) work for piping plover habitat creation to include a conceptual planning step that identifies and evaluates the opportunities and tradeoffs associated with a wide variety of management actions on enhancing quality and quantity of existing habitat (e.g., island shaping and augmentation, top dressing, vegetation control, etc.) as well as through construction of new habitat. MRRIC recommends that the opportunities and tradeoffs identified by the PED phase be considered by USACE when assessing the need for

mechanical construction of ESH. MRRIC also recommends formulating the process in FY'19 with funding to fully implement in FY'20 and '21.

USACE RESPONSE: The USACE concurs with this recommendation. We have already begun to work with USFWS and MRRIC's Bird Work Group to outline an engagement process for early (prior to and independent of site-specific PED) exploration of habitat creation options. The process will build on Chapter 3 of the SAMP, and will include a goal of answering pertinent questions from Table 21 of the SAMP. In keeping with the federal plan (as outlined in the Record of Decision), which includes mechanical construction only for bird habitat creation, the process will focus on the various means of mechanical construction, including sand bar shaping and augmentation, top-dressing, manipulation of dunes, and construction of new habitat. Priority for this effort will depend upon availability of program appropriations and urgency of other program needs. Completion of this effort, while beneficial, is not required prior to initiation of site-specific PED, should construction of habitat be determined to be necessary. Annual implementation of vegetation management, predator management, and human restriction measures will continue, subject to availability of appropriations.

B. Regarding Bird Monitoring

33. MRRIC supports USACE plans for the new bird monitoring program to determine whether Missouri River habitat management is enhancing the Piping Plover population or creating a sink; and include data necessary for model parameters and reducing model uncertainty. Further, MRRIC recommends USACE optimize the program's ability to understand the contribution of Missouri River habitats (river and reservoir separately) and management actions in context of the regional sub-population, the overall piping plover population, and the species objectives.

USACE RESPONSE: The monitoring program is intended to monitor annual trends in population, productivity, and habitat for the piping plover and interior least tern, as well as loss of adults, eggs and/or chicks due to USACE operations of the dams and other causes. While monitoring would provide information helpful to the USFWS in evaluating the role of the Missouri River in the larger demographic unit, the ability to do so would depend on additional monitoring efforts beyond the Missouri River. Our primary focus and authority includes performance metrics and objectives as included in the 2018 Biological Opinion. We will continue to work with the USFWS, Bird WG and the ISAP on development and implementation of a monitoring program that focuses on MRRP management actions and objectives and meets the needs of decision-makers. If broader monitoring efforts materialize we will provide data from the Missouri River to contribute to analyses of the broader demographic unit.

34. MRRIC supports USACE plans to develop a monitoring plan for assessing the effectiveness of predation management activities and opportunities while continuing to evaluate predation impacts. (SP pg. 27)

USACE RESPONSE: We are currently developing monitoring plans which focus on several potential MRRP management actions (referred to as Effectiveness Monitoring). Predation management is a potential management action identified in our BA and BiOp and as such we will provide an approach to monitoring its effectiveness if implemented.

35. MRRIC recommends, as part of the development of the revised piping plover recovery plan, USFWS coordinate monitoring efforts with entities in a way that encourages sharing plover data.

USFWS RESPONSE: The USFWS concurs with this recommendation and will be working with the Northern Great Plains Piping Plover Recovery Plan, as well as, the USFWS national leads for piping plover recovery to ensure data sharing protocols are developed and utilized.

36. MRRIC supports USACE plans regarding ISAP review of the final Bird and Fish Monitoring Programs (and HC elements within those plans), and following MRRIC's approved engagement strategy with ISAP, supports TPSN engagement in ongoing informational discussions with MRRIC and the appropriate work groups regarding panel expertise for the review.

USACE RESPONSE: We will continue to work with ISAP on development and implementation of a selected monitoring plan. The final bird monitoring plan will be reviewed by ISAP in late 2019 or early 2020 and the fish monitoring plan will be reviewed in the spring of 2020. We will continue to work with the appropriate work groups regarding panel expertise for the reviews.

C. Regarding Modeling and Studies

37. MRRIC supports the SP (3.3.2) plan to develop an implementation plan and schedule that identifies steps and decision points for review and update of bird models reflecting 2018 MRRIC recommendations, ISAP recommendations, metapopulation study results, uncertainties (adult survival, dispersion, emigration and immigration) and including five model parameters addressed at the AM workshop. MRRIC supports including in this plan and schedule identification of the highest priority studies, science activities, and research needed to enhance model predictions and reduce uncertainties. This creates knowledge of the process for MRRIC members and allows tracking, discussion, and decision making. MRRIC recommends USACE provide regular updates to BWG as part of the process, and consider with BWG whether this implementation plan for the bird models should receive input and/or review from the ISAP.

USACE RESPONSE: Ongoing and future science efforts will provide critical information for decision making including model refinements. This is and will continue to be a part of the annual AM cycle. We are currently developing a plan which includes a prioritized list and timeline of research needs and analyses needed to evaluate bird model behavior and sensitivity to new data. The strategic plan includes known research

and associated timelines for funding. We will continue to provide updates to the Bird WG and MRRIC during upcoming engagements.

38. MRRIC supports USACE use of the results of the metapopulation study to better understand population, dispersal, and habitat dynamics of the Missouri River in relation to the population and habitat dynamics in the region including additional data collection, analysis and modeling to determine any changes that might be needed to the targets or criteria by which the targets are evaluated. (SP 2.4 .2, 3.3.2)

USACE RESPONSE: We continue to concur with the need to understand and apply results from the metapopulation study once they become available. Understanding immigration and emigration is important in understanding bird dynamics on the Missouri River and the responses we see from management actions. As results of the metapopulation study become available, they will be shared with MRRIC during our AM engagements as will the implications for management and model refinements. Decisions regarding additional data collection are unknown at this time.

39. MRRIC recommends USACE provide the BWG with a description and schedules of studies and research presently underway (or to be initiated later) as part of SAMP implementation, including, but not limited to, vegetation control, predator control, sandbar modification (augmentation, shaping, etc.), and the habitat quality and optimization study referenced at the AM Workshop and the SP 3.3.2. USACE should keep the BWG updated as studies and research are implemented.

USACE RESPONSE: We have provided a summary of current science activities and research related to the biological hypotheses in the AM & ESA Compliance Report. Future research and timelines are also identified in the strategic plan. We will continue to share updates with the Bird WG during upcoming engagements as future science activities and schedules are developed.

40. MRRIC supports USACE implementation of the RPM #3 feasibility study as identified in the 2019 SP pg. 27 (3.3.3), with the inclusion of actions regarding reservoir habitat as included in the SAMP 3.2.4.3. MRRIC supports USACE developing and providing to the BWG a study plan and schedule to address the implementation of the evaluation of the potential to isolate or secure habitat on the reservoirs that would minimize or reduce take and contribute to species targets/objectives due to water level fluctuation in accordance with SAMP sections 3.2.3.1.2. MRRIC recommends the USACE consider with the BWG whether the study plan and schedule should receive input and/or review by ISAP.

USACE RESPONSE: Beginning in FY20, we will initiate an evaluation of the potential to implement measures to isolate or secure habitat on the reservoir reaches that would minimize or eliminate the take of least terns and piping plovers as a result of reservoir fluctuation. This will be shared and discussed with the Bird WG during our upcoming engagements.

D. Regarding Opportunistic Learning

41. MRRIC recommends USACE investigate the Niobrara, Lewis & Clark Lake, and Gavins reach, in coordination with the National Park Service to determine the changes in habitat created by the 2019 flood and whether the birds have responded, as soon as possible, and then prepare management actions where applicable to best utilize the created habitat for the next several years.

USACE RESPONSE: We concur with the need to understand effects of the 2019 high flows. Ongoing habitat and bird monitoring efforts on the Missouri River will continue to provide information for decision making that focuses on MRRP management actions and objectives, including adjusting habitat actions based on habitat changes from the 2019 high flows. We will continue to coordinate with agencies that monitor areas outside of the USACE's authorities.

42. MRRIC recommends the USACE bird monitoring program contain a plan for "opportunistic learning" (investigation and reporting) from natural flow events (such as 2011 and 2019) regarding bird and habitat effects/learning.

USACE RESPONSE: We concur and we already to do have such a plan and any refinements to monitoring efforts will continue to include learning from high flows. Consistent with the SAMP, we do collect data to document changes in the system and changes in bird use resulting from changing flow conditions, especially from high water events. For example, following the high water of 2018, LiDAR and Ortho imagery were collected in the Garrison reach and will be collected in the Gavins Point reach when conditions allow. Analysis for the Garrison reach Geomorphic Assessment are ongoing and should be completed in fall of 2019. Monitoring of nesting habitat and bird populations will continue under the current and future monitoring program. These data are collected each year, including high water years such as 2011 and 2019. Results will continue to be shared with MRRIC during AM engagements.

E. Regarding Additional Funding

43. MRRIC recommends that should additional funding become available in FY'20 that priorities should include:

- a. Full Bird WG engagement (see recommendation 44);
- b. PED early planning and exploration (see recommendation 32); and
- c. Initiating the Sandbar Habitat Optimization Study (SAMP 3.5.5) in FY'20 rather than FY'21 given available capacity to undertake this study in FY'20 described in the Strategic Plan.

USACE RESPONSE: Bird WG engagement, early planning and exploration, and the sandbar optimization study are among the high priorities for MRRP and the bird program. USACE will give consideration to those activities between now and FY20 as we learn and understand future budgets and the unknown priorities that may arise to

compete with these actions between now and then. USACE will also continue to describe and explain funding priorities during collaboration on the strategic plan.

44. MRRIC appreciates USACE time and effort to initiate information sharing and discussion early in the exploration of MRRP program issues and potential actions. This is important in establishing the foundation for informed recommendations from MRRIC and mutual collaboration.

MRRIC recommends the following topics be discussed in more depth with the Bird Work Group in FY'20:

- a. The role of the interchange of piping plovers between the northern river reaches and the prairie potholes regarding the effects in the calculations of lambda on the Missouri River independent of the broader population.
- b. Changes that have occurred or are planned to occur within BWG Technical Team (SP pg. 18)
- c. A description and understanding of the planned Effectiveness Monitoring program (SP pg. 23)
- d. ISAP recommendations and questions from AM Compliance Report Review, including:
 - i. Should AM Report better provide a forecast of outcomes of future management scenarios and outline recommendations for managers and stakeholders?
 - ii. Should the AM be included in the broader agenda? Does this need to be discussed?
 - iii. From the ISAP report: "The management response functions should be focal points for framing up the adaptive management program" - How do we address this basic AM recommendation?
 - iv. Do we need to improve the peer-to-peer exchange?
 - v. Will we need a new piping plover CEM?
- e. Whether the population survival target (95% survival of 50 birds over 50 years) could be replaced with a more focused target related to the habitat on the Missouri River.
- f. How current decision support tools in the SAMP (e.g. Section 3.5.3 Table 34, Section 3.6.5) will be used to inform management decisions (e.g. whether to construct ESH) in a variety of scenarios in order to better understand how these decisions will be made as well as identify potential refinements to the tools and process. Example scenarios include: productivity targets are not being met primarily because reservoir productivity is very low, productivity targets are not being met despite ESH remaining

above targets due to escalating predation, or bird targets are being met but ESH falls below targets.

USACE RESPONSE: Starting as early as FY19, USACE will continue to advance all of those topics during regular work group engagement, collaborating on the strategic plan, the fall science meetings, the AM workshop, and during engagements with the ISAP and the MRRIC plenary. We look forward to the support provided by the MRRIC and the learning we anticipate as a result.

