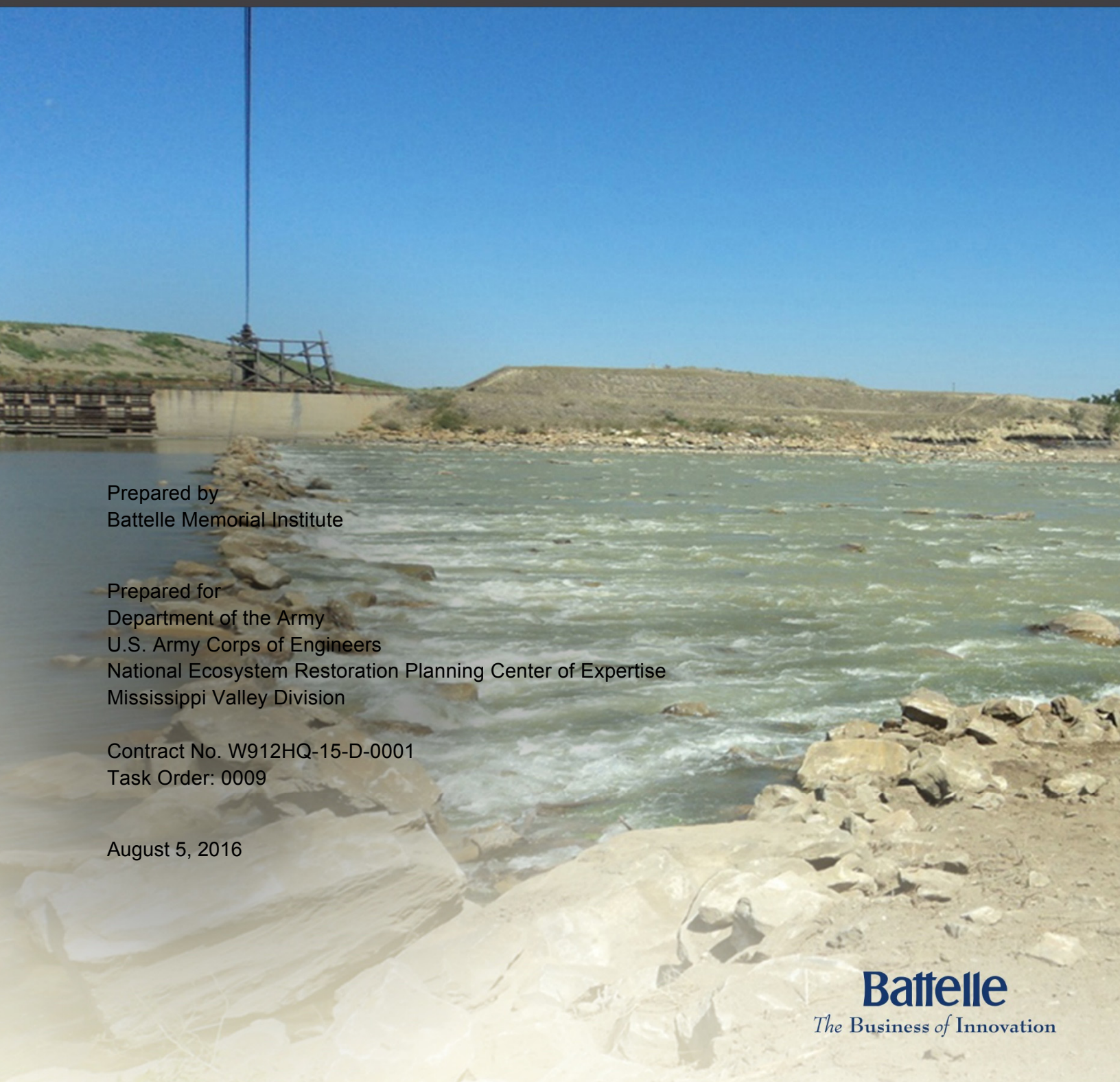
Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana

FINAL - Appendix I

Independent External Peer Review Documentation

OCTOBER 2016

Final Independent External Peer Review Report Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana Draft Environmental Impact Statement



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Battelle Memorial Institute

Prepared for
Department of the Army
U.S. Army Corps of Engineers
National Ecosystem Restoration Planning Center of Expertise
Mississippi Valley Division

Contract No. W912HQ-15-D-0001
Task Order: 0009

August 5, 2016

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Executive Summary

PROJECT BACKGROUND AND PURPOSE

The United States Army Corps of Engineers (USACE) and the U.S. Bureau of Reclamation (Reclamation) have prepared an Environmental Impact Statement (EIS) to analyze direct, indirect, and cumulative effects associated with actions to improve fish passage at the Lower Yellowstone Intake Diversion Dam (Intake Diversion Dam), Dawson County, Montana. The proposed Federal action is to improve passage for the endangered pallid sturgeon and other native fish at the Intake Diversion Dam.

The Lower Yellowstone Project (LYP) was authorized by the Secretary of the Interior on May 10, 1904. Construction of the LYP began in 1905 and included the Intake Diversion Dam (also known as Yellowstone River Diversion Dam)—a 12-foot-high wood and stone diversion dam that spans the Yellowstone River and diverts water into the Main Canal for irrigation. The LYP was authorized to provide a dependable water supply sufficient to irrigate approximately 54,300 acres of land on the west bank of the Yellowstone River. Water is also supplied to irrigate approximately 830 acres in the Intake Irrigation Unit and 2,200 acres in the Savage Unit. Both of the smaller irrigation projects pump water from the Main Canal. The average annual volume of water diverted for these projects is 327,046 acre-feet.

In 1990, the U.S. Fish and Wildlife Service (USFWS) listed the pallid sturgeon as endangered under the Endangered Species Act (ESA). Numerous studies suggest that the Intake Diversion Dam impedes upstream migration of pallid sturgeon and their access to spawning and larval drift habitats. The Lower Yellowstone River is considered by the USFWS to provide one of the best opportunities for recovery of pallid sturgeon. Both Reclamation and USACE have general responsibility under Section 7(a)(1) of the ESA to use their authorities to conserve and recover Federally listed species and ecosystems upon which the species depends. In addition, both agencies need to avoid jeopardizing the pallid sturgeon in funding or carrying out any agency action per Section 7(a)(2) of the Act.

The Pallid Sturgeon Recovery Plan specifically identifies providing passage at the Intake Diversion Dam to protect and restore pallid sturgeon populations. By improving passage at the Intake Diversion Dam, approximately 165 river miles of spawning and larval drift habitat would become accessible in the Yellowstone River and major tributaries such as the Powder River.

In 2010, Reclamation and USACE authorized the construction of a rock ramp and new screened headworks with the completion of an Environmental Assessment (EA) and Finding of No Significant Impact (FONSI). During the final design of the rock ramp, following the release of the 2010 EA and FONSI, important new information on the design, constructability, and sustainability of the proposed rock ramp surfaced along with new information regarding pallid sturgeon movement, which led to a reevaluation of fish passage options.

A draft EA was completed on the Intake Fish Passage Project in 2013, which underwent independent external peer review (IEPR) overseen by Battelle in 2013. A final EA and FONSI were issued in 2015. The Defenders of Wildlife and the Natural Resources Defense Council filed a lawsuit against USACE, Reclamation, and USFWS alleging violations of the National Environmental Policy Act (NEPA), ESA, and the Clean Water Act (CWA). U.S. Federal Judge Brian Moore signed a stipulated stay agreement on the lawsuit in January 2016 ordering USACE and Reclamation to complete an EIS by the end of 2016. The current (2016) IEPR is of the draft EIS (DEIS) being prepared by USACE and Reclamation.

Independent External Peer Review Process

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis. USACE is conducting an IEPR of the Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana Draft Environmental Impact Statement[1] (hereinafter: Lower Yellowstone River Intake DEIS IEPR). As a 501(c)(3) non-profit science and technology organization, Battelle is independent, free from conflicts of interest (COIs), and meets the requirements for an Outside Eligible Organization (OEO) per guidance described in USACE (2012). Battelle has experience in establishing and administering peer review panels for USACE and was engaged to coordinate the IEPR of the Lower Yellowstone River Intake DEIS. The IEPR was external to the agency and conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2012) and OMB (2004). This final report presents the Final Panel Comments of the IEPR Panel (the Panel). Details regarding the IEPR (including the process for selecting panel members, the panel members' biographical information and expertise, and the charge submitted to the Panel to guide its review) are presented in appendices.

Based on statements in the Performance Work Statement (PWS) that members of the previous Lower Yellowstone River IEPR Panel should be used if possible, Battelle contacted the panel members who participated in the previous review of the Lower Yellowstone River EA in the following key technical areas: fisheries biology and environmental law compliance, economics, geotechnical engineering, and hydraulic engineering. These four panel members were rescreened and determined not to have any COIs. Also based on the PWS, Battelle identified potential candidates for the Civil Works planner position because the previous planner's organization had a COI. Battelle screened for candidates most closely meeting the selection criteria and evaluated them for potential COIs and availability. USACE was given the list of final candidates (i.e., the new Civil Works planner and previous four panel members) to confirm that they had no COIs. Battelle made the final selection of the full five-person panel.

The Panel received electronic versions of the Lower Yellowstone River Intake DEIS IEPR review documents (1,734 pages in total), along with a charge that solicited comments on specific sections of the documents to be reviewed. Following guidance provided in USACE (2012) and OMB (2014), USACE prepared the charge questions, which were included in the draft and final Work Plans.

The USACE Project Delivery Team briefed the Panel and Battelle during a kick-off meeting held via teleconference prior to the start of the review to provide the Panel an opportunity to ask questions of

[1] The official title of the Task Order 0009 award that Battelle received (dated 2016 May 26) from USACE was titled the "Independent External Peer Review Report Lower Yellowstone River Project, Montana Intake Dam Modification Supplemental (Amended) Analysis to the 26 April 2010 Environmental Assessment and Appendices." For clarity and to reflect the actual review documents that underwent peer review, Battelle has used the name of the actual document supplied for review "Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana Draft Environmental Impact Statement" throughout this deliverable.

USACE and clarify uncertainties. Other than Battelle-facilitated teleconferences, there was no direct communication between the Panel and USACE during the peer review process.

IEPR panel members reviewed the Lower Yellowstone River Intake DEIS documents individually, and produced individual comments in response to the charge questions. The panel members then met via teleconference with Battelle to review key technical comments and reach agreement on the Final Panel Comments to be provided to USACE. Each Final Panel Comment was documented using a four-part format consisting of: (1) a comment statement; (2) the basis for the comment; (3) the significance of the comment (high, medium/high, medium, medium/low, or low); and (4) recommendations on how to resolve the comment. Overall, eight Final Panel Comments were identified and documented. Of these, three were identified as having high significance, four were identified as having medium significance, and one had medium/low significance.

Results of the Independent External Peer Review

The panel members agreed on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012; p. D-4) in the Lower Yellowstone River Intake DEIS review documents. Table ES-1 lists the Final Panel Comment statements by level of significance. The full text of the Final Panel Comments is presented in Section 4.2 of this report. The following summarizes the Panel's findings.

Based on the Panel's review, the DEIS is thorough and well written and presents information and data on a broad range of alternatives, including dam removal and multiple pump alternatives. The Panel did identify several elements of the project that should be further explained, clarified, or revised.

Environmental: The Panel noted that impact analyses are well done and inclusive for all alternatives. However, given the large amount of detail provided in the draft, particularly in relation to impact analyses, the analysis of the revised alternatives was not as robust as expected (DEIS Section 3.4). The selection process appears to be based on the outcome of the fish passage analysis and cost-effectiveness computations. The Panel is concerned that a much more comprehensive process should have been applied given the importance of the project, expected project costs, and the risks and uncertainties associated with the various alternatives.

DEIS Appendix E states an objective for upstream passage as "Greater than or equal to 85% of motivated adult pallid sturgeon (fish that move up to the weir) annually pass upstream of the weir location during the spawning migration period (April 1 to June 15) within a reasonable amount of time without substantial delay (≥ 0.19 miles/hour)". However, evidence to support this as an achievable objective under the preferred alternative has not been provided in the DEIS. The Panel believes there is substantial risk that the preferred alternative bypass channel will not provide upstream passage of pallid sturgeon in significant numbers to facilitate a measurable, population-level response in natural recruitment. To address this concern, the Panel suggests that an alternative analysis be conducted that assesses the potential for upstream passage exclusively for pallid sturgeon for each stated alternative.

Engineering: The engineering level of effort, analysis methods, and assumptions are appropriate for the preliminary studies in support of the alternative analysis and DEIS. Under both the bypass channel alternative (preferred) and the modified side channel alternative, the inlet to these channels from the river at the upstream end is being improved to allow water to flow at lower river flow thresholds than exist now.

This is beneficial to pallid sturgeon movements, because climate change may lead to reduced flow in the river, and viable fish passage should not be lost because of decreased flow in the river.

The bypass channel and the modified side channel alternatives both require maintenance access to the south side of the river; however, only the modified side channel alternative includes a new bridge. Inclusion of a bridge impacts the cost of the modified side channel alternative and potentially affects the selection of the preferred alternative. To address this issue, the Panel recommends that USACE consider eliminating the proposed bridge from the modified side channel alternative. If the proposed bridge is retained, potential flood damage impacts to bridge abutments should be addressed.

The current design of the bypass channel does not include erosion control measures to counter flood damage when flood flows overtop Joe's Island. Flood flow crossing the bypass channel is a foreseeable event, and the design should include measures to prevent damage to the bypass channel. In addition, the bypass channel alternative should function as intended, whether the existing side channel is filled in and abandoned or left as is. The DEIS does not document why the existing side channel needs to be filled in. The Panel sees benefits to flood conveyance and occasional fish passage when this channel is left as is.

Economics: The cost-effectiveness/incremental cost analysis (CE/ICA) comparisons of alternatives are consistent with USACE planning guidelines for ecosystem restoration projects. The economic models used for this study are adequate and assumptions about future economic conditions are reasonable. Information about the region and local economy that utilizes water from the LYP irrigation canal was comprehensive.

A new weir across the Yellowstone River is proposed under the bypass channel alternative as a way to reduce the potential for displaced rock to obstruct the bypass channel's lower entrance and to reduce future maintenance costs; however, a new weir is not required for continued water delivery to the main canal, and its costs are not adequately justified. A new diversion weir may be beneficial to the continued operation of the LYP, but a cost/benefit analysis of a new weir versus continued maintenance of the existing weir is not provided. The proposed new weir is a costly element of the overall project. To address this concern, one of the Panel's recommendations includes conducting a cost/benefit analysis of maintaining the existing Intake Diversion Dam versus constructing a new weir under the bypass channel alternative.

Planning: Planning was conducted in a systematic manner using a well-organized process and logical procedures. The preferred alternative addresses some of the major problems associated with partial or total blockage of fish passage.

The Fish Passage Connectivity Index (FPCI) and the CE analysis based on the index do not adequately represent the significance of pallid sturgeon passage as an objective of the proposed action and the uncertainty associated with pallid sturgeon migration. The pallid sturgeon is just one of 14 fish species assessed, and the Panel recognizes that the expected habitat units (EHUs) for pallid sturgeon have little impact on the overall results and identification of a preferred alternative. Because the FPCI and CE analysis are the primary decision tools used to select the preferred alternative, further information about critical parameters used to evaluate alternatives can lead to better risk-informed decisions.

The Panel noted that information was lacking in the Monitoring and Adaptive Management Plan. The Monitoring and Adaptive Management Plan does not identify specific, quantified fish passage objectives and targets for pallid sturgeon or other native fish species (which are necessary to assess project

success), the need for adaptive management actions, and the potential future costs of such actions. This issue can be addressed by including quantifiable pallid sturgeon and native fish species passage targets with timeframes that are compatible with the objectives to reach specific adaptive management milestones at reasonably accurate estimated costs. The Panel also recommends providing more detail on the monitoring methods to assess progress toward the stated objectives for both pallid sturgeon and native fish species. The Monitoring and Adaptive Management Plan relies upon other Federal and state agencies to conduct elements of the monitoring. Establishing formal agreements (if not already in place) are needed to ensure quality and completeness of the Monitoring and Adaptive Management Plan.

Table ES-1. Overview of Eight Final Panel Comments Identified by the Lower Yellowstone River Intake DEIS IEPR Panel

No.	Final Panel Comment
Significance – High	
1	There is substantial risk that the preferred alternative bypass channel will not provide upstream passage of pallid sturgeon in significant numbers to facilitate a measurable, population-level response in natural recruitment.
2	The FPCI and the CE analysis based on the index do not adequately represent the significance of pallid sturgeon passage as an objective of the proposed action and the uncertainty associated with pallid sturgeon passage.
3	The Monitoring and Adaptive Management Plan does not provide specific, quantified fish passage objectives and targets for pallid sturgeon or other native fish species, which are necessary to identify the need for adaptive management actions and the potential future costs of such actions.
Significance – Medium	
4	The need for a new bridge for maintenance and recreation access under the modified side channel alternative is not well justified.
5	Maintaining the existing Intake Diversion Dam, as opposed to installing a new weir, is not fully considered under the bypass channel alternative.
6	The existing side channel should remain open to accommodate flood flows and fish passage during high-flow events.
7	The current design of the bypass channel does not include erosion control measures to counter flood damage when flood flows overtop Joe's Island.
Significance – Medium/Low	
8	The Monitoring and Adaptive Management Plan does not mention the establishment of formal agreements with Federal and state agencies to conduct vital monitoring elements.

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LIST OF ACRONYMS

AFS	American Fisheries Society
ASCE	American Society of Civil Engineers
ATR	Agency Technical Review
BRT	Biological Review Team
CE	Cost Effectiveness
COI	Conflict of Interest
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
DrChecks	Design Review and Checking System
EA	Environmental Assessment
EC	Engineer Circular
EHU	Expected Habitat Unit
EIS	Environmental Impact Statement
ERDC	Engineer Research and Development Center
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
FPCI	Fish Passage Connectivity Index
HEC-HMS	Hydrologic Engineering Center-Hydrologic Modeling System
HEC-RAS	Hydrologic Engineering Center-River Analysis System
HEP	Habitat Evaluation Procedures
ICA	Incremental Cost Analysis
IEPR	Independent External Peer Review
IWR	Institute of Water Resources
LYP	Lower Yellowstone Project
NEPA	National Environmental Policy Act
NRCS	Natural Resources Conservation Service
O&M	operation and maintenance
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
PCX	Planning Center of Expertise

PDT	Project Delivery Team
PWS	Performance Work Statement
Reclamation	U.S. Bureau of Reclamation
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service

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1. INTRODUCTION

The United States Army Corps of Engineers (USACE) and the U.S. Bureau of Reclamation (Reclamation) have prepared an Environmental Impact Statement (EIS) to analyze direct, indirect, and cumulative effects associated with actions to improve fish passage at the Lower Yellowstone Intake Diversion Dam (Intake Diversion Dam), Dawson County, Montana. The proposed Federal action is to improve passage for the endangered pallid sturgeon and other native fish at the Intake Diversion Dam.

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A draft EA was completed on the Intake Fish Passage Project in 2013, which underwent independent external peer review (IEPR) overseen by Battelle. A final EA and FONSI were issued in 2015. The Defenders of Wildlife and the Natural Resources Defense Council filed a lawsuit against USACE, Reclamation, and USFWS alleging violations of the National Environmental Policy Act (NEPA), ESA, and the Clean Water Act (CWA). U.S. Federal Judge Brian Moore signed a stipulated stay agreement on the lawsuit in January 2016 ordering USACE and Reclamation to complete an EIS by the end of 2016. The current (2016) IEPR is of the draft EIS (DEIS) being prepared by USACE and Reclamation.

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis. The objective of the work described here was to conduct an IEPR of the Lower Yellowstone

Intake Diversion Dam Fish Passage Project, Montana Draft Environmental Impact Statement[2] (hereinafter: Lower Yellowstone River Intake DEIS IEPR) in accordance with procedures described in the Department of the Army, USACE, Engineer Circular (EC) *Civil Works Review* (EC 1165-2-214) (USACE, 2012) and the Office of Management and Budget (OMB), *Final Information Quality Bulletin for Peer Review* (OMB, 2004). Supplemental guidance on evaluation for conflicts of interest (COIs) was obtained from the *Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports* (The National Academies, 2003).

This final report presents the Final Panel Comments of the IEPR Panel (the Panel) on the existing engineering, economic, environmental, and plan formulation analyses contained in the Lower Yellowstone River Intake DEIS IEPR documents (Section 4). Appendix A describes in detail how the IEPR was planned and conducted. Appendix B provides biographical information on the IEPR panel members and describes the method Battelle followed to select them. Appendix C presents the final charge to the IEPR panel members for their use during the review; the final charge was submitted to USACE on June 9, 2016. Appendix D presents the organizational conflict of interest form that Battelle completed and submitted to the Institute for Water Resources (IWR) prior to the award of the Lower Yellowstone River Intake DEIS IEPR.

2. PURPOSE OF THE IEPR

To ensure that USACE documents are supported by the best scientific and technical information, USACE has implemented a peer review process that uses IEPR to complement the Agency Technical Review (ATR), as described in USACE (2012).

In general, the purpose of peer review is to strengthen the quality and credibility of the USACE decision documents in support of its Civil Works program. IEPR provides an independent assessment of the engineering, economic, environmental, and plan formulation analyses of the project study. In particular, the IEPR addresses the technical soundness of the project study's assumptions, methods, analyses, and calculations and identifies the need for additional data or analyses to make a good decision regarding implementation of alternatives and recommendations.

In this case, the IEPR of the Lower Yellowstone River Intake DEIS was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization (OEO) (as defined by EC 1165-2-214). Battelle, a 501(c)(3) organization under the U.S. Internal Revenue Code, has experience conducting IEPRs for USACE.

3. METHODS FOR CONDUCTING THE IEPR

The methods used to conduct the IEPR are briefly described in this section; a detailed description can be found in Appendix A. Table 1 presents the major milestones and deliverables of the Lower Yellowstone

[2] The official title of the Task Order 0009 award that Battelle received (dated 2016 May 26) from USACE was titled the "Independent External Peer Review Report Lower Yellowstone River Project, Montana Intake Dam Modification Supplemental (Amended) Analysis to the 26 April 2010 Environmental Assessment and Appendices." For clarity and to reflect the actual review documents that underwent peer review, Battelle has used the name of the actual document supplied for review "Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana Draft Environmental Impact Statement" throughout this deliverable.

River Intake DEIS IEPR. Due dates for milestones and deliverables are based on the award/effective date of May 26, 2016. Note that the work items listed under Task 6 occur after the submission of this report. Battelle anticipates submitting the pdf printout of the USACE's Design Review and Checking System (DrChecks) project file (the final deliverable) on October 12, 2016. The actual date for contract end will depend on the date that all activities for this IEPR are conducted.

Table 1. Major Milestones and Deliverables of the Lower Yellowstone River Intake DEIS IEPR

Task	Action	Due Date
1	Award/Effective Date	5/26/2016
	Review documents available	5/31/2016
	Public comment documents available	8/2/2016
2	Battelle submits list of selected panel members	6/2/2016
	USACE confirms the panel members have no COI	6/3/2016
3	Battelle convenes kick-off meeting with USACE	6/1/2016
	Battelle convenes kick-off meeting with USACE and panel members	6/6/2016
4	Panel members complete their individual reviews	7/5/2016
	Panel members provide draft Final Panel Comments to Battelle	7/18/2016
	Battelle sends public comments to Panel	8/2/2016
	Panel completes its review of public comments	8/8/2016
5	Battelle submits Final IEPR Report to USACE	8/5/2016
	Battelle submits Addendum to Final IEPR Report to USACE	8/12/2016
6[a]	Battelle convenes Comment-Response Teleconference with panel members and USACE	9/27/2016
	Battelle submits pdf printout of DrChecks project file to USACE	10/12/2016
	Contract End/Delivery Date	12/31/2016

[a] *Task 6 occurs after the submission of this report.*

Based on statements in the Performance Work Statement (PWS) that members of the previous Lower Yellowstone River IEPR Panel should be used if possible, Battelle contacted the panel members who participated in the previous review of the Lower Yellowstone River EA in the following key technical areas: fisheries biology and environmental law compliance, economics, geotechnical engineering, and hydraulic engineering. These four panel members were rescreened and determined not to have any COIs. Also based on the PWS, Battelle identified potential candidates for the Civil Works planner position because the previous planner's organization had a COI. Battelle screened for candidates most closely meeting the selection criteria and evaluated them for COIs and availability. USACE was given the list of final candidates (the new Civil Works planner and previous four panel members) to confirm that they had no COIs. Battelle made the final selection of the full five-person panel.

The Panel reviewed the Lower Yellowstone River Intake DEIS document and produced eight Final Panel Comments in response to 43 charge questions provided by USACE. Battelle instructed the Panel to develop the Final Panel Comments using a standardized four-part structure:

1. Comment Statement (succinct summary statement of concern)
2. Basis for Comment (details regarding the concern)
3. Significance (high, medium/high, medium, medium/low, or low; in accordance with specific criteria for determining level of significance)
4. Recommendation(s) for Resolution (at least one implementable action that could be taken to address the Final Panel Comment).

Battelle reviewed all Final Panel Comments for accuracy, adherence to USACE guidance (EC 1165-2-214, Appendix D), and completeness prior to determining that they were final and suitable for inclusion in the Final IEPR Report. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Panel's findings are summarized in Section 4.1; the Final Panel Comments are presented in full in Section 4.2.

4. RESULTS OF THE IEPR

This section presents the results of the IEPR. A summary of the Panel's findings and the full text of the Final Panel Comments are provided.

4.1 Summary of Final Panel Comments

The panel members agreed on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012; p. D-4) in the Lower Yellowstone River Intake DEIS IEPR review document. The following summarizes the Panel's findings.

Based on the Panel's review, the DEIS is thorough and well written and presents information and data on a broad range of alternatives, including dam removal and multiple pump alternatives. The Panel did identify several elements of the project that should be further explained, clarified, or revised.

Environmental: The Panel noted that impact analyses are well done and inclusive for all alternatives. However, given the large amount of detail provided in the draft, particularly in relation to impact analyses, the analysis of the revised alternatives was not as robust as expected (DEIS Section 3.4). The selection process appears to be based on the outcome of the fish passage analysis and cost-effectiveness computations. The Panel is concerned that a much more comprehensive process should have been applied given the importance of the project, expected project costs, and the risks and uncertainties associated with the various alternatives.

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The current design of the bypass channel does not include erosion control measures to counter flood damage when flood flows overtop Joe's Island. Flood flow crossing the bypass channel is a foreseeable event, and the design should include measures to prevent damage to the bypass channel. In addition, the bypass channel alternative should function as intended, whether the existing side channel is filled in and abandoned or left as is. The DEIS does not document why the existing side channel needs to be filled in. The Panel sees benefits to flood conveyance and occasional fish passage when this channel is left as is.

