



DEPARTMENT OF THE ARMY  
U.S. ARMY CORPS OF ENGINEERS  
441 G STREET, NW  
WASHINGTON, DC 20314-1000

CECW-LRD

JUL 12 2017

MEMORANDUM FOR RECORD

SUBJECT: Bluestone Dam, Hilton, West Virginia, Dam Safety Modification Report - Final U.S. Army Corps of Engineers Response (USACE) to Independent External Peer Review (IEPR)

1. Independent External Peer Review (IEPR) was conducted for the subject project in accordance with Section 2034 of the Water Resource Development Act of 2007, EC 1165-2-209 (superseded by EC 1165-2-214, 15 Dec 2012), and the Office of Management and Budget's Final Information Quality Bulletin for Peer Review (2004).
2. Analysis, Planning and Management Institute, a non-profit science and engineering organization, was engaged (by Logistics Management Institute) to conduct the IEPR for the Bluestone Dam Draft Dam Safety Modification Study and its supporting documentation. The IEPR consisted of six members with expertise in civil engineering, biological resources and environmental law compliance, economics and planning, engineering geology, hydraulic and hydrologic engineering, and structural engineering.
3. The final written agency responses to the IEPR are hereby certified. The enclosed document contains the final written responses of the Chief of Engineers to the issues raised and the recommendations contained in the IEPR report. The IEPR report and the USACE responses have been coordinated with the vertical team, endorsed by the Risk Management Center and approved by the Great Lakes and Ohio River Division, and will be posted on the Internet, as required in EC 1165-2-214.
4. If you have any questions on this matter, please contact me or have a member of your staff contact Yvonne Prettyman-Beck, Deputy Chief, Great Lakes and Ohio River Division Regional Integration Team at 202-761-4670.

Encl

A handwritten signature in blue ink, appearing to read "J. Dalton".

JAMES C. DALTON, P.E.  
Director of Civil Works

**Bluestone Dam, Hinton, West Virginia  
Dam Safety Modification Study**

**U.S. Army Corps of Engineers Response to  
Independent External Peer Review  
May 2017**

Independent External Peer Review (IEPR) was conducted for the subject study in accordance with Section 2034 of WRDA 2007, EC 1165-2-214, and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (2004). The goal of the U.S. Army Corps of Engineers (USACE) Civil Works program is to always provide scientifically sound, sustainable water resources solutions for the nation. The USACE review processes are essential to ensuring project safety and quality of the products USACE provides to the American people.

Analysis, Planning and Management Institute (APMI), a non-profit science and engineering organization, was engaged (by Logistics Management Institute) to conduct the IEPR for the *Bluestone Dam Draft Dam Safety Modification Study* and its supporting documentation. The IEPR consisted of six members with expertise in civil engineering, biological resources and environmental law compliance, economics and planning, engineering geology, hydraulic and hydrologic engineering, and structural engineering.

APMI/LMI issued its Final Independent External Peer Review Report on October 31, 2016 and an Addendum to that report on February 1, 2017, to include consideration of public review comments that were received subsequent to finalization of the initial report. The review resulted in a total of 36 Final Panel Comments. Of these, three were identified with High Significance, six with Medium/High Significance, twenty with Medium Significance, three with Medium/Low Significance, and four with Low Significance.

The following discussion presents a summary of the USACE final responses to the recommendations contained in the comments.

**1. High Significance - It is not clear from the SDEIS (Supplemental Draft Environmental Impact Statement) or Draft DSMR (Dam Safety Modification Report) whether there might be disproportional impacts to Environmental Justice populations and/or children as a result of the implementation of the project.**

Two specific recommendations were made with this comment. Both were adopted.

1. Provide a more robust analysis and discussion of potential impacts to Environmental Justice populations and children within the SDEIS and Draft DSMR as noted above.

**USACE Response: Adopted.**

**Action Taken:** Additional discussion has been added to Section 5.14 of the Final Supplemental Environmental Impact Statement to clarify and substantiate the finding that there is no disproportionate effect to minority, low-income populations and children. Although no homes or businesses would be displaced as a result of construction, properties within the vicinity of construction activities would continue to sustain minor effects during the period of construction. These effects would be most pronounced and somewhat isolated to the Bellepoint Area of Hinton, where Best Management Practices utilized during ongoing construction would continue. The minority population percentage of the Bellepoint area is not meaningfully greater than that of the general population. Similarly, the study for the Supplemental Environmental Impact Statement found income levels in the Bellepoint area can generally be considered comparable to or greater than that of the surrounding county and state. Therefore, neither minority populations nor low-income populations would be disproportionately affected.

There are children residing in the Bellepoint area who may experience effects associated with construction activities. However, these effects are expected to be minor, as discussed in Section 5.14.1 of the SEIS, and will be minimized through Best Management Practices and traffic restrictions. Best Management Practices to reduce impacts to air quality include, but are not limited to, the use of water trucks to reduce dust, spray bars to clean trucks, dust collectors for the concrete batch plant, and no burning on site. Noise control is being achieved by monitoring and ensuring allowable levels are not exceeded. Currently, truck traffic is limited to the hours of 9:00AM to 2:00PM Monday through Friday during school hours to reduce the effect on children.