F. Regarding MRRP Strategic Plan Content

45. MRRIC recommends that USACE include in the SP acreage numbers for land acquisition (as well as costs) and how resources are being spent. (SP pg. 15)

USACE RESPONSE: The USACE does not believe including a cost and acreage estimate is appropriate in the Strategic Plan prior to negotiating price on specific land tracts.

46. MRRIC recommends future versions of the SP include the acres anticipated to be treated in addition to the dollars for vegetation management, and support for the AM Compliance Report including the actual acres treated.

USACE RESPONSE: We will continue to provide dollar figures for what is obligated on a contract in the actual year it was obligated; however, in future versions of the SP, USACE will provide an estimate of the acreage to be treated in future years. USACE will also continue to include the actual number of acres treated each year within the AM Compliance report appendices. Table 1-10 of the 2018 report includes a table with acreages treated from 2012 through 2018.

47. MRRIC recommends that USACE costs associated with implementing the SAMP associated with MRRIC engagements (i.e., labor/in-house travel), remain in the USACE Program Management/Integration costs (as separate line item if needed) and not under the MRRIC line item.

USACE RESPONSE: USACE will be capturing travel costs for USACE personnel to attend MRRIC facilitated engagements, as well as the actual labor time spent in facilitated engagements in the MRRIC line item titled “internal labor and travel”. Doing so provides more accurate accounting for upward reporting of the technical, managerial and administrative resources needed to support MRRIC. Additionally, it provides MRRP more flexibility to ensure certain key staff members are engaged in MRRIC related business.

48. MRRIC recommends that the cost of studies and management actions be included in each fiscal year, even if funded in a previous year, so the total annual cost of implementing the SP on an annual basis is apparent (previously year funding costs can remain in a different color).

USACE RESPONSE: The USACE believes including estimated obligations (vs expenditures) in each fiscal year is reasonable since it is not always possible to estimate expenditures accurately for each year of a multiple year obligation. In these cases the dollar sign symbol (\$) is used to indicate which years the specific activity is funded from a prior year obligation. The USACE will continue to report actual expenditures for the fiscal year completed. In some cases, i.e. Pallid research activities, the estimated cost of specific activities cannot reasonably be broken out from the total estimate of a group of activities. This is because some specific study activities cannot be broken out from the overall cost of a contract because some of the efforts are interrelated and support other study activities conducted by the contractor or partner agency.

**Independent Science Advisory Panel Evaluation of
Fort Peck Adaptive Management Framework for Upper Missouri River Pallid Sturgeon**

14 August 2019

Introduction

This report from the Independent Scientific Advisory Panel (ISAP¹) reviews the *Fort Peck Adaptive Management Framework for Upper Missouri River Pallid Sturgeon* (dated 12 December 2018), a planning document in service to the Missouri River Recovery Program authored by the U.S. Army Corps of Engineers (USACE) and U.S. Fish and Wildlife Service (FWS). The Fort Peck Framework and accompanying supplementary material (*Supplement to the Draft Fort Peck Adaptive Management Framework for Upper Missouri River Pallid Sturgeon – Draft Effects Pathway Diagrams*) describes “a potential approach that was developed by the Missouri River Recovery Program Technical Team to formulate and evaluate test flow releases from Fort Peck Dam for pallid sturgeon...” The document offers “an adaptive management framework for their implementation based on the best available scientific information about the species and current knowledge of potential management actions.” In doing so “two conceptual hydrographs are presented, along with a set of studies gleaned from a review of existing information and an expert elicitation process.” The supplement to the *Fort Peck Adaptive Management Framework* presents Draft Effects Pathway Diagrams (detailing material information in Section 1.5.2 and Appendix A1 of the Framework) that are “illustrative in nature” and are “intended to inform and facilitate scientific discussion and communicate with stakeholders.” The ISAP was provided the supplement so that it could better evaluate analyses referenced in the Framework document; the supplement itself was not the subject of ISAP review.

The recent USFWS 2018 Biological Opinion pertaining to operations of the six dams on the Missouri River concludes that actions incidental to normal operations by the USACE cause

¹ ISAP members contributing to this review include Steve Bartell, Christopher Guy, Dennis Murphy, John Loomis, and Melinda Daniels.

negative impacts to recruitment of the endangered pallid sturgeon due to alterations of the natural hydrograph, water temperatures, and turbidity. In response to that finding, the agencies developed the Fort Peck Adaptive Management Framework, which includes Level 1 and Level 2 studies (as described in the *Science and Adaptive Management Plan – SAMP*) that are intended help resource managers better understand ways to alter discharge conditions that encourage pallid sturgeon to move upstream to spawn near the Milk River, which in turn may allow adequate drift distance of embryos to benefit pallid sturgeon recruitment in the upper Missouri River.

At the time of the drafting of the Framework, there was a legal constraint on the implementation of a fish passage structure in the Yellowstone River near Intake, Montana, making that adaptive-management action, as described in the SAMP, not operational. A Fort Peck management action proposed in the Framework then was viewed as a reasonable conservation-action alternative targeting pallid sturgeon in the upper Missouri River system. As described in the Framework, the legal challenge to the fish-passage structure has been lifted and fish passage construction will proceed. Therefore, “no special considerations have been incorporated to address decisions regarding operations of Fort Peck Dam due to uncertainty about the existence of a passage structure in the Yellowstone River near Intake, Montana.” Nonetheless, “the Fort Peck AM Framework presented in this report was developed to assess critical uncertainties regarding recruitment of pallid sturgeon in the upper Missouri River while maintaining opportunities for recruitment in the Yellowstone River” (Framework page 2).

The ISAP acknowledges that the Framework document was a response to a commitment stated in a January 19, 2018 letter from David Ponganis (USACE) to Michael Thibault (USFWS). The letter formally amended a proposed action described in the 2017 Biological Assessment (BA), when developing the Fort Peck Adaptive Management Framework.

The Framework was produced by extra-agency efforts under the Missouri River Recovery Program (MRRP), including consultation with and input from the program’s Adaptive Management Technical Team between December 2017 and November 2018, interaction with MRRIC’s working groups, and “technical perspectives” from outside pallid sturgeon experts. The Framework is represented as “a new component of the MRRP Science and Adaptive

Management Plan for the Missouri River Basin... providing a structured process through which substantive decisions regarding the appropriate role of Fort Peck Dam operations and other management actions to support Upper Missouri River pallid sturgeon can be made and would be adjusted over time as new information is obtained” (Framework page 1). The Framework emphasizes that it is a starting point for further engagements between “the federal agencies, MRRIC, Tribes and other stakeholders.” Important regarding this review, the Framework states that final project designs or actions for implementation have not been developed and that “Actions in the proposed framework are a starting point for consideration and discussion. Some proposed actions may require further analysis and adjustment to this proposed framework in the future.”

The Framework is based on, guided by, and references the SAMP as providing the template for its supporting analytical approach. It is unclear whether the standing Framework and supplement document(s) will be amended, added to, or formally completed. Accordingly, rather than offering discrete recommendations for adjustments to the Framework, the ISAP offers in this review observations on the approach and the available technical information, and observes whether both are exercised consistent with protocols and directions in the SAMP. That noted, the overarching observation that can be made by the ISAP is that the Framework in approach, direction, and process steps hews closely to the SAMP. The Framework uses relevant material information from the pallid sturgeon effects analysis, new information from research and monitoring accrued since completion of the effects analysis, and the outcomes from an expert elicitation carried out specifically to address prospective consequences of alternative pallid sturgeon adaptive management actions in the upper Missouri River. The effects analysis and SAMP, upon which the Framework is based and linked, have been subject to previous review by the ISAP and have been judged to constitute the “best available scientific information” as required under the federal Endangered Species Act and intended in the Biological Opinion. The Framework, as well, can be reasonably characterized as meeting programmatic intent under the MRRP.

The ISAP was guided in its review by three compound “questions” — better described as task statements — that were provided it by the federal agencies after consideration and amendment by the Fish and HC Work Groups (Attachment 1). The ISAP was compelled to adjust the three task statements to make them more tractable to technical assessment and to answer; the amended

task statements head the individual response sections below. The full intent of the original “questions” was retained in the refined task statements.

Stimulated by the Fort Peck Framework document and the supplement, the ISAP considered worthy of comment three additional issues that affect the implementation of management actions in an adaptive framework under the MRRP: (1) the absence of a well-developed population model for pallid sturgeon that can contribute to the selection of management actions from among alternatives; (2) the apparent slow progress in producing monitoring tools that allow the size and trajectories of the Missouri River pallid sturgeon populations to be estimated and the performance of management actions to be evaluated; and (3) the challenge of making progress in better understanding the ecology of pallid sturgeon and managing for its future in an experimental “decision-space” that is narrowly defined by stakeholder prerogatives and concerns. These three issues are addressed near the end of this report. The ISAP anticipates that the brief discussion herein may stimulate focused discussion of the issues by the Adaptive Management Team and relevant work groups operating in support of the MRRP.

Responses to the questions -

1) Was the best available scientific information and analysis used in formulating the Level 1 studies, conceptual hydrographs in support of Level 2 prescribed test flows, and other adaptive management actions and activities described in the Fort Peck Adaptive Management Framework? Identify and evaluate the nature of that science, which may include published information, reports and assessments, modeling efforts (both completed and ongoing), and the results of expert elicitation.

The Fort Peck Adaptive Management Framework is based on the premise that if pallid sturgeon spawn near Fort Peck Dam (that is, near the confluence of the Milk River and the Missouri River) then there is an increased likelihood of pallid sturgeon recruiting to age 1. There are three pieces of empirical scientific evidence that support the premise. First, during the flooding of 2011, high discharge from the emergency spillway at Fort Peck Dam in combination with record high discharge from the Milk River provided conditions that were suitable for pallid sturgeon to

spawn in the Missouri River near the confluence with the Milk River. That those highly turbid conditions were suitable to attract, retain, aggregate, and trigger spawning was confirmed by tracking data on reproductively active pallid sturgeon and sampling pallid sturgeon free embryos directly downstream of the spawning location. Second, in 2018, three reproductively active female pallid sturgeon (one wild and two of hatchery origin) ascended the Missouri River in the spring during high discharge from the Milk River. Subsequently, the Milk River discharge receded, but the fish stayed in the Missouri River near Fort Peck Dam under increased discharge from the spillway at Fort Peck Dam — suggesting adequate retaining or aggregation flow despite reduced turbidity. Third, a pallid sturgeon larval drift study was conducted in 2016 where pallid sturgeon free embryos were released near Fort Peck Dam to study the drift dynamics. In the next year, one of the pallid sturgeon released in the experiment was collected during standardized sampling in the Missouri River below the confluence of the Yellowstone River upstream of Lake Sakakawea; age 1 and genetically confirmed from the family cross used in the study — family cross 1F497F1801 X 0A180E0E7E — began hatching at Garrison Dam NFH at 0200 on 26 June 2016. Those findings indicate that pallid sturgeon will spawn in the Missouri River under certain (abiotic) conditions and that there is enough drift distance for pallid sturgeon to develop beyond its free-drifting stage before encountering anoxic conditions in Lake Sakakawea. It is, however, worth noting that those findings do not confirm that pallid sturgeon spawning events in the upper Missouri River can be sufficient to produce a self-sustaining population. However, the level of recruitment necessary to maintain a self-sustaining pallid sturgeon population could be estimated using the pallid sturgeon population model.

The high flows in 2011 and 2018 were extreme events and are not readily reproducible under average discharge conditions and because of operational constraints on the system. Additionally, the Milk River is not managed by the USACE and has minimal capacity for experimental flows. Given these circumstances, two conceptual hydrographs were developed that could be implemented by managing discharges from Fort Peck Dam (Framework Figures 3 and 4). These hydrographs are experimental in the sense that they are fundamentally the “treatments” in the described Level 1 and Level 2 studies.