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Planning: Planning was conducted in a systematic manner using a well-organized process and logical procedures. The preferred alternative addresses some of the major problems associated with partial or total blockage of fish passage.

The Fish Passage Connectivity Index (FPCI) and the CE analysis based on the index do not adequately represent the significance of pallid sturgeon passage as an objective of the proposed action and the uncertainty associated with pallid sturgeon migration. The pallid sturgeon is just one of 14 fish species assessed, and the Panel recognizes that the expected habitat units (EHUs) for pallid sturgeon have little

impact on the overall results and identification of a preferred alternative. Because the FPCI and CE analysis are the primary decision tools used to select the preferred alternative, further information about critical parameters used to evaluate alternatives can lead to better risk-informed decisions.

The Panel noted that information was lacking in the Monitoring and Adaptive Management Plan. The Monitoring and Adaptive Management Plan does not identify specific, quantified fish passage objectives and targets for pallid sturgeon or other native fish species (which are necessary to assess project success), the need for adaptive management actions, and the potential future costs of such actions. This issue can be addressed by including quantifiable pallid sturgeon and native fish species passage targets with timeframes that are compatible with the objectives to reach specific adaptive management milestones at reasonably accurate estimated costs. The Panel also recommends providing more detail on the monitoring methods to assess progress toward the stated objectives for both pallid sturgeon and native fish species. The Monitoring and Adaptive Management Plan relies upon other Federal and state agencies to conduct elements of the monitoring. Establishing formal agreements (if not already in place) are needed to ensure quality and completeness of the Monitoring and Adaptive Management Plan.

4.2 Final Panel Comments

This section presents the full text of the Final Panel Comments prepared by the IEPR panel members.

Final Panel Comment 1

There is substantial risk that the preferred alternative bypass channel will not provide upstream passage of pallid sturgeon in significant numbers to facilitate a measurable, population-level response in natural recruitment.

Basis for Comment

The bypass channel has been designed to meet criteria for water velocities and depths provided by the Biological Review Team (BRT) (Section 2.3.5.1 Bypass Channel Features), but it is unknown if these features meet the needs of adult pallid sturgeon attempting to migrate upstream. There is no evidence that the behavior of adult fish can be manipulated to attract them to the bypass channel, that they would be motivated to swim upstream through the bypass channel, or that they would navigate upstream through the proposed bypass channel in sufficient numbers to enable meaningful levels of spawning and recruitment in the Yellowstone River. In the DEIS, Section 2.5.2 Sturgeon Use of Bypass Channel, concerns are raised as to "…whether bypass channels, in general, have been demonstrated to actually be used by sturgeon for passage." Further, it is stated in Section 2.5.2.1 The Potential for Successful Passage in a Bypass Channel by Pallid Sturgeon, that "…to date, no successful upstream fish passage facility of any type has been built for shovelnose or pallid sturgeon."

The following issues regarding the potential for adult pallid sturgeon to move upstream through the bypass channel during their spring migration remain unaddressed:

a. It is unknown if pallid sturgeon can be attracted to the entrance to the bypass channel. Given the configuration of the Yellowstone River below the Intake Diversion Dam, research indicates that pallid sturgeon will swim upstream primarily on the north side of the channel on the inside of a river bend, which is habitat shown to be preferred by the species during upstream migrations. Typically, 13% of the river flow will be diverted through the bypass channel. It is unknown if this is a sufficiently large flow to attract adult pallid sturgeon. Further, it is unknown if adult fish will actively search for upstream pathways outside of main channel habitat that they have been identified to prefer. Additionally, attraction of adult fish to the entrance to the bypass channel is likely to be confounded by turbulent flows downstream from the Intake Diversion Dam.

b. Adult pallid sturgeon that may find their way to the entrance of the bypass channel would encounter a grade-control structure. The proposed grade-control structure "would be composed of buried riprap covered with gravel/cobble" (Section 2.3.5.2, page 2-49). Insufficient information is provided to make judgments regarding the ability of adult pallid sturgeon to pass over the structure. Further, it is unknown if adult fish will be motivated to swim upstream over this structure. Adult pallid sturgeon are bottom-oriented and select migration paths with sand substrates on the inside of bends near the borders of deep channels during migration. The proposed grade control structure at the entrance to the bypass channel differs substantially from habitat selected by adults during migration in the Yellowstone River.

c. Within the bypass channel, two vertical grade-control structures (riprap sills) are proposed "for maintaining channel slope and allowing for early identification of channel movement" (Section 2.3.5.2, page 2-49). At the upstream end of the bypass channel, another grade-control

structure is also proposed. These structures would be "over-excavated and backfilled with natural river rock to give the appearance of a seamless channel invert while providing stability during extreme events" (Section 2.3.5.2, page 2-49). Insufficient information is provided to make judgments regarding the ability of adult fish to swim upstream over the structures. Further, it is unknown if adult pallid sturgeon will be motivated to swim upstream over these structures.

d. Water velocity and depth features proposed for the bypass channel may be sufficient to allow adult pallid sturgeon to move through the bypass channel, but it is not known if they are adequate to motivate movements through the bypass channel. Swimming ability determined in the laboratory is unlikely to be a predictor of behavior or habitat preference.

The DEIS states that upstream migration of adult pallid sturgeon through the bypass channel "may be a rare event" (Section 2.1, page 2-22). There is no evidence provided that sufficient numbers of adult pallid sturgeon would migrate upstream annually through the bypass channel to form spawning aggregations at suitable spawning sites, spawn, and contribute to natural recruitment in the Yellowstone River. Appendix E states an objective for upstream passage as "Greater than or equal to 85% of motivated adult pallid sturgeon (fish that move up to the weir) annually pass upstream of the weir location during the spawning migration period (April 1 to June 15) within a reasonable amount of time without substantial delay (≥ 0.19 miles/hour)" (page 2). Evidence to support this as an achievable objective is lacking.

Significance – High

Because the potential for upstream migration of adult pallid sturgeon relative to each alternative is not fully addressed, it is unknown whether the preferred alternative will facilitate passage of adult fish.

Recommendation for Resolution

1. Conduct an alternative analysis exclusively for pallid sturgeon that assesses the potential for upstream passage for each stated alternative. Include relevant literature on upstream migration behavior and habitat selection by adult pallid sturgeon, utilization of bypass structures by various sturgeon species in other systems, and actual swimming capabilities of adult pallid sturgeon (not just extrapolations of adult swimming capabilities based on studies of juvenile fish). The analysis should consider the following:

    a. Probabilities that adult pallid sturgeon will be attracted to the entrance of the bypass channel or modified side channel, will enter the bypass channel or modified side channel over possible impediments, will migrate upstream through the bypass channel or modified side channel over possible impediments, and will exit the bypass channel or modified side channel to continue upstream migration.

    b. The size of the population of adult pallid sturgeon that migrate annually up the Yellowstone River to Intake Diversion Dam, the proportion of the migrants that are likely to migrate upstream through the bypass channel or modified side channel, and the subsequent population-level response resulting from natural recruitment by the proportion that successfully migrate.

Final Panel Comment 2

The FPCI and the CE analysis based on the index do not adequately represent the significance of pallid sturgeon passage as an objective of the proposed action and the uncertainty associated with pallid sturgeon passage.

Basis for Comment

The stated purpose of the proposed action is to improve upstream passage for pallid sturgeon and other native fish at the Intake Diversion Dam, continue the viable and effective operation of the LYP, and contribute to ecosystem restoration (ES, p. xxvi). In addition, given the endangered status of pallid sturgeon (DEIS, pp. 1-7 to 1-8), it is stated "…the primary purpose of a fish passage project at Intake Dam is to improve pallid sturgeon passage…" (Appendix D, p. 1).

To compare alternatives, the FPCI was used to estimate EHUs under each alternative. The FPCI was developed to evaluate ecosystem outputs of alternative fish passage improvements for navigation dams on the Upper Mississippi River System, but the pallid sturgeon was not included in the model development (USACE, 2011). As an ecosystem restoration metric, the FPCI provides a consistent framework to evaluate the effects of restoration on an array of fish species. For this application to the LYP, the FPCI has three major shortcomings. First, it does not adequately represent the significance of pallid sturgeon passage as an objective of the proposed action. Second, the FPCI does not reflect the uncertainty associated with pallid sturgeon migration through the bypass channel or modified side channel alternatives. Third, this uncertainty is not reflected in the parameter values used to characterize pallid sturgeon migration behavior in the FPCI.

Based on the information in Appendix D, the spreadsheet "Fish Passage Connectivity Index_w_pallid_14species_v4.xlsx" (hereinafter FPCI_v4), and USACE (2011), the FPCI is a simple arithmetic index [(Ei x Ui x Di)/25] for each species, where E is the chance of encountering a passage entrance (1 – 5), U is the potential to use the passage (0 – 5), and D is the duration over which passage is available. The number 25 is used to normalize the index value for each species. The resulting connectivity value, Єi, is then multiplied by the potentially available habitat for each species to determine the EHUs for that species relative to a passage alternative. This calculation is repeated to EHUs for each species that might use the passage, and the results are then averaged across all species used in the analysis.

For this application to the LYP, 14 species were used in the analysis, so the EHUs for pallid sturgeon have little impact on the overall results and identification of a preferred alternative. For example, Appendix D (Table 2-4) presents the ICA with 7,116 net EHUs under the bypass channel alternative and 11,011 net EHUs under the multiple pump alternative. With annual costs of $5,170,000 under the bypass channel alternative and $10,594,000 under the multiple pump alternative, the incremental cost per EHU is $727 under the bypass channel alternative and $962 under the multiple pump alternative. If pallid sturgeon were dropped completely from the analysis and only the remaining 13 species were used, the new net EHUs would be 7,123 under the bypass channel alternative and 10,929 under the multiple pump alternative. The resulting incremental costs per EHU would be $726 and $1,032, respectively. The bypass channel alternative is indicated to be the 'best buy' under both applications of the FPCI, and the inclusion of pallid sturgeon habitat availability has no impact on the identification of a preferred alternative.

Appendix D states that in using the FPCI, “The inclusion of pallid sturgeon does not change the ranking of alternatives, but provides a better differentiation between similar alternatives” (page 3). This statement is questionable if the uncertainty surrounding pallid sturgeon migratory behavior is factored into the analysis. For example, Table 1-7 in Appendix D presents the rating for E for pallid sturgeon in the FPCI as a 4 under the bypass channel alternative and a 2 under the side channel alternative, both on a scale of 1 – 5 where 5 is the “no dam” rating. What makes it questionable is the lack of documented studies to support the assumption that a bypass channel would provide nearly the same connectivity as a free-flowing river for pallid sturgeon. If uncertainty about the potential success of the bypass channel is considered and the rating is lowered to a 2 (the same as the side channel), the net EHUs under the bypass channel alternative in Table 2-4 would change from 7,116 to 6,935 using the 14-species FPCI. The incremental cost per EHU would increase from $727 to $746. Given that the cost per EHU for the side channel alternative is $791 in Table 2-4, the bypass channel alternative would be indicated to be the ‘best buy’ even though both alternatives have exactly the same connectivity rating for pallid sturgeon. Note also that the bypass channel with the same connectivity as the side channel is the preferred alternative despite the lower annual cost for the side channel ($5,137,000 vs $5,170,000).

The importance of pallid sturgeon passage and uncertainty about the success of the bypass channel alternative for passage of pallid sturgeon can be evaluated directly by calculating the FPCI for pallid sturgeon only. Under the baseline assumptions in the DEIS, Appendix D and FPCI_v4, the bypass channel FPCI for pallid sturgeon is 0.60 ((3 x 5 x 1)/25), resulting in 7,582 EHUs (0.6 x 12,637). The no action alternative is 551 EHUs, so the net EHUs would be 7,031. At an annual cost of $5,170,000, the incremental cost is $727 per EHU. If the bypass channel is less successful and the FPCI for pallid sturgeon is only 0.30 ((1.5 x 5 x 1)/25), the net EHUs would be 3,240 (3,791 – 551). The risk-adjusted incremental cost would be $1,596 per EHU, or more than double the baseline assumption.

The risk-adjusted incremental cost under the bypass channel alternative can now be compared with the multiple pump alternative using only the pallid sturgeon FPCI. Under the baseline assumptions in the DEIS, Appendix D and FPCI_v4, the multiple pump FPCI for pallid sturgeon is 1.0 ((5 x 5 x 1)/25), resulting in 12,637 EHUs (1.0 x 12,637). The no action alternative is 551 EHUs, so the net EHUs would be 12,086 (12,637 – 551). At an annual cost of $10,594,000 in Table 2-4, the incremental cost is $877 per pallid sturgeon EHU. This cost is lower than the $962 per EHU for the multiple pump alternative in Table 2-4 because the net change in EHUs is smaller (11,011) for the 14 species used in the baseline FPCI.

Comparing the bypass channel alternative with the multiple pump alternative, the risk-adjusted incremental cost of $1,596 per pallid sturgeon EHU for the bypass channel alternative is significantly greater than the baseline incremental cost of $877 per pallid sturgeon EHU for the multiple pump alternative. Accounting for the uncertainty associated with pallid sturgeon passage through the bypass channel would indicate the multiple pump alternative as the ‘best buy.’

Significance – High

Because the FPCI and CE analysis are the primary decision tools used to select the preferred alternative, further information about critical parameters used to evaluate alternatives can lead to better risk-informed decisions.

Recommendation for Resolution

1. Provide more information about the effects of uncertainty on the parameters used in the FPCI and explain how this uncertainty influences the EHUs under each alternative.
2. Provide a CE analysis using only a pallid sturgeon FPCI to determine EHUs under each alternative and directly integrate uncertainty about parameters in the FPCI into the analysis.
3. Compare the CE results using the baseline 14-species FPCI and the pallid sturgeon FPCI to illustrate the differences in expected outcomes.
4. Document any new or revised information generated from recommendations 1-3 in the FEIS.

Literature Cited

USACE (2011). Fish Passage Connectivity Index. A Planning Model Developed to Upper Mississippi River System Fish Passage Improvement Ecosystem Restoration Projects. January.

Final Panel Comment 3

The Monitoring and Adaptive Management Plan does not provide specific, quantified fish passage objectives and targets for pallid sturgeon or other native fish species, which are necessary to identify the need for adaptive management actions and the potential future costs of such actions.

Basis for Comment

The stated objective of the Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana is "to improve passage of pallid sturgeon and other native fish at the Lower Yellowstone Project Intake Diversion Dam while continuing a viable and effective operation of the Project" (DEIS Executive Summary).

Pallid Sturgeon:
Little information is provided in peer-reviewed literature regarding the parameters necessary to facilitate upstream passage for adult pallid sturgeon. As a result, many of the design features are based on the best professional judgment of a qualified multi-disciplined team of experts. This approach results in a level of risk and uncertainty that must be addressed using a robust and quantitative monitoring and adaptive management approach. The draft Monitoring and Adaptive Management Plan states, "… as there are very few examples of fish passage projects designed for sturgeon species and none specific to pallid sturgeon, uncertainty exists regarding the assumptions made about the physical and biological response to the alternatives and their relative effectiveness to improve fish passage past Intake Diversion Dam." (Appendix E, section 1.0, p. 1).

The definition and purpose of monitoring and adaptive management as stated are, "… a decision-making process that provides for implementing management actions in the face of uncertainty. Included in this appendix are objectives, metrics, and targets for proposed management actions and potential adjustments that may be warranted based on the results of the proposed monitoring" (Appendix E, section 1.0, p. 1).

The Monitoring and Adaptive Management Plan provides two objectives pertinent to pallid sturgeon. Objective 1 identifies physical criteria for water depths and velocities in fish passageways that are measurable; this objective is readily quantifiable and is adequately addressed in the plan. Objective 2 addresses upstream and downstream passage of pallid sturgeon. The first element of Objective 2, addressing upstream passage, states "Greater than or equal to 85% motivated adult pallid sturgeon (fish that move up to the weir) annually pass upstream of the weir location during the spawning migration period (April 1 to June 15) within a reasonable amount of time without substantial delay ($\geq$ 0.19 miles/hour)." This element does not provide a timeframe for achieving the objective or by what time in the future the proponents expect the objective to be reached. Further, "motivation" of adult pallid sturgeon cannot be measured. This element of Objective 2 would be more precise if that term were omitted and the objective were stated as, "Greater than or equal to 85% of adult pallid sturgeon that move up to the weir annually pass upstream…"

The second element of Objective 2, addressing downstream passage of adult pallid sturgeon following the spawning period, begins with this statement: "Mortality of adult pallid sturgeon that migrate downstream of the weir location cannot exceed 1% annually during the first 10 years." (Appendix E, section 1.0, p. 2). Additional components of this element to assess injury and stress are mentioned, but no statement is provided as to how injury or stress may be measured or quantified. Further, no timeframe for achieving

these elements of the objective is provided. A second component addressing downstream passage focuses on impingement and entrainment of larval and young-of-year fish. Again, quantifiable measures of impingement and entrainment and a timeframe for assessment are not provided.

It is recognized that the Monitoring and Adaptive Management Plan is preliminary and will be expanded, but more precise objectives, as well as more detail regarding the monitoring methods that will be used to assess progress toward objectives, are needed. The objectives for monitoring pallid sturgeon provide very limited "quantifiable targets for proposed management actions and potential adjustments that may be warranted" as stated on page 1 of the plan. Quantifiable targets are necessary to ensure that the fish passage produces projected species-specific and ecosystem benefits. If specific quantifiable targets are not documented in the Adaptive Management Plan, it will be difficult to determine if the project falls short or succeeds in achieving the stated objectives.

Native Fish Species:
The Monitoring and Adaptive Management Plan does not present quantitative objectives or targets for native fish species successfully passing upstream and downstream through the Intake Diversion Dam area. Objective 3 is relevant to native fish species, stating "Determine if native fish can effectively migrate upstream and downstream of the weir location." No quantifiable metrics or timeframe for assessment are provided. The Panel understands that an elevated level of significance is placed on successful passage by pallid sturgeon. However, the alternatives analysis was conducted predominantly on the basis of the potential for fish passage of the 14 native species considered to "…represent the migratory species typically found in the Yellowstone River at Intake Diversion Dam and the species provide good representation of the various guilds of fish based on their various migration behaviors" (Appendix D, section 1.3.1.2, p. 3). For the same reasons mentioned above regarding pallid sturgeon, quantitative objectives and targets are necessary for other native fishes in the adaptive management plan.

Costs:
Further information on quantitative objectives and targets would also help to identify potential future costs for the adaptive management plan that are based on specific actions rather than the fixed percentage of total project cost estimates used in the alternative selection process.

The Panel recognizes that the current Monitoring and Adaptive Management Plan acknowledges that a more detailed plan may be developed in the future.

Significance – High

Refinement of objectives and more quantitative details to the Monitoring and Adaptive Management Plan are essential to ensure the success of the proposed project.

Recommendation for Resolution

1. Include quantifiable pallid sturgeon and native fish species passage targets with timeframes that are compatible with the objectives to reach specific adaptive management milestones at reasonably accurate estimated costs.

2. Provide more details on the methods used to (a) achieve the elements of the monitoring plan and (b) assess progress toward the stated objectives for pallid sturgeon and other native fish species.

Final Panel Comment 4

The need for a new bridge for maintenance and recreation access under the modified side channel alternative is not well justified.

Basis for Comment

Maintenance Access

The bypass channel and the modified side channel alternatives both require similar maintenance access to the south side of the river; however, only one includes a new bridge. This inconsistency has resulted in the modified side channel being more expensive than the bypass channel. The following instances throughout the document indicate where this inconsistency was noted.

The preferred alternative (bypass channel) includes a replacement weir, but does not include a bridge across the bypass channel. The justification provided in the DEIS is that only infrequent access to the south side of the weir will be necessary due to reduced need to maintain the new concrete weir (Section 2.3.5). A new bridge is not provided for maintenance access. When access is required, a temporary cofferdam would be constructed across the bypass channel.

The DEIS suggests that under the modified side channel alternative, reuse of the existing Intake Diversion Dam with periodic rock placement would require a new bridge for maintenance access (Section 2.3.6). The bypass channel alternative includes a new weir, but not a new bridge due to the bypass channel's reduced maintenance needs.

The goal of the bypass channel and the side channel alternatives is to provide fish passage opportunities for the pallid sturgeon. Upstream migration is known to occur in the spring and early summer, when flow in the river reaches seasonal highs. The DEIS states that maintenance work on the existing weir does not occur until late July or August, when flow in the river has decreased. Since the timing of maintenance work does not conflict with the timing of sturgeon migration, a temporary cofferdam should suffice to allow for maintenance access under either alternative scenario.

Currently, maintenance access is primarily from the north bank. Rock is stockpiled with a loader, dumped into a skid, and then hauled by an existing overhead trolley cableway over the river to be dumped. It is unclear why, under the modified side channel alternative, a bridge for access from the south is necessary for this operation. A bridge may have unresolved design issues and potential impacts that have not been fully addressed. The DEIS states that the bridge may need to be elevated up to 10 feet above the floodplain level to accommodate flowing ice in the bypass channel. Bridge approach embankments, which would be necessary for a higher bridge elevation, may cause barriers to floodwater flow. This could result in erosion damage to the embankments, bypass channel, and surrounding land.

Recreation Access

Recreation access was cited as a benefit of bridge construction, but no documentation was provided that indicated that recreation access was required during the late spring and early summer season when flow in the river is high. Since recreation is not part of the new project's purpose and need, it should not be used as justification for a proposed new bridge.

Significance – Medium

Inclusion of a bridge impacts the cost of the modified side channel alternative and potentially affects the selection of the preferred alternative.

Recommendation for Resolution

1. Consider eliminating the proposed bridge from the modified side channel alternative.
2. If the proposed bridge is retained, address potential flood damage impacts of bridge abutment construction on embankments, the bypass channel, and the surrounding land.

Final Panel Comment 5

Maintaining the existing Intake Diversion Dam, as opposed to installing a new weir, is not fully considered under the bypass channel alternative.

Basis for Comment

The revised project Purpose and Need statement includes the continued operation of the LYP and the normal functioning of the main irrigation canal. The DEIS states that the existing diversion weir provides sufficient water surface elevation to provide for the normal operation of the main canal and its new intake structure.

The DEIS justifies the installation of a new weir as a measure to reduce the potential for rock displaced from the Intake Diversion Dam obstructing the bypass channel's lower entrance over time. The entrance to the side channel is located further downstream of the Intake Diversion Dam. The DEIS indicates that the side channel's lower entrance location negates the need for a new weir.

A new weir across the Yellowstone River is proposed under the bypass channel alternative as a way to reduce the potential for displaced rock to obstruct the bypass channel's lower entrance and to reduce future maintenance costs; however, a new weir is not required for continued water delivery to the main canal, and its costs are not adequately justified. Over many years, the existing Intake Diversion Dam has required maintenance due to periodic rock displacement. However, it is not clear that the potential for periodic displaced rock obstructing the lower bypass channel entrance justifies a new weir. The potential for obstruction can be mitigated through monitoring and adaptive management. Removal of sediment/displaced rock from the channel's lower entrance is addressed in the Monitoring and Adaptive Management Plan.

A new diversion weir may be beneficial to the continued operation of the LYP, but a cost/benefit analysis of a new weir versus continued maintenance of the existing weir is not provided. The proposed new weir is a costly element of the overall project. Since it may not be necessary in order to meet the project objectives, it warrants careful consideration as a stand-alone project element.

Significance – Medium

Construction of a new weir impacts the cost of the alternatives and potentially affects the selection of the preferred alternative.

Recommendation for Resolution

1. Conduct a cost/benefit analysis of maintaining the existing Intake Diversion Dam versus construction of a new weir under the bypass channel alternative.
2. Consider a design modification that would reduce the potential for bypass channel obstruction due to rock displacement.

Final Panel Comment 6

The existing side channel should remain open to accommodate flood flow and fish passage during high-flow events.

Basis for Comment

The bypass channel alternative utilizes the existing side channel entrance as the upstream starting point for the new bypass channel and uses fill to plug the existing side channel. This effectively closes the existing side channel to any future use by fish for upstream passage. The Panel believes that leaving the side channel open for flood flow and upstream fish passage during high-flow events would:

- Allow some flood flows to cross Joe's Island without crossing the bypass channel.
- Allow upstream fish passage during moderate- to high-flow events (this is the one proven route for upstream migration of pallid sturgeon under current conditions).
- Promote overall ecosystem health by maintaining as much aquatic and biotic connectivity as possible.

It does not appear that the functionality of the bypass channel alternative depends on closure of the existing side channel. It does appear that the inlet to the new bypass channel could be altered or relocated slightly to accommodate flood flow into the existing side channel, without compromising the bypass channel design.

Significance – Medium

With so little known about the migration behavior of the pallid sturgeon, the retention of any potential option for upstream passage would support the primary objective of the proposed Federal action.

Recommendation for Resolution

1. Consider relocating the inlet to the new bypass channel downstream by 500 feet, and constructing a high-flow inlet weir that allows flow into the existing side channel when discharge in the river exceeds 30,000 cubic feet per second.

Final Panel Comment 7

The current design of the bypass channel does not include erosion control measures to counter flood damage when flood flows overtop Joe's Island.

Basis for Comment

The bypass channel will be covered with flood flow in the 100-year event (and probably in smaller flood events) because floodwater will be flowing down-valley, which is perpendicular to the direction of flow in the bypass channel. The Panel believes that damage to the bypass channel is likely and ideally would be mitigated as much as possible through design rather than dealt with as a maintenance issue. In the 2013 IEPR, the Panel identified a similar comment based on the original design. However, this concern is now compounded because the proposed new diversion weir would raise the base water surface in the river by an additional 0.5 feet or more, increasing the frequency of water overtopping Joe's Island.

Flood flow crossing the bypass channel will have two potential effects: (1) erosion of the channel side slopes and deposition of sediment in the channel itself, and (2) changes to the hydraulics of the bypass channel during an overtopping flow event. The response to the 2013 IEPR Panel comment concluded that sedimentation issues would be limited to "isolated deposits," but did not provide a detailed analysis of the locations where this would occur, the volumes of sediment deposition expected, or the frequency of sedimentation events. The 2016 DEIS acknowledges this potential problem by stating that some of the soil excavated from the bypass channel could be sidecast on the left bank of the new channel, and that action may reduce the risk of sediment deposition in the bypass channel from flood flows. The Panel believes that the damage to the bypass channel from erosion and sedimentation could be much more than isolated sediment deposits.

The hydraulic analysis demonstrates that the bypass channel meets the BRT criteria for fish passage, but only when flow is limited to the bypass channel itself. Hydraulic conditions in the bypass channel will change when floodwater is overtopping this channel and flowing perpendicular to the channel alignment. There does not appear to be any 2D or 3D modeling that confirms that fish passage hydraulics will be maintained during an overtopping flood event.