2. Include a note in each relevant subsection of the SDEIS, Section 4, to indicate whether the objectives of the referenced Executive Orders are met by the TSP (the selected plan), and where within the document additional information might be located.

**USACE Response: Adopted.**

**Action Taken:** Additional documentation has been provided within the “Environmental Consequences” Section 5.14 of the Final Supplemental Environmental Impact Statement to more clearly indicate that the objectives of Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations” and Executive Order 13045, “Protection of Children from Environmental Health Risks and Safety Risks” have been met by the selected plan.

**2. High Significance - It is not clear from the SDEIS (Supplemental Draft Environmental Impact Statement) whether invasive species proliferation and control has been adequately considered.**

This comment includes one recommendation, which was adopted.

1. Revise the SDEIS to clearly include additional information on invasive species management, monitoring, and control as noted above.

**USACE Response: Adopted.**

**Action Taken:** Disturbance by construction activities can provide opportunities for spread of invasive species. Additional information has been added to Section 5.1 of the Final Supplemental Environmental Impact Statement to support the finding that with the selected plan, these effects would be minimal. Only very limited clearing of vegetation (approximately 0.7 acres) is planned during implementation of the selected plan, providing limited opportunity for the spread of invasive species.

As described in Section 5.1 of the Supplemental Environmental Impact Statement, to minimize spread of invasive species, management activities carried out jointly by the West Virginia Department of Natural Resources and the USACE would continue within the area of construction once the project is completed. Additionally, a comprehensive long-term vegetation monitoring plan will also be instituted, in which monitoring will be coordinated with resource agencies and appropriate mitigation would be employed if determined necessary.

With regard to downstream aquatic resources, construction may provide a potential opportunity for spread of invasive species, as described in Section 5.3. However, given the general lack of presence of native or invasive mussels in the immediate downstream area, which would be most affected by construction, the effect to the spread of aquatic invasive species associated with construction would be minimal to negligible.

**3. Medium/High Significance - The spacing of the drains in the stilling basin is relatively large compared to the spacing of the drains in the new spillway gallery and other similar stilling basin underdrain systems. The methodology used for the design of the drain spacing for the existing spillway apron and the apron extensions appears inconsistent within the documentation and there is no discussion on how the spacing was selected.**

This comment includes two recommendations. Both were adopted.

1. Reevaluate and verify the spacing of the drains for the existing stilling basin apron and the apron extensions.

**USACE Response: Adopted.**

**Action Taken:** Drain spacing was re-evaluated. This resulted in a design modification to provide more drains beneath the existing stilling basin apron and proposed apron

extensions. The need for more drains or a change in spacing will be evaluated again during the design phase and the effectiveness of the system will be verified using instrumentation after construction.

2. Document the methodology used for the drain spacing design in the final design report.

**USACE Response: Adopted.**

**Action Taken:** The methodology used to determine drain spacing and all aspects of the drainage system design will be thoroughly documented in the final design, which will be completed in the pre-construction, engineering and design (PED) phase.

**4. Medium/High Significance - The structural analysis of the supercavitating baffle blocks incorrectly assumes that the spine of the baffle will act like a sloped column and ignores the rigid connection with the slab along the bottom side.**

This comment includes two recommendations. Both were adopted.

1. Analyze the baffle using a finite element model consisting of plane stress elements (or other appropriate elements) to more accurately model the behavior of the concrete.

**USACE Response: Adopted.**

**Action Taken:** A finite element model will be developed in the design phase to aid in understanding stress distribution through the baffle block.

2. Use the results from the finite element model to design the reinforcement for the baffle.

**USACE Response: Adopted.**

**Action Taken:** In the design phase, a finite element model will be utilized to inform and refine the design of the baffle block.

**5. Medium/High Significance - System-wide flood effects resulting from coincident flooding during large, single-storm events or from the landing of multiple “tracking storms” have not been considered adequately in determining breach and non-breach flood impacts.**

This comment includes four recommendations and two of the four were adopted.

1. At a minimum, revise the main report and Appendix D, Hydrology and Hydraulics, to include a discussion of how (or if) coincident flooding has been evaluated. If policy considerations restrict inclusion of coincident flooding impacts in the consequences evaluation, some explanation of the practical implications for citizens should still be included in the report.

**USACE Response: Adopted.**

**Action Taken:** Additional text has been included in Appendix D, Hydrology and Hydraulics, of the Dam Safety Modification Report to describe how coincident flooding

was evaluated. Because coincidental flooding on large tributaries downstream could limit the ability to release water from the dam, a high reservoir elevation was assumed as a starting point prior to modeling the impacts from a potential large storm event like the Probable Maximum Precipitation (PMP). The amount of coincidental flooding downstream of the dam was also varied to help understand its effect on flood impacts from large storm events, for both breach and non-breach scenarios.

2. If USACE believes, like the Panel, that coincident system-wide effects should be considered, revise the report to discuss the additional modeling necessary during PED (the design phase) to address the issue.