The Framework describes a process for developing example hydrographs as management alternatives for evaluation in compliance with the 2018 Biological Opinion. Suitable hydrologic

and hydraulic models, HEC ResSim and HEC RAS, representing the best available science, were utilized to conduct preliminary analyses of these conceptual flow regimes.

Available historical flow regime records were compared with the post-dam flow regime (Framework Figure 1) using the Indices of Hydrologic Alteration (IHA) analytical framework. The IHA approach represents a technically defensible analytical tool to compare historical and modern flow regimes. After identifying the differences in the regulated (modern) and pre-regulation (historical) flow regimes, data from a recent unregulated flow event and the current understanding of the pallid sturgeon reproductive ecology were used to develop the conceptual hydrographs. These hydrographs seek to mimic critical components of the pre-regulation flow regime that are hypothesized to be important for pallid sturgeon reproduction. The Framework provides a clear explanation of why some parameters (for example falling-limb duration) of the flow regime were set at values represented in the conceptual hydrographs that link these parameters explicitly to the pallid sturgeon ecology (for example larval drift-distance regulation) and human considerations (for example bank erosion); however, other features of the hydrographs are not discussed in detail (for example duration of the peak-flow).

The conceptual hydrographs were altered (slightly) to elicit specific behavioral responses from the reproductively active pallid sturgeon, with discharge levels intended to attract and retain the pallid sturgeon (see Figures 3 and 4). The attract, retain, aggregate, and spawn discharges outlined in the Framework are based on the current knowledge of pallid sturgeon reproductive ecology, including several years of tracking reproductively active pallid sturgeon in the Yellowstone and Missouri rivers. It is important to note that after pallid sturgeon spawn, discharge is decreased in each conceptual hydrograph to reduce free-embryo drift speed and increase development time to allow the pallid sturgeon embryos to mature and settle out of the drift before they enter anoxic conditions at Lake Sakakawea.

The Framework addresses potential irrigation intake concerns regarding the reduced summer releases designed to reduce free-embryo drift speed by acknowledging that the conceptual hydrographs contain reduced summer flows similar to current median conditions. The Framework states that “in conceptual hydrograph 1, flow is maintained at 4,200 cfs through August 20 to match median conditions,” which would result in no alteration to the current

services provided to irrigation intakes on the system. The potential impacts from conceptual hydrograph 2 are less clear, as the Framework states that flows are reduced following the flood pulse until “conventional flow operation is achieved,” with some discussion of possible further reductions to limit free-embryo drift if needed. Clearly delineating summer-flow levels in conceptual hydrograph 2 would help clarify potential impacts at downstream irrigation intakes. Completion of the planned free-embryo drift dispersion modeling on the upper Missouri River (Framework, Table 5) might further inform the design of summer flows to meet requirements of pallid sturgeon while addressing stakeholder concerns regarding water intakes.

The best available science concerning the factors that influence pallid sturgeon reproductive ecology and drift dynamics were used to develop the conceptual hydrographs for the Level 1 and Level 2 studies and the Framework. The science and logic are well described using Effects Pathways Diagrams in the *Supplement to the Draft Fort Peck Adaptive Management Framework for the Upper Missouri River Pallid Sturgeon*. Additionally, ten pallid sturgeon experts were engaged to assess the evidence supporting or refuting each of the Effects Pathways (Framework page 21). The Technical Team concluded from the expert elicitation that the limiting factors for the upper Missouri River are essentially the same as described in the effects analysis, SAMP, and biological opinion, noting "In general across the range of experts, the current interpretation of the available evidence is that pallid sturgeon recruitment in the Upper River is most likely limited, in whole or in part, by flows and temperatures to attract fish to the Missouri River, and by issues related to insufficient larval development (i.e. determined by available distance, temperature and current velocities) during drift."

Despite the empirical evidence regarding movement and spawning of pallid sturgeon relating to discharge and water temperature presented above, considerable uncertainty remains. For example, not all reproductively active pallid sturgeon spawned at the confluence of the Milk River in 2011; some pallid sturgeon continued to use the Yellowstone River. Similarly, not all reproductively active pallid sturgeon ascended the Missouri River during high discharge in 2018. In the Missouri River above Fort Peck Reservoir, some hatchery-origin reproductively active pallid sturgeon spawn and others become atretic within the same spawning season when exposed to identical discharge and temperature regimes. The micro- and meso-scale conditions that elicit spawning in pallid sturgeon are not well understood; those conditions might be mutually

exclusive of the macro-scale discharge and temperature regimes that are measured and used to define the conceptual hydrographs for the Level 1 and Level 2 studies. The Framework states that Level 1 studies will be used to address key uncertainties, but understanding micro- and meso-scale metrics, such as small-scale habitat selection, mate selection, etc. could require decades of study.

Given the current degree of understanding of pallid sturgeon reproduction and recruitment, Level 1 and Level 2 studies can still be informative, but only if the performance metric benchmarks (success criteria) are relevant, that is commensurate with the understanding of abiotic factors that influence pallid sturgeon spawning. The Framework is not designed to prescribe the specific, final experimental frame, monitoring design, or performance-metric benchmarks. However, the Framework should explicitly recognize the importance of establishing and evaluating those benchmarks. For example, should a managed flow action be considered a success if one reproductively active pallid sturgeon moves up the Missouri River during the event? Or, should success be defined as all reproductively active pallid sturgeon ascending the Missouri River to Fort Peck Dam during a flow-management action? In other words, the anticipated outcomes of managed flows (or temperature or turbidity manipulations) outlined in the Framework and associated documents could be inaccurately evaluated without clearly defined metrics of success and a corresponding monitoring design necessary to sample and evaluate those metrics. Performance criteria should be identified and established prior to implementation of managed flows, a monitoring scheme needs to be designed to ensure that the data collected can be used to assess the performance metric benchmarks. The Framework addresses this topic and sets expectations commensurate with the scientific knowledge in the discussion on page 19, where it is stated "Effects on pallid sturgeon reproductive ecology will be necessarily indirect because reliable, direct models do not presently exist. For example, in the near term, success of the attractant pulse may be evaluated through estimation of the frequency, magnitude, and duration of simulated pulses relative to pulses in the unregulated flow regime. Similarly, effects of low flows intended to maximize drift time may be evaluated through estimation of relative performance calculated through simple advection-dispersion models." It is also important to recognize that the metrics for Level 1 and Level 2 studies differ from the goals and management objectives as stated in section 3.1.

Continuing to explore and develop a set of alternative release scenarios from Fort Peck Dam (managed hydrographs) as an adaptive-management option will avoid complete reliance on flows from the Yellowstone and Milk rivers. Accordingly, the ISAP supports ongoing efforts to develop “a hydrograph for testing recruitment of pallid sturgeon to age-1 on the Upper Missouri River using the best scientific understanding of biological needs of the fish, recognizing that opportunity for fish passage at Intake Dam on the Yellowstone River is imminent, and that management actions at Fort Peck should complement, but not detract from, potential for successful recruitment on the Yellowstone River.” Conceptual hydrographs for the upper Missouri River can be adjusted in real time to account for local major tributary inputs from the Yellowstone and Milk rivers, consistent with the experimental nature of the Level 1 and Level 2 studies. The Framework document emphasizes the interconnections between the Missouri, Yellowstone, and Milk rivers in stimulating the Level 1 and Level 2 studies, but the Framework also offers the contradictory statement that “If pallid sturgeon use the Yellowstone River, discharge or temperature actions at Fort Peck Dam will not be relevant.” Although one might expect that spawning in the Yellowstone River will be the more viable option for reproductively active pallid sturgeon following fish passage at Intake, given the natural variability in flow regimes in the upper Missouri River system, pallid sturgeon in the Yellowstone River in certain years will inevitably experience conditions that translate to lesser likelihood of reproductive success. At such times, well-considered options for strategically applied Fort Peck Dam releases to promote beneficial conditions for pallid sturgeon reproduction on the upper Missouri River could contribute directly to the fish’s viability and recovery.

Several additional observations and questions emerged during the Framework review. For example, it is unclear why the peak flow is held for three days in conceptual hydrograph 1. What information and data were used to establish the three-day duration? It is perplexing that the designed peak flow magnitude in conceptual hydrograph 2 is arbitrary, given that the flow action is an experiment, one for which control of a “treatment effect” should be exercised as much as possible.

The outline on how to prioritize and sequence activities is well developed and should be followed and updated as needed. At the same time, at what point do Tables 5 and 6 get inserted into the prioritization and sequence of events schedule?

While Figure 7 clearly defines the process for implementing Level 2 flow releases from Fort Peck Dam, the difference between maximizing learning and maximizing fish benefit is unclear. These objectives appear mutually exclusive in the diagram, but it can be argued that they are not.

The section “Flow adjustments to minimize harm to the Yellowstone” (3.5.6) is confusing. Unless it is determined that pallid sturgeon spawn considerably upstream of Intake Diversion Dam, then it would appear the upper Missouri River might be the more likely contributor to pallid sturgeon recovery. At this point, proof of concept has been established for the upper Missouri River potential contributions to reproductive success by pallid sturgeon. Table 9 presents a detailed set of Level 1 and Level 2 studies aimed at increasing understanding of the potential contribution of managing temperature (Big Q3) and turbidity (Big Q4) to pallid sturgeon reproduction and recruitment. The nature of the studies and corresponding “if-then” decision points and metrics suggest that the best available science is being directed at the potential management actions. However, the absence of sufficiently robust management-response functions to anticipate the effective design and implementation of temperature or turbidity-based management actions should be noted. Level 1 and Level 2 studies might be conducted using the Fort Peck Dam infrastructure (to address temperature) or possible sediment bypass (to address turbidity). However, the current operations capabilities to actively manage temperature and/or turbidity to the benefit of pallid sturgeon remain limited to increasing temperature or turbidity downriver of Fort Peck Dam. The relations between temperature and turbidity, and pallid sturgeon recruitment are not completely understood at this point; these circumstances do not strongly support the design or implementation of temperature or turbidity manipulations until results of the proposed Level 1 and Level 2 studies are obtained to guide them.

2) Does the Framework reflect the intent and process for resource management under the Missouri River Recovery Program as described in the Science and Adaptive Management Plan, including a structured approach to project design that uses a clearly articulated experimental framework for implementing management actions and gathering monitoring data, that addresses the Big Questions, that develops actionable decision criteria, and that contributes to identifying next management actions and studies not yet envisioned?

Consider those adaptive management project attributes and time frame in evaluating proposed management action scenarios offered in the Framework as they relate to 1) competing dispersion model predictions, 2) potential temperature and sediment effects on management outcomes, 3) baseline and flow-test monitoring designs that are sufficiently (statistically) robust to evaluate project performance, and 4) near-term learning regarding project benefits to pallid sturgeon that can be applied in adapting proposed management actions and identifying new actions.

As underscored in the SAMP, Level 1 and Level 2 studies are not anticipated to result in population-level impacts on pallid sturgeon (or plovers and terns). Level 1 and Level 2 studies are primarily foundational research in nature and are intended to inform Level 3 and Level 4 management actions. Therefore, Level 1 and Level 2 studies are not necessarily subject to the requirements of adaptive management as developed in the SAMP. However, the Framework demonstrates that it is possible to design Level 1 and Level 2 studies within a structured adaptive management process that tests (evaluates) management-action hypotheses and identifies potential future Level 3 and Level 4 actions that might be anticipated to have favorable population-level benefits for the sturgeon.