Without a quantitative analysis demonstrating that flood damage to the bypass channel will be minimal, and that hydraulic conditions for fish passage can be maintained over a wide range of spring flood events in the river, the efficacy of the design cannot be confirmed. The Panel believes that the threat of flood damage and the disruption of hydraulic conditions that may facilitate fish passage can be minimized by design.

In addition, a low levee between the river and the bypass channel would be more effective at reducing sediment deposits in the bypass channel than a pile of sidecast soil. A low levee would reduce the frequency of flood flows crossing the bypass channel, and the frequency of potentially damaging flows could be limited to extreme events only. As a side benefit, a significant portion of soil from bypass channel excavation could be disposed of in this levee with only a short haul distance. Fuse plugs in the levee could be used to control where levee failures are most likely to occur, and that allows for control of where the bypass channel might need extra erosion protection.

Significance – Medium

The success of the preferred alternative depends on the bypass channel being designed to withstand erosional and depositional forces and being a viable waterway for fish passage under a wide range of flow conditions.

Recommendation for Resolution

1. Consider revising the design to allow the existing side channel to carry a portion of the total flood flow over Joe's Island, or document in the DEIS with quantitative hydraulic modeling why the current design can withstand an overtopping event without suffering damage.
2. Instead of side-casting soil excavation to protect the bypass channel from overtopping flow damage, consider compacting that soil into a low levee between the river and the bypass channel.

Final Panel Comment 8

The Monitoring and Adaptive Management Plan does not mention the establishment of formal agreements with Federal and state agencies to conduct vital monitoring elements.

Basis for Comment

The Monitoring and Adaptive Management Plan includes monitoring efforts to be conducted by multiple agencies. It is not clear whether appropriate formal agreements have been established but are omitted from the document or whether these types of agreements are currently being pursued. For example, upstream adult fish monitoring would be conducted by the U.S. Geological Survey, USFWS, and Montana Fish, Wildlife & Parks (Appendix E, p. 6), while the Bureau of Reclamation would be involved in future downstream monitoring of larval pallid sturgeon (Appendix E, p. 7).

Regarding agency participation in upstream monitoring, Appendix E states, “This effort is expected to continue to ensure a portion of the population is tagged and can be tracked every year” (p. 6). Since monitoring and adaptive management are critical to the success of the proposed project, it is necessary to establish Federal and state commitments to conduct monitoring. If critical monitoring elements are not conducted, then it will be difficult to determine if the project achieves the projected ecosystem benefits.

In addition, these types of commitments and/or agreements should contain important details such as:

1. Who is responsible for collecting, integrating, and evaluating monitoring data?
2. Who will be responsible for initiating the adaptive management process if data indicate that project goals are not being achieved?
3. What is the timeline for responding to monitoring results leading to implementation of adaptive management measures?

Such details regarding individual agency responsibilities are necessary components of an effective monitoring and adaptive management program.

Significance – Medium/Low

Including information regarding interagency agreements in the monitoring and adaptive management plan would improve the quality and completeness of the report. Establishing such agreements (if not already in place) would improve the quality of the Monitoring and Adaptive Management Plan.

Recommendation for Resolution

1. If agreements regarding monitoring elements already exist or are currently being pursued, document those agreements in the Monitoring and Adaptive Management Plan.
2. If agreements regarding monitoring elements do not exist and are not being pursued, document the approach that is being taken, and/or provide reasons why they will not be pursued.

5. REFERENCES

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APPENDIX A

IEPR Process for the Lower Yellowstone River Intake DEIS Project

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A.1 Planning and Conduct of the Independent External Peer Review (IEPR)

Table A-1 presents the schedule followed in executing the Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana Draft Environmental Impact Statement Independent External Peer Review (hereinafter: Lower Yellowstone River Intake DEIS IEPR). Due dates for milestones and deliverables are based on the award/effective date of May 26, 2016. The U.S. Army Corps of Engineers (USACE) provided the review documents on May 31, 2016. Note that the work items listed under Task 6 occur after the submission of this report.

Battelle will enter the eight Final Panel Comments developed by the Panel into USACE's Design Review and Checking System (DrChecks), a Web-based software system for documenting and sharing comments on reports and design documents, so that USACE can review and respond to them. USACE will provide responses (Evaluator Responses) to the Final Panel Comments, and the Panel will respond (BackCheck Responses) to the Evaluator Responses. Battelle will document all USACE and Panel responses. Battelle will provide USACE and the Panel a pdf printout of all DrChecks entries, through comment closeout, as a final deliverable and record of the IEPR results.

Table A-1. Lower Yellowstone River Intake DEIS Complete IEPR Schedule

Task	Action	Due Date
1	Award/Effective Date	5/26/2016
	Review documents available	5/31/2016
	Public comments available	8/4/2016
	Battelle submits draft Work Plan to USACE[a]	6/2/2016
	USACE provides comments on draft Work Plan to Battelle	6/7/2016
	Battelle submits final Work Plan to USACE[a]	6/9/2016
2	Battelle requests input on the conflict of interest (COI) questionnaire from USACE	5/31/2016
	USACE provides comments on COI questionnaire to Battelle	6/1/2016
	Battelle submits list of selected panel members to USACE[a]	6/2/2016
	USACE confirms the panel members have no COI	6/3/2016
	Battelle completes subcontracts for panel members	6/6/2016
3	Battelle convenes kick-off meeting with USACE	6/1/2016
	Battelle sends review documents to panel members	6/6/2016
	Battelle convenes kick-off meeting with panel members	6/6/2016
	Battelle convenes kick-off meeting with USACE and panel members	6/6/2016
	Battelle submits Mid-Review questions from the panel members to USACE for clarification	6/21/2016
4	Panel members complete their individual reviews	7/5/2016

Table A-1. Lower Yellowstone River Intake DEIS Complete IEPR Schedule (continued)

Task	Action	Due Date
4	Battelle provides talking points for Panel Review Teleconference to panel members	7/6/2016
	Battelle convenes Panel Review Teleconference	7/7/2016
	Battelle provides Final Panel Comment templates and instructions to panel members	7/8/2016
	Panel members provide draft Final Panel Comments to Battelle	7/18/2016
	Battelle provides feedback on draft Final Panel Comments to panel members; panel members revise Final Panel Comments	7/19-7/26/2016
	Panel finalizes Final Panel Comments	7/27/2016
	Battelle sends public comments to Panel	8/3/2016
	Panel completes its review of public comments	8/8/2016
	Battelle and Panel review Panel's responses to public comments	8/11/2016
	Panel drafts Final Panel Comment for public comments, if needed	8/12/2016
	Panel finalizes Final Panel Comment regarding public comments	8/16/2016
	Battelle submits Public Comment Review Addendum to Final Report (if necessary) to USACE	8/19/2016
5	Battelle provides Final IEPR Report to panel members for review	8/1/2016
	Panel members provide comments on Final IEPR Report to Battelle	8/3/2016
	Battelle submits Final IEPR Report to USACE[a]	8/5/2016
	USACE Planning Center of Expertise (PCX) provides decision on Final IEPR Report acceptance to Battelle	8/12/2016
6[b]	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	8/16/2016
	Battelle convenes teleconference to review the Post-Final Panel Comment Response Process with USACE	8/16/2016
	Battelle convenes teleconference to review the Post-Final Panel Comment Response Process with Panel	8/16/2016
	USACE Project Delivery Team (PDT) provides draft Evaluator Responses to USACE PCX for review	9/9/2016
	USACE PCX reviews draft Evaluator Responses and works with USACE PDT regarding clarifications to responses, if needed	9/15/2016
	USACE PCX provides draft PDT Evaluator Responses to Battelle	9/16/2016
	Battelle provides the draft PDT Evaluator Responses to panel members	9/20/2016
	Panel members provide draft BackCheck Responses to Battelle	9/23/2016
	Battelle convenes teleconference to discuss draft BackCheck Responses with panel members	9/26/2016

Table A-1. Lower Yellowstone River Intake DEIS Complete IEPR Schedule (continued)

Task	Action	Due Date
6[b]	Battelle convenes Comment-Response Teleconference with panel members and USACE	9/27/2016
	USACE inputs final PDT Evaluator Responses to DrChecks	10/4/2016
	Battelle provides final PDT Evaluator Responses to panel members	10/5/2016
	Panel members provide final BackCheck Responses to Battelle	10/11/2016
	Battelle inputs the Panel's final BackCheck Responses in DrChecks	10/12/2016
	Battelle submits pdf printout of DrChecks project file to USACE[a]	10/12/2016
	Contract End/Delivery Date	12/31/2016

a Deliverable.

b Task 6 occurs after the submission of this report

At the beginning of the Period of Performance for the Lower Yellowstone River Intake DEIS IEPR, Battelle held a kick-off meeting with USACE to review the preliminary/suggested schedule, discuss the IEPR process, and address any questions regarding the scope (e.g., clarify expertise areas needed for panel members). Any revisions to the schedule were submitted as part of the final Work Plan. The final charge consisted of 43 charge questions provided by USACE (all questions were included in the draft and final Work Plans), and general guidance for the Panel on the conduct of the peer review (provided in Appendix C of this final report).

Prior to beginning their review and within 1 day of their subcontracts being finalized, all the members of the Panel attended a kick-off meeting via teleconference planned and facilitated by Battelle in order to review the IEPR process, the schedule, communication procedures, and other pertinent information for the Panel. Battelle planned and facilitated a second kick-off meeting via teleconference during which USACE presented project details to the Panel. Before the meetings, the IEPR Panel received an electronic version of the final charge, as well as the Lower Yellowstone River Intake DEIS review documents and reference materials listed below. The documents and files in bold font were provided for review; the other documents were provided for reference or supplemental information only.

- **Lower Yellowstone Intake Diversion Fish Passage Draft EIS_untagges.pdf (May 2016 version, 734 pages)**
- **Appendix A_Lower Yellowstone Intake Fish Passage EIS_Engineering.pdf (May 2016 version, 527 pages)**
- **Appendix B_Lower Yellowstone Intake Fish Passage EIS_Cost Engineering.pdf (May 2016 version, 173 pages)**
- **Appendix C_Lower Yellowstone Intake Fish Passage EIS_404b1.pdf (May 2016 version, 86 pages)**
- **Appendix D_Lower Yellowstone Intake Fish Passage EIS_FPCO and CEICA.pdf (May 2016 version, 31 pages)**
- **Appendix E_Lower Yellowstone Intake Fish Passage EIS_Adaptive Management.pdf (42 pages)**

- **Appendix F_Lower Yellowstone Intake Fish Passage EIS_Correspondence.pdf (91 pages)**
- USACE guidance, *Civil Works Review* (EC 1165-2-214), December 15, 2012
- Office of Management and Budget, *Final Information Quality Bulletin for Peer Review,* December 16, 2004.

About halfway through the review of the Lower Yellowstone River Intake DEIS IEPR documents, the Panel provided Battelle 4 questions regarding the project. USACE answered the questions and responded to Battelle via email. Based on a review of the information provided in the email, the Panel determined that a Mid-Review Teleconference with USACE was not necessary.

In addition, throughout the review period, USACE provided the following documents at the request of panel members. These documents were provided to Battelle and then sent to the Panel as additional information only and were not part of the official review.

- IMPLAN_Reference Manual
- UMRS Fish Passage Connectivity Index 201100817.pdf
- 2010 version_Fish Passage Connectivity Index_w_pallid_14 species_v4.xlsx
- RAS_Workmap_existing.pdf
- RAS_Workmap_high_flow_Channel.pdf
- Intake Diversion Dam Modification Lower Yellowstone Project, Montana Bypass Channel 60% Design – August 2014 Hydraulics Appendix (2015_app_a2.pdf)

A.2 Review of Individual Comments

The Panel was instructed to address the charge questions/discussion points within a charge question response form provided by Battelle. At the end of the review period, the Panel produced individual comments in response to the charge questions/discussion points. Battelle reviewed the comments to identify overall recurring themes, areas of potential conflict, and other overall impressions. At the end of the review, Battelle summarized the individual comments in a preliminary list of 14 overall comments and discussion points. Each panel member's individual comments were shared with the full Panel.

A.3 IEPR Panel Teleconference

Battelle facilitated a 2.5-hour teleconference with the Panel so that the panel members could exchange technical information. The main goal of the teleconference was to identify which issues should be carried forward as Final Panel Comments in the Final IEPR Report and decide which panel member should serve as the lead author for the development of each Final Panel Comment. This information exchange ensured that the Final IEPR Report would accurately represent the Panel's assessment of the project, including any conflicting opinions. The Panel engaged in a thorough discussion of the overall positive and negative comments, added any missing issues of significant importance to the findings, and merged any related individual comments. At the conclusion of the teleconference, Battelle reviewed each Final Panel Comment with the Panel, including the associated level of significance, and confirmed the lead author for each comment.

A.4 Preparation of Final Panel Comments

Following the teleconference, Battelle prepared a summary memorandum for the Panel documenting each Final Panel Comment (organized by lead author and level of significance). The memorandum provided the following detailed guidance on the approach and format to be used to develop the Final Panel Comments for the Lower Yellowstone River Intake DEIS IEPR:

- Lead Responsibility: For each Final Panel Comment, one Panel member was identified as the lead author responsible for coordinating the development of the Final Panel Comment and submitting it to Battelle. Battelle modified lead assignments at the direction of the Panel. To assist each lead in the development of the Final Panel Comments, Battelle distributed a summary detailing each draft final comment statement, an example Final Panel Comment following the four-part structure described below, and templates for the preparation of each Final Panel Comment.

- Directive to the Lead: Each lead was encouraged to communicate directly with the other panel members as needed and to contribute to a particular Final Panel Comment. If a significant comment was identified that was not covered by one of the original Final Panel Comments, the appropriate lead was instructed to draft a new Final Panel Comment.

- Format for Final Panel Comments: Each Final Panel Comment was presented as part of a four-part structure:

  1. Comment Statement (succinct summary statement of concern)
  2. Basis for Comment (details regarding the concern)
  3. Significance (high, medium/high, medium, medium/low, and low; see descriptions below)
  4. Recommendation(s) for Resolution (see description below).

- Criteria for Significance: The following were used as criteria for assigning a significance level to each Final Panel Comment:

  1. **High:** Describes a fundamental issue with the project that affects the current recommendation or justification of the project, and which will affect its future success, if the project moves forward without the issue being addressed. Comments rated as high indicate that the Panel determined that the current methods, models, and/or analyses contain a “showstopper” issue.

  2. **Medium/High:** Describes a potential fundamental issue with the project, which has not been evaluated at a level appropriate to this stage in the Planning process. Comments rated as medium/high indicate that the Panel analyzed or assessed the methods, models, and/or analyses available at this stage in the Planning process and has determined that if the issue is not addressed, it could lead to a “showstopper” issue.

  3. **Medium:** Describes an issue with the project, which does not align with the currently assessed level of risk assigned at this stage in the Planning process. Comments rated as medium indicate that, based on the information provided, the Panel identified an issue that would raise the risk level if the issue is not appropriately addressed.

4. **Medium/Low:** Affects the completeness of the report at this time in describing the project, but will not affect the recommendation or justification of the project. Comments rated as medium/low indicate that the Panel does not currently have sufficient information to analyze or assess the methods, models, or analyses.

5. **Low:** Affects the understanding or accuracy of the project as described in the report, but will not affect the recommendation or justification of the project. Comments rated as low indicate that the Panel identified information that was mislabeled or incorrect or that certain data or report section(s) were not clearly described or presented.

- Guidelines for Developing Recommendations: The recommendation section was to include specific actions that USACE should consider to resolve the Final Panel Comment (e.g., suggestions on how and where to incorporate data into the analysis, how and where to address insufficiencies, areas where additional documentation is needed).

Battelle reviewed and edited the Final Panel Comments for clarity, consistency with the comment statement, and adherence to guidance on the Panel's overall charge, which included ensuring that there were no comments regarding either the appropriateness of the selected alternative or USACE policy. At the end of this process, eight Final Panel Comments were prepared and assembled. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Final Panel Comments are presented in the main report.

APPENDIX B

Identification and Selection of IEPR Panel Members
for the Lower Yellowstone River Intake DEIS Project

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B.1 Panel Identification

The candidates for the Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana Draft Environmental Impact Statement (hereinafter: Lower Yellowstone River Intake DEIS IEPR) Panel were evaluated based on their technical expertise in the following key areas: Civil Works planning, fisheries biology and environmental law compliance, economics, geotechnical engineering, and hydraulic engineering. These areas correspond to the technical content of the Lower Yellowstone River Intake DEIS IEPR review documents and overall scope of the Lower Yellowstone River Intake DEIS project.

Based on statements in the Performance Work Statement (PWS) that members of the previous Lower Yellowstone River IEPR Panel should be used if possible, Battelle contacted the panel members who participated in the previous review of the Lower Yellowstone River EA in the following key technical areas: fisheries biology and environmental law compliance, economics, geotechnical engineering, and hydraulic engineering. These four panel members were rescreened and determined not to have any conflicts of interest (COIs). Also based on the PWS, Battelle identified potential candidates for the Civil Works planner position because the previous planner's organization had a COI. To identify candidate panel members for this discipline, Battelle reviewed the credentials of the experts in Battelle's Peer Reviewer Database, sought recommendations from colleagues, contacted former panel members, and conducted targeted Internet searches. Battelle screened for candidates most closely meeting the selection criteria and evaluated them for potential COIs and availability. Of these candidates, Battelle chose the most qualified individuals, confirmed their interest and availability, and ultimately selected five experts for the final Panel. The remaining candidates were not proposed for a variety of reasons, including lack of availability, disclosed COIs, or lack of the precise technical expertise required. The U.S. Army Corps of Engineers (USACE) was given the list of final candidates (the new Civil Works planner and previous four panel members) to confirm that they had no COIs. Battelle made the final selection of the entire panel, including the Civil Works planner.

The candidates were screened for the following potential exclusion criteria or COIs.[3] These COI questions serve as a means of disclosure and to better characterize a candidate's employment history and background. Providing a positive response to a COI screening question did not automatically preclude a candidate from serving on the Panel. For example, participation in previous USACE technical peer review committees and other technical review panel experience was included as a COI screening question. A positive response to this question could be considered a benefit.

[3] Battelle evaluated whether scientists in universities and consulting firms that are receiving USACE-funding have sufficient independence from USACE to be appropriate peer reviewers. See OMB (2004, p. 18), "….when a scientist is awarded a government research grant through an investigator-initiated, peer-reviewed competition, there generally should be no question as to that scientist's ability to offer independent scientific advice to the agency on other projects. This contrasts, for example, to a situation in which a scientist has a consulting or contractual arrangement with the agency or office sponsoring a peer review. Likewise, when the agency and a researcher work together (e.g., through a cooperative agreement) to design or implement a study, there is less independence from the agency. Furthermore, if a scientist has repeatedly served as a reviewer for the same agency, some may question whether that scientist is sufficiently independent from the agency to be employed as a peer reviewer on agency-sponsored projects."

- Previous and/or current involvement by you or your firm[4] in the Lower Yellowstone River Project, Montana Intake Dam Modification Supplemental (Amended) Analysis to the 26 April 2010 Environmental Assessment and Appendices.
- Previous and/or current involvement by you or your firm[2] with ecosystem restoration studies along the Lower Yellowstone River, The Missouri River, the City of Glendive, Dawson County, Montana, eastern Montana, and/or western North Dakota.
- Previous and/or current involvement by you or your firm[2] in the Lower Yellowstone River Project, Montana Intake Dam Modification Supplemental (Amended) Analysis to the 26 April 2010 Environmental Assessment and Appendices or related projects.
- Previous and/or current involvement by you or your firm[2] in the conceptual or actual design, construction, or operation and maintenance (O&M) of any projects in the Lower Yellowstone River Project, Montana Intake Dam Modification Supplemental (Amended) Analysis to the 26 April 2010 Environmental Assessment and Appendices or related projects.
- Current employment by USACE.
- Previous and/or current involvement with paid or unpaid expert testimony related to the Lower Yellowstone River Project, Montana Intake Dam Modification Supplemental (Amended) Analysis to the 26 April 2010 Environmental Assessment and Appendices.
- Previous and/or current employment or affiliation with members of the following cooperating Federal, state, county, local and regional agencies, environmental organizations, and interested groups (for pay or pro bono): Missouri River Recovery Program, Bureau of Reclamation, State of Montana Department of Fish, Wildlife and Parks, U.S. Fish and Wildlife Service, Natural Resource Conservation Service, Montana Department of Environmental Quality, The Nature Conservancy, Yellowstone River Conservation District Council, Lower Yellowstone Irrigation Project, or Defenders of Wildlife and Natural Resources Defense Council.
- Past, current, or future interests or involvements (financial or otherwise) by you, your spouse, or your children related to the Lower Yellowstone River, the Missouri River, the City of Glendive, Dawson County, Montana, eastern Montana, and/or western North Dakota.
- Current personal involvement with other USACE projects, including whether involvement was to author any manuals or guidance documents for USACE. If yes, provide titles of documents or description of project, dates, and location (USACE district, division, Headquarters, Engineer Research and Development Center [ERDC], etc.), and position/role. Please highlight and discuss in greater detail any projects that are specifically with the Omaha District.
- Previous or current involvement with the development or testing of modeling software that will be used for or in support of the Lower Yellowstone River Project, Montana Intake Dam Modification Supplemental (Amended) Analysis to the 26 April 2010 Environmental Assessment and Appendices project.
- Current firm[2] involvement with other USACE projects, specifically those projects/contracts that are with the Omaha District. If yes, provide title/description, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role. Please also clearly delineate the

[4] Includes any joint ventures in which a panel member's firm is involved and if the firm serves as a prime or as a subcontractor to a prime.

percentage of work you personally are currently conducting for the Omaha District. Please explain.

- Any previous employment by the USACE as a direct employee or contractor (either as an individual or through your firm[2]) within the last 10 years, notably if those projects/contracts are with the Omaha District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
- Previous experience conducting technical peer reviews. If yes, please highlight and discuss any technical reviews concerning ecosystem restoration, and include the client/agency and duration of review (approximate dates).
- Pending, current, or future financial interests in the Lower Yellowstone River Project, Montana Intake Dam Modification Supplemental (Amended) Analysis to the 26 April 2010 Environmental Assessment and Appendices or related contracts/awards from USACE.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last 3 years came from USACE contracts.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last 3 years from contracts with the Missouri River Recovery Program.
- Any publicly documented statement (including, for example, advocating for or discouraging against) related to the Lower Yellowstone River Project, Montana Intake Dam Modification Supplemental (Amended) Analysis to the 26 April 2010 Environmental Assessment and Appendices.
- Participation in relevant prior Federal studies relevant to this project and the Lower Yellowstone River Project, Montana Intake Dam Modification Supplemental (Amended) Analysis to the 26 April 2010 Environmental Assessment and Appendices.
- Previous and/or current participation in prior non-Federal studies relevant to this project and/or the Lower Yellowstone River Project, Montana Intake Dam Modification Supplemental (Amended) Analysis to the 26 April 2010 Environmental Assessment and Appendices.
- Is there any past, present, or future activity, relationship, or interest (financial or otherwise) that could make it appear that you would be unable to provide unbiased services on this project? If so, please describe.

B.2 Panel Selection

In selecting the final members of the Panel, Battelle chose experts who best fit the expertise areas and had no COIs. Two of the five final reviewers are affiliated with consulting companies; the others are independent consultants. Battelle established subcontracts with the panel members when they indicated their willingness to participate and confirmed the absence of COIs through a signed COI form. USACE was given the list of candidate panel members, but Battelle selected the final Panel.

Table B-1 presents an overview of the credentials of the final five members of the Panel and their qualifications in relation to the technical evaluation criteria. More detailed biographical information regarding each panel member and his area of technical expertise is given in Section B.3.

Table B-1. Lower Yellowstone River Intake DEIS IEPR Panel: Technical Criteria and Areas of Expertise

Technical Criterion	Pugh	Hubert	Milon	Rudolph	Philips
Civil Works Planning					
Minimum of 10 years of demonstrated experience in public works planning	X				
Familiar with USACE plan formulation processes, procedures, and standards	X				
Familiar with evaluation of alternative plans for ecosystem restoration	X				
Experience related to evaluating traditional Civil Works plan benefits associated with ecosystem restoration, to include experience in USACE methodologies for performing cost-effectiveness/incremental cost analysis (CE/ICA)	X				
Experience in determining the cost effectiveness of alternatives evaluations	X				
Fisheries Biology and Environmental Law Compliance					
At least 15 years of experience directly related to water resource environmental evaluation or review and National Environmental Policy Act (NEPA) compliance		X			
Minimum MS degree or higher in a related field		X			
Familiar with the habitat, fish, and wildlife species that may be affected by the project alternatives in this study area		X			
Familiar with fisheries species (spawning, rearing, freshwater migration), and has knowledge of riverine systems.		X			
An expert in compliance with additional environmental laws, policies, and regulations, including compliance with Fish and Wildlife Coordination Act and Endangered Species Act (ESA)		X			
Particular knowledge of construction impacts on fisheries and aquatic ecology of the Yellowstone River and warm water fish passage		X			
Economics					
At least 10 years of demonstrated experience directly related to water resource economic evaluation or review			X		
Minimum Master's degree or higher in economics			X		
Two years of experience in reviewing Federal water resource economic documents justifying construction efforts			X		
Experience related to evaluating traditional National Ecosystem Restoration plan benefits associated with ecosystem projects, to include experience in USACE methodologies for performing CE/ICA analysis			X		
Experience in determining cost effectiveness of fish passage			X		

Table B-1. Lower Yellowstone River Intake DEIS IEPR Panel: Technical Criteria and Areas of Expertise (continued)

Technical Criterion	Pugh	Hubert	Milon	Rudolph	Philips
Geotechnical Engineering					
Registered professional engineer with a minimum of 10 years of experience in geotechnical engineering or a professor from academia with extensive background in large river processes in complex systems and geotechnical theory and practice				X	
Minimum Master's degree or higher in engineering with an emphasis on large river engineering projects, geomorphology, sediment transport and design of secondary channels in large river systems; and design and construction of engineered structures in large rivers				X	
Experienced in the design and construction of foundations, earthworks, pavement subgrades required for the construction of low-head dams				X	
Familiarity with large, complex Civil Works projects with high public and interagency interests				X	
Hydraulic Engineering					
Registered professional engineer with a minimum of 10 years of experience in hydraulic engineering with an emphasis on large river engineering projects in complex systems, or a professor from academia with extensive background in large river processes and hydraulic theory and practice					X
A minimum Master's degree or higher in engineering					X
Experience in hydraulic engineering with an emphasis on large public works projects associated with ecosystem restoration and natural channel design					X
Familiar with Hydrologic Engineering Center-River Analysis System (HEC-RAS) 4.0 and similar USACE hydrologic and hydraulic computer models					X
Experienced with both computer simulation and physical modeling of large river systems					X

B.3 Panel Member Qualifications

Steven Pugh	
Role: Civil Works Planning	**Affiliation:** Independent Consultant

Mr. Pugh is an independent consultant with 24 years of direct planning experience, including 7 years with the USACE Baltimore District Planning Division and 7 years as an independent consultant providing technical review of USACE Civil Works planning studies and models. He earned his B.S. in natural resources management from the University of Maryland in 1997 and is a graduate of the USACE Planning Associates Program class of 2003. He is an expert in the field of ecosystem restoration, Civil Works planning, plan formulation, and the evaluation of ecosystem restoration projects and watershed studies. Mr. Pugh worked for the USACE Baltimore District Planning Division - Civil Works Branch for 7 years, where he participated as a planner and ecologist on approximately 50 Civil Works studies and projects. He was a PROSPECT course developer and instructor for the course "Planning for Ecosystem Restoration" and is knowledgeable of current Civil Works planning policies, methodologies, and procedures. He is also practiced in the development and application of ecosystem models such as Habitat Evaluation Procedures (HEP) and has worked on large USACE ecosystem restoration studies such as the Chesapeake Marshlands Restoration Study, which evaluated the restoration of up to 20,000 acres of marshlands, the Lower Potomac River Watershed Study, and the Anacostia River Watershed Restoration Comprehensive Plan.

Mr. Pugh is proficient in the application of the Institute for Water Resources (IWR) Planning Suite and used it on USACE studies as an employee of the Baltimore District. He also assisted in instructing the IWR Planning Suite module for the PROSPECT course “Planning for Ecosystem Restoration,” and participated on the External Independent Technical Review team for the IWR Planning Suite Multi-Criteria Decision Analysis Module. In addition, he has participated in cost-effectiveness/incremental cost analysis (CE/ICA) on many Civil Works planning studies as a planner and ecologist with the USACE Baltimore District and has assisted in teaching modules on CE/ICA in the context of multi-purpose watershed and ecosystem restoration studies for the PROSPECT course. Mr. Pugh has been a panel member on several IEPR teams reviewing large-scale ecosystem restoration studies and on several planning model review teams for the certification of models to be used in CE/ICA. Mr. Pugh is an active member of the Society for Ecological Restoration.

Wayne Hubert, Ph.D.	
Role: Fisheries Biology and Environmental Law Compliance	**Affiliation:** Hubert Fisheries Consulting, LLC

Dr. Hubert is President/CEO of Hubert Fisheries Consulting LLC with more than 40 years of experience as an aquatic biologist. Dr. Hubert earned his Ph.D. at Virginia Polytechnic Institute and State University in 1979 and is a Certified Fisheries Professional with the American Fisheries Society (AFS).

Dr. Hubert has conducted research on native riverine fishes of the Mississippi/Missouri River system, including warm-water tributaries to the Lower Yellowstone River, since 1972. He was employed by the Tennessee Valley Authority (1972-1979) where his work focused on riverine fishes. From 1979 to 1982, he served as the Assistant Leader of the Iowa Cooperative Fisheries Research Unit at Iowa State University, where he conducted research on upper Mississippi River fishes, particularly paddlefish and shovelnose sturgeon. From 1982 to 2010, Dr. Hubert served as the Assistant Leader and Leader of the Wyoming Cooperative Fish and Wildlife Research Unit at the University of Wyoming. There, he conducted numerous fisheries research projects in the Lower Yellowstone River watershed upstream from Intake, Montana, on the Powder, Bighorn, and Tongue rivers. These projects addressed needs for information on the ecology of native fishes as a result of human activities in the Yellowstone River drainage. Specific research included studies on seasonal movements, habitat associations, and effects of barriers to movements on shovelnose sturgeon, channel catfish, sauger, and burbot, as well as research on factors affecting communities of small fishes. Through his research, Dr. Hubert has published numerous reports and is familiar with the literature on the Lower Yellowstone River and Upper Missouri River systems, the ecology of the native fishes in these rivers, and the water development issues related to preservation of native fishes in these rivers.

In addition to his research on native riverine fishes, Dr. Hubert has been familiar with the National Environmental Policy Act (NEPA) since its inception in 1969 and taught the requirements of the Act in courses at the University of Wyoming from 1982 to 2010. Furthermore, he has contributed information to Federal agencies for environmental assessments (EAs) and environmental impact statements (EISs) throughout his career.

Dr. Hubert has been involved with rare fish issues and the Endangered Species Act (ESA) since its passage in 1973, and while at the University of Wyoming, he taught courses that addressed the processes and requirements of the ESA. Additionally, substantial portions of his research program in Iowa and Wyoming focused on fish species listed as threatened or endangered or species in decline that may warrant listing.

Dr. Hubert has been very active in his field. He was elected as Second Vice President of the AFS in 2007 and served as an officer for the next 5 years, including President (2010 to 2011). Additionally, he has served as an associate editor and editor of the North American Journal of Fisheries Management. He has been the recipient of several AFS awards, including the Award of Excellence for Outstanding Career Accomplishments, Colorado/Wyoming Chapter; the Award for Excellence in Fisheries Education; and the Award of Excellence, Western Division. He was inducted to the Fisheries Management Hall of Excellence, AFS, in 2006 and was appointed as an AFS Fellow in 2015.

J. Walter Milon, Ph.D.

Role: Economics	**Affiliation:** Independent Consultant

Dr. Milon is the Provost's Distinguished Research Professor in the Department of Economics at the University of Central Florida's College of Business Administration, where he teaches graduate-level courses in benefit-cost and social impact analyses, economic theory, and natural resource and environmental economics. He earned his Ph.D. in economics from Florida State University in 1978 and

has more than 30 years of experience in natural resource and environmental economics and water resource economic evaluation. He is a member of the Association of Environmental and Resource Economists and the American Economics Association.

Dr. Milon has more than 10 years of experience reviewing Federal water resource economic documents justifying construction efforts. He has participated in the planning and technical advisory for the USACE Florida Everglades Restudy (1995 to 1999) and was lead economist on five USACE IEPRs, including the Everglades C-111 construction project (2009), the Louisiana Coastal Areas Restoration Project (2009 to 2011), the White Oak Bayou, Texas, flood control plan (2011), and the Cano Martin Pena Ecosystem Restoration Project, San Juan, Puerto Rico (2013).

Dr. Milon is experienced in the evaluation of traditional National Ecosystem Restoration plan benefits associated with ecosystem restoration. In addition to more than 30 years of experience in teaching and research related to estimation of ecosystem benefits and ecosystem restoration, he has been a member of the National Research Council Committee with USACE Water Resources Science, Engineering, and Planning. He is experienced in USACE methodologies for performing CE/ICA and has over 30 years of experience in teaching and research related to cost-benefit and CE/ICA analysis. He is also experienced in determining the CE of fish passages, as demonstrated by his 20 years of experience in research and economic analysis associated with fisheries economics and recreational fishing. Additionally, he has supervised several fisheries research projects for the National Marine Fisheries Service and served as technical expert for Federal fishery management councils and journals.

Through his research and teaching experiences, Dr. Milon has authored an economics book and more than 15 book chapters; 45 reports; and 40 journal articles. He has been involved with more than 25 university contracts and grants and serves as a private economic consultant to both government and private clients.

R. William Rudolph, P.E., G.E.

Role: Geotechnical Engineering	**Affiliation:** Independent Consultant

Mr. Rudolph is the an independent, licensed P.E., G.E., and Principal Engineer with 37 years of experience on a wide variety of geotechnical engineering projects throughout the western United States. He earned his M.S. degree in geotechnical engineering from the University of California at Berkeley in 1978 and is an active member of the American Society of Civil Engineers (ASCE) and the Coasts, Oceans, Ports, and Rivers Institute.

Mr. Rudolph has project experience with large river and Civil Works projects with high levels of public and interagency interest, including his work on the American, Sacramento, and San Joaquin Rivers near Sacramento, California, and projects on the Mississippi River in Illinois, Missouri, and New Orleans, Louisiana. He has consulted on projects involving weirs, drop structures, embankments, and low-head dams for water diversion and flood control, including flood control projects in Contra Costa and Napa counties, California. He has been a principal consultant on more than 150 small, earth-fill dams and reservoirs for the Vineyard Development Water Supply Reservoirs in California, and has consulted on site selection, including geologic and seismic assessment, material sources, and design alternatives. Several

of the projects involved diversion structures within nearby rivers. Many of the projects are in sensitive environments and required coordination with the Department of Fish and Game for spillway design and modification, including seepage cutoffs and construction of paved weirs for low-head dams.

Additionally, Mr. Rudolph has supervised geomorphologic studies in support of geotechnical evaluations of complex river systems and levee designs across the United States. He has also worked closely with sediment transport modeling on numerous studies and has provided geotechnical input to the sediment transport models.

Mr. Rudolph is experienced in the design and construction of secondary channels on large river systems and has been involved in many flood control projects with elements including secondary channels in large river systems such as the Truckee River in Reno, Nevada. His experience in the design and construction of engineered structures in large river systems and estuaries is reflected in his involvement with projects that included the construction of weirs, bridge piers, and intake and outlet structures. He has extensive design and construction experience with foundations and earthworks for low-head dams, and has designed and evaluated various deep foundations, including driven piles and cast-in-drilled-hole piles. He also has extensive experience with the design and construction of ground improvement for enhanced foundation support and lateral stability, including cement deep soil mixing columns, stone columns, and grouting. Mr. Rudolph has designed and monitored large earthworks, including earth-fill dams and mass grading, and has designed and monitored many earth-fill dams and reservoirs.

Christopher Philips, P.E., CFM

Role: Hydraulic Engineering	**Affiliation:** Riverbend Engineering

Mr. Philips is the owner and senior engineer at Riverbend Engineering in Albuquerque, New Mexico. He earned his Master's degree in civil engineering, with a specialty in water resources, in 1996 from the University of New Mexico. He is a registered P.E. in New Mexico, Colorado, and Texas; a certified floodplain manager in New Mexico; and Natural Resources Conservation Service (NRCS) Technical Services Provider in New Mexico and Colorado. He has 30 years of experience in hydrologic and hydraulic engineering, with an emphasis on large public works projects associated with ecosystem restoration and natural channel design. He has designed more than 60 river restoration, fish habitat, and fish passage/barrier projects, most of which were based on natural channel design methods. His design work has included all types of flood conveyance systems: closed conduit and open channel, with and without detention facilities, energy dissipaters, weirs, and side-channel spillways. He also designed more than 50 irrigation diversion structures on rivers.

Mr. Philips is familiar with USACE hydrologic and hydraulic computer models, including HEC-RAS 4.0, and has project experience using HEC-1, HEC-2, and HEC-Hydrologic Modeling System (HEC-HMS) models. Mr. Philips' specific hydraulic modeling experience includes two Alamogordo Flood Control channels for the USACE Albuquerque District; the Rio Fernando in Taos, New Mexico; the San Juan River at Pagosa Springs, Colorado; La Cueva arroyo in Albuquerque, New Mexico; and the Uncompahgre River in Ridgway, Colorado. Additionally, he is experienced with both computer simulation and physical modeling of large river systems and has project experience using HEC-6 and SAMwin.

Relevant projects include watershed-based sedimentation studies and reach level sediment transport analyses on the Zuni River and sediment transport studies on numerous arroyos in New Mexico.

Mr. Philips' firm, Riverbend Engineering, has its own in-house laboratory for physical hydraulic modeling of river systems (fixed boundary) and has combined numeric and physical scale modeling of hydraulic structures on the San Juan and Animas Rivers. In addition to his work experiences, he actively participates in related professional societies, including the ASCE and the American Water Resources Association.

APPENDIX C

Final Charge to the IEPR Submitted to USACE on June 9, 2016 for the Lower Yellowstone River Intake DEIS Project

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CHARGE QUESTIONS AND GUIDANCE TO THE PANEL MEMBERS FOR THE IEPR OF THE LOWER YELLOWSTONE INTAKE DIVERSION DAM FISH PASSAGE PROJECT, MONTANA DRAFT ENVIRONMENTAL IMPACT STATEMENT

BACKGROUND

The United States Army Corps of Engineers (USACE) and the U.S. Bureau of Reclamation (Reclamation) have prepared an Environmental Impact Statement (EIS) to analyze direct, indirect, and cumulative effects associated with actions to improve fish passage at the Lower Yellowstone Intake Diversion Dam (Intake Diversion Dam), Dawson County, Montana. The proposed Federal action is to improve passage for the endangered pallid sturgeon and other native fish at the Intake Diversion Dam.

Reclamation's Lower Yellowstone Project (LYP) is located in eastern Montana and western North Dakota. The Intake Diversion Dam is located approximately 70 miles upstream of the confluence of the Yellowstone and Missouri rivers near Glendive, Montana (Figure 1).

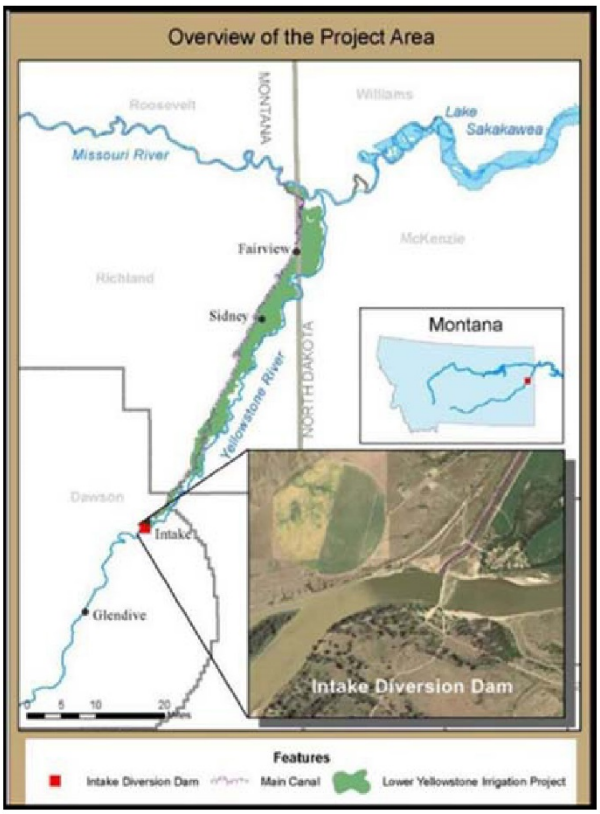

Figure 1. Lower Yellowstone Intake Diversion Dam Fish Passage Project

The action area for the EIS is defined as the Yellowstone River from the Cartersville diversion dam at river mile 237 downstream to its confluence with the Missouri River; the Missouri River downstream to

Lake Sakakawea in North Dakota; and lands serviced by the four irrigation districts that receive waters from the headworks and main irrigation water distribution canal served by the Intake Diversion Dam (Yellowstone Irrigation Districts #1 and #2, Intake Irrigation District, and Savage Irrigation District). District lands are located in Dawson, Wibaux, and Richland counties, Montana, and McKenzie and Williams counties, North Dakota.

The LYP was authorized by the Secretary of the Interior on May 10, 1904. Construction of the LYP began in 1905 and included the Intake Diversion Dam (also known as Yellowstone River Diversion Dam)—a 12-foot-high wood and stone diversion dam that spans the Yellowstone River and diverts water into the Main Canal for irrigation. The LYP was authorized to provide a dependable water supply sufficient to irrigate approximately 54,300 acres of land on the west bank of the Yellowstone River. Water is also supplied to irrigate approximately 830 acres in the Intake Irrigation Unit and 2,200 acres in the Savage Unit. Both of the smaller irrigation projects pump water from the Main Canal. The average annual volume of water diverted for these projects is 327,046 acre-feet.

The U.S. Fish and Wildlife Service (USFWS) listed the pallid sturgeon as endangered under the Endangered Species Act (ESA) in 1990. Numerous studies suggest that the Intake Diversion Dam impedes upstream migration of pallid sturgeon and their access to spawning and larval drift habitats. The Lower Yellowstone River is considered by the USFWS to provide one of the best opportunities for recovery of pallid sturgeon. Both Reclamation and USACE have general responsibility under Section 7(a)(1) of the ESA to use their authorities to conserve and recover Federally listed species and ecosystems upon which they depend. In addition, both agencies need to avoid jeopardizing the pallid sturgeon in funding or carrying out any agency action per Section 7(a)(2) of the Act.

Section 7(a)(2) requires each Federal agency to consult on any action authorized, funded, or carried out by the agency to ensure it does not jeopardize the continued existence of any endangered or threatened species. Reclamation has been in formal consultation with USFWS to identify potential conservation measures to minimize adverse effects to pallid sturgeon associated with continued operation of the LYP. The Pallid Sturgeon Recovery Plan specifically identifies providing passage at the Intake Diversion Dam to protect and restore pallid sturgeon populations. By improving passage at the Intake Diversion Dam, approximately 165 river miles of spawning and larval drift habitat would become accessible in the Yellowstone River and major tributaries such as the Powder River.

In 2010, Reclamation and USACE authorized the construction of a rock ramp and new screened headworks with the completion of an Environmental Assessment (EA) and Finding of No Significant Impact (FONSI). The construction of the new headworks is complete and began operation during the 2012 irrigation season. During the final design of the rock ramp, following the release of the 2010 EA and FONSI, important new information on the design, constructability, and sustainability of the proposed rock ramp surfaced along with new information regarding pallid sturgeon movement, which led to a reevaluation of fish passage options.

The purpose of the proposed action is to improve passage of pallid sturgeon and other native fish at the Intake Diversion Dam, provide ecosystem restoration, and continue the effective delivery of the Lower Yellowstone Irrigation Project's water right.

Improvements to fish passage at the Intake Diversion Dam will support migration for numerous fish species and contribute to the sustainability of fish populations in the Yellowstone River. This project will support ecosystem functions by restoring fish habitat on a population level, throughout the Lower Yellowstone River ecosystem, including the Missouri River.

The selected alternative would require the construction of a new concrete weir to elevation 1,990.5 feet. This new weir is required to reliably deliver water for irrigation purposes and fish passage. For fish

passage, the alternative includes the excavation and construction of an 11,150-foot-long bypass channel. This channel will divert approximately 13% to 15% of the total Yellowstone River flows. The bypass channel will be designed and constructed to the criteria specified by USFWS for flows, depths, and velocities. The selected alternative was identified as the preferred alternative and it is also considered to be the least costly alternative.

A draft EA was completed on the Intake Fish Passage Project in 2013, which underwent independent external peer review (IEPR) overseen by Battelle. A final EA and FONSI were issued in 2015. The Defenders of Wildlife and the Natural Resources Defense Council filed a lawsuit against USACE, Reclamation, and USFWS alleging violations of the National Environmental Policy Act (NEPA), ESA, and Clean Water Act (CWA). U.S. Federal Judge Brian Moore signed a stipulated stay agreement on the lawsuit in January 2016 ordering USACE and Reclamation to complete an EIS by the end of 2016.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the Lower Yellowstone River Project, Montana Intake Dam Modification Supplemental (Amended) Analysis to the 26 April 2010 Environmental Assessment and Appendices (hereinafter: Lower Yellowstone River Intake DEIS IEPR) in accordance with the Department of the Army, USACE, Water Resources Policies and Authorities' *Civil Works Review* (Engineer Circular [EC] 1165-2-214, dated December 15, 2012), and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (December 16, 2004).

Peer review is one of the important procedures used to ensure that the quality of published information meets the standards of the scientific and technical community. Peer review typically evaluates the clarity of hypotheses, validity of the research design, quality of data collection procedures, robustness of the methods employed, appropriateness of the methods for the hypotheses being tested, extent to which the conclusions follow from the analysis, and strengths and limitations of the overall product.

The purpose of the IEPR is to assess the "adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (EC 1165-2-214; p. D-4) for the Lower Yellowstone River Intake DEIS. The IEPR will be limited to technical review and will not involve policy review. The IEPR will be conducted by subject matter experts (i.e., IEPR panel members) with extensive experience in Civil Works planning, fisheries biology and environmental law compliance, economics, geotechnical engineering, and hydraulic engineering issues relevant to the project. They will also have experience applying their subject matter expertise to ecosystem restoration.

The Panel will be "charged" with responding to specific technical questions as well as providing a broad technical evaluation of the overall project. Per EC 1165-2-214, Appendix D, review panels should identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods. Review panels should be able to evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable. Reviews should focus on assumptions, data, methods, and models. The panel members may offer their opinions as to whether there are sufficient analyses upon which to base a recommendation.

DOCUMENTS PROVIDED

The following is a list of documents, supporting information, and reference materials that will be provided for the review.

Documents for Review

The following documents are to be reviewed by designated discipline:

Title	Actual No. of Pages	Required Disciplines
Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana Draft EIS	734	All Disciplines
Appendix A – Engineering	527	Hydraulic Engineer, Geotechnical Engineer
Appendix B – Cost Engineering	173	Economist
Appendix C – Section 404(b)(1)	86	Fisheries Biologist and Environmental Law Compliance
Appendix D – Fish Passage Connectivity Index and Cost Effectiveness and Incremental Cost Analysis	31	Fisheries Biologist and Environmental Law Compliance, Economist
Appendix E – Monitoring and Adaptive Management	42	Fisheries Biologist and Environmental Law Compliance, Civil Works Planner
Appendix F – Correspondence	91	All Disciplines
Public Comments	50*	All Disciplines
Total Page Count	1,734	

* - estimated page count

Documents for Reference

- USACE guidance *Civil Works Review,* (EC 1165-2-214, December 15, 2012)
- Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (December 16, 2004)
- USACE Climate Change Adaptation Plan (June 2014)

SCHEDULE

This schedule is based on the May 31, 2016, receipt of the final review documents. Note that dates presented in the schedule below could change due to panel member and USACE availability.

Task	Action	Due Date
Conduct Peer Review	Battelle sends review documents to panel members	6/6/2016
	Battelle convenes kick-off meeting with panel members	6/6/2016
	Battelle convenes kick-off meeting with USACE and panel members	6/6/2016
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	6/20/2016
	Panel members complete their individual reviews	7/5/2016
Prepare Final Panel Comments and Review Public Comments	Battelle provides talking points for Panel Review Teleconference to panel members	7/7/2016
	Battelle convenes Panel Review Teleconference	7/8/2016
	Battelle provides Final Panel Comment templates and instructions to panel members	7/8/2016
	Panel members provide draft Final Panel Comments to Battelle	7/18/2016
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	7/19-26/2016
	Panel finalizes Final Panel Comments	7/27/2016
	Battelle receives public comments from USACE	7/18/2016
	Battelle sends public comments to Panel	7/19/2016
	Panel completes its review of public comments	7/22/2016
	Battelle and Panel review Panel's responses to public comments	7/25/2016
	Panel drafts Final Panel Comment for public comments, if necessary	7/26/2016
	Panel finalizes Final Panel Comment regarding public comments	7/28/2016
Review Final IEPR Report	Battelle provides Final IEPR Report to panel members for review	8/1/2016
	Panel members provide comments on Final IEPR Report	8/3/2016
	*Battelle submits Final IEPR Report to USACE	8/5/2016
	USACE Planning Center of Expertise (PCX) provides decision on Final IEPR Report acceptance	8/12/2016
Comment/ Response Process	Battelle inputs Final Panel Comments to Design Review and Checking System (DrChecks) and provides Final Panel Comment response template to USACE	8/16/2016
	Battelle convenes teleconference with Panel to review the Comment Response process	8/16/2016
	USACE Project Delivery Team (PDT) provides draft Evaluator Responses to USACE PCX for review	9/9/2016
	USACE PCX reviews draft Evaluator Responses and works with USACE PDT regarding clarifications to responses, if needed	9/15/2016
	USACE PCX provides draft PDT Evaluator Responses to Battelle	9/16/2016

Task	Action	Due Date
	Battelle provides draft PDT Evaluator Responses to panel members	9/20/2016
	Panel members provide draft BackCheck Responses to Battelle	9/23/2016
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	9/26/2016
	Battelle convenes Comment-Response Teleconference with panel members and USACE	9/27/2016
	USACE inputs final PDT Evaluator Responses to DrChecks	10/4/2016
	Battelle provides final PDT Evaluator Responses to panel members	10/5/2016
	Panel members provide final BackCheck Responses to Battelle	10/11/2016
	Battelle inputs panel members' final BackCheck Responses to DrChecks	10/12/2016
	*Battelle submits pdf printout of DrChecks project file	10/12/2016

* indicates deliverables

CHARGE FOR PEER REVIEW

Members of this IEPR Panel are asked to determine whether the technical approach and scientific rationale presented in the Lower Yellowstone River Intake DEIS are credible and whether the conclusions are valid. The Panel is asked to determine whether the technical work is adequate, competently performed, and properly documented; satisfies established quality requirements; and yields scientifically credible conclusions. The Panel is being asked to provide feedback on economic, engineering, environmental resource, and plan formulation data. The panel members are not being asked whether they would have conducted the work in a similar manner.

Specific questions for the Panel (by report section or appendix) are included in the general charge guidance, which is provided below.

General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the Lower Yellowstone River Intake DEIS. Please focus your review on the review materials assigned to your discipline/area of expertise and technical knowledge. Even though there are some sections with no questions associated with them, that does not mean that you cannot comment on them. Please feel free to make any relevant and appropriate comment on any of the sections and appendices you were asked to review. In addition, please note the following guidance. Note that the Panel will be asked to provide an overall statement related to 2 and 3 below per USACE guidance (EC 1165-2-214; Appendix D).

1. Your response to the charge questions should not be limited to a “yes” or “no.” Please provide complete answers to fully explain your response.

2. Assess the adequacy and acceptability of the economic and environmental assumptions and projections, project evaluation data, and any biological opinions of the project study.

3. Assess the adequacy and acceptability of the economic analyses, environmental analyses, engineering analyses, formulation of alternative plans, methods for integrating risk and uncertainty, and models used in evaluating economic or environmental impacts of the proposed project.

4. If appropriate, offer opinions as to whether there are sufficient analyses upon which to base a recommendation.

5. Identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods.

6. Evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable.

7. Please focus the review on assumptions, data, methods, and models.

Please **do not** make recommendations on whether a particular alternative should be implemented, or whether you would have conducted the work in a similar manner. Also please **do not** comment on or make recommendations on policy issues and decision making. Comments should be provided based on your professional judgment, **not** the legality of the document.

1. If desired, panel members can contact one another. However, panel members **should not** contact anyone who is or was involved in the project, prepared the subject documents, or was part of the USACE Agency Technical Review (ATR).

2. Please contact the Battelle Project Manager (Lynn McLeod, mcleod@battelle.org) or Program Manager (Rachel Sell; sellr@battelle.org) for requests or additional information.

3. In case of media contact, notify the Battelle Program Manager, Rachel Sell (sellr@battelle.org) immediately.

4. Your name will appear as one of the panel members in the peer review. Your comments will be included in the Final IEPR Report, but will remain anonymous.

Please submit your comments in electronic form to Lynn McLeod, **mcleod@battelle.org**, no later than July 5, 2016, 10 pm ET.