Project design — The Fort Peck AM Framework was developed to address key uncertainties regarding the recruitment of pallid sturgeon on the upper Missouri River. The Technical Team constructed Effects Pathway (or influence) diagrams to describe the implications of new information beyond that addressed previously in the Effects Analyses. The diagrams were constructed to be conceptually compatible with the conceptual ecological model developed previously for pallid sturgeon in the Missouri River. The diagrams effectively interrelate the complex environmental factors with known pallid sturgeon reproductive behavior toward

guiding the design of modifications to flows, temperature, and turbidity, all aimed at increasing the likelihood of pallid recruitment in the upper Missouri River. In the supplemental material, the diagrams provide active links to detailed descriptions and data supporting specific causal linkages between proposed managed flows, sediment augmentation, and pallid reproductive requirements, as well as survival of age-0 pallid sturgeon during transport down river.

The two examples of managed flows derive from knowledge of pre-construction hydrographs and apparent/hypothesized needs of pallid sturgeon to reproduce and recruit to the upper-river population (see Figure 1 in the Framework). The Framework describes hydrographs in relation to hypothesized requirements for successful reproduction and recruitment of pallid sturgeon in the upper river, including (1) an attractant high flow designed to motivate pallid sturgeon to migrate upriver, (2) subsequent high flows that will retain fish in the upriver reaches, (3) an additional pulse aimed at cuing fish to spawn, and (4) lower flows on the receding limb of the hydrograph to maximize drift durations for maturing embryos. All of these aspects related to pallid sturgeon reproduction and recruitment were addressed in developing the example hydrographs presented in the Framework. Correspondingly, separate Effects Pathway Diagrams were developed for each of the four components of the example hydrographs.

Experts were convened to identify factors that could be responsible in limiting pallid sturgeon reproduction and recruitment in the upper Missouri River. The Framework did not indicate how many of the experts had participated in previous elicitation efforts concerning possible factors that control pallid sturgeon population dynamics in the Missouri River. The expert elicitation appeared to offer little in the way of new insights or information concerning potential factors that limit pallid sturgeon reproductive success in the upper river. Rather, the results of their deliberations largely confirm previous suspicions that flows, temperature, and turbidity influence pallid sturgeon reproduction in the upper river. A possible addition to the state of understanding was recognition of the high degree of uncertainty associated with the potential importance of turbidity in affecting pallid sturgeon spawning (Figure 5). The experts also prioritized spawning habitat availability, hatchery-related effects, and mortality in the drift of embryos as important to include in the Effects Pathway diagrams. Pheromones were also suggested as an alternative to attractant flow pulses.

Two example flow manipulations (see Framework Figures 3 and 4) were developed on the basis of unregulated flow regimes ² and unpublished observations of upriver pallid sturgeon movements. Maximum managed flows of 16,000 cfs were derived from observations of pallid sturgeon movement up the Missouri River when spring-early summer flows were roughly double that of corresponding seasonal flows in the Yellowstone River (about 8,000 cfs). The example hydrographs were similarly informed by observations that pallid sturgeon tend to spawn on the receding limb of the May-June pulse if water temperature is 16° C or higher. Yet, the Framework recognizes that there is no known relation between the unregulated-flow upper river hydrographs and pallid sturgeon reproduction. The example hydrographs might not have any impact on pallid sturgeon. That and other uncertainties will likely attend selection of a managed flow action. The “signal strength” of (permissible) managed flows in the upper river to increase pallid reproductive behavior might be insufficient to elicit a measurable response in reproduction or subsequent recruitment. A near-term challenge lies in continued evaluation of hypothesized relationships between successful pallid sturgeon reproduction and recruitment and the absolute magnitudes, timing, and durations of the four components of the managed hydrographs.

Implementation — The Framework underscores the limitations of infrastructure (the dam) and operational constraints in designing and, perhaps more importantly, implementing a managed flow. Implementation will depend on water availability in relation to authorized uses and requirements to maintain specified pool volumes and discharges at different times of the year. Managing floods in the upper Missouri River adds another constraining dimension of unknown, but likely increasing frequency with concomitant constraints on flows mobilized to benefit pallid sturgeon.

Water temperatures down river appear only in part manageable, depending on the magnitude of flows and corresponding sources of flow as defined by the structure and operation of the dam (the power house and spillway). The Framework describes water temperatures associated with

² The Framework and Supplement do not define unregulated flows. Are these estimates of historical pre-construction flows or simply unmanaged flows through the existing infrastructure? It appears that the unregulated flow characteristics were based on values of an Index of Hydrologic Alteration (IHA, Nature Conservancy 2005) based on output of two physical models, the Daily Routing Model (period of 1898-1997) and the ResSim (period of 1930-2012). Table 2 in the Framework summarizes the environmental flow characteristics (EFCs) based on the results of the two models.

different parts of the example hydrographs as not necessarily detrimental to pallid sturgeon, but likely not optimal for pallid sturgeon reproduction, or growth and survival of age-0 fish. Options regarding temperature modification are limited by the design of Fort Peck Dam spillway and the required pool elevation to effect top (warm) releases. The uncertain relationships between water temperature and pallid sturgeon recruitment, combined with the constrained ability to manage temperatures downriver of Fort Peck Dam only generally, suggest that Level 1 and Level 2 studies aimed at better understanding the role of temperature as it affects pallid sturgeon recruitment ought to be given high priority in the near term. If water temperature and turbidity are determined to influence pallid sturgeon reproduction and recruitment, modifications to infrastructure, for example a tower at the power house and/or a warm-water and sediment pipeline intake at the head of the reservoir, to increase capability for water temperature and turbidity modifications downriver of Fort Peck Reservoir are potentially available.

The Framework implicitly suggests that implementation of even certain components of an overall managed hydrograph might prove beneficial to pallid sturgeon recruitment in the upper Missouri River. There are no known peer-reviewed studies that explicitly address this assumption — the assumptions are based on observations from 2011, 2016, and 2018. It is similarly possible that the effectiveness of successive seasonal flow conditions is contingent on previous flows. That is, it might make little difference if low flows in late summer are successfully implemented absent a high spring pulse (managed or not). If entire managed hydrographs are required at a minimum interval, say every 2 or 3 years, to benefit measurably pallid sturgeon reproduction and recruitment, the likelihood of successful implementation decreases correspondingly, and more importantly, it could lie beyond the control of the adaptive managers.

Additionally, a piece-meal, opportunistic approach to flow management might further weaken the “signal strength” of managed hydrographs already constrained by authorized purposes, human considerations to the extent that it might become increasingly difficult to measure reliably pallid sturgeon responses and/or unequivocally attribute any measured responses to a management action.

The USACE rightly recognizes that additional NEPA analysis may be required (and in fact is currently underway) prior to implementing any proposed flow management actions. Consistent with AM as described in the SAMP, the Framework states that, during the implementation of Level 2 or Level 3 actions, it might be apparent that particular (specific) actions are not needed, actions might require modification to increase effectiveness, or novel actions not previously explored might be required.

Monitoring — The Framework rightly recognizes the importance of monitoring and assessing the results of management actions, and in evaluating Level 1 and Level 2 actions in relation to the overall management objectives. However, the document eschews detailed prescriptions for monitoring based on the assertion that an actual managed discharge remains to be defined and implemented. Perhaps the degree of monitoring described, mainly effectiveness monitoring, is appropriate for evaluating Level 1 and Level 2 studies within an AM framework consistent with the SAMP. If these studies translate into Level 3 and Level 4 management actions, it is expected that monitoring programs (plans) would correspondingly increase in dimension, detail, and quantitative rigor.

Some reference to specific monitoring activities is included in the Framework in Appendix D. The ISAP appreciates the summary of monitoring activities in Table 7 (page 46), but observe that the performance metrics listed have been subjected to little more than anecdotal validation, and several will inevitably be challenging or not functional. It is beyond the scope of the Framework to include a detailed monitoring plan at this juncture; however, the Framework needs to more clearly articulate the central role of monitoring in assessing managed flow actions to determine if Level 1 and Level 2 studies are to meet the established performance metric benchmarks. Reasonable performance metrics are listed in Table 7, such as water temperature, discharge, and river mile location, but the links to project success are absent (for example, what river-mile location would determine success?) Monitoring plans and performance-metric benchmarks need to be established now, because learning is ongoing.

Decision-making — The Framework describes how the use of monitoring results will support decision-making in relation to adaptive management. Table 6 outlines the overall methods, describes metrics, and addresses decision-making in the form of “if-then” statements that might

generally inform decisions. However, the information in the table, such as monitoring metrics, should not be interpreted as meeting the technical requirements of a rigorous monitoring program in support of adaptive management. The if-then statements do not lead to concrete decisions, rather they seem to be included to suggest support (or not) for continuing to pursue identified studies or management actions.

Several of the if-then decision statements in Table 6 include the phrase “sufficient to have a population-level effect,” yet that sufficiency is not quantified in relation to pallid sturgeon population dynamics in the upper river in either the Framework or Supplement documents. The Framework defaults to the 5,000 individual pallid sturgeon per management unit as designated in the SAMP, while understanding that this number surely will change as more information accumulates. These circumstances might be addressed through a series of sensitivity-analysis simulations using the pallid sturgeon population model. While understanding the uncertainties associated with the model, it would nevertheless seem worthwhile to explore modeled pallid sturgeon population dynamics in relation to relationships, even hypothesized relationships, between managed flow elements and pallid sturgeon responses (including spawning, recruitment).

The questions and evidentiary framework in that section of the Framework seem too vague for learning. Moving forward, the questions should be focused on the experimental design of the conceptual hydrographs, which was established as the foundation for the Framework in the beginning of the document. For example, the authors might frame a question as such "Did 25% of the reproductively active pallid sturgeon in the upper Missouri River (Missouri and Yellowstone rivers) aggregate near the Milk River when conceptual hydrograph 1 was implemented?" This establishes a benchmark that is tied to the conceptual hydrograph. There is an opportunity here to perform large-scale experimental designs, which can be quantitatively powerful if conducted correctly.

Table 8 can be extremely useful. For example, in the row 4, column 3 it states "IF Fort Peck flows are likely to have biological benefits without causing unacceptable impacts to human considerations, that THEN supports moving to BQ/L2/C5." But what is meant by biological benefits? The Framework should strive to define decision criteria within the context of what is

actually being measured or monitored, such as numbers of fish that moved, maximum upstream location, spawning location, and number of free embryos sampled.

Governance — The Framework (Pages 27 and 48) refers generally to the governance process in the SAMP. The word governance appears only three times in the Framework document.

Data Management — The Framework and supporting documentation do not address data management, which represents an essential element to adaptive management in relation to the MRRP (as per the SAMP). The words “data management” do not appear in the Framework. Given that specific management actions and corresponding monitoring programs have yet to be defined, it might be premature to consider data management in any detail; however, the Framework would benefit from strategic articulation of how data will be developed, analyzed, presented, and otherwise managed.

3) Is the Framework structured and presented such that the evaluation of Human Considerations (HCs) is apparent in management-action planning and decision-making, project implementation, and project assessment? Elaborate on essential framework attributes that address HC concerns.

One of the four primary purposes of the Framework is to “Summarize monitoring and assessment activities that may be needed to evaluate the effectiveness once a test flow action has been implemented and, potentially, to assess effects on human considerations ” (Framework page 3). One of the guiding principles in developing the Framework was to “Build an approach to integrate technical aspects of human considerations seamlessly when and if this becomes necessary” (Page 4).