Independent External Peer Review

for the

Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana Draft Environmental Impact Statement

Charge Questions and Relevant Sections as Supplied by USACE

The following outlines the objectives of the Independent External Peer Review (IEPR) for the subject study and identifies specific items for consideration for the IEPR Panel.

The objective of the IEPR is to obtain an independent evaluation of whether the interpretations of analysis and conclusions based on analysis are reasonable for the subject study. The IEPR Panel is requested to offer a broad evaluation of the overall study decision document in addition to addressing the specific technical and scientific questions included in the Review Charge. The Panel has the flexibility to bring important issues to the attention of decision makers, including positive feedback or issues outside those specific areas outlined in the Review Charge. The Panel can use all available information to determine what scientific and technical issues related to the decision document may be important to raise to decision makers. This includes comments received from agencies and the public as part of the public review process.

The Panel review is to focus on scientific and technical matters, leaving policy determinations for USACE and the Army. The Panel should not make recommendations on whether a particular alternative should be implemented or present findings that become “directives” in that they call for modifications or additional studies or suggest new conclusions and recommendations. In such circumstances, the Panel would have assumed the role of advisors as well as reviewers, thus introducing bias and potential conflict in their ability to provide objective review.

Panel review comments are to be structured to fully communicate the Panel’s intent by including the comment, why it is important, any potential consequences of failure to address, and suggestions on how to address the comment.

The Panel is asked to consider the following items as part of its review of the decision document and supporting materials.

Broad Evaluation Review Charge Questions

1. Is the need for and intent of the decision document clear?

2. Does the decision document adequately address the stated need and intent relative to scientific and technical issues?

3. Given the need for and intent of the decision document, assess the adequacy and acceptability of the project evaluation data used in the study analyses.

4. Given the need for and intent of the decision document, assess the adequacy and acceptability of the economic, environmental, and engineering assumptions that underlie the study analyses.

5. Given the need for and intent of the decision document, assess the adequacy and acceptability of the economic, environmental, and engineering methodologies, analyses, and projections.

6. Given the need for and intent of the decision document, assess the adequacy and acceptability of the models used in the evaluation of existing and future without-project conditions and of economic or environmental impacts of alternatives.

7. Given the need for and intent of the decision document, assess the adequacy and acceptability of the methods for integrating risk and uncertainty.

8. Given the need for and intent of the decision document, assess the adequacy and acceptability of the formulation of alternative plans and the range of alternative plans considered.

9. Given the need for and intent of the decision document, assess the adequacy and acceptability of the quality and quantity of the surveys, investigations, and engineering sufficient for conceptual design of alternative plans.

10. Given the need for and intent of the decision document, assess the adequacy and acceptability of the overall assessment of significant environmental impacts and any biological analyses.

11. Evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable.

12. Assess the considered and preferred alternatives from the perspective of systems, including systemic aspects being considered from a temporal perspective and addressing the potential effects of climate change.

Specific Technical and Scientific Review Charge Questions

Plan Formulation/EIS

13. Comment on whether you agree or disagree with how the preferred alternative was formulated and selected. Comment on the plan formulation. Does it meet the study objectives and avoid violating the study constraints?

14. Do you agree with the general analyses of the existing social, financial, and natural resources within the study area?

15. For your particular area of expertise, provide an in-depth review of whether the analyses of the existing social, financial, and natural resources within the project area are sufficient to support the estimate of the impacts of the array of alternatives.

16. Given your area of expertise, does the EIS appropriately address the existing conditions of all resources pertinent to the study?

17. Were the potential effects of climate change on alternatives addressed?

18. Was a reasonably complete array of possible measures considered in the development of alternatives?

19. Please comment on the screening of the proposed alternatives. Are the screening criteria appropriate? In your professional opinion, are the results of the screening acceptable? Were any measures or alternatives screened out too early?

20. Are the scope and detail of the potential adverse effects that may arise as a result of project implementation sufficiently described and supported?

21. Have the short- and long-term impacts associated with the alternatives been adequately discussed and evaluated?

22. Are the descriptions of projected impacts on aquatic resources, vegetated resources, water quality and salinity, fisheries, recreation, hydrology, flow and water levels, socioeconomics, cultural resources, and soils and water bottoms for each alternative reasonable and factually supported?

23. Are cumulative impacts adequately described and discussed? If not, please explain.

24. Is it clear that the restored ecological resource quality will be sustainable over the long run?

25. In terms of sufficient geophysical support (hydrology and geomorphology), are the risks facing successful restoration of sustainable ecological resource quality clearly shown to be managed, and are any residual risks identified?

26. In terms of sufficient environmental chemistry, are the risks facing successful restoration of sustainable ecological resource quality clearly shown to be managed, and are any residual risks identified?

27. In terms of sufficient biological support (i.e., food, habitat, and sufficiency of the preferred alternative to accomplish habitat goals), are the risks facing successful restoration of sustainable ecological resource quality clearly shown to be managed, and are any residual risks identified?

28. In terms of changes in climate and in the influential ecoregion (i.e., major land use changes), are the risks facing successful restoration of sustainable ecological resource quality clearly shown to be managed, and are any residual risks identified?

29. Is adaptive management adequately addressed?

30. Are the required long-term commitments (both Federal and non-Federal) to sustaining the restored ecological resources adequately described and adequately demonstrated?

<u>Engineering</u>

31. Was the hydrology discussion sufficient to characterize current baseline conditions and to allow for evaluation of how forecasted conditions (with and without proposed actions) are likely to affect hydrologic conditions? Please comment on the completeness of the discussion on the relationship between subsurface hydrology and the hydrodynamics of the project area.

32. Are future operation, maintenance, repair, replacement, and rehabilitation efforts adequately described, and are the estimated costs of those efforts reasonable for each alternative?

33. Are the descriptions of the risk and uncertainties associated with the level of detail in the designs that comprise the preferred alternative sufficiently comprehensive?

34. Were the technical assumptions outlined in the engineering appendix sufficiently comprehensive and conservative for a feasibility study, given the level of design detail?

35. Are the key assumptions used to complete the cost estimating adequate? Is anything missing? In your opinion, do the major findings of the cost estimates provide adequate support for scheduling, budgeting, and project control purposes?

36. Were appropriate engineering solutions (not engineered solutions) developed for achieving planning objectives related to ecosystem processes?

Economics

37. Was the methodology used to conduct the incremental cost analysis adequate and valid?

38. Was the Fish Passage Connectivity Index (FPCI) applied in an appropriate manner?

39. Are the required long-term commitments (both Federal and non-Federal) to sustaining the restored ecological resources adequately described and adequately demonstrated?

General/Summary

40. Was the best available science used to develop the alternatives and complete the impact analysis?

41. What is the most important concern you have with the document or its appendices that was not covered in your answers to the questions above?

42. Please identify the most critical concerns (up to five) you have with the project and/or review documents. These concerns can be (but do not need to be) new ideas or issues that have not been raised previously.

43. Does information or do concerns raised by the public raise any additional discipline-specific technical concerns with regard to the overall report?

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APPENDIX D

Conflict of Interest Form

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Conflicts of Interest Questionnaire

Independent External Peer Review

LOWER YELLOWSTONE PROJECT, MONTANA, INTAKE DIVERSION DAM MODIFICATION

The purpose of this document is to help the U.S. Army Corps of Engineers identify potential organizational conflicts of interest on a task order basis as early in the acquisition process as possible. Complete the questionnaire with background information and fully disclose relevant potential conflicts of interest. Substantial details are not necessary; USACE will examine additional information if appropriate. Affirmative answers will not disqualify your firm from this or future procurements.

NAME OF FIRM: **Battelle Memorial Institute**
REPRESENTATIVE'S NAME: **Jason M. Jenkins**
TELEPHONE: **614-424-4873**
ADDRESS: **505 King Avenue, Columbus, OH 43201**
EMAIL ADDRESS: **jenkinsj@battelle.org**

I. INDEPENDENCE FROM WORK PRODUCT. Has your firm been involved in any aspect of the preparation of the subject study report and associated analyses (field studies, report writing, supporting research etc.) **No** Yes (if yes, briefly describe):

II. INTEREST IN STUDY AREA OR OUTCOME. Does your firm have any interests or holdings in the study area, or any stake in the outcome or recommendations of the study, or any affiliation with the local sponsor? **No** Yes (if yes, briefly describe):

III. REVIEWERS. Do you anticipate that all expert reviewers on this task order will be selected from outside your firm? No **Yes** (if no, briefly describe the difficulty in identifying outside reviewers):

IV. AFFILIATION WITH PARTIES THAT MAY BE INVOLVED WITH PROJECT IMPLEMENTATION. Do you anticipate that your firm will have any association with parties that may be involved with or benefit from future activities associated with this study, such as project construction? **No** Yes (if yes, briefly describe):

V. ADDITIONAL INFORMATION. Report relevant aspects of your firm's background or present circumstances not addressed above that might reasonably be construed by others as affecting your firm's judgment. Please include any information that may reasonably: impair your firm's objectivity; skew the competition in favor of your firm; or allow your firm unequal access to nonpublic information.

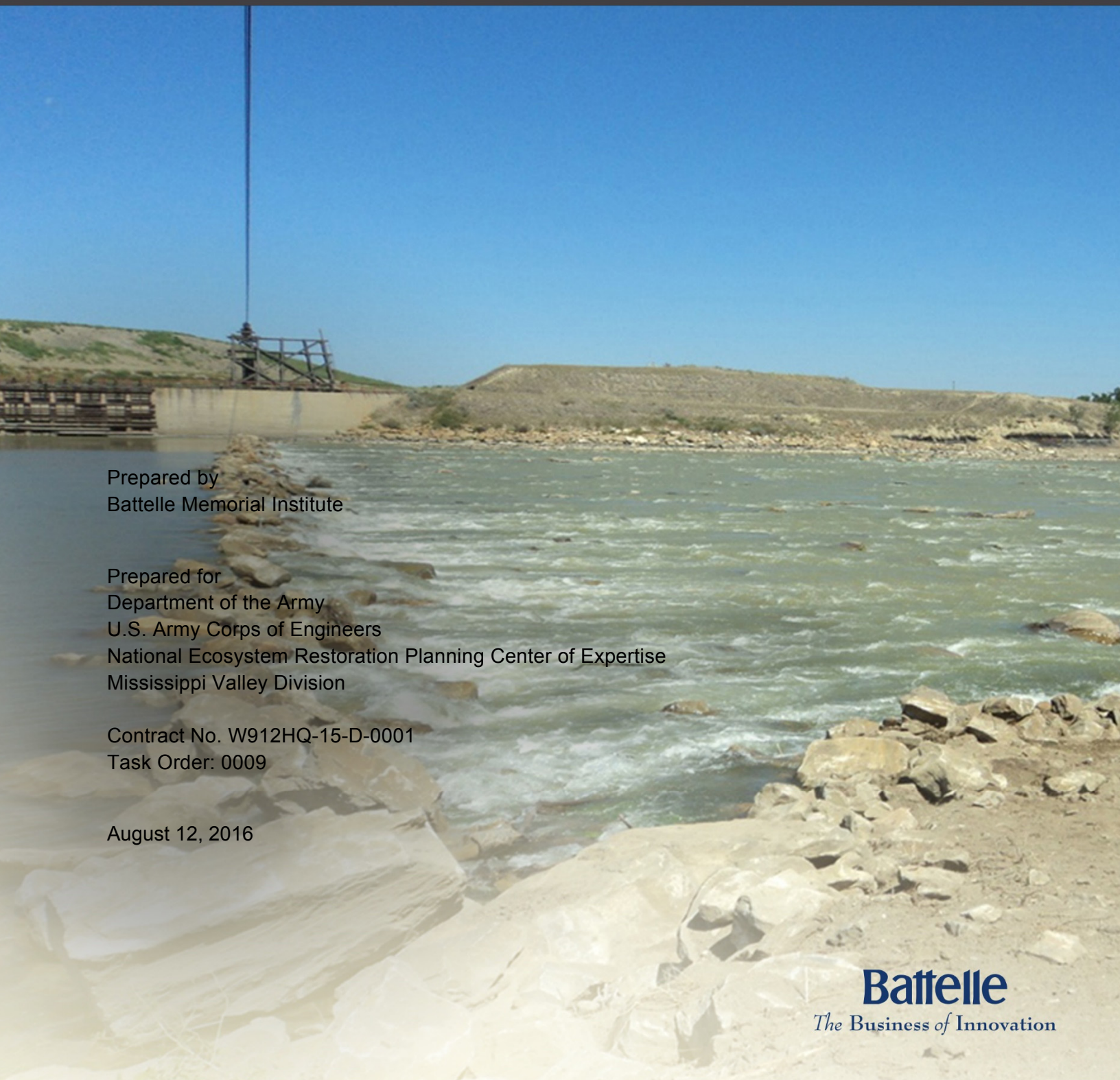
No additional information to report.

Jason Jenkins

5/19/2016
Date

Battelle
The Business *of* Innovation

Addendum to the Final Independent External Peer Review Report for the Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana Draft Environmental Impact Statement



Prepared by
Battelle Memorial Institute

Prepared for
Department of the Army
U.S. Army Corps of Engineers
National Ecosystem Restoration Planning Center of Expertise
Mississippi Valley Division

Contract No. W912HQ-15-D-0001
Task Order: 0009

August 12, 2016

Battelle
The Business of Innovation

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CONTRACT NO. W912HQ-15-D-0001
Task Order: 0009

Addendum to the Final Independent External Peer Review Report for the Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana Draft Environmental Impact Statement

Prepared by

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505 King Avenue
Columbus, Ohio 43201

for

Department of the Army
U.S. Army Corps of Engineers
National Ecosystem Restoration Planning Center of Expertise
Mississippi Valley Division

August 12, 2016

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Table of Contents

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1. INTRODUCTION 1
2. METHODS 1
3. FINAL PANEL COMMENTS 3

LIST OF ACRONYMS

DEIS	Draft Environmental Impact Statement
DrChecks	Design Review and Checking System
EC	Engineer Circular
IEPR	Independent External Peer Review
NEPA	National Environmental Policy Act
USACE	United States Army Corps of Engineers

1. INTRODUCTION

This addendum is a supplement to the Final Independent External Peer Review (IEPR) Report for the Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana Draft Environmental Impact Statement[1] (DEIS: hereinafter: Lower Yellowstone River Intake DEIS IEPR) submitted on August 5, 2016, by Battelle. It was prepared to document activities associated with the IEPR Panel's review of the public comments on the Lower Yellowstone River Intake DEIS.

This addendum contains two additional Final Panel Comments (presented in Section 3) and briefly details the IEPR process that determined the need for, and led to the generation of, these comments. The Final Panel Comments in this addendum are numbered Final Panel Comments 9 and 10, continuing the Final Panel Comment numbering presented in the Lower Yellowstone River Intake DEIS Final IEPR Report, which stopped at Final Panel Comment 8.

2. METHODS

This section summarizes the activities associated with the review of the public and agency comments conducted for this project.

The U.S. Army Corps of Engineers (USACE) received 13,000 comment letters from various state and Federal agencies, non-governmental organizations, and members of the general public. Based on information provided by USACE, of the comment letters received, approximately 10 comment letters provided detailed scientific and technical comments; the remaining comments were general form letters expressing support or opposition.

Battelle requested that USACE provide two categories of comment letters: all of the letters that had scientific and technical comments, plus representative examples of the remaining form letters that encapsulated a general overview of the public's concerns. In accordance with procedures described in the Department of the Army, USACE, Engineer Circular (EC) *Civil Works Review* (EC 1165-2-214)[2], Appendix D, Battelle focused the IEPR Panel's public comment review on assessing scientific and technical issues with regard to the assumptions, data, methods, and models used in the project. Battelle received electronic versions of the requested public comments from USACE on August 2, 2016. Battelle reviewed the comments and then provided them in their original full-text format to the panel members.

Each panel member was asked to independently determine whether the public comments contained any additional scientific or technical concerns regarding the project which were not previously identified and which should be addressed by USACE in the Lower Yellowstone River Intake project documents. The

[1] The official title of the Task Order 0009 award that Battelle received (dated 2016 May 26) from USACE was titled the "Independent External Peer Review Report Lower Yellowstone River Project, Montana Intake Dam Modification Supplemental (Amended) Analysis to the 26 April 2010 Environmental Assessment and Appendices." For clarity and to reflect the actual review documents that underwent peer review, Battelle has used the name of the actual document supplied for review "Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana Draft Environmental Impact Statement" throughout this deliverable.

[2] USACE (2012). Water Resources Policies and Authorities: Civil Works Review. Engineer Circular (EC) 1165-2-214. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. December 15.

Panel was charged with focusing on scientific and technical issues and not policy-related comments, per EC 1165-2-214, Appendix D.

Comments submitted by state and Federal agencies were provided to the Panel "For Information Only." Battelle understands that under the National Environmental Policy Act (NEPA), USACE must address state and Federal agency comments as part of the consultation process; therefore, issues brought up by these agencies, and USACE's subsequent responses, were considered policy related. However, if issues noted in the public letters were also discussed in the agency letters, the Panel noted the agency letters as well.

The Lower Yellowstone River Intake DEIS IEPR panel members received the public and agency comments from Battelle on August 3, 2016. The five Lower Yellowstone River Intake DEIS IEPR panel members reviewed two comment letters from state and Federal agencies as well as 166 emails, letters, and comment cards from a variety of companies, non-profit organizations, and members of the general public. The Lower Yellowstone River Intake DEIS IEPR panel members were required to answer one charge question with regard to the public comments.

1. **Does information or do concerns raised in the public comments raise any additional discipline-specific technical concerns with regard to the overall report?**

The panel members submitted responses to this charge question, and Battelle reviewed those responses to identify any issues, areas of potential conflict, and other overall impressions. Each panel member's individual comments were shared with the full Panel. Battelle then facilitated a teleconference with the panel members to determine if any of their identified issues should be carried forward as Final Panel Comments.

Based on the Panel's review, most of the public comments fell into the category of general support or opposition or were discussed in previous Final Panel Comments submitted in the Lower Yellowstone River Intake DEIS Final IEPR Report. However, by the end of the discussion, the panel members identified two issues within the public comments that needed additional clarifying information in order to strengthen the Lower Yellowstone River Intake DEIS. Each issue was addressed as its own Final Panel Comment to make it easier for USACE to evaluate and respond.

Some concerns noted by the public paralleled the Panel's concerns identified during the IEPR of the Lower Yellowstone River Intake DEIS review documents and documented in previous Final Panel Comments. The Panel did not repeat those concerns in Final Panel Comments 9 or 10. All other concerns raised by agencies and other stakeholders were deemed by Battelle and the Panel to be related to policy and therefore outside the purview of the Panel's review.

All panel members reviewed and provided input on the issues discussed in Final Panel Comments 9 and 10 (presented in Section 3 of this addendum). Battelle prepared this addendum and conducted a final review and edit of Final Panel Comments 9 and 10 for clarity and consistency. There was no direct communication between the Panel and USACE during the review and preparation of the Final Panel Comments.

It is anticipated that Battelle will enter Final Panel Comments 9 and 10 into USACE's Design Review and Checking System (DrChecks), a Web-based software system for documenting and sharing comments on reports and design documents, so that USACE can review and respond to them. USACE will provide an Evaluator Response to Final Panel Comments 9 and 10, and the Panel will respond via BackCheck

Response to the Evaluator Responses. The USACE and Panel responses will be documented in DrChecks. Battelle will provide USACE and the Panel a pdf printout of all DrChecks entries, through comment closeout, as a final deliverable and record of the results of the IEPR and the public and agency comment review.

3. FINAL PANEL COMMENTS

This section presents the full text of Final Panel Comments 9 and 10 prepared by the Lower Yellowstone River Intake DEIS IEPR panel members.

Final Panel Comment 9

Impacts of downstream passage on mortality of drifting fish larvae associated with proposed structures and water intakes under each alternative, including the preferred alternative, are not addressed in the DEIS.

Basis for Comment

The Montana Chapter of the American Fisheries Society (5.MTAFS_Intake_Draft.pdf), and Defenders of Wildlife and Natural Resources Defense Council (6. Defenders and NRDC.pdf, Section C, pages 18-19) state in their public comment submissions that both larval fish drift post spawning and larval fish mortality are important factors in the survival of pallid sturgeon.

Many riverine fishes, including pallid sturgeon, migrate upstream in the spring to spawn, with subsequent drift of fertilized eggs and/or larvae downstream. Flowing water is needed for larval fish to remain suspended in the water column as they grow to the point where they can swim and maintain themselves in the water column. In the case of pallid sturgeon, fisheries scientists who have studied the species in the Yellowstone River have concluded that there is currently not a sufficient length of river distance between the Intake Diversion Dam and Lake Sakakawea for drifting larvae to remain suspended and survive. With the ability of adult pallid sturgeon to migrate upstream beyond the Intake Diversion Dam, it is likely that there will be a sufficient length of river for their larvae to drift in current, survive, and contribute to natural recruitment.

Larval fishes are very fragile and have little or no swimming ability. Consequently, mortality can occur through battering when these fishes drift downstream over dams or pass through turbulent cascades. Further, mortality can occur when larval fishes are removed from a river by entrainment associated with water diversion structures or pumps.

Currently, all of the alternatives considered will, to some degree, contribute to the mortality of larval fishes in the Yellowstone River as the fishes drift downstream over the Intake Diversion Dam or are removed from the river by water diversion structures or pumps. The relative contributions to mortality of larval fishes, especially pallid sturgeon, under each alternative are not provided in the DEIS.

Significance – Medium/High

By not including information on the extent of fish larvae mortality, particularly for the pallid sturgeon, estimates of the benefits to fish populations under the preferred project alternative and other alternatives associated with enhanced upstream fish passage may not be accurate.

Recommendation for Resolution

1. Provide information on the extent of drifting larval fish mortality associated with structures and pumps under the preferred alternative and other alternatives.
2. Document whether the preferred alternative will result in higher or lower levels of larval fish mortality than the other alternatives.

Final Panel Comment 10

The design criteria used to identify the non-dam alternatives do not explain how the multiple pump alternatives were developed.

Basis for Comment

The design criteria used to identify the non-dam alternatives are very general, and it is unclear how the multiple pump alternatives were developed. This uncertainty about the design criteria is reflected in the following DEIS statement:

> The two pumping alternatives have been structured in a way that discrete elements from either alternative could be combined or added to one another to achieve a more optimal alternative if new information indicates such combinations would improve alternative performance, reduce impacts, and/or reduce costs (DEIS p. 2-64).

Several public comments raised issues regarding the design of the non-dam alternatives, including the reliability of the pumping/power supply alternatives (4. USCOE Comment Letter, 12. LYREC Bypass Letter); the number of pumps necessary to meet irrigation demand (6. and 7. Defenders of Wildlife and the Natural Resource Defense Council, 10. American Rivers); the cost-effectiveness of irrigation conservation measures (6. and 7. Defenders of Wildlife and the Natural Resource Defense Council, 10. American Rivers); and the potential financial impacts of changes in Lower Yellowstone Project operation and maintenance costs on member farms (4. USCOE Comment Letter, 6. and 7. Defenders of Wildlife and the Natural Resource Defense Council).

These design issues influence the costs of the non-dam alternatives and the overall selection of the preferred alternative.

Significance – Medium/Low

Providing additional information on how the configurations of the non-dam alternatives were selected would contribute to a greater understanding of the alternatives assessment process.

Recommendation for Resolution

1. Document the design criteria used for the non-dam alternatives and clarify whether these criteria could be achieved with alternative pumping/power supply configurations.
2. Provide information on the reliability and the initial and recurring costs of different pumping power supply configurations, including the impacts of variable water supplies and conservation measures on crop yields/revenues.

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Comment Response Record for the Independent External Peer Review of the Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana Draft Environmental Impact Statement

Panel Final BackCheck Responses to USACE PDT Final Evaluator Responses

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for

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National Ecosystem Restoration Planning Center of Expertise
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LIST OF ACRONYMS

AFS	American Fisheries Society
ASCE	American Society of Civil Engineers
ATR	Agency Technical Review
BRT	Biological Review Team
CE	Cost Effectiveness
COI	Conflict of Interest
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
DrChecks	Design Review and Checking System
EA	Environmental Assessment
EC	Engineer Circular
EHU	Expected Habitat Unit
EIS	Environmental Impact Statement
ERDC	Engineer Research and Development Center
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
FPCI	Fish Passage Connectivity Index
HEC-HMS	Hydrologic Engineering Center-Hydrologic Modeling System
HEC-RAS	Hydrologic Engineering Center-River Analysis System
HEP	Habitat Evaluation Procedures
ICA	Incremental Cost Analysis
IEPR	Independent External Peer Review
IWR	Institute of Water Resources
LYP	Lower Yellowstone Project
NEPA	National Environmental Policy Act
NRCS	Natural Resources Conservation Service
O&M	operation and maintenance
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
PCX	Planning Center of Expertise
PDT	Project Delivery Team
PWS	Performance Work Statement
Reclamation	U.S. Bureau of Reclamation
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service

Final Panel Comment 1

There is substantial risk that the preferred alternative bypass channel will not provide upstream passage of pallid sturgeon in significant numbers to facilitate a measurable, population-level response in natural recruitment.

Basis for Comment

The bypass channel has been designed to meet criteria for water velocities and depths provided by the Biological Review Team (BRT) (Section 2.3.5.1 Bypass Channel Features), but it is unknown if these features meet the needs of adult pallid sturgeon attempting to migrate upstream. There is no evidence that the behavior of adult fish can be manipulated to attract them to the bypass channel, that they would be motivated to swim upstream through the bypass channel, or that they would navigate upstream through the proposed bypass channel in sufficient numbers to enable meaningful levels of spawning and recruitment in the Yellowstone River. In the DEIS, Section 2.5.2 Sturgeon Use of Bypass Channel, concerns are raised as to "…whether bypass channels, in general, have been demonstrated to actually be used by sturgeon for passage." Further, it is stated in Section 2.5.2.1 The Potential for Successful Passage in a Bypass Channel by Pallid Sturgeon, that "…to date, no successful upstream fish passage facility of any type has been built for shovelnose or pallid sturgeon."

The following issues regarding the potential for adult pallid sturgeon to move upstream through the bypass channel during their spring migration remain unaddressed:

a. It is unknown if pallid sturgeon can be attracted to the entrance to the bypass channel. Given the configuration of the Yellowstone River below the Intake Diversion Dam, research indicates that pallid sturgeon will swim upstream primarily on the north side of the channel on the inside of a river bend, which is habitat shown to be preferred by the species during upstream migrations. Typically, 13% of the river flow will be diverted through the bypass channel. It is unknown if this is a sufficiently large flow to attract adult pallid sturgeon. Further, it is unknown if adult fish will actively search for upstream pathways outside of main channel habitat that they have been identified to prefer. Additionally, attraction of adult fish to the entrance to the bypass channel is likely to be confounded by turbulent flows downstream from the Intake Diversion Dam.

b. Adult pallid sturgeon that may find their way to the entrance of the bypass channel would encounter a grade-control structure. The proposed grade-control structure "would be composed of buried riprap covered with gravel/cobble" (Section 2.3.5.2, page 2-49). Insufficient information is provided to make judgments regarding the ability of adult pallid sturgeon to pass over the structure. Further, it is unknown if adult fish will be motivated to swim upstream over this structure. Adult pallid sturgeon are bottom-oriented and select migration paths with sand substrates on the inside of bends near the borders of deep channels during migration. The proposed grade control structure at the entrance to the bypass channel differs substantially from habitat selected by adults during migration in the Yellowstone River.

c. Within the bypass channel, two vertical grade-control structures (riprap sills) are proposed "for maintaining channel slope and allowing for early identification of channel movement" (Section 2.3.5.2, page 2-49). At the upstream end of the bypass channel, another grade-control

structure is also proposed. These structures would be "over-excavated and backfilled with natural river rock to give the appearance of a seamless channel invert while providing stability during extreme events" (Section 2.3.5.2, page 2-49). Insufficient information is provided to make judgments regarding the ability of adult fish to swim upstream over the structures. Further, it is unknown if adult pallid sturgeon will be motivated to swim upstream over these structures.

d. Water velocity and depth features proposed for the bypass channel may be sufficient to allow adult pallid sturgeon to move through the bypass channel, but it is not known if they are adequate to motivate movements through the bypass channel. Swimming ability determined in the laboratory is unlikely to be a predictor of behavior or habitat preference.

The DEIS states that upstream migration of adult pallid sturgeon through the bypass channel "may be a rare event" (Section 2.1, page 2-22). There is no evidence provided that sufficient numbers of adult pallid sturgeon would migrate upstream annually through the bypass channel to form spawning aggregations at suitable spawning sites, spawn, and contribute to natural recruitment in the Yellowstone River. Appendix E states an objective for upstream passage as "Greater than or equal to 85% of motivated adult pallid sturgeon (fish that move up to the weir) annually pass upstream of the weir location during the spawning migration period (April 1 to June 15) within a reasonable amount of time without substantial delay (≥ 0.19 miles/hour)" (page 2). Evidence to support this as an achievable objective is lacking.

Significance – High

Because the potential for upstream migration of adult pallid sturgeon relative to each alternative is not fully addressed, it is unknown whether the preferred alternative will facilitate passage of adult fish.

Recommendation for Resolution

1. Conduct an alternative analysis exclusively for pallid sturgeon that assesses the potential for upstream passage for each stated alternative. Include relevant literature on upstream migration behavior and habitat selection by adult pallid sturgeon, utilization of bypass structures by various sturgeon species in other systems, and actual swimming capabilities of adult pallid sturgeon (not just extrapolations of adult swimming capabilities based on studies of juvenile fish). The analysis should consider the following:

    a. Probabilities that adult pallid sturgeon will be attracted to the entrance of the bypass channel or modified side channel, will enter the bypass channel or modified side channel over possible impediments, will migrate upstream through the bypass channel or modified side channel over possible impediments, and will exit the bypass channel or modified side channel to continue upstream migration.

    b. The size of the population of adult pallid sturgeon that migrate annually up the Yellowstone River to Intake Diversion Dam, the proportion of the migrants that are likely to migrate upstream through the bypass channel or modified side channel, and the subsequent population-level response resulting from natural recruitment by the proportion that successfully migrate.

PDT Final Evaluator Response (FPC 1)			
X	**Concur**		**Non-Concur**

The PDT added additional information to the EIS to clarify in more detail why the bypass channel design maximizes the likelihood of passing pallid sturgeon, based on the best available science. Also, information was added to provide more detail on why the agencies believe the bypass channel is the best course of action.

The agencies recognize the uncertainties regarding whether adult pallid sturgeon, under any alternative, would migrate and spawn in sufficient numbers far enough upstream to allow for sufficient drift distance for free embryos and larvae to develop and settle into suitable habitats before reaching the headwaters of Lake Sakakawea. The NEPA Implementing Regulations (40 CFR 1502.22) address this issue and Department of the Interior Regulations (43 CFR 46.125) provide additional detail stating, “In circumstances where the provisions of 40 CFR 1502.22 apply, bureaus must consider all costs to obtain information. These costs include monetary costs as well as other non-monetized costs when appropriate, such as social costs, delays, opportunity costs, and non-fulfillment or non-timely fulfillment of statutory mandates.” While the monetary costs to obtain this information are likely considerable, the non-monetary costs are also significant in this case, especially the delays in implementing passage for the remaining wild pallid sturgeon population and the resulting non-timely fulfillment of statutory mandates (i.e., complying with ESA).The best available science strongly indicates that the Yellowstone River provides the best opportunity for natural spawning and recruitment of pallid sturgeon (as opposed to manipulations at Fort Peck Dam); although spawning and recruitment are outside the control and scope of this site-specific fish passage project. A key component of this project will be the Monitoring and Adaptive Management Plan (Appendix E) to specifically monitor the number of fish that do migrate upstream and to take adaptive management actions if the success criteria are not met. Additional information has been added to Appendix E (also see responses to Comment #3). However, measurable, population-level response in natural recruitment is uncertain for any of the alternatives and must be monitored over time to inform further management actions. Specific elements of clarification are provided below.

A. Regarding whether pallid sturgeon can be attracted to the entrance of the bypass channel, additional information has been added to Section 4.9.6.3 (formerly Section 4.10.6.3) about the design of the channel and behavior of pallid sturgeon. Tracking of radio telemetered wild adult pallid sturgeon has shown that pallid sturgeon will migrate up the Yellowstone River to Intake Diversion Dam (Delonay et al. 2014, 2015; Rugg 2014, 2015, 2016). Tracking has shown that some telemetered fish swim along the north side of the river in the two or so miles downstream of the weir (Figure 40 in Delonay et al. 2014), which generally coincides with the main channel location and includes both an outside bend and an inside bend. However, these fish do not statically reside only on the north side of the river but instead appear to “explore” around the weir and move both downstream and back upstream, indicating they may be searching for a passageway. Several of the telemetered fish have been recorded over multiple days or weeks in the vicinity of Intake Diversion Dam.

   Positioning the bypass entrance just downstream from the weir is acceptable, and desirable, when providing passage for migrant fish species (Clay 1995). This configuration has worked at dams in numerous countries. During their spawning migration, pallid sturgeon likely have a strong drive to migrate upstream to spawn.

In 2014 and 2015, adult pallid sturgeon were documented passing upstream of Intake Diversion Dam via the existing side channel around Joe's Island (Rugg 2014, 2015, 2016). In 2014, six wild adult pallid sturgeon migrated upstream (one female and five males) through the existing side channel; it is unclear whether any of these fish initially migrated to Intake Diversion Dam and then subsequently found the existing side channel, or if they were attracted to the existing side channel and used it without ever migrating to the weir. In 2015, one male wild adult pallid sturgeon migrated to Intake Diversion Dam and moved around in the 10 mile reach below the weir for over a month before using the existing side channel to bypass the weir.

The existing side channel is located on the south side of the river, nearly 2 miles downstream of the weir, and conveys only 2-6% of the river flow (the calibrated HEC-RAS model used in the design shows that the existing side channel conveys approximately 570 cfs at river flows of 30,000 cfs [2% of flow], 2,200 cfs at river flows of 54,200 cfs [4%] and 4,000 cfs at river flows of 63,000 cfs [6%]). Adult pallid sturgeon used the existing side channel at flows ranging from approximately 40,000 cfs in 2015 and 47,300 to 68,100 cfs in 2014, when the side channel was conveying 5-6% of the flow. The location of the existing side channel is likely to be difficult for fish to find as there is a large island that splits the river flow downstream of the channel entrance and several shifting bars present very near to the channel entrance. In addition, one juvenile hatchery-produced pallid sturgeon was documented passing upstream and then downstream through the existing side channel in 2015 (Rugg 2016).

Radio tracking of telemetered wild adult pallid sturgeon has also revealed that during their upstream migrations, they can and will use side channels (documented in the Lower Missouri River in constructed side channels in Delonay et al. 2014, 2016a, 2016b; documented in natural side channels in the Upper Missouri River in Braaten et al. 2015 and in natural side channels in the Lower Yellowstone River in Delonay et al. 2014). For example, in Delonay et al. (2014), 11 different pallid sturgeon were documented in 12 side channels in the Lower Yellowstone River, of which three individuals in three different side channels were unambiguously observed to have entered from the downstream end. Some of the channels used were too shallow for the research boat to enter, thus even channels with low flow volumes and depths are sometimes used. Current literature on bypass designs for sturgeon all highlight that the best approaches include those that mimic natural side channels. This would include building a channel with similar geometry, facilitate passage under a range of discharge conditions, and incorporate a broad range of hydraulic criteria that emulate the range, depths and velocities that have been successfully negotiated by targeted migratory fish. (Braaten et al. 2015, Aadland 2010, Jager et al. 2016)

For the design of the bypass channel, extensive input from pallid sturgeon experts, including the Biological Review Team (BRT) convened by the U.S. Fish and Wildlife Service, State of Montana, the U.S. Army Corps of Engineers and the Bureau of Reclamation, has been used to develop flow volume, depth, and velocity criteria and to inform the location and orientation of the channel and to avoid and minimize risks and concerns such as turbulence, eddies, and the ability of the fish to find the downstream entrance to the channel. The current scientific understanding indicates that providing good attraction flows is very important; thus, the BRT's criterion was developed for 13-15% of the river flow, which is nearly 3 times the flow volume of the existing side channel. In order to maximize the potential for upstream migrating pallid sturgeon to find the

bypass channel, its entrance has been located immediately downstream of the rock rubble field below the weir. Thus, it is in proximity to where fish have been tracked to be present (see Figure 40 in Delonay et al. 2014) and is below the rock rubble field that has turbulent flow that pallid sturgeon have been shown to avoid. The existing side channel entrance is nearly two miles downstream of Intake Diversion Dam which is well out of the immediate weir zone where fish may be exploring to find a passageway, but nonetheless, some fish have found it. Further, both 2-dimensional and 3-dimensional modeling (i.e. a physical model) were conducted to inform the design of the downstream channel entrance. Placement of fill and grading along both the right and left bank of the channel as it enters the Yellowstone River were recommended based on this modeling to avoid the scour hole immediately downstream of the rock rubble field and to reduce the eddy that exists along the right bank of the river near the proposed channel entrance. Also, the elevation of the bypass channel has been raised slightly at the downstream end to increase attraction flows and keep sediment mobilized out into the main channel of the Yellowstone River.

B. The proposed grade control structures will be buried beneath 9 inches of natural cobble/gravel similar to the larger material present in the river. They are included in the bypass channel design to keep the bypass channel from eroding and incising its bed. . The bypass channel flows and velocities will be within the ranges that occur in natural side channels that pallid sturgeon have been shown to use in the Lower Yellowstone River and those side channels have gravel/cobble substrates. However, the modeling conducted for the design indicated at some flows there could be sufficient shear stresses on the bed to cause some erosion. The grade control structures are insurance to protect the channel from any rapid erosion/incision that could occur during a flood or from severe ice scour, but are otherwise generally expected to remain buried. Thus, pallid sturgeon would not have to swim “over” these structures as the channel bed will be continuous with a slope of 0.0696% at the downstream structure and even flatter slopes for the other three structures. This slope is within the range of slopes of side channels pallid sturgeon have been shown to use on the Yellowstone River.

   Regarding whether pallid sturgeon will migrate over gravel and cobble – the Lower Yellowstone River has a natural substrate of predominantly gravel and cobble upstream of River mile (RM) 31 (Bramblett & White 2001), similar to what is proposed within the bypass channel which is at approximately RM 70. This substrate would be expected to form naturally over time if not incorporated in the initial design of the bypass channel.

C. As stated above in the response to item B, the other proposed grade control structures in the bypass channel would also be buried under 9 inches of cobble and gravel similar to the material present in the Yellowstone River. Pallid sturgeon would not need to swim “over” them as the bed will be continuous at each of these locations at slopes of approximately 0.07%. This slope is within the range of slopes of natural side channels pallid sturgeon have been shown to use on the Yellowstone River.

D. The water velocity and depth criteria developed by the BRT were based on the best available science that includes laboratory studies of juvenile and adult pallid sturgeon and shovelnose sturgeon (Adams et al. 1999, 2003; White & Mefford 2002; Hoover et al. 2011; Kynard et al. 2002) and more importantly, by tracking of wild adult pallid sturgeon migrating upstream in the Yellowstone River (Braaten et al. 2015). Braaten et al (2015) demonstrates that wild adult pallid sturgeon do migrate successfully upstream in velocities ranging from 0.77 to 1.95 m/s (2.5 to 6.4

feet/sec) and use depths of 2.2 to 3.4 meters (7.2 to 11.2 feet). Additional detail on depths and velocities actually used by wild adult pallid sturgeon is provided in Delonay et al 2014 and 2015.

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Recommendation 1:		**Adopt**	**X**	**Not Adopt**

The PDT does not think that additional analysis to attempt to develop a statistical probability of adult pallid sturgeon passage upstream through the bypass channel or other alternatives is feasible at this time. There is a lack of comprehensive data on pallid sturgeon passage behavior, and as such, we must rely on available literature that describe observed pallid sturgeon migration behavior through river features that are similar to a bypass or improved sidechannel (Delonay et al. 2014, 2016a, 2016b; Braaten et al. 2015, Rugg 2014, 2015, 2016), rely on studies for similar sturgeon species' use of passage structures (Jaeger 2016) and expert opinion such as that of the BRT. In order to complete a quantitative analysis on the probabilities that adult pallid sturgeon will be attracted to, enter, migrate through and exit the bypass channel or modified side channel would require much time and effort to appropriately design and scope a study, and complete the significant data collection and evaluation that would be required. In addition to the problem of insufficient time to complete a study, there is the issue of having enough data points (i.e. observation of a rare fish) to have enough statistical power to develop probabilities for these specific behavioral responses, as well as the issue of lacking the specific fish passage structures in which to complete such a study.

Additional modeling was considered by the PDT to potentially provide an analytical evaluation of the probability of fish passage success for each alternative. We considered assessing the pattern of complex hydraulic variables and how these variables influence pallid sturgeon swim-path selection to reduce the uncertainty and further understand the risks associated with the Bypass Project. Specifically, we discussed utilizing an Eulerian-Lagrangian-agent Method (ELAM; e.g., Numerical Fish Surrogate (NFS)) coupled with a multi-dimensional hydraulics model (e.g., 2-D ADH; model resolution should be matched to the channel geomorphology and how pallid sturgeon use the habitat) (Goodwin et al. 2006) to forecast and evaluate adult pallid sturgeon behavior relative to the Intake Dam structure (e.g., migratory pathways based on pallid telemetry information) and the design elements (e.g., bypass entrance locations and orientations, physical conditions at the bypass entrances and within the bypass channel) of the proposed Intake fish bypass. The NFS could be used to forecast how pallid sturgeon may respond to the bypass structure before it is built to determine how the design can be optimized or it could be used after it is built to better understand potential problem areas and prescribe modifications. This methodology has been used successfully by Dr. Dave Smith (USACE's Engineer, Research, and Development Center; ERDC) to evaluate shovelnose sturgeon behavior below Lock and Dam 22 on the Mississippi River (simulations with and without a fish ladder; Smith et al. 2012) and could be used to evaluate and maximize the Intake bypass design.

However, we feel that close adherence to the BRTs recommendations on the design criteria for the side channel is our best bet to maximizing passage potential at this point. These experts have the most up-to-date knowledge of pallid science and relevant passage efforts related to other sturgeons. In addition to

the BRT input, we also have new additional information that provides good insights that suggest sturgeon would use a bypass channel and/or modified side channel, such as literature that observed pallid sturgeon migration behavior through natural and constructed river features that are similar to a bypass or improved side channel alternative (Delonay et al. 2014, 2016a, 2016b; Braaten et al. 2015, Rugg 2014, 2015, 2016) as well as the (Jaeger 2016) report that supports the idea of natural designs for sturgeon passage are most successful. Once the project is completed, additional data collection could increase the usefulness and confidence in this modeling approach such that it could be very valuable in understanding potential fixes if impediments to passage become evident.

Similarly, developing a population-scale model to predict the specific recruitment is also not currently feasible at this time. Furthermore, based on the science and studies outlined above, it is reasonable to conclude pallid sturgeon will use the bypass channel.

At this point, a rigorous analysis of this type cannot be completed due to the lack of critical pieces of information such as transitional survival probabilities from egg to age-1 and what proportion of the adult population will be motivated to migrate above Intake and spawn and how far upstream they will choose to spawn. These unknowns exist for all passage options including dam removal. It would be unwise to spend time in developing an EIS to take the many years that it would take to develop this information.

Success of the Intake Diversion Dam Fish Passage Project will be determined by its ability to successfully pass fish. There are no assurances that any type of bypass system or even complete weir removal will lead to a self-sustaining population of pallid sturgeon. However, it is widely acknowledged by the scientific community and the Service (USFWS 2014) that a lack of drift distance sufficient for development of free embryos prior to settling into reservoir habitats is limiting natural recruitment of pallid sturgeon in the upper basin population. If this is true, providing access to habitats above Intake Dam will give drifting free embryos additional time and distance for development and may ultimately provide natural recruitment. It is not certain how many pallid sturgeon will be motivated to pass upstream regardless of the passage alternative, how far upstream they may choose to spawn, and what level of recruitment may result. As a result, the Missouri River Management Plan that is currently being developed does not assume success for any of these options but instead sets up a comprehensive strategy to learn from providing passage at Intake as well as continuing studies to decrease relevant uncertainties on both the Missouri and Yellowstone River so that subsequent actions on either system will be informed on the evolving science.

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Panel Final BackCheck Response (FPC 1)

X	Concur		Non-Concur
It is acknowledged that while the preferred alternative bypass channel may improve the potential for fish passage at the Intake Diversion Dam there is a substantial risk it may not provide upstream passage of pallid sturgeon in numbers consistent with the BRT criteria outlined in Section 4.9.3. A bypass channel to facilitate upstream passage of pallid sturgeon around a dam has not been tried previously. There is a lack of data on pallid sturgeon passage behavior and it is uncertain how many pallid sturgeon may be motivated to pass upstream through a bypass channel.			

Final Panel Comment 2

The FPCI and the CE analysis based on the index do not adequately represent the significance of pallid sturgeon passage as an objective of the proposed action and the uncertainty associated with pallid sturgeon passage.

Basis for Comment

The stated purpose of the proposed action is to improve upstream passage for pallid sturgeon and other native fish at the Intake Diversion Dam, continue the viable and effective operation of the LYP, and contribute to ecosystem restoration (ES, p. xxvi). In addition, given the endangered status of pallid sturgeon (DEIS, pp. 1-7 to 1-8), it is stated "…the primary purpose of a fish passage project at Intake Dam is to improve pallid sturgeon passage…" (Appendix D, p. 1).

To compare alternatives, the FPCI was used to estimate EHUs under each alternative. The FPCI was developed to evaluate ecosystem outputs of alternative fish passage improvements for navigation dams on the Upper Mississippi River System, but the pallid sturgeon was not included in the model development (USACE, 2011). As an ecosystem restoration metric, the FPCI provides a consistent framework to evaluate the effects of restoration on an array of fish species. For this application to the LYP, the FPCI has three major shortcomings. First, it does not adequately represent the significance of pallid sturgeon passage as an objective of the proposed action. Second, the FPCI does not reflect the uncertainty associated with pallid sturgeon migration through the bypass channel or modified side channel alternatives. Third, this uncertainty is not reflected in the parameter values used to characterize pallid sturgeon migration behavior in the FPCI.

Based on the information in Appendix D, the spreadsheet "Fish Passage Connectivity Index_w_pallid_14species_v4.xlsx" (hereinafter FPCI_v4), and USACE (2011), the FPCI is a simple arithmetic index [(Ei x Ui x Di)/25] for each species, where E is the chance of encountering a passage entrance (1 – 5), U is the potential to use the passage (0 – 5), and D is the duration over which passage is available. The number 25 is used to normalize the index value for each species. The resulting connectivity value, Єi, is then multiplied by the potentially available habitat for each species to determine the EHUs for that species relative to a passage alternative. This calculation is repeated to EHUs for each species that might use the passage, and the results are then averaged across all species used in the analysis.

For this application to the LYP, 14 species were used in the analysis, so the EHUs for pallid sturgeon have little impact on the overall results and identification of a preferred alternative. For example, Appendix D (Table 2-4) presents the ICA with 7,116 net EHUs under the bypass channel alternative and 11,011 net EHUs under the multiple pump alternative. With annual costs of $5,170,000 under the bypass channel alternative and $10,594,000 under the multiple pump alternative, the incremental cost per EHU is $727 under the bypass channel alternative and $962 under the multiple pump alternative. If pallid sturgeon were dropped completely from the analysis and only the remaining 13 species were used, the new net EHUs would be 7,123 under the bypass channel alternative and 10,929 under the multiple pump alternative. The resulting incremental costs per EHU would be $726 and $1,032, respectively. The bypass channel alternative is indicated to be the 'best buy' under both applications of the FPCI, and the inclusion of pallid sturgeon habitat availability has no impact on the identification of a preferred alternative.

Appendix D states that in using the FPCI, “The inclusion of pallid sturgeon does not change the ranking of alternatives, but provides a better differentiation between similar alternatives” (page 3). This statement is questionable if the uncertainty surrounding pallid sturgeon migratory behavior is factored into the analysis. For example, Table 1-7 in Appendix D presents the rating for E for pallid sturgeon in the FPCI as a 4 under the bypass channel alternative and a 2 under the side channel alternative, both on a scale of 1 – 5 where 5 is the “no dam” rating. What makes it questionable is the lack of documented studies to support the assumption that a bypass channel would provide nearly the same connectivity as a free-flowing river for pallid sturgeon. If uncertainty about the potential success of the bypass channel is considered and the rating is lowered to a 2 (the same as the side channel), the net EHUs under the bypass channel alternative in Table 2-4 would change from 7,116 to 6,935 using the 14-species FPCI. The incremental cost per EHU would increase from $727 to $746. Given that the cost per EHU for the side channel alternative is $791 in Table 2-4, the bypass channel alternative would be indicated to be the ‘best buy’ even though both alternatives have exactly the same connectivity rating for pallid sturgeon. Note also that the bypass channel with the same connectivity as the side channel is the preferred alternative despite the lower annual cost for the side channel ($5,137,000 vs $5,170,000).

The importance of pallid sturgeon passage and uncertainty about the success of the bypass channel alternative for passage of pallid sturgeon can be evaluated directly by calculating the FPCI for pallid sturgeon only. Under the baseline assumptions in the DEIS, Appendix D and FPCI_v4, the bypass channel FPCI for pallid sturgeon is 0.60 ((3 x 5 x 1)/25), resulting in 7,582 EHUs (0.6 x 12,637). The no action alternative is 551 EHUs, so the net EHUs would be 7,031. At an annual cost of $5,170,000, the incremental cost is $727 per EHU. If the bypass channel is less successful and the FPCI for pallid sturgeon is only 0.30 ((1.5 x 5 x 1)/25), the net EHUs would be 3,240 (3,791 – 551). The risk-adjusted incremental cost would be $1,596 per EHU, or more than double the baseline assumption.

The risk-adjusted incremental cost under the bypass channel alternative can now be compared with the multiple pump alternative using only the pallid sturgeon FPCI. Under the baseline assumptions in the DEIS, Appendix D and FPCI_v4, the multiple pump FPCI for pallid sturgeon is 1.0 ((5 x 5 x 1)/25), resulting in 12,637 EHUs (1.0 x 12,637). The no action alternative is 551 EHUs, so the net EHUs would be 12,086 (12,637 – 551). At an annual cost of $10,594,000 in Table 2-4, the incremental cost is $877 per pallid sturgeon EHU. This cost is lower than the $962 per EHU for the multiple pump alternative in Table 2-4 because the net change in EHUs is smaller (11,011) for the 14 species used in the baseline FPCI.

Comparing the bypass channel alternative with the multiple pump alternative, the risk-adjusted incremental cost of $1,596 per pallid sturgeon EHU for the bypass channel alternative is significantly greater than the baseline incremental cost of $877 per pallid sturgeon EHU for the multiple pump alternative. Accounting for the uncertainty associated with pallid sturgeon passage through the bypass channel would indicate the multiple pump alternative as the ‘best buy.’

Significance – High

Because the FPCI and CE analysis are the primary decision tools used to select the preferred alternative, further information about critical parameters used to evaluate alternatives can lead to better risk-informed decisions.

Recommendation for Resolution

1. Provide more information about the effects of uncertainty on the parameters used in the FPCI and explain how this uncertainty influences the EHUs under each alternative.
2. Provide a CE analysis using only a pallid sturgeon FPCI to determine EHUs under each alternative and directly integrate uncertainty about parameters in the FPCI into the analysis.
3. Compare the CE results using the baseline 14-species FPCI and the pallid sturgeon FPCI to illustrate the differences in expected outcomes.
4. Document any new or revised information generated from recommendations 1-3 in the FEIS.

PDT Final Evaluator Response (FPC 2)

X	Concur		Non-Concur

In response to this comment and other similar comments received on the DEIS, the PDT has added additional text and a sensitivity analysis to Appendix D to explain in more detail how each number in the FPCI was selected, based on the best available science and professional judgment of the project team. The sensitivity analysis was completed to evaluate if the outcome would be affected if only the pallid sturgeon scores were used. Secondly, a change in the value assigned to fishway location (Fl) for the bypass channel was evaluated to see if that would affect the results. The results indicate the outcome is not affected by either change.

Also, for clarification, in the fourth paragraph of the comment, the EHU cost for the Multiple Pumping Alternative has been calculated by the commentor to be $1,032. However, using the commentor's formula the figure should actually be $969.

As stated in the response to Comment #1, pallid sturgeon have been documented using numerous side channels in their upstream migrations in both the Yellowstone and Missouri rivers. The bypass channel has been designed to have similar flows, depths, velocities, and substrate to natural channels. Also, as stated above, the location of the downstream end of the bypass channel immediately downstream of the existing rock rubble field below the weir, is the best location for a bypass channel as it is in immediate proximity to where the fish stop when confronted with the turbulence and high velocities at the weir and rock rubble field. Field tracking data show fish move around in this area, likely looking for a passageway to continue their upstream migrations. Thus, the fishway location (Fl) was assigned a score of 4 – it does not merit a score of 5 because the bypass channel is not the main channel where sturgeon would primarily be migrating, but the location is better than typical side channels because it occurs where the fish seek to continue upstream migration via an alternate passageway.