As described in section 1.4 of the Framework and in supplemental information provided to the ISAP (see Attachment 2 below), the USACE met with stakeholders via MRRIC Fish and Human Considerations Work Groups regarding the development of the Framework starting in May, 2018, subsequently at the Fall Science Meeting webinar, and then at the MRRP MRRIC Plenary Meeting in November, 2018. These engagements continued into 2019, including a Fish and HC webinar, an Adaptive Management Workshop and discussion at the May 2019 MRRIC Plenary

Meeting. The Framework acknowledges “further engagement will be needed... particularly as they might pertain to impacts to Human Considerations” (Page 5). ISAP commends the USACE for those early engagements in support of transparent development of the Framework document and its potential Fort Peck test-flow cases, and for the agency’s mindful recognition that continued engagement is needed. Table 1 (Framework page 6), indicates that during the first step in its development, HCs were explicitly recognized in the design and preliminary analysis of the two conceptual hydrographs. The USACE acknowledges that in the ongoing development of the Framework scope “HC monitoring may ultimately be an important factor, but specific needs for HC monitoring cannot be predicted without first specifying the precise nature of the actions to be examined” (Page 12). Accordingly, substantial reliance on MRRP vehicles for integrating stakeholder input into the Framework, with emphasis on HC issues can and should be expected.

Human Considerations are included in the discussion of the Framework’s “preferred” four-step evaluation of conceptual hydrograph 2 (Page 19). Specifically, in the fourth step, HCs are included in the analysis of the flow effects associated with the conceptual hydrograph. In addition, when the USACE assesses the conditions necessary for a Level 2 experiment to be implemented, it is stated that HCs would be among the factors potentially assessed (Page 28).

The Framework includes a short section (section 3.4.3) specifically considering monitoring of salient HC factors (variables) (see Pages 31-32) and indicates that it will be necessary to assess impacts to HCs that may result from potential Level 2 actions. Importantly, the Framework does not provide any specific guidance toward HC monitoring, apparently due to uncertainty as to “...which of the possible Level 2 actions that might be of interest will actually be implemented” (Page 31). Upon identification of a Level 2 action, an updated Framework might be expected that describes an HC monitoring design that follows the sequential step-down development previously presented for piping plover.

The Framework Section 3.4.3 on HC monitoring references the SAMP Section 5.3.2. This section of the SAMP identifies physical elements of the system that are routinely monitored. Several of these may be relevant to assessing any potential impacts to HCs associated with a wide range of possible management actions related to pallid sturgeon. That section of the SAMP also refers to the Master Manual, which in turn provides a detailed list of routine targeted

monitoring elements, at least some of which have direct relevance to HCs (e.g., river flows, water temperatures). The Framework also references Section 5.4.7 of the SAMP in addressing criteria for prioritizing new monitoring requests and attending targeted environmental factors. Taken together, Section 3.4.3 of the Framework includes by reference a number of elements that could serve as indicators (factors) for an HC-focused monitoring program that is consistent with the in-preparation DEIS for Implementing Test Releases.

The listing in the Framework of Level 2 studies in Table 6 includes decision criteria and metrics that provide evidence of recognition by USACE of the importance of HCs in the selection of managed flow alternatives (HCs are also referred to as authorized purposes in Table 6).

Specifically, Table 6 indicates that model-based predictions of HC responses to Level 2 flow manipulations at Fort Peck would be made during studies in years 1-5 (Page 39). Results of those studies appraising impacts associated with HC responses would be part of the determination of the feasibility of implementing low-flow measures on the upper Missouri River (Page 40).

During years 6-10, studies of the observed effects on HCs of a Level 2 experimental flow release from Fort Peck would be performed (Page 41). Similarly, impacts to HCs from field experiments involving warm-water releases from Fort Peck would also be studied in years 6-10 (Page 41).

Meeting those commitments to monitoring of human considerations will confirm that HC considerations are appropriately integrated into the resource-monitoring program.

Section 3.6 describes effectiveness monitoring and recognizes the need to monitor human considerations. However, Table 7 does not provide any performance metrics for HCs. Rather, that section notes that “The need for additional monitoring activities to support assessment of *effects on human considerations* could be considered in conjunction with related analyses of any alternatives developed and evaluated as part of the NEPA process.” (Page 47). The USACE should plan and design monitoring for human considerations timed so that those elements can be incorporated in the NEPA assessment process for the proposed test flow.

The appendices to the Framework include a discussion of HCs. First, HCs are acknowledged in the discussion of the *Effects Pathway Diagrams* (Page 54), but at this time they are not included in Figures 8-11 (Diagrams A-D). Rather it is in Appendix A.4. *Components for Upper Missouri River AM Framework* that the USACE provides several examples of how integration of HCs into

decision criteria accompanying Level 2 flow manipulations might occur. Specifically, Table 8 in the Framework’s Appendix A.4 – item BQ1/L2/C4³ – explicitly lists “human considerations” as a Key Metric when evaluating “Level 2 flow manipulations at Fort Peck.” As part of the If-Then Decision Criteria for BQ1/L2/C4⁴ “without causing unacceptable impacts to human considerations” is listed as a requirement for moving from “flow manipulations” to an “experimental flow release from Fort Peck.” Likewise, Decision Criteria for both BQ2/L1/C1 to move to Level 2 experiments and BQ2/L2/C5 to move forward to field experimentation of flow naturalization include statements to proceed to this next step if proceeding is not expected to cause or is without “unacceptable risks to other authorized purposes.” Similarly, the Decision Criteria to move to field implementation of sediment bypass requires a determination that sediment bypass “...can be feasibly implemented without unacceptable impacts to human considerations.” These examples demonstrate that the Framework explicitly incorporates the broad concept of human considerations in decision criteria.

Given that the release date of the draft Framework (12 December 2018) occurred after several USACE public engagements, some specific examples of HCs that are affected by flow experiments could have been identified in the Framework. Specifically, a listing of several of the HCs that stakeholders identified that could be affected by a few of the possible Level 2 alternatives – for example reduction in the value or quantity of hydropower resulting from potential management actions that change the timing of flows through the turbines or potentially bypassing the turbines. From knowledge of HCs that generate high stakeholder concern, corresponding representative monitoring metrics could be identified. The Framework could have identified HC monitoring metrics relevant to managed hydrographs in general and the two conceptual hydrographs in particular.

In summary, the importance of evaluating and monitoring Human Considerations (HCs) is acknowledged throughout the Framework and in Appendix A.4. The actual section on HC monitoring primarily incorporates HCs by reference to the Science and Adaptive Management

³ BQ is Big Question; L is Level as in Level 1, 2, 3, 4; C is component as in 1, 2, 3, 4

⁴ Note that this explicit incorporation of “unacceptable impacts to human considerations” in the Decision Criteria is missing in Table 6 “If-Then Decision Criteria for BQ1/L2/C4.” ISAP recommends the phrase “unacceptable impacts to human considerations” be included in Table 6 if any revisions are made to the Framework document.

Plan. Monitoring of any HC effects associated with potential flow and warm water releases from Fort Peck is implied in Level 2 studies in years 6-10 in Table 6. Appendix A.4 indicates that any decision to move forward with flow manipulations, flow naturalizations or sediment field experiments would require determining that “unacceptable impacts” to human considerations or authorized purposes are avoided. The approach taken and material presented in the Framework illustrates how HCs can be incorporated into planning, decision-making, and selection of Fort Peck management actions for implementation. Following the process guidance presented in the SAMP, the Framework provides a template and mechanisms to identify those HCs that require or could benefit from directed monitoring associated with the implementation of selected management actions.

Overall, the ISAP concludes that what is presented in the Framework provides a credible start toward an effective process to consider HCs in decision making for informing the design, implementation, monitoring, and evaluation of Fort Peck managed flows.

Additional Observations and Concerns

The pallid sturgeon population model is referred to as a potentially useful application that will be informed by the results of the Level 1 and Level 2 studies and will be implemented in the indefinite future to possibly assist in the design and exploration of future managed flows in relation to pallid population dynamics in the upper Missouri River. An alternative approach would be to focus near-term efforts on standing up the pallid sturgeon population model, recognizing remaining uncertainties, to perform simulations aimed at evaluating the likely impacts of the two example hydrographs on pallid population dynamics in the upper Missouri River. The ISAP understands that the seemingly halting development of the pallid sturgeon population model may be headed for fresh engagement. An advanced pallid sturgeon model would have substantive application in the Framework and other coming efforts elsewhere on the river. Fast-tracking its development would have estimable value in advancing the MRRP.

The Framework, while certainly consistent and compatible with the SAMP, seems unnecessarily redundant of the SAMP, despite the statement that "This Fort Peck AM Framework can be

included as a new component of the MRRP Science and Adaptive Management Plan for the Missouri River Basin." Note that the SAMP already includes actions under consideration for the upper Missouri River. Having both the Fort Peck Adaptive Management Framework and the SAMP as separate stand-alone documents sets the stage for potential confusion in moving forward under the MRRP. Do aspects of the Framework supersede the SAMP? Which adaptive management plan should be followed during implementation of Level 1 and Level 2 actions in the upper river? Is less-complementary material in the SAMP regarding Fort Peck no longer relevant? Also contributing to some confusion are the many usages of the term "framework" in the Fort Peck AM document, including AM framework, framework of four implementation levels, modeling framework, legal framework. Reserving "framework" solely for the title of the main document would help avoid confusion.

Advances on technical fronts under the MRRP are increasingly occurring ahead of the ISAP's formal assignments and ability to keep up. It might be expected that a monitoring design for pallid sturgeon is moving forward apace beyond the ISAP's recognition. But, Table 7 in the Framework suggests otherwise. The simple two-column table presents "monitoring activities" and "performance metrics" without further explanation or justification. That presentation, as noted above, is awfully thin, and is just the latest evidence that the pallid sturgeon-monitoring component of the greater conservation program is in a continuous, indefinite, and not well-defined state of development. The ISAP encourages agency staff and the technical teams to make serious real-time progress in developing monitoring tools, including identifying and validating metrics, indicators, surrogates, and proxy measures that can be applied to the MRRP's adaptive management efforts as they are implemented.

The ISAP recognizes the considerable effort devoted to constructing the Effects Pathways Diagrams and designing the example conceptual hydrographs. The Effects Pathways analysis was used to interpret the best available science in order to determine what most likely is limiting pallid sturgeon recruitment in the upper Missouri River. The results of an expert elicitation generally concluded that flows and temperature influence the attraction of pallid sturgeon. Limited drift distance influences larval development and survival. The conceptual hydrographs were correspondingly developed to evaluate the hypotheses related to discharge, temperature, and drift distance. Given conceptual hydrographs 1 and 2, it can be surmised that pallid sturgeon

migrate up the Missouri River and spawn near Fort Peck Dam and that the free-embryos have enough drift distance to develop, settle out of the drift before entering Lake Sakakawea, and recruit to age-1. In responding to Question 1, the ISAP sees the best available science supporting that reasonable logic chain and worthy of addressing with Level 1 and Level 2 studies. This is essentially where the Fort Peck Adaptive Management Framework stops. However, there remains a substantial amount of work in designing the Level 1 and Level 2 studies needed to inform Fort Peck Dam releases. The effort needed to develop Level 1 and Level 2 studies for Fort Peck releases will likely be similar in scope and intensity to that described for developing the IRCs in the SAMP's Appendix E (Attachment E.1). The Fort Peck flow manipulations represented by the example hydrographs present a valuable opportunity to implement large-scale field experiments, which have proven effective in ecological studies elsewhere.

The uncertain relationships between flow, temperature, and turbidity, and pallid sturgeon reproduction and recruitment to age-1, combined with the requirements to avoid, minimize, and mitigate the human impacts of management actions, create circumstances that challenge the fundamental practice of adaptive management of flows in the upper Missouri River. Lacking quantitative functions that project the anticipated outcomes of differently scaled management actions (managed flows), logic and expediency would recommend action(s) with sufficient “signal strength” to all but guarantee response(s) that would be (1) readily measured using realistically available monitoring resources and (2) unequivocally attributable to the management action. Implementing sufficiently scaled flows, given current HC concerns relevant to the upper Missouri River, might prove increasingly difficult: the remaining feasible “decision space” that delineates the design and implementation of managed flows could very well preclude effective management actions. The agencies and MRRIC will be challenged to identify those subunits of the permissible decision-space that could in all likelihood manifest as measurable and interpretable responses. Considerations of an HC-constrained decision-space engender additional questions and concerns, as in the following.

Given the number and degrees of uncertainties regarding relationships between flow, temperature, and turbidity and pallid sturgeon reproduction and recruitment to age-1, each adaptive management action should be fully capitalized upon as an opportunity to generate new knowledge and address current gaps in the best available science. When a management action is

undertaken, how will response variables be identified and monitored? Will sufficient samples be collected and analyzed to distinguish between signal and noise in biologically meaningful variables? Developing this information to establish a solid study design is not a trivial exercise; it must be accomplished or the results from Level 1 and Level 2 studies will potentially be overwhelmed with uncertainties. The management process requires difficult decisions on what to measure and what is biologically significant, because studying and sampling all environmental factors referenced in the project's "evidentiary framework" will not likely be feasible, even as prioritized in Table 8 (on page 48, labeled as Table 5). For example, given a treatment (an implemented hydrograph), a response variable may be defined as the number of reproductively active pallid sturgeon migrating up the Missouri River. Correspondingly, biological significance might require ascertaining that 50% of all the reproductively active pallid sturgeon tagged in the Missouri and Yellowstone rivers had migrated. These specific metrics permit a quantitative assessment of the "treatment" effect of the management action. The ISAP is concerned that these kinds of definitive metrics and monitoring will not be accomplishable given the history of the pallid sturgeon population-monitoring program. The ISAP advises against performing a management action under the MRRP without a robust study design and sampling design (monitoring), and with biological significance defined and quantifiable decision criteria identified.

Summary and Recommendations

The ISAP does not advocate for substantial revision to the Fort Peck Adaptive Management Framework. The development of documents of this type in the future could be greatly economized by following the overall structure of the SAMP and simply incorporating the comprehensive material in the SAMP by reference. It would be less confusing if "framework" documents were identified as project-specific implementations of the SAMP, rather than as separate adaptive-management frameworks. Only one SAMP is necessary. Corresponding adaptive management sections in "implementation" documents, such as the *Fort Peck Adaptive Management Framework*, could then provide concise statements related to specific project design, implementation, monitoring, evaluation, data management, governance, and data base management without revisiting the already-detailed conceptual context previously articulated in the SAMP. Documents such as these then could be added as appendices to the living, evergreen

SAMP to maintain programmatic organization and continuity. An abbreviated documentation of the Fort Peck management actions, with appropriate description of project-specific elements, delivered as an appendix to the SAMP, might facilitate stakeholder understanding of how Fort Peck management actions relate to other management actions in the upper Missouri River basin (see SAMP Figure 53) and the MRRP.

Attachment 1

The assigned charge statement –

Charge Questions for ISAP relating to the Draft Ft. Peck AM Framework (“ISAP Charge Questions DFPAMF Final,” from Fish and HC Work Groups)

We have received additional input from the USACE, Third Party Science Neutral Robb Turner, and the Planning Groups to address comments received on the May 9 conference call. Based on Work Group input on the call and subsequent clarifications, the Planning Groups are proposing the following set of questions to guide the ISAP as it reviews the Draft Ft. Peck AM Framework (hereafter, ‘the draft Framework’).

Proposed Charge Questions

Please review the draft Framework and assess whether:

1. Best available science (e.g., a product of the scientific process; a synthesis of the most reliable knowledge available at this point in time; an expert elicitation; critical evaluation of observational data; model applications that link environmental stressor data to species and habitat responses, etc.) was used in formulating the level 1 studies and conceptual hydrographs for level 2 test flows outlined in the draft Framework;
2. The draft Framework presents an adequate approach and time frame for evaluating the efficacy of the described studies (including those assessing potential temperature and sediment effects and competing dispersion model predictions) and actions for achieving benefits to the sturgeon (i.e., testing hypotheses, answering questions regarding future management actions that may be needed);
3. The draft Framework is consistent with the SAMP, including links to the Big Questions;
4. The draft Framework provides a clear and effective process to consider HCs in decision making regarding its implementation; and
5. The draft Framework has mechanisms for identification and exploration of studies/actions not currently envisioned.

Attachment 2

Additional public engagement documentation requested by the ISAP and received from USACE (Craig Fleming) by email on 3 July 2019.

Fort Peck Engagements

USACE has coordinated with MRRIC throughout the development of the DRAFT FPDTR-EIS in addition to receiving formal consensus recommendations. Coordination has included in-person plenary meetings, webinars, in-person and virtual meetings with MRRIC work groups, and collaboration on the preparation and review of the Fort Peck AM Framework document. In addition to regularly scheduled engagements with MRRIC's Fish Work Group and Human Considerations Work Group, MRRIC members were invited to participate in the following activities:

- Joint Fish Work Group and Human Considerations Work Group Meeting, Sioux Falls, South Dakota, May 21, 2018
- Update during Fall Science Meeting webinars, October 2018
- Update during MRRIC Plenary Meeting, Kansas City, Missouri, November 2018
- Released Draft Fort Peck Adaptive Management Framework, December 21, 2018
- Joint Fish Work Group and Human Considerations Work Group webinar, February 1, 2019
- Adaptive Management Workshop, Nebraska City, Nebraska, February 25-27, 2019
- Hydropower analysis discussion with a subset of the Human Considerations Work Group, web meeting March 7, 2019
- Scoping Results Webinar, April 22, 2019
- Update and discussion during MRRIC Plenary Meeting, Sioux Falls, South Dakota, May 21-23, 2019
- ISAP review of Draft Fort Peck AM Framework document

Public and Agency Scoping:

To solicit public input in the FPDTR-EIS process, the USACE conducted public scoping meetings at the Fort Peck Interpretive Center in Fort Peck, Montana on February 19, 2019 and the Williams County Administration Building in Williston, North Dakota on February 20, 2019. The dates, times, and locations of the public scoping meetings were announced in the Notice of

Intent, published in the Federal Register on February 8, 2019; via a press release from the Omaha District Public Affairs Office on February 5, 2019; through social media, and in mass emails .

Members of the public were invited to submit questions and comments in-person at the scoping meetings, by mail, or email. The comment period was open from February 8, 2019 through March 26, 2019, during which approximately 50 correspondences were received. The content of comments received is summarized in FPDTR-EIS Scoping Summary Report (available at www.moriverrecovery.org).

Meetings with Tribes:

USACE's Omaha District sent a letter to Omaha District tribes (don't have a list of which ones) on February 6, 2019 advising basin tribes of purpose of this EIS and inviting them to attend the scoping meetings. At the request of the Fort Peck Tribe, an additional scoping meeting was held in the Tribal Chambers, on February 20, 2019.

**USACE Response to the Independent Science Advisory Panel (ISAP)’s Evaluation of
Dec 2018 Draft Fort Peck Adaptive Management Framework for Upper Missouri River Pallid Sturgeon**

13 September 12, 2019

USACE appreciates the ISAP’s review of the December 2018 Draft Fort Peck Adaptive Management Framework for Upper Missouri River Pallid Sturgeon and the opportunity to respond to some specific points before these findings are presented in detail to MRRIC.

We are in general agreement with the points made in the review, which we consider to be balanced and fair and which contains helpful ideas and suggestions for future development of this work. As ISAP notes, in the months since the Draft AM Framework was written, work has advanced in ways that ISAP has not yet seen. We will be presenting a summary of this work in conjunction with the 2019 Fall Science Meeting and anticipate continued discussion of related topics as we move forward.

Specific responses to questions or comments raised in the ISAP’s review follow. These largely relate to updates on efforts subsequent to the Draft Framework or are offered as points of clarification.

Introduction

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|---|-----------|--|
| 1 | Pages 1-3 | We generally concur with the ISAP’s characterization of the context for, and approach to the AM Framework, and their finding that, <i>“the overarching observation that can be made by the ISAP is that the Framework in approach, direction, and process steps hews closely to the SAMP”</i> . |
| 2 | Page 4 | Re: <i>Stimulated by the Fort Peck Framework document and the supplement, the ISAP considered worthy of comment three additional issues that affect the implementation of management actions in an adaptive framework under the MRRP: (1) the absence of a well-developed population model for pallid sturgeon that can contribute to the selection of management actions from among alternatives; (2) the apparent slow progress in producing monitoring tools that allow the size and trajectories of the Missouri River pallid sturgeon populations to be estimated and the performance of management actions to be evaluated; and (3) the challenge of making progress in better understanding the ecology of pallid sturgeon and managing for its future in an experimental “decision-space” that is narrowly defined by stakeholder prerogatives and concerns. These three issues are addressed near the end of this report. The ISAP anticipates that the brief discussion herein may stimulate focused discussion of the issues by the Adaptive Management Team and relevant work groups operating in support of the MRRP.</i> |

We agree that a population model would be highly desirable. However, we note that a population model is not the only way to compare the relative performance of alternatives, and other metrics may also prove helpful in this regard.

Considerable progress has been made on the development of a population model for pallid sturgeon during 2019, in addition to various other technical advancements relevant to understanding fish response.

Progress on these issues will be presented to the ISAP and MRRIC at webinars in preparation for the Fall Science Meeting (FSM), with further face to face discussions with the ISAP at the FSM.

With respect to population monitoring, considerable progress has been made on implementation of PSPAP2.0 in the Upper Missouri River (as well as the Lower Missouri River). This work, led by Mike Colvin, will be presented at the 2019 FSM and will be described in an updated Appendix D to the SAMP. Coordination by MRRP's Integrated Science Program (ISP) with other agencies has been positive, and efforts are underway to replicate portions of PSPAP 2.0 in the Yellowstone River (Montana Fish, Wildlife and Parks; USFWS) and Mississippi River (Missouri Dept. of Conservation; USFWS).

With respect to effectiveness monitoring, much of the experimental design work described in Appendix E.4 (Monitoring Pallid Sturgeon Responses to Spawning-Cue Pulses) and Appendix E.5 (Monitoring Design for the Upper Missouri and Yellowstone Rivers) is transferable to effectiveness monitoring of Fort Peck Dam test flows, as emphasized in Section 3.6 of the Fort Peck AM Framework. A monitoring plan specific to test flows will be developed prior to their implementation. In addition, efforts are underway by ESSA scientists to develop a unified evidentiary framework for all fish actions that incorporates both population and effectiveness monitoring and builds on ISAP recommendations #39 and #40 from August 2018.

1) Was the best available scientific information and analysis used in formulating the Level 1 studies, conceptual hydrographs in support of Level 2 prescribed test flows, and other adaptive management actions and activities described in the Fort Peck Adaptive Management Framework?

3 Page 4

Re: *"The Fort Peck Adaptive Management Framework is **based on the premise that if pallid sturgeon spawn near Fort Peck Dam (that is, near the confluence of the Milk River and the Missouri River) then there is an increased likelihood of pallid sturgeon recruiting to age 1.**"*

Perhaps a better articulation of the underlying premise might be that recruitment potential for pallid sturgeon on the Upper Missouri River is low. If operational changes that promote attraction, retention, and spawning as far

upriver as possible could be implemented with flow/temperature/turbidity conditions that favor settling of exogenously feeding PS larvae within the free-flowing segments of the river, the recruitment potential may be increased.