In the originally approved model (Corps 2011), side channels were assigned a Fl score of 3 for strong benthic swimmers such as sturgeon, but the judgment of the PDT indicated that a 4 was merited. The sensitivity analysis was conducted using an Fl score of 3 to see if that substantially changed the results – it revises the pallid sturgeon index from 0.6 to 0.5, but does not change the CE/ICA results. The Modified Side Channel Alternative, on the other hand, has a downstream entrance located nearly 2 miles downstream of the weir and behind sand/gravel bars on the opposite bank from the main channel. In the two years that fish were documented to use this channel, the number of adult pallid sturgeon using it is estimated to range from 14 – 50% of the fish that migrated up to Intake Diversion Dam (Rugg 2014, 2015;

6 of 12 in 2014 and 1 of 7 in 2015). Improving the attraction flows would likely increase the number of fish that find this existing side channel, but it is unclear if even half of the pallid sturgeon would find it given its distance from the weir. Thus, the PDT estimated that the fishway location (Fl) was only a 2. This results in a pallid sturgeon index of 0.4. The Fl score is only half of the resulting Ei score (Potential to Encounter). Ei results from averaging Fs (Fishway Size) and Fl (Fishway Location).

The PDT does not agree that either the bypass channel or the modified side channel are so unlikely for fish to find that the Ei score should be 1.5. This would require a Fishway Location (Fl) score of 1, indicating that it is unlikely that any of the fish would encounter the fishway. Fish clearly do find the existing side channel, and pallid sturgeon have even used it in small numbers. Furthermore, the information provided in response to Comment #1 clearly indicates pallid sturgeon make use of side channels.

Recommendation 1:	**X**	**Adopt**		**Not Adopt**

The PDT has added additional discussion on the selection of the Fishway Location scores to Appendix D.

Recommendation 2:	**X**	**Adopt**		**Not Adopt**

A sensitivity analysis addressing both recommendations 2 and 3 was completed and added in Section 2.5 of Appendix D.

In order to evaluate the sensitivity of the CE/ICA results to changes in the FPCI model outputs, two sensitivity scenarios were modeled. In the first scenario, revised fishway location, the scores were reduced for the bypass channel, which reduces that alternative's habitat outputs. In the second scenario, pallid sturgeon only, only the variable for pallid sturgeon was included, which changes the total habitat outputs for all alternatives. These two scenarios reasonably evaluate the possibility of reduced effectiveness for the bypass channel and a focus on pallid sturgeon-specific benefits. Note that the Modified Side Channel alternative in both scenarios always has been given a lower score than the Bypass Channel Alternative as the location of the entrance for upstream migrating fish is approximately 2 miles downstream of Intake Diversion Dam and distant from the main channel so fish are less likely to find it as compared to the bypass channel.

Tables in the appendix summarize the FPCI revisions for each scenario. Based on these revised habitat output values, and using the same costs, the CE/ICA model was re-run twice.

Even when components of the FPCI scoring are revised, the order of alternatives in terms of average cost per unit output does not change.

- Scenario 1 – Revised Fishway Location Scenario: the reduced output of the Bypass Channel alternative makes its average cost per unit output more expensive, though it remains less expensive per unit than the Modified Side Channel, resulting in no changes to the identified cost effective and best buy plans.
- Scenario 2 – Pallid Sturgeon Only: by only considering Pallid Sturgeon in the FPCI, the relative cost effectiveness of the alternatives does not change. The Bypass Channel remains the first best buy plan. However, the total output possible for the Rock Ramp, Modified Side Channel, and Bypass Channel alternatives are all reduced. In this scenario, the Bypass Channel would provide for about 48% of possible habitat output, rather than 65% as in the main analysis which considered 14 species.

In both scenarios, the order of alternatives in terms of average cost per unit output did not change. Based on this analysis, it was determined that there is reasonable confidence that, as currently designed, the Bypass Channel Alternative is less costly per unit than the Multiple Pump Alternative, and that the two best buy action alternatives are the Bypass Channel and the Multiple Pump Alternative. Additional

information has been added to Appendix D to clarify that scores are based on best professional judgement.				
Recommendation 3:	**X**	**Adopt**		**Not Adopt**
See response to Recommendation 2, both were combined in one response.				
Recommendation 4:	**X**	**Adopt**		**Not Adopt**
Results of the sensitivity analysis have been described in the revised Appendix D FPCI and CE/ICA. In addition, information has been added to the EIS in Section 2.3.5 describing how the design of the bypass channel was informed by the best available science and why the agencies believe the channel will pass pallid sturgeon. Current literature on bypass designs for sturgeon all highlight that the best approaches include those that mimic natural side channels. This would include building a channel with similar geometry, facilitate passage under a range of discharge conditions, and incorporate a broad range of hydraulic criteria that emulate the range and depths and velocities that have been successfully negotiated by targeted migratory fish. (Braaten et al. 2015, Aadland 2010, Jager et al. 2016). Pallid sturgeon have been shown to use natural side channels in the upper Missouri River (Braaten et al. 2015), the Yellowstone River, and constructed side-channels in the lower Missouri River (DeLonay et al. 2014, 2015, 2016) during spawning migration. In the upper Missouri River, pallid sturgeon migrating upriver passed through a variety of short (0.4-km long; 0.25 mi) and long (3.9-km long; 2.42 mi) side channels (Braaten et al. 2015). The constructed side channels in the lower Missouri River, even though not constructed with adult sturgeon migration in mind, have demonstrated that sturgeon will use constructed channels and at times will choose to use them even when the main channel is unobstructed. The physical and resulting hydraulic features of the proposed bypass channel at Intake were modeled according to the features within known migratory pathways (main channel and side channel) used by pallid sturgeon in the upper Missouri River and Yellowstone River. The final geometry of the proposed bypass channel falls within the range of all parameters, including length, width, sinuosity, bend radius, and meander wavelength. In addition, this bypass channel has been engineered with expert input to increase the odds of use by sturgeon by optimal location and orientation of the downstream entrance, a flow split which is higher than side channels which have been used by pallid sturgeon, and water velocities and depths suitable for passage at a wide range of flows. Because pallid sturgeon have been observed to use side channels (both constructed and natural) on the Missouri River and Yellowstone River, even when the main channel is unobstructed, and because the designs mimic physical parameters of natural side channels actually used by pallid sturgeon on the Yellowstone, we believe that construction of the bypass channel will result in a high likelihood of use and passage under a variety of flows. Lastly, the design of the bypass is constructed with the entrance near the base of the obstruction, rather than located some distance downstream. The best entrance locations are at the base of the obstructions because a fish's natural tendency is to seek an alternate upstream passage at the obstruction. Entrances located significant distances downstream of the barrier may cause fish to swim past and become trapped below the dam by their natural instinct to swim upstream (Aadland et al. 2010). Fish passage attempts which have failed for sturgeon or are not suitable for sturgeon typically involve ladders, fishways with baffles, sharp turns, passage through large reservoirs, and dams with turbines (Jager et al. 2016). Fishways and nature-like fishways, however, have been successful in passing sturgeon species. Nature-like fishways (the Intake bypass falls into this category) have reconnected lake sturgeon populations in Minnesota through 36 migration barriers (Jager et al. 2016)				
Panel Final BackCheck Response (FPC 2)				
X	**Concur**		**Non-Concur**	

Acknowledging the risk of project failure is an integral part of an adaptive management strategy. The sensitivity analysis for the CE/ICA results for selecting a preferred alternative in the revised Appendix D is consistent with the comment/response teleconference discussion with USACE.

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Final Panel Comment 3

The Monitoring and Adaptive Management Plan does not provide specific, quantified fish passage objectives and targets for pallid sturgeon or other native fish species, which are necessary to identify the need for adaptive management actions and the potential future costs of such actions.

Basis for Comment

The stated objective of the Lower Yellowstone Intake Diversion Dam Fish Passage Project, Montana is "to improve passage of pallid sturgeon and other native fish at the Lower Yellowstone Project Intake Diversion Dam while continuing a viable and effective operation of the Project" (DEIS Executive Summary).

Pallid Sturgeon:
Little information is provided in peer-reviewed literature regarding the parameters necessary to facilitate upstream passage for adult pallid sturgeon. As a result, many of the design features are based on the best professional judgment of a qualified multi-disciplined team of experts. This approach results in a level of risk and uncertainty that must be addressed using a robust and quantitative monitoring and adaptive management approach. The draft Monitoring and Adaptive Management Plan states, "… as there are very few examples of fish passage projects designed for sturgeon species and none specific to pallid sturgeon, uncertainty exists regarding the assumptions made about the physical and biological response to the alternatives and their relative effectiveness to improve fish passage past Intake Diversion Dam." (Appendix E, section 1.0, p. 1).

The definition and purpose of monitoring and adaptive management as stated are, "… a decision-making process that provides for implementing management actions in the face of uncertainty. Included in this appendix are objectives, metrics, and targets for proposed management actions and potential adjustments that may be warranted based on the results of the proposed monitoring" (Appendix E, section 1.0, p. 1).

The Monitoring and Adaptive Management Plan provides two objectives pertinent to pallid sturgeon. Objective 1 identifies physical criteria for water depths and velocities in fish passageways that are measurable; this objective is readily quantifiable and is adequately addressed in the plan. Objective 2 addresses upstream and downstream passage of pallid sturgeon. The first element of Objective 2, addressing upstream passage, states "Greater than or equal to 85% motivated adult pallid sturgeon (fish that move up to the weir) annually pass upstream of the weir location during the spawning migration period (April 1 to June 15) within a reasonable amount of time without substantial delay ($\geq$ 0.19 miles/hour)." This element does not provide a timeframe for achieving the objective or by what time in the future the proponents expect the objective to be reached. Further, "motivation" of adult pallid sturgeon cannot be measured. This element of Objective 2 would be more precise if that term were omitted and the objective were stated as, "Greater than or equal to 85% of adult pallid sturgeon that move up to the weir annually pass upstream…"

The second element of Objective 2, addressing downstream passage of adult pallid sturgeon following the spawning period, begins with this statement: "Mortality of adult pallid sturgeon that migrate downstream of the weir location cannot exceed 1% annually during the first 10 years." (Appendix E, section 1.0, p. 2). Additional components of this element to assess injury and stress are mentioned, but no statement is provided as to how injury or stress may be measured or quantified. Further, no timeframe for achieving

these elements of the objective is provided. A second component addressing downstream passage focuses on impingement and entrainment of larval and young-of-year fish. Again, quantifiable measures of impingement and entrainment and a timeframe for assessment are not provided.

It is recognized that the Monitoring and Adaptive Management Plan is preliminary and will be expanded, but more precise objectives, as well as more detail regarding the monitoring methods that will be used to assess progress toward objectives, are needed. The objectives for monitoring pallid sturgeon provide very limited "quantifiable targets for proposed management actions and potential adjustments that may be warranted" as stated on page 1 of the plan. Quantifiable targets are necessary to ensure that the fish passage produces projected species-specific and ecosystem benefits. If specific quantifiable targets are not documented in the Adaptive Management Plan, it will be difficult to determine if the project falls short or succeeds in achieving the stated objectives.

Native Fish Species:
The Monitoring and Adaptive Management Plan does not present quantitative objectives or targets for native fish species successfully passing upstream and downstream through the Intake Diversion Dam area. Objective 3 is relevant to native fish species, stating "Determine if native fish can effectively migrate upstream and downstream of the weir location." No quantifiable metrics or timeframe for assessment are provided. The Panel understands that an elevated level of significance is placed on successful passage by pallid sturgeon. However, the alternatives analysis was conducted predominantly on the basis of the potential for fish passage of the 14 native species considered to "…represent the migratory species typically found in the Yellowstone River at Intake Diversion Dam and the species provide good representation of the various guilds of fish based on their various migration behaviors" (Appendix D, section 1.3.1.2, p. 3). For the same reasons mentioned above regarding pallid sturgeon, quantitative objectives and targets are necessary for other native fishes in the adaptive management plan.

Costs:
Further information on quantitative objectives and targets would also help to identify potential future costs for the adaptive management plan that are based on specific actions rather than the fixed percentage of total project cost estimates used in the alternative selection process.

The Panel recognizes that the current Monitoring and Adaptive Management Plan acknowledges that a more detailed plan may be developed in the future.

Significance – High

Refinement of objectives and more quantitative details to the Monitoring and Adaptive Management Plan are essential to ensure the success of the proposed project.

Recommendation for Resolution

1. Include quantifiable pallid sturgeon and native fish species passage targets with timeframes that are compatible with the objectives to reach specific adaptive management milestones at reasonably accurate estimated costs.

2. Provide more details on the methods used to (a) achieve the elements of the monitoring plan and

(b) assess progress toward the stated objectives for pallid sturgeon and other native fish species.

PDT Final Evaluator Response (FPC 3)			
X	Concur		Non-Concur
As referenced in the comment and stated in the DEIS a more detailed monitoring and adaptive management plan has been developed and is included in the FEIS. The PDT has been coordinating concurrently with the Service to develop metrics and targets as part of Section 7 consultation. Once a project is approved, the plan will continue to be refined and updated with more detail in coordination with the Service and the State of Montana.			
Recommendation 1:	X	**Adopt**	**Not Adopt**
The revised monitoring and adaptive management plan has clarified the project objectives, which includes the Biological Review Team physical and biological criteria to be met. It describes the monitoring to be conducted, which specifies specific elements to be monitored annually and proposed responsible entity. The plan describes the decision-making process that will be used to implement adaptive management measure and provides a suite of adaptive management measures to be used in response to monitoring findings.			
Recommendation 2:	X	**Adopt**	**Not Adopt**
Draft adaptive management measures are identified for the objectives that have been identified in the plan. They include timing and action items (adaptive management measures) thought to be necessary to achieve the elements of the plan.			

Panel Final BackCheck Response (FPC 3)			
X	Concur		Non-Concur

Final Panel Comment 4

The need for a new bridge for maintenance and recreation access under the modified side channel alternative is not well justified.

Basis for Comment

Maintenance Access

The bypass channel and the modified side channel alternatives both require similar maintenance access to the south side of the river; however, only one includes a new bridge. This inconsistency has resulted in the modified side channel being more expensive than the bypass channel. The following instances throughout the document indicate where this inconsistency was noted.

The preferred alternative (bypass channel) includes a replacement weir, but does not include a bridge across the bypass channel. The justification provided in the DEIS is that only infrequent access to the south side of the weir will be necessary due to reduced need to maintain the new concrete weir (Section 2.3.5). A new bridge is not provided for maintenance access. When access is required, a temporary cofferdam would be constructed across the bypass channel.

The DEIS suggests that under the modified side channel alternative, reuse of the existing Intake Diversion Dam with periodic rock placement would require a new bridge for maintenance access (Section 2.3.6). The bypass channel alternative includes a new weir, but not a new bridge due to the bypass channel's reduced maintenance needs.

The goal of the bypass channel and the side channel alternatives is to provide fish passage opportunities for the pallid sturgeon. Upstream migration is known to occur in the spring and early summer, when flow in the river reaches seasonal highs. The DEIS states that maintenance work on the existing weir does not occur until late July or August, when flow in the river has decreased. Since the timing of maintenance work does not conflict with the timing of sturgeon migration, a temporary cofferdam should suffice to allow for maintenance access under either alternative scenario.

Currently, maintenance access is primarily from the north bank. Rock is stockpiled with a loader, dumped into a skid, and then hauled by an existing overhead trolley cableway over the river to be dumped. It is unclear why, under the modified side channel alternative, a bridge for access from the south is necessary for this operation. A bridge may have unresolved design issues and potential impacts that have not been fully addressed. The DEIS states that the bridge may need to be elevated up to 10 feet above the floodplain level to accommodate flowing ice in the bypass channel. Bridge approach embankments, which would be necessary for a higher bridge elevation, may cause barriers to floodwater flow. This could result in erosion damage to the embankments, bypass channel, and surrounding land.

Recreation Access

Recreation access was cited as a benefit of bridge construction, but no documentation was provided that indicated that recreation access was required during the late spring and early summer season when flow in the river is high. Since recreation is not part of the new project's purpose and need, it should not be used as justification for a proposed new bridge.

Significance – Medium

Inclusion of a bridge impacts the cost of the modified side channel alternative and potentially affects the selection of the preferred alternative.

Recommendation for Resolution

1. Consider eliminating the proposed bridge from the modified side channel alternative.
2. If the proposed bridge is retained, address potential flood damage impacts of bridge abutment construction on embankments, the bypass channel, and the surrounding land.

PDT Final Evaluator Response (FPC 4)

	Concur	**X**	**Non-Concur**

Maintenance Access - A point of clarification is required before responding to this comment. In the first sentence of the 5th paragraph under maintenance access this comment states that "*Currently, maintenance access is primarily from the north bank*." Currently access for weir maintenance is on Joe's Island, which is the south bank of the Yellowstone River. Clarification has been added to the FEIS to ensure this is clear. This maintenance includes the import of rock for use on the weir, which includes hauling rock across the existing side channel. Rock is stockpiled with a loader, dumped into a skid, and then hauled by an existing overhead trolley cableway over the river for placement on the weir. Since the existing weir is not being replaced under the Modified Side Channel Alternative, there will be a similar frequency of rock hauling as in the No Action alternative or baseline condition. This would require crossing the modified side channel frequently, certainly more frequently than under the Bypass Channel Alternative under which the weir is being replaced.

Since the existing side channel is proposed for modifications under the Modified Side Channel Alternative to provide fish passage and would be between 2-5 feet lower (deeper) than the current side channel and have more frequent flows for a longer duration, the PDT determined that a bridge for maintenance access would be preferable to making frequent modifications to the side channel to allow haul vehicles to cross it, which would thereby reduce impacts to the side channel. Given the design slopes of the modified side channel (necessary to achieve the physical criteria), it would be difficult for dump trucks to cross the slopes on the modified channel without making modifications to it when necessary to cross. There is the risk that frequent interruption and modifications to the side channel would make it difficult to maintain the fish passage criteria to which that design was developed. Please see Figure 2-6 of the DEIS which depicts the conceptual bridge location and existing dirt roads, and the quarry from where maintenance rock is acquired.

Recreation Access- Recreation access is not a project purpose, and benefits of recreation were not used to justify the bridge. Any recreation access from the bridge would be incidental.

Recommendation 1:		**Adopt**	**X**	**Not Adopt**

For the reasons described above the agencies believe the bridge is necessary to provide access across the modified side channel thereby reducing the need for frequent, routine crossing or modifications of the channel proposed for fish passage. Under the Bypass Channel Alternative, there will not be as frequent access required for rocking because the weir is being replaced with a concrete weir and the existing side channel will have more gradual slopes and be less deep than under the Modified Side Channel Alternative.

Therefore, we believe it is important to include the proposed bridge with the Modified Side Channel and will maintain it as part of the proposed alternative.

Recommendation 2:	**X**	**Adopt**		**Not Adopt**

The bridge design and cost estimate are sufficient for alternative comparison in the NEPA document. As stated in Section 2.3.6 and Appendix A the bridge abutments are set outside the main channel banks to minimize encroachment. The new low chord of the bridge is also set two (2) feet above the 100-year water surface in accordance with the State of Montana and the National Flood Insurance Program criteria. The design appendix states that as a worst case scenario the bridge may need to be elevated up to 10 feet and this has been accounted for in uncertainties and cost estimates (see cost and schedule risk analysis in Appendix C). The design appendix states that should the alternative be selected for further analysis these items would be addressed.

If the modified side channel alternative is selected for implementation, additional design and analysis would be conducted during the design phase.

Panel Final BackCheck Response (FPC 4)

X	**Concur**		**Non-Concur**

The additional detail provided by the PDT clarifies the maintenance access requirements of the existing weir, as well the modified side channel depth and slopes. This information provides sufficient justification to include the bridge in the Modified Side Channel Alternative.

Final Panel Comment 5

Maintaining the existing Intake Diversion Dam, as opposed to installing a new weir, is not fully considered under the bypass channel alternative.

Basis for Comment

The revised project Purpose and Need statement includes the continued operation of the LYP and the normal functioning of the main irrigation canal. The DEIS states that the existing diversion weir provides sufficient water surface elevation to provide for the normal operation of the main canal and its new intake structure.

The DEIS justifies the installation of a new weir as a measure to reduce the potential for rock displaced from the Intake Diversion Dam obstructing the bypass channel's lower entrance over time. The entrance to the side channel is located further downstream of the Intake Diversion Dam. The DEIS indicates that the side channel's lower entrance location negates the need for a new weir.

A new weir across the Yellowstone River is proposed under the bypass channel alternative as a way to reduce the potential for displaced rock to obstruct the bypass channel's lower entrance and to reduce future maintenance costs; however, a new weir is not required for continued water delivery to the main canal, and its costs are not adequately justified. Over many years, the existing Intake Diversion Dam has required maintenance due to periodic rock displacement. However, it is not clear that the potential for periodic displaced rock obstructing the lower bypass channel entrance justifies a new weir. The potential for obstruction can be mitigated through monitoring and adaptive management. Removal of sediment/displaced rock from the channel's lower entrance is addressed in the Monitoring and Adaptive Management Plan.

A new diversion weir may be beneficial to the continued operation of the LYP, but a cost/benefit analysis of a new weir versus continued maintenance of the existing weir is not provided. The proposed new weir is a costly element of the overall project. Since it may not be necessary in order to meet the project objectives, it warrants careful consideration as a stand-alone project element.

Significance – Medium

Construction of a new weir impacts the cost of the alternatives and potentially affects the selection of the preferred alternative.

Recommendation for Resolution

1. Conduct a cost/benefit analysis of maintaining the existing Intake Diversion Dam versus construction of a new weir under the bypass channel alternative.
2. Consider a design modification that would reduce the potential for bypass channel obstruction due to rock displacement.

PDT Final Evaluator Response (FPC 5)			
	Concur	**X**	**Non-Concur**

The purpose and need has not changed and does not include a statement requiring normal functioning of the main irrigation canal. Per requirements of NEPA, the alternatives evaluated in the EIS were formulated to disclose the potential impacts that could occur from a range of reasonable alternatives. A final decision could include a variation of the alternatives within the range of impacts disclosed. – Alternatives were considered both with and without the concrete weir.

Not constructing a new weir under the Bypass Channel Alternative would result in the need to rebuild the trolley system, which is a significant cost since it would have to span the Yellowstone River and the bypass channel, and result in higher annual O&M costs than the bypass channel since annual rock placement would need to occur.

Expanded discussion pertaining to the value for a concrete weir with the Bypass Channel Alternative has been added to Section 2.3.5.4 of the FEIS. There are other factors that weigh into the decision on whether to include a new weir in the alternative besides costs. In summary the advantages of the concrete weir under the Bypass Channel Alternative are:

1.) The new weir would not require the annual placement of rock on the weir crest like the existing structure. If the existing weir structure was maintained there would be continued risk of rock migrating downstream in front of the bypass channel, which would likely have a negative effect on passage success. The location of the downstream outlet of the bypass channel immediately downstream of the weir and boulder field is an optimal location for fish passage, moving the channel further downstream adds to the risk of fish not finding it.

2.) The new weir provides better reliability for continued diversions of 1,374 cfs into the Main Canal down to 3,000 cfs in the Yellowstone River and for delivery of water into the bypass channel.

3.) The new weir would provide a smoother transition through the area for downstream migrating adult pallid sturgeon and downstream drifting free embryos and larvae.

Recommendation 1:		**Adopt**	**X**	**Not Adopt**

Based on the description above the PDT believes this is unnecessary. The analysis has already addressed the range of alternatives sufficient for the NEPA process. There have been analysis of alternatives with and without a new weir.

Recommendation 2:		**Adopt**	**X**	**Not Adopt**

There is uncertainty whether rock migration will create an issue for pallid sturgeon location of the bypass channel. As a result, the adaptive management plan identifies monitoring to determine if rock migration has an adverse effect on pallid bypass channel location, and measures to address this issue.

Panel Final BackCheck Response (FPC 5)			
X	**Concur**		**Non-Concur**

The revised Section 2.3.5 does a good job in addressing the issues brought up in this Final Panel Comment. Adding expanded discussion pertaining to the value of the proposed new concrete weir will clarify this issue in the EIS. The Panel acknowledges that a new weir has multiple benefits, including reduced O&M costs, reduced risk of displaced rock impacting the bypass channel, more reliable water diversion and a smoother water surface transition, which may be beneficial to pallid sturgeon larvae that drift over the Intake Diversion Dam.

Final Panel Comment 6

The existing side channel should remain open to accommodate flood flow and fish passage during high-flow events.

Basis for Comment

The bypass channel alternative utilizes the existing side channel entrance as the upstream starting point for the new bypass channel and uses fill to plug the existing side channel. This effectively closes the existing side channel to any future use by fish for upstream passage. The Panel believes that leaving the side channel open for flood flow and upstream fish passage during high-flow events would:

- Allow some flood flows to cross Joe's Island without crossing the bypass channel.
- Allow upstream fish passage during moderate- to high-flow events (this is the one proven route for upstream migration of pallid sturgeon under current conditions).
- Promote overall ecosystem health by maintaining as much aquatic and biotic connectivity as possible.

It does not appear that the functionality of the bypass channel alternative depends on closure of the existing side channel. It does appear that the inlet to the new bypass channel could be altered or relocated slightly to accommodate flood flow into the existing side channel, without compromising the bypass channel design.

Significance – Medium

With so little known about the migration behavior of the pallid sturgeon, the retention of any potential option for upstream passage would support the primary objective of the proposed Federal action.

Recommendation for Resolution

1. Consider relocating the inlet to the new bypass channel downstream by 500 feet, and constructing a high-flow inlet weir that allows flow into the existing side channel when discharge in the river exceeds 30,000 cubic feet per second.

PDT Final Evaluator Response (FPC 6)

	Concur	**X**	**Non-Concur**

The ability of the bypass channel alternative to meet Biological Review Team physical criteria is dependent on closure of the existing side channel. The inlet of the proposed bypass channel was selected based on the historical location and relative stability of the existing high flow channel. Higher uncertainty regarding the stability of the upstream end of the proposed bypass channel (bypass exit by fish orientation) would arise if the location was moved downstream. Allowing flow into the existing side channel above 30,000 cfs would reduce the amount of flow in the proposed bypass channel in the 30,000 to 63,000 cfs range. Pallid Sturgeon migrations are likely to occur when the Yellowstone River flows are in this range. The agencies felt utilizing the full extent of flow available for the bypass would better serve project objectives as opposed to splitting flows between two different alignments, which would reduce the

potential effectiveness of each. Splitting the flows of the Yellowstone River three ways adds substantial uncertainty to the geomorphic stability of the system. If a high flow weir were incorporated to convey flows to the existing high flow channel, it could be a passage barrier, limiting the benefit of conveying flows through the existing side channel.