4 Page 5

*Re: "It is, however, worth noting that those findings do not confirm that pallid sturgeon spawning events in the upper Missouri River can be sufficient to produce a self-sustaining population. However, the **level of recruitment necessary to maintain a self-sustaining pallid sturgeon population** could be estimated using the pallid sturgeon population model."*

Recent work by Drs. Sara Reynolds and Dr. Craig Fischenich is examining what combinations of spawning success, flow, temperature, embryo retention and drift survival are required to generate a positive population growth rate ($\lambda > 1$) in the Upper Missouri River. These results will be presented at the 2019 FSM.

We agree with ISAP's note that recent findings do not confirm that pallid spawning events in the upper Missouri River can be sufficient to produce a self-sustaining population and add the observation that, while there is empirical evidence of attraction, holding, presumed spawning, and one recruited fish, there is no instance where all of those have occurred in a single year (i.e., the one known recruited fish was hatchery produced and released).

5 Page 6

*Re: "The Framework provides a clear explanation of why some parameters (for example falling-limb duration) of the flow regime were set at values represented in the conceptual hydrographs that link these parameters explicitly to the pallid sturgeon ecology (for example larval drift-distance regulation) and human considerations (for example bank erosion); **however, other features of the hydrographs are not discussed in detail (for example duration of the peak-flow).**"*

Duration of the peak flow in the example hydrographs (also discussed on p. 9 of this document) was set at 3 days to provide a reliable, stable signal that the specified peak had been reached, while minimizing water use. Other aspects of the hydrographs have subsequently been described in various forums including a web meeting shortly after their development, the 2018 FSM and the 2018 AMWS. The description of the evolution of the hydrographs evaluated in the upcoming draft EIS will include discussions of the biological and economic reasons affecting adjustments. However, we concede that additional details could be added to the AM Framework to thoroughly document and rationalize the selection of specific aspects of the hydrographs.

6 Page 6

*Re: "The Framework addresses potential irrigation intake concerns regarding the reduced summer releases designed to reduce free-embryo drift speed by acknowledging that the conceptual hydrographs contain reduced summer flows similar to current median conditions. The Framework states that **"in conceptual hydrograph 1, flow is maintained at 4,200 cfs through August 20 to match***

median conditions,” which would result in no alteration to the current services provided to irrigation intakes on the system””

We note that this statement was incorrect in the AM Framework and it will be amended in future documentation. A range of alternative hydrographs are under investigation in the draft EIS, and impacts to irrigation (and other stakeholder concerns) will be evaluated as part of the effort.

- 7 Page 6 Re: *“The potential impacts from conceptual hydrograph 2 are less clear, as the Framework states that flows are reduced following the flood pulse until “conventional flow operation is achieved,” with some discussion of possible further reductions to limit free-embryo drift if needed. Clearly delineating summer-flow levels in conceptual hydrograph 2 would help clarify potential impacts at downstream irrigation intakes”*

The discussion in the draft AM Framework is hypothetical. Analyses of a range of alternative hydrographs are underway in the draft EIS, and these issues will be explored during that process.

- 8 Page 7 Re: *“**Completion of the planned free-embryo drift dispersion modeling** on the upper Missouri River (Framework, Table 5) might further inform the design of summer flows to meet requirements of pallid sturgeon while addressing stakeholder concerns regarding water intakes.”*

The HEC ResSim and HEC RAS modeling being performed for the Fort Peck Dam Test Releases EIS (discussed above, to be presented at via various forums in the fall of 2019) is yielding useful insights on the design of summer flows, and the important influence of year to year variation in weather on river temperatures and embryonic development.

- 9 Page 7 Re: *“The best available science concerning the factors that influence pallid sturgeon reproductive ecology and drift dynamics were used to develop the conceptual hydrographs for the Level 1 and Level 2 studies and the Framework”*

We concur, and we appreciate the ISAP making this clear statement in their review. We note also that the best available science is transitory and we continue to advance our understanding on related issues. Accordingly, views on management actions related to flows may evolve and an adaptive management framework is required to accommodate possible change.

- 10 Page 8 Re: *“The micro- and meso-scale conditions that elicit spawning in pallid sturgeon are not well understood; those conditions might be mutually exclusive of the macro-scale discharge and temperature regimes that are measured and used to define the conceptual hydrographs for the Level 1 and Level 2 studies. The Framework states that Level 1 studies will be used to address key uncertainties, **but understanding micro- and meso-scale metrics, such as small-scale habitat selection, mate selection, etc. could require decades of study.***

There will always be a healthy debate between more reductionist approaches to study and research prior to implementation of Level 2 AM experiments versus strategies that move more quickly towards Level 2 AM experiments. As discussed in the SAMP in Section 4.2.2, there are limitations to what can be understood from analyses of the current system and from laboratory and mesocosm studies.

11 Page 8

Re: “However, the Framework should explicitly recognize the importance of establishing and evaluating those benchmarks. For example, should a managed flow action be considered a success if one reproductively active pallid sturgeon moves up the Missouri River during the event? Or, should success be defined as all reproductively active pallid sturgeon ascending the Missouri River to Fort Peck Dam during a flow-management action? In other words, the anticipated outcomes of managed flows (or temperature or turbidity manipulations) outlined in the Framework and associated documents could be inaccurately evaluated without clearly defined metrics of success and a corresponding monitoring design necessary to sample and evaluate those metrics.” ”

We agree with the importance of benchmarks and note that the abiotic and biological modeling currently underway will help establish a range of physical and biological benchmarks for Fort Peck test flow experiments. Table E.27 in Appendix E.4 of the SAMP provides a set of candidate response variables, and definitions of “success benchmarks” (not to be confused with ‘success’ in terms of meeting fundamental objectives, which may be a different matter). These candidate response variables will be improved upon through application of the flow, drift, temperature, and population models, which also allow us to simulate Level 2 management experiments and help develop a monitoring plan to detect effects of the experiments.

12 Page 9

Re: “Conceptual hydrographs for the upper Missouri River can be adjusted in real time to account for local major tributary inputs from the Yellowstone and Milk rivers, consistent with the experimental nature of the Level 1 and Level 2 studies.”

Yes, real-time decision support systems will be important to ensure the desired flows and other attributes (temperature and turbidity). These real-time decision support systems would be enhanced with an improved network of temperature and turbidity monitoring sites in the Upper Missouri.

13 Page 9

*Re: “The Framework document emphasizes the interconnections between the Missouri, Yellowstone, and Milk rivers in stimulating the Level 1 and Level 2 studies, **but the Framework also offers the contradictory statement that “If pallid sturgeon use the Yellowstone River, discharge or temperature actions at Fort Peck Dam will not be relevant.”**”*

For clarification, the quote on page 9 from the review is attributed to the Framework document. The statement, **“If pallid sturgeon use the Yellowstone River, discharge or temperature actions at Fort Peck Dam will not be relevant.”**, is found in Section A-8 **Flow affects adult pallid sturgeon attraction and holding** of the supplemental document (DFPAMF Supplemental V1.02). Under that context the bullet statement was made referring to the adult pallid sturgeon not experiencing the Missouri River cues if it is in the Yellowstone River at the time those actions take place. The statement is not contradictory from that perspective. We agree with your conclusion following the quote, “...well-considered options for strategically applied Fort Peck Dam releases to promote beneficial conditions for pallid sturgeon reproduction on the upper Missouri River could contribute directly to the fish’s viability and recovery.”

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| 14 | Page 9 | <p>Re: <i>“Several additional observations and questions emerged during the Framework review. For example, it is unclear why the peak flow is held for three days in conceptual hydrograph 1”...</i></p> <p>See response #5.</p> |
| 15 | Page 9 | <p><i>“It is perplexing that the designed peak flow magnitude in conceptual hydrograph 2 is arbitrary, given that the flow action is an experiment, one for which control of a “treatment effect” should be exercised as much as possible.”</i></p> <p>We should not have used the word "arbitrary" because there was a scientific rationale for the flow magnitude. In the case of the second hydrograph, 2 times the powerhouse flow results in a peak essentially identical to the peak used in hydrograph 1, which was based on analysis of the unregulated hydrograph.</p> |
| 16 | Page 10 | <p>Re: <i>“The outline on how to prioritize and sequence activities is well developed and should be followed and updated as needed. At the same time, at what point do Tables 5 and 6 get inserted into the prioritization and sequence of events schedule?</i></p> <p>The prioritization of research is identified in the Strategic Plan. The Strategic Plan builds on the discussions and insights generated at the FSM webinars and workshop, the AM Compliance Report, and AM workshop, as well as recommendations from MRRIC.</p> |
| 17 | Page 10 | <p>Re: <i>“While Figure 7 clearly defines the process for implementing Level 2 flow releases from Fort Peck Dam, the difference between maximizing learning and maximizing fish benefit is unclear. These objectives appear mutually exclusive in the diagram, but it can be argued that they are not.”</i></p> <p>We agree that a better description should be provided in future documentation but note that there may be situations in which a choice might be made to take actions to address a critical uncertainty versus taking an action that, in the short</p> |

term at least, might be expected to be of greater benefit to fish. For example, releases to identify/test a lower threshold for attracting flows or temperatures might be undertaken in the knowledge that a higher flow or temperature might provide greater biological benefit. This would help establish response functions that could then be used to inform trade-off analyses and future management actions. Another example is attempting to induce attraction in various combinations with Milk River flows to help establish the importance of turbidity. Studying drift only without fully executing the entire hydrograph is a third example. We will make this aspect of the figure clearer in future documentation.

- 18 Page 10 Re: *“The section ‘Flow adjustments to minimize harm to the Yellowstone’ (3.5.6) is confusing.”*

We agree this section is not clear and will be re-written in future documentation. It should discuss longer-term consideration of system-level tradeoffs with the objective of managing at system levels. However, we also consider that it is premature to say whether the Yellowstone or Missouri Rivers are the more likely contributor to pallid sturgeon recovery. Effectiveness monitoring of passage at Intake, effectiveness monitoring of actions at Fort Peck, and analyses with a parameterized population model will help inform these decisions in time.

- 19 Page 10 Re: *“However, the absence of sufficiently robust management-response functions to anticipate the effective design and implementation of temperature or turbidity-based management actions should be noted”*

We have a better understanding of temperature response functions (for both spawning and drift phases) today than we did at the time we drafted the Framework. We agree that further improvement is needed for both temperature and turbidity.

- 20 Page 10 Re: *“The relations between temperature and turbidity, and pallid sturgeon recruitment are not completely understood at this point; these circumstances do not strongly support the design or implementation of temperature or turbidity manipulations until results of the proposed Level 1 and Level 2 studies are obtained to guide them.”*

We agree that these relations are not fully understood and that Level 1 studies can both further that understanding and provide important information for experimental designs. However, Level 2 temperature manipulations through changes to operations and (potentially) sediment augmentation are likely necessary to understand and demonstrate those relations, adding important scaling factors to the results of more controlled (but less realistic) Level 1 mesoscale studies.

2) Does the Framework reflect the intent and process for resource management under the Missouri River Recovery Program as described in the Science and Adaptive Management Plan, including a structured approach to project design that uses a clearly articulated experimental framework for implementing management actions and gathering monitoring data, that addresses the Big Questions, that develops actionable decision criteria, and that contributes to identifying next management actions and studies not yet envisioned?