Even if the existing high flow channel were allowed to carry flow in higher events (above 63,000 cfs), the likelihood and duration of flows above 63,000 cfs are relatively small. The 20% annual chance exceedance (ACE) discharge - commonly referred to as the 5-year flood - is approximately 74,400 cfs while the 10% ACE discharge (10-year flood) is 87,600 cfs. With a high flow channel designed to begin flowing at approximately 63,000 cfs, approximately 90,000 cfs would be required in the main channel to divert a sufficient amount of water into the high flow channel for pallid sturgeon passage (based on BRT criteria of 1 meter depth). Therefore, on average, once every 10 years there would be less than a single day that would likely provide sufficient flow in the proposed third channel for passage. Another consideration (besides flow frequency) is flow duration. During the months of April-June, a flow of 66,600 cfs is equaled or exceeded 1% of the time. The USGS streamflow statistics are not computed beyond the 1% exceedance by duration.

The stability near the upstream end of a three channel system would be even more complex than the existing conditions or the proposed bypass channel. As shown in the attached, the upstream end of the existing high flow channel has moved 200-300ft eastward in the past 66 years. Much consideration went into the stabilization for the proposed bypass channel; adding a third branch in the vicinity of the confluence would add another level of complexity.

The existing state of the science in hydraulic engineering allows for relatively high confidence in computing flow splits. Even so, the split into two separate side channel is complex and adds uncertainty. Given that, the computation of the split of sediment is much more difficult, even for one side channel. Adding another side channel increases the uncertainty exponentially. The main concern is that even if the computed flow splits are relatively accurate, one of the side channels may pull water with a lower sediment concentration, leaving the other side channel with a much higher sediment concentration, resulting in the potential for major deposition and/or erosion.

The Bureau of Reclamation's Technical Service Center (TSC) reviewed a proposed second side channel suggested by the State of Montana Fish, Wildlife, and Parks. The TSC had a number of comments and concerns which were made available to the panel.

The configuration of the existing high flow channel would require significant alteration to function as a fish passage route in a two side channel system. Previous bypass channel designs considered building a channel "plug" near the upstream end of the existing side channel to prevent flow splits from occurring at low flows. The plug would essentially be an earthen levee/dam. Using this to prevent diversion flows until the main channel is at 63,000 cfs would result in a large obstruction near the upstream end of the bypass. Fish that had migrated the 4+ miles up the side channel would be unable to continue upstream. Another method would be to add a rock ramp at significant cost and with significant uncertainty on passability. Yet another method would be to raise the invert of the existing side channel for a long distance, gradually sloping it back to existing grades. However, this major change would fundamentally alter the existing side channel's functionality. **See file, FPC 6 Response V2.pdf.**

Recommendation 1:		**Adopt**	**X**	**Not Adopt**

The existing side channel will be closed off to maximize passage potential and geomorphic stability of the proposed bypass.
Panel Final BackCheck Response (FPC 6)
X Concur **Non-Concur**
Supplemental information provided with the Final Evaluator Response (V2.pdf) substantiates the reasoning why the existing side channel should not be maintained for fish passage. Attachments to the Final Evaluator Response include comments from Bureau of Reclamation from their review of the hydraulic conditions occurring if both side channels were utilized. BuRec's conclusions support the PDT's decision not to maintain the existing side channel. With this supplemental information, the Panel better understands the prior analysis and decision making process, and can now support the PDT's non-concur to this Final Panel Comment.

Final Panel Comment 7

The current design of the bypass channel does not include erosion control measures to counter flood damage when flood flows overtop Joe's Island.

Basis for Comment

The bypass channel will be covered with flood flow in the 100-year event (and probably in smaller flood events) because floodwater will be flowing down-valley, which is perpendicular to the direction of flow in the bypass channel. The Panel believes that damage to the bypass channel is likely and ideally would be mitigated as much as possible through design rather than dealt with as a maintenance issue. In the 2013 IEPR, the Panel identified a similar comment based on the original design. However, this concern is now compounded because the proposed new diversion weir would raise the base water surface in the river by an additional 0.5 feet or more, increasing the frequency of water overtopping Joe's Island.

Flood flow crossing the bypass channel will have two potential effects: (1) erosion of the channel side slopes and deposition of sediment in the channel itself, and (2) changes to the hydraulics of the bypass channel during an overtopping flow event. The response to the 2013 IEPR Panel comment concluded that sedimentation issues would be limited to "isolated deposits," but did not provide a detailed analysis of the locations where this would occur, the volumes of sediment deposition expected, or the frequency of sedimentation events. The 2016 DEIS acknowledges this potential problem by stating that some of the soil excavated from the bypass channel could be sidecast on the left bank of the new channel, and that action may reduce the risk of sediment deposition in the bypass channel from flood flows. The Panel believes that the damage to the bypass channel from erosion and sedimentation could be much more than isolated sediment deposits.

The hydraulic analysis demonstrates that the bypass channel meets the BRT criteria for fish passage, but only when flow is limited to the bypass channel itself. Hydraulic conditions in the bypass channel will change when floodwater is overtopping this channel and flowing perpendicular to the channel alignment. There does not appear to be any 2D or 3D modeling that confirms that fish passage hydraulics will be maintained during an overtopping flood event.

Without a quantitative analysis demonstrating that flood damage to the bypass channel will be minimal, and that hydraulic conditions for fish passage can be maintained over a wide range of spring flood events in the river, the efficacy of the design cannot be confirmed. The Panel believes that the threat of flood damage and the disruption of hydraulic conditions that may facilitate fish passage can be minimized by design.

In addition, a low levee between the river and the bypass channel would be more effective at reducing sediment deposits in the bypass channel than a pile of sidecast soil. A low levee would reduce the frequency of flood flows crossing the bypass channel, and the frequency of potentially damaging flows could be limited to extreme events only. As a side benefit, a significant portion of soil from bypass channel excavation could be disposed of in this levee with only a short haul distance. Fuse plugs in the levee could be used to control where levee failures are most likely to occur, and that allows for control of where the bypass channel might need extra erosion protection.

Significance – Medium

The success of the preferred alternative depends on the bypass channel being designed to withstand erosional and depositional forces and being a viable waterway for fish passage under a wide range of flow conditions.

Recommendation for Resolution

1. Consider revising the design to allow the existing side channel to carry a portion of the total flood flow over Joe's Island, or document in the DEIS with quantitative hydraulic modeling why the current design can withstand an overtopping event without suffering damage.
2. Instead of side-casting soil excavation to protect the bypass channel from overtopping flow damage, consider compacting that soil into a low levee between the river and the bypass channel.

PDT Final Evaluator Response (FPC 7)

	Concur	X	Non-Concur

Also refer to Comment 6 as it pertains to Recommendation 1.

The PDT acknowledges a bypass channel left bank levee would serve to reduce damage risk when river stages inundate the surrounding floodplain. Floodplain concerns, which include a likely rise in surface water elevation from construction of a levee, prevented us from developing it fully. This issue is the primary reason a levee is not included in the final design. An additional concern with constructing a levee on the bypass channel left bank pertains to the potential for sediment to accumulate on the upstream side of the levee. Over time, the deposition could result in a larger floodplain constriction resulting in even higher water surfaces.

An evaluation would need to be conducted to determine the increase in water surface against the headworks structure during extreme events, especially ice-affected stages.

Hydraulic characteristics as they relate to fish passage considered up to 63,000 cfs total Yellowstone flow.

In order to place a significant amount of water in the overbank areas at the project site, an event in excess of 100 year recurrence would need to be experienced. 2D Hydraulic modeling of the 30% design indicates that portions of the bypass channel are likely to go ineffective in terms of velocity somewhere between the 1% and 0.2% annual chance of exceedance event. In other words, at extreme flows the bypass will be at risk for deposition/erosion. Somewhere between the 100 year and 500 year flood overbank flows orient in an entirely downstream direction and there is a discontinuity of flow/velocity through the bypass. When this occurs there is risk of deposition

Current O&M estimates account for routine O&M. These do not account for the removal of sediments from the bypass channel, as all analysis to date has indicated a slightly degradational trend to be experienced. While true that there is potential for deposition in the proposed bypass during a valley-wide flood event, it would not be accounted for in the lifecycle costs assumed in routine O&M estimates.

Damage to the channel is likely during an overbank flooding event, however grade control and bank stabilization design elements are expected to serve to maintain the function of the channel once a flood passes.				
Recommendation 1:		**Adopt**	**X**	**Not Adopt**
Please see response to comment 6. The existing side channel will be closed off to maximize passage potential and geomorphic stability of the proposed bypass.				
Recommendation 2:		**Adopt**	**X**	**Not Adopt**
Floodplain impacts, such as a rise in surface water elevation which could induce flooding would prohibit the inclusion of the left bank bypass levee.				
Panel Final BackCheck Response (FPC 7)				
X	**Concur**		**Non-Concur**	
Based on the PDT Evaluator's Response, the Panel understands that the frequency of flood flows crossing the bypass channel in a perpendicular direction is relatively low. If designed to accommodate a variety of overtopping conditions, "grade control and bank stabilization design elements" should be effective at minimizing flood damage to the new bypass channel. The Panel acknowledges that a full levee on the left bank of the bypass channel may create secondary flooding problems for the project. The Panel noted this is the most substantial documentation so far describing bank stabilization control design elements and should be carried over into the design.				

Final Panel Comment 8

The Monitoring and Adaptive Management Plan does not mention the establishment of formal agreements with Federal and state agencies to conduct vital monitoring elements.

Basis for Comment

The Monitoring and Adaptive Management Plan includes monitoring efforts to be conducted by multiple agencies. It is not clear whether appropriate formal agreements have been established but are omitted from the document or whether these types of agreements are currently being pursued. For example, upstream adult fish monitoring would be conducted by the U.S. Geological Survey, USFWS, and Montana Fish, Wildlife & Parks (Appendix E, p. 6), while the Bureau of Reclamation would be involved in future downstream monitoring of larval pallid sturgeon (Appendix E, p. 7).

Regarding agency participation in upstream monitoring, Appendix E states, “This effort is expected to continue to ensure a portion of the population is tagged and can be tracked every year” (p. 6). Since monitoring and adaptive management are critical to the success of the proposed project, it is necessary to establish Federal and state commitments to conduct monitoring. If critical monitoring elements are not conducted, then it will be difficult to determine if the project achieves the projected ecosystem benefits.

In addition, these types of commitments and/or agreements should contain important details such as:

1. Who is responsible for collecting, integrating, and evaluating monitoring data?
2. Who will be responsible for initiating the adaptive management process if data indicate that project goals are not being achieved?
3. What is the timeline for responding to monitoring results leading to implementation of adaptive management measures?

Such details regarding individual agency responsibilities are necessary components of an effective monitoring and adaptive management program.

Significance – Medium/Low

Including information regarding interagency agreements in the monitoring and adaptive management plan would improve the quality and completeness of the report. Establishing such agreements (if not already in place) would improve the quality of the Monitoring and Adaptive Management Plan.

Recommendation for Resolution

1. If agreements regarding monitoring elements already exist or are currently being pursued, document those agreements in the Monitoring and Adaptive Management Plan.
2. If agreements regarding monitoring elements do not exist and are not being pursued, document the approach that is being taken, and/or provide reasons why they will not be pursued.

PDT Final Evaluator Response (FPC 8)

X	**Concur**		**Non-Concur**

As mentioned in the DEIS the Monitoring and Adaptive Management Plan was draft and would include more detail for the FEIS. There is an existing MOA between the Corps and Reclamation that lays out the commitments and responsibilities of each agency in the role of adaptive management and monitoring. There are current working relationships with the State of Montana and USGS for other related pallid sturgeon monitoring actions and it is anticipated that those relationships would continue as the details of the plan are developed. Once a project is approved, monitoring details and adaptive management measures will be further developed in detail.

A revised Monitoring and Adaptive Management Plan has been prepared and will be appended to the FEIS. This revised document provides addition information on the roles and responsibilities of agencies engaged in the project, timing, and funding.

Recommendation 1:	**X**	**Adopt**		**Not Adopt**

Reclamation and the Corps signed an MOA (April 7, 2015) outlining agency roles and responsibilities as they pertain to the adaptive management plan. The plan being included with the FEIS includes a section titled Agency Roles, Responsibilities, and Funding. There will also be more details on reporting and data management once an alternative has been selected for implementation.

Recommendation 2:	**X**	**Adopt**		**Not Adopt**

See PDT response to Recommendation 1.

Panel Final BackCheck Response (FPC 8)

X	**Concur**		**Non-Concur**

Final Panel Comment 9

Impacts of downstream passage on mortality of drifting fish larvae associated with proposed structures and water intakes under each alternative, including the preferred alternative, are not addressed in the DEIS.

Basis for Comment

The Montana Chapter of the American Fisheries Society (5.MTAFS_Intake_Draft.pdf), and Defenders of Wildlife and Natural Resources Defense Council (6. Defenders and NRDC.pdf, Section C, pages 18-19) state in their public comment submissions that both larval fish drift post spawning and larval fish mortality are important factors in the survival of pallid sturgeon.

Many riverine fishes, including pallid sturgeon, migrate upstream in the spring to spawn, with subsequent drift of fertilized eggs and/or larvae downstream. Flowing water is needed for larval fish to remain suspended in the water column as they grow to the point where they can swim and maintain themselves in the water column. In the case of pallid sturgeon, fisheries scientists who have studied the species in the Yellowstone River have concluded that there is currently not a sufficient length of river distance between the Intake Diversion Dam and Lake Sakakawea for drifting larvae to remain suspended and survive. With the ability of adult pallid sturgeon to migrate upstream beyond the Intake Diversion Dam, it is likely that there will be a sufficient length of river for their larvae to drift in current, survive, and contribute to natural recruitment.

Larval fishes are very fragile and have little or no swimming ability. Consequently, mortality can occur through battering when these fishes drift downstream over dams or pass through turbulent cascades. Further, mortality can occur when larval fishes are removed from a river by entrainment associated with water diversion structures or pumps.

Currently, all of the alternatives considered will, to some degree, contribute to the mortality of larval fishes in the Yellowstone River as the fishes drift downstream over the Intake Diversion Dam or are removed from the river by water diversion structures or pumps. The relative contributions to mortality of larval fishes, especially pallid sturgeon, under each alternative are not provided in the DEIS.

Significance – Medium/High

By not including information on the extent of fish larvae mortality, particularly for the pallid sturgeon, estimates of the benefits to fish populations under the preferred project alternative and other alternatives associated with enhanced upstream fish passage may not be accurate.

Recommendation for Resolution

1. Provide information on the extent of drifting larval fish mortality associated with structures and pumps under the preferred alternative and other alternatives.
2. Document whether the preferred alternative will result in higher or lower levels of larval fish mortality than the other alternatives.

PDT Final Evaluator Response (FPC 9)			
X	Concur		Non-Concur

The PDT added information to Section 4.9 (formerly Section 4.10) of the EIS to evaluate the potential effects on pallid sturgeon larvae from each of the alternatives. It is anticipated that there would be limited potential for injury or mortality of free embryos/larvae passing downstream. The new weir, existing weir and rubble field would be similar to bluff pools and rapids that drifting embryos encounter naturally on the Yellowstone River. A preliminary laboratory evaluation of the potential effects of riprap on white sturgeon larvae indicated no differences in injury or mortality to fish drifting past riprap versus a control group (Kynard et al. 2014). Considering that free embryos and larvae are neutrally buoyant and are present in the lower part of the water column where velocities are lower, and their constant swim-up and drift behavior, it is less likely they would be adversely affected when drifting through the Project Area.

Specific to water diversions, it has been estimated that prior to the installation of screens at the Intake headworks that in some years as much as 8% of the fish entrained into the irrigation canal were shovelnose sturgeon. Since screens were installed in 2012, only one sturgeon larvae has been found entrained into the canal (Reclamation unpublished sampling data 2013-2015). It appears that the screens, although designed to prevent entrainment of all fish larger than 40 mm, have to date, reduced entrainment for most larval fish above 10 mm (Horn & Trimpe 2012). If pallid sturgeon successfully spawned upstream of Intake Diversion Dam, their larvae would likely be in the 9-12 mm size (P. Braaten, pers. comm. 2015), thus minimizing the potential for entrainment at the headworks. Information from drift studies (Kynard et al., 2002, 2007; Braaten, 2008, 2010, 2012), indicates that most pallid sturgeon free embryos drift in the lower 0.5 m (1.6 feet) of the water column, but a few will be caught in the upper portions of the water column, depending on turbulence and secondary currents (P. Braaten, personal communication 2015). When in use, the headworks screens are located approximately 2 feet above the river bottom and have an approach velocity of 0.4 meters per second (1.3 feet/second) and a sweeping velocity of 2-4 feet/second. This helps sweep small non-swimming fish past the screens and reduces the chance of free embryos, larvae and small fish being impinged upon the screens or entrained into the canal.

Additionally, Based on 2D modeling results, the area of influence from the screen extends approximately 50 feet into the Yellowstone River during river flows of 24,000 to 25,000 cfs. This is a relatively small area of influence as the Yellowstone River is approximately 700 feet wide at this location. As flows increase in the Yellowstone River during runoff conditions, this area of influence would be expected to decrease, decreasing the likelihood of entrainment. Additionally the thalweg is located approximately 100 -150 feet away from the headworks which is outside of the area of influence further reducing that chances of entrainment or impingement.

The vast majority of pallid sturgeon free embryos drift in or adjacent to the thalweg where velocities are high. Although a few free embryos will drift in regions of lower velocity (for example, along inside bends), most will be concentrated in the higher velocity regions. On river bends (similar to where the Intake screens are located), very high concentrations of drifting free embryos can be found in the region that extends from about mid-channel through the thalweg to the outside bend of the channel (Braaten et al. 2012).

The proposed new weir to be constructed approximately 40 feet upstream of the existing weir would have a smooth concrete top and a 125 foot-wide low-flow notch located approximately 100 feet out from the left bank, near to the channel thalweg. Rock and cobble will be placed sloping up to the new weir from the upstream side and then sloping down from the weir on the downstream side. This will smooth out flows and reduce turbulence. Further, as there will no longer be rock placed on the crest of the weir, there will not be turbulent and plunging flows associated with the rock. Downstream of the weir, the rock rubble

field will still be present.

The drifting free embryo are fragile, but their continuous day and night swim-up and drift swimming behavior is sufficient to move them far downstream and out of side eddies (Kynard et al. 2002, 2007). Although it seems that mass mortality would occur when these fragile fish drift downstream over dams or pass through turbulent cascades, a study observing mortality of free embryos of white sturgeon drifting at fast velocity (1 m/s) over a bottom of rip-rap found only a slight mortality and no significant difference compared to a smooth bottom control. High survival appears to be related to the swim-up and drift behavior of the embryos, which keeps them in the water column (Kynard et al. 2014). While the results are not conclusive for effects on pallid sturgeon, they suggest drifting pallid larvae survive well from passing over dams and rapids and can swim up in the water column to avoid eddies and other turbulence.

Kynard, B., E. Henyey, M. Horgan. 2002. Ontogenetic behavior, migration, and social behavior of pallid sturgeon, Scaphirhynchus albus, and shovelnose sturgeon, S. platorhynchus, with notes on the adaptive significance of body color. Env. Biol. Fish. 63:389-403.

Kynard, B., E. Parker, D. Pugh, and T. Parker. 2007. Use of laboratory studies to develop a dispersal model for Missouri River pallid sturgeon early life intervals. J. Appl. Ichthyol. 23:365-374.

Kynard, B., B.E. Kynard, M. Horgan, and A. Giraldo. 2014. Artificial stream studies on Kootenai River white sturgeon: 2013-2014. Final Rep. to Kootenai Tribe of Idaho, Bonners Ferry, ID. pp.36.

Recommendation 1:	**X**	**Adopt**		**Not Adopt**

Although there is not sufficient information on larval fish mortality from rock and similar structures to estimate this for any of the alternatives, additional information has been added to Sec. 4.9 on potential effects.

Recommendation 2:	**X**	**Adopt**		**Not Adopt**

Although there is not sufficient information on larval fish mortality from rock and similar structures to estimate this for any of the alternatives, additional information has been added to Sec. 4.9 on potential effects.

Panel Final BackCheck Response (FPC 9)

X	**Concur**		**Non-Concur**

The Panel believes that inclusion of the additional information is appropriate.

Final Panel Comment 10

The design criteria used to identify the non-dam alternatives do not explain how the multiple pump alternatives were developed.

Basis for Comment

The design criteria used to identify the non-dam alternatives are very general, and it is unclear how the multiple pump alternatives were developed. This uncertainty about the design criteria is reflected in the following DEIS statement:

> The two pumping alternatives have been structured in a way that discrete elements from either alternative could be combined or added to one another to achieve a more optimal alternative if new information indicates such combinations would improve alternative performance, reduce impacts, and/or reduce costs (DEIS p. 2-64).

Several public comments raised issues regarding the design of the non-dam alternatives, including the reliability of the pumping/power supply alternatives (4. USCOE Comment Letter, 12. LYREC Bypass Letter); the number of pumps necessary to meet irrigation demand (6. and 7. Defenders of Wildlife and the Natural Resource Defense Council, 10. American Rivers); the cost-effectiveness of irrigation conservation measures (6. and 7. Defenders of Wildlife and the Natural Resource Defense Council, 10. American Rivers); and the potential financial impacts of changes in Lower Yellowstone Project operation and maintenance costs on member farms (4. USCOE Comment Letter, 6. and 7. Defenders of Wildlife and the Natural Resource Defense Council).

These design issues influence the costs of the non-dam alternatives and the overall selection of the preferred alternative.

Significance – Medium/Low

Providing additional information on how the configurations of the non-dam alternatives were selected would contribute to a greater understanding of the alternatives assessment process.

Recommendation for Resolution

1. Document the design criteria used for the non-dam alternatives and clarify whether these criteria could be achieved with alternative pumping/power supply configurations.
2. Provide information on the reliability and the initial and recurring costs of different pumping power supply configurations, including the impacts of variable water supplies and conservation measures on crop yields/revenues.

PDT Final Evaluator Response (FPC 10)

	Concur	**X**	**Non-Concur**

O&M estimates that are located in the draft EIS are based on actual O&M expenses associated with the Buffalo Rapids Irrigation District, Sidney Irrigation District and similar Reclamation projects. These estimates account for uncertainties associated with the design and replacement costs that would occur within the 50 year timeline established within the document.

Section 2.3 describes the alternatives evaluated in the EIS. The alternatives evaluated in the EIS were formulated to evaluate a range of reasonable alternatives and disclose the potential impacts that could occur. A final decision could include a variation of project elements within the range of alternatives evaluated. The costs developed for each alternative are based on the reality of the types of pumps and existing limited electricity available to the site. If the Multiple Pumps Alternative were to be selected to move forward for more detailed design, some elements could be optimized for efficiency and cost savings. However, it is typically rare for a project's costs to be significantly reduced when moving from a feasibility level to the final design level as numerous factors are included as detailed line items that are currently considered in the contingency value.

The Multiple Pumping Station alternative is described in Section 2.3.7 and in Appendix A-2. This alternative is designed with a total diversion capacity of 1,374 cfs with pumping stations constructed along the river to deliver water to the main canal. We acknowledge that there are comments pertaining to the reliability of the pumping and power supply for the pumps. This was recognized during alternative development and as described in the alternative descriptions and details provided in Appendix A-2, and A-3 discussions occurred with the local utility and power upgrades were incorporated into the cost and design. In addition based on experience with power outages backup generators were included in the designs.

The power supply for this alternative in the DEIS was assumed to be from the local utility and costs developed with that assumption, with the option to acquire Pick-Sloan power. Per comments received, the FEIS includes the costs of Pick-Sloan power instead. The costs of supplying wind power to the project was analyzed and disclosed as part of the Multiple Pumps with Conservation Measures alternative and is described in the EIS document.

As explained in Section 1.7 and 2.3.8 the Multiple Pumping with Conservation Measures Alternative was proposed by public comment in scoping. It proposes removing the weir and reducing the gravity diversion while compensating for that with conservation measures. Section 2.3.8.7 of the EIS explains the irrigation water requirements of the current crops and shows that it cannot be met with a proposed reduced diversion.

Note that some of the comments referenced appear to assume that the current water right and annual diversions can be reduced but the analysis in Section 2.3.8.7 shows that the full water right is necessary to support peak demands of the current crop mix. The Multiple Pumping Alternative was designed to provide 1,374 cfs capacity. Without the weir, diversion can be achieved through gravity diversion during 17% of the irrigation season based on 30,000 cfs in the Yellowstone River, but almost never occurs during August and September (See FEIS 2.3.7.6 and Section 3.1.1.2 of Appendix A).

Additional calculations of diversion data have been added to the FEIS, Appendix A. The calculations provided in public comments differ from the data. Average daily flow rate from 2000-2015 has been calculated as 1,135 cfs and comparing to the period from 1968 to 2015 the average flow rate during the irrigation season is 1,122 cfs. This is merely average historic diversions, which is not the factor by which the design was developed of providing the water right of 1,374 cfs. The design was developed for 1,374 cfs, which meets the peak crop demands.

Based on those lower diversion rates, comments suggest using three pumping sites instead of five and lowering the design flow rate for the system to 825 cfs, with the remainder of the required irrigation water being provided by gravity through the existing Intake when the river level is high enough to allow it. A review of the diversion-exceedance data previously presented in the DEIS shows that the proposed

reduced-capacity system (3 pumps) would fail to provide the 1374 cfs of irrigation water on 30% to 40% of the days during a typical irrigation season.

Furthermore the LYID canal system is designed for gravity diversions and upstream control. Should a modified system such as pumping water from sites 3-5 be implemented, the irrigation system would require modifications (physical and operational). This could be in the form of reductions in canal capacity, additional check structures, or additional pumping stations. There would be cost and impacts involved with such changes that are not accounted for in the assumption that reducing the pumps from 5 to 3 would reduce costs.

Recommendation 1:		**Adopt**	**X**	**Not Adopt**

As stated in the EIS the design criteria for the Multiple Pumping Alternative is to provide the current water right (1,374 cfs) to the irrigation canal without the weir. The analysis describes the period and percentage of time that gravity diversion could occur, and incorporated that into the cost and benefit analysis. Two alternate power and pumping alternatives have been analyzed in the document and a third was dismissed (Ram Pumps, see 2.3.1) as not feasible. Two pumping and power scenarios are compared in the Environmental Impact Statement.

Recommendation 2:		**Adopt**	**X**	**Not Adopt**

Information pertaining to the costs and impacts of two different pumping and power supply configurations have been disclosed in the EIS. Section 2.3.8.7 describes the irrigation water requirements of the current crop mix irrigated in the LYID. The two alternatives analyzed provide a range of benefits and effects. Providing less than the 1,374 cfs water right does not meet the peak crop demands and therefore would not likely meet the purpose and need of continuing the viable and effective operation of the project. Changing the water supply quantities and crop mixes based on different scenarios is also beyond the scope. The EIS does address the costs associated with the different pumping alternatives (of which one includes conservation measures) and the different O&M costs of doing so are described in Socioeconomics section of Chapter 4.

Panel Final BackCheck Response (FPC 10)

X	**Concur**		**Non-Concur**

The Panel believes the PDT is clarifying and addressing the issue in the public comments and adding it to the report in a succinct way.

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