- 21 Page 13 *Re: “Two example flow manipulations (see Framework Figures 3 and 4) were developed on the basis of unregulated flow regimes and unpublished observations of upriver pallid sturgeon movements.”*
- The flows were derived using considerations in addition to unregulated flow regimes and pallid sturgeon movement observations; we also employed data on spawning in both the Yellowstone River and Lower Missouri River, operational considerations for Fort Peck (e.g. maximum powerhouse capacity and spillway design), and included HC factors (e.g. limiting drawdown rates so as to avoid excessive bank failure/erosion).
- 22 Page 13 *Re: “A near-term challenge lies in continued evaluation of hypothesized relationships between successful pallid sturgeon reproduction and recruitment and the absolute magnitudes, timing, and durations of the four components of the managed hydrographs.”*
- We agree with this assertion; it is central to the Level 1 and 2 studies advocated in the Framework.
- 23 Page 13 *Re: “Water temperatures down river appear only in part manageable, depending on the magnitude of flows and corresponding sources of flow as defined by the structure and operation of the dam (the power house and spillway).”*
- This is correct. It is also true that climatic conditions have a significant effect on water temperatures, and can vary substantially from year to year. Therefore, it may be prudent to implement flow management experiments at Fort Peck in warmer years, where temperatures are more conducive to both spawning and embryonic development.
- 24 Page 14 *Re: “If water temperature and turbidity are determined to influence pallid sturgeon reproduction and recruitment, modifications to infrastructure, for example a tower at the power house and/or a warm-water and sediment pipeline intake at the head of the reservoir , to increase capability for water temperature and turbidity modifications downriver of Fort Peck Reservoir are potentially available.”*
- Increasing turbidity would be more effectively accomplished (and much more cost effective) by augmenting fine sediment below Fort Peck than by transporting sediment from the reservoir to the reach below the dam. Ongoing

modeling is exploring the extent to which operations can affect water temperatures.

- 25 Page 14 *Re: “The Framework implicitly suggests that implementation of even certain components of an overall managed hydrograph might prove beneficial to pallid sturgeon recruitment in the upper Missouri River.”*

If this is implicit in the framework, it was unintentional. We believe implementation of hydrograph components might be sufficient for learning, but it is likely that all the components (i.e. full hydrograph) would be needed for recruitment.

- 26 Page 14 *Re: “If entire managed hydrographs are required at a minimum interval, say every 2 or 3 years, to benefit measurably pallid sturgeon reproduction and recruitment, the likelihood of successful implementation decreases correspondingly, and more importantly, it could lie beyond the control of the adaptive managers.”*

As we believe ISAP agrees, managed flows may not be required every 2 or 3 years. Some sturgeon species only reproduce once a decade. It may be better to align all of the necessary attributes (flow, temperature, turbidity) less frequently but under conditions that maximize the probability of successful reproduction and survival to age 1.

- 27 Page 14 *Re: “Additionally, a piece-meal, opportunistic approach to flow management might further weaken the “signal strength” of managed hydrographs already constrained by authorized purposes, human considerations to the extent that it might become increasingly difficult to measure reliably pallid sturgeon responses and/or unequivocally attribute any measured responses to a management action.”*

We would be interested to hear additional detail from the ISAP on this point. It could be an important consideration if correct.

- 28 Page 15 *Re: “Perhaps the degree of monitoring described, mainly effectiveness monitoring, is appropriate for evaluating Level 1 and Level 2 studies within an AM framework consistent with the SAMP. If these studies translate into Level 3 and Level 4 management actions, it is expected that monitoring programs (plans) would correspondingly increase in dimension, detail, and quantitative rigor.”*

Detailed monitoring designs would be required prior to the implementation of a Level 2 management experiment at Fort Peck, building on the work in Appendix E.4 and E.5 of the SAMP.

- 29 Page 15 *Re: “The ISAP appreciates the summary of monitoring activities in Table 7 (page 46), but observe that the performance metrics listed have been subjected to little*

more than anecdotal validation, and several will inevitably be challenging or not functional.”

SAMP Appendix E provides a detailed approach previously reviewed by ISAP. We agree that more detailed monitoring designs are required prior to the implementation of a Level 2 management experiment at Fort Peck. The suite of advection-dispersion-population models (as well as results from the 2019 drift experiment) could be very helpful in refining monitoring designs, including definition of the spatial and temporal resolution of monitoring.

30 Page 15

Re: “Reasonable performance metrics are listed in Table 7, such as water temperature, discharge, and river mile location, but the links to project success are absent (for example, what river-mile location would determine success?)”

Yes, we will add an explanation of the importance and role of the monitoring plan to the Framework. That explanation will elaborate on the process for development of performance-metric benchmarks, and those will be included in the monitoring plan.

31 Page 16

Re: “However, the information in the table, such as monitoring metrics, should not be interpreted as meeting the technical requirements of a rigorous monitoring program in support of adaptive management.”

Table 6 is a summary of the much more detailed description of Level 1 and Level 2 studies in Appendix C of the SAMP, and associated indicators of success. But we acknowledge that more specific performance criteria are required to evaluate success prior to any Level 2 management action and that appropriate benchmarks will ultimately be needed to inform decisions regarding the effectiveness of these actions. A monitoring plan will be developed prior to implementation.

32 Page 16

Re: “Several of the if-then decision statements in Table 6 include the phrase “sufficient to have a population-level effect,” yet that sufficiency is not quantified in relation to pallid sturgeon population dynamics in the upper river in either the Framework or Supplement documents”.

Sensitivity analyses of the kind suggested here are currently underway with the flow, drift, temperature, and population models. We anticipate discussion of these studies at the 2019 FSM.

33 Page 16

Re: “For example, the authors might frame a question as such “Did 25% of the reproductively active pallid sturgeon in the upper Missouri River (Missouri and Yellowstone rivers) aggregate near the Milk River when conceptual hydrograph 1 was implemented?” This establishes a benchmark that is tied to the conceptual hydrograph.”...”

This is a good suggestion. Sensitivity analyses with the suite of advection-dispersion-pallid sturgeon models can be used to help define these benchmarks.

We note that it will be helpful to increase the number of telemetered adult pallid sturgeon, as discussed in Appendix E.4.

- 34 Page 16 *Re: “The Framework should strive to define decision criteria within the context of what is actually being measured or monitored, such as numbers of fish that moved, maximum upstream location, spawning location, and number of free embryos sampled.”*

This is a fair comment, and provides good direction for refining both the Appendix E.4 and the decision criteria.

- 35 Page 17 *Re: “Governance — The Framework (Pages 27 and 48) refers generally to the governance process in the SAMP. The word governance appears only three times in the Framework document.”*

With respect to both Governance and to Data Management, we aren’t proposing separate initiatives for either of these other than those being used for the program at large.

- 36 Page 17 *Re: “The words “data management” do not appear in the Framework ...”*

A fair comment. Considerable progress has been made on the development of an Information Management System. It’s prudent to consider data management requirements for the types of data associated with any Fort Peck experiments. A progress report on the IMS work is anticipated at the November MRRIC meeting.

3) Is the Framework structured and presented such that the evaluation of Human Considerations (HCs) is apparent in management-action planning and decision-making, project implementation, and project assessment? Elaborate on essential framework attributes that address HC concerns.

- 37 Page 18 *Re: “The USACE acknowledges that in the ongoing development of the Framework scope “HC monitoring may ultimately be an important factor, but specific needs for HC monitoring cannot be predicted without first specifying the precise nature of the actions to be examined” (Page 12). Accordingly, substantial reliance on MRRP vehicles for integrating stakeholder input into the Framework, with emphasis on HC issues can and should be expected”*

We agree that we will be using MRRP vehicles for integrating stakeholder input, as the test flows are an MRRP project.

- 38 Page 18 *Re: “Importantly, the Framework does not provide any specific guidance toward HC monitoring, apparently due to uncertainty as to “...which of the possible Level 2 actions that might be of interest will actually be implemented” (Page 31). Upon identification of a Level 2 action, an updated Framework might be expected that describes an HC monitoring design that follows the sequential step-down development previously presented for piping plover.”*

The NEPA process will identify what impacts may occur. Those impacts will indicate what, if any, additional HC's may need to be monitored. Many HCs are already monitored through other Corps programs and are considered in and inform management actions; it is unlikely we would create a monitoring plan in the Ft. Peck Framework for those HCs already monitored. If impacts to additional HCs arise via the analysis (or under implementation) the Corps will work with Stakeholders to develop monitoring plan where necessary and appropriate.

- 39 Page 20 *Re: "These examples demonstrate that the Framework explicitly incorporates the broad concept of human considerations in decision criteria."*

We appreciate this statement. By way of clarification, the definitions of 'acceptable' in terms of flows will, at least in the near term, be explored during the Fort Peck Test Flow EIS. Currently, sediment augmentation at Level 2 is not being explored in the EIS, though Level 1 science may be established to clarify the relative need for and approach to sediment augmentation at some other future point.

- 40 Page 20 *Re: "Given that the release date of the draft Framework (12 December 2018) occurred after several USACE public engagements, some specific examples of HCs that are affected by flow experiments could have been identified in the Framework. ..."*

The AM Framework focuses on the scientific aspects of potential management actions that could be implemented to meet species objectives. The EIS is the vehicle through which impacts from test flow releases from Fort Peck Dam will be evaluated. Through the NEPA process, a more considered survey of HC monitoring needs will be identified.

- 41 Page 21 *Re: "An alternative approach would be to focus near-term efforts on standing up the pallid sturgeon population model..."*

This is being done by the Technical Team, led by Dr. Sara Reynolds, and will be presented and discussed at the 2019 FSM. We appreciate the ISAP's patience in waiting for more progress on the population model.

- 42 Page 22 *Re: "Having both the Fort Peck Adaptive Management Framework and the SAMP as separate stand-alone documents sets the stage for potential confusion in moving forward under the MRRP. Do aspects of the Framework supersede the SAMP? ..."*

The draft Framework has been implicitly and temporarily incorporated as an addendum to the SAMP. By the time they are ready for use, the Framework's contents will be fully integrated into the SAMP via an update and the Framework document itself will no longer exist.

- 43 Page 22 *Re: "Reserving 'framework' solely for the title of the main document would help avoid confusion ..."*
- Agreed, we will fix in future updates.
- 44 Page 23 *Re: "It might be expected that a monitoring design for pallid sturgeon is moving forward apace beyond the ISAP's recognition. But, Table 7 in the Framework suggests otherwise. The simple two-column table presents "monitoring activities" and "performance metrics" without further explanation or justification. That presentation, as noted above, is awfully thin, and is just the latest evidence that the pallid sturgeon-monitoring component of the greater conservation program is in a continuous, indefinite, and not well-defined state of development"*
- We recognize there is much remaining work to couple a monitoring program to Fort Peck actions, but it is premature to do so lacking a) a specific plan, and b) an experimental design.
- 45 Page 23 *Re: "Lacking quantitative functions that project the anticipated outcomes of differently scaled management actions (managed flows), logic and expediency would recommend action(s) with sufficient "signal strength" to all but guarantee response(s) that would be (1) readily measured using realistically available monitoring resources and (2) unequivocally attributable to the management action."*
- We agree in principle; however, we believe the Management Actions will have sufficient signal strength.
- 46 Page 24 *Re: "The ISAP is concerned that these kinds of definitive metrics and monitoring will not be accomplishable given the history of the pallid sturgeon population-monitoring program. The ISAP advises against performing a management action under the MRRP without a robust study design and sampling design (monitoring), and with biological significance defined and quantifiable decision criteria identified."*
- While we agree, we note that expectations should be reasonable regarding our understanding of "biological significance" as well as our ability to fully define decision criteria for early experiments.

Summary and Recommendations

- 47 Page 25 *Re: "Documents such as these then could be added as appendices to the living, evergreen SAMP to maintain programmatic organization and continuity ..."*
- We agree and this is our intent.