**USACE Response: Not Adopted.**

Coincident system-wide effects have been considered in the modeling performed for the Dam Safety Modification Report. Text has been added to Chapter 4 and Appendix D, Hydrology and Hydraulics, of the Dam Safety Modification Report to better describe how these effects were evaluated.

3. Clarify what evaluations (if any) were completed regarding the multiple “tracking” storm scenario, other than consideration of antecedent conditions.

**USACE Response: Adopted.**

**Action Taken:** Additional narrative has been added to Appendix D, Hydrology and Hydraulics, of the Dam Safety Modification Report to clarify how the potential for multiple “tracking” storms was evaluated. The analysis to determine the Probable Maximum Precipitation and Probable Maximum Flood included consideration of these types of storms, with both tropical and extra-tropical storm complexes. These types of storms also affected estimates of how likely various flood events are to occur.

4. If USACE believes, like the Panel, that the multiple tracking storm scenario is important, revise the report to discuss the additional modeling necessary during PED to address the issue.

**USACE Response: Not Adopted.**

The multiple “tracking” storm scenario was included in the modeling for the Dam Safety Modification Study. Text has been added to Appendix D, Hydrology and Hydraulics, of the Dam Safety Modification Report to better describe how this scenario was analyzed.

**6. Medium/High Significance - It is not clear whether there may be unidentified impacts to important biologic communities resulting from a lack of supporting data, studies, or other sufficiently substantive consideration.**

This comment includes three recommendations, which were all adopted.

1. As appropriate, revise the SDEIS (Supplemental Draft Environmental Impact Statement) to address the above noted concerns, or reference where information can be found within the

document (or both), including preconstruction surveys and/or documentation of current conditions for T&E (Threatened and Endangered) species.

**USACE Response: Adopted.**

**Action Taken:** Text has been included in Section 4.2 of the Final Supplemental Environmental Impact Statement and Final Fish and Wildlife Coordination Act Report to better substantiate that threatened and endangered species, such as the Indiana bat, would not be impacted by the implementation of the selected plan. Investigations were conducted to supplement existing information on threatened and endangered species habitat in the project area. The USACE conducted the consultation required in Section 7 of the Endangered Species Act, coordinating closely with the US Fish and Wildlife Service throughout the process.

2. As appropriate, revise the SDEIS to address the above noted concerns, or reference where information can be found within the document (or both), including impacts to sensitive wildlife populations (i.e., instream and adjacent forested habitats).

**USACE Response: Adopted.**

**Action Taken:** Text has been included in Section 4.3 of the Final Supplemental Environmental Impact Statement and in the Final Fish and Wildlife Coordination Act Report to better substantiate that there would be no significant impacts to sensitive wildlife populations, such as native mussel species, from the implementation of the selected plan. Recent mussel surveys have found small populations of two species, but none in the area directly impacted by construction. Diversion measures have been added to minimize the indirect impacts to downstream populations. The USACE has coordinated closely with the US Fish and Wildlife Service in reaching the conclusion that neither these species nor other sensitive wildlife populations would be significantly impacted.

3. As appropriate, revise the SDEIS to address the above noted concerns, or reference where information can be found within the document (or both), including more robust discussion regarding impacts and potential complications for habitat restoration stemming from “*significant, long-term but non-permanent impacts*”.

**USACE Response: Adopted.**

**Action Taken:** Text has been included in Chapter 5 of the Final Supplemental Environmental Impact Statement and in the Final Fish and Wildlife Coordination Act Report to further discuss potential impacts to biological communities and additional mitigation and monitoring plans. The USACE has conducted further coordination with USFWS, West Virginia Department of Natural Resources, and West Virginia Department of Environmental Protection, and added a diversion measure as part of the construction to reduce impacts to habitats. This measure would reduce the indirect impacts from the originally defined 51 habitat units to 9 habitat units.

The USACE conducted a limited field survey upstream of the dam to assess potential indirect impacts. In addition to the routine management activities during and after

construction, these areas will continue to be monitored for invasive species and for changes in the vegetative communities. A comprehensive long-term vegetation monitoring plan will be developed in the design phase that includes a more detailed survey of current vegetation conditions as well as periodic monitoring for any changes to plant species. Monitoring will be coordinated with appropriate resource agencies and appropriate mitigation will be employed, if determined necessary.

**7. Medium/High Significance - It is not clear whether mitigation for construction impacts is fully supportable based on the information provided in the Draft DSMR (Dam Safety Modification Report) and SDEIS (Supplemental Draft Environmental Impact Statement).**

This comment includes three recommendations. Two of the recommendations were adopted.

1. Provide more robust discussion within the SDEIS regarding impacts and potential complications for habitat restoration and mitigation stemming from “significant, long-term but non-permanent impacts”, including discussion regarding mitigation for time to recovery for affected habitats.

**USACE Response: Adopted.**

**Action Taken:** Documentation has been included in the Final Supplemental Environmental Impact Statement to support the conclusion that there are viable mitigation options for the impacts resulting from construction of the selected plan, including mitigation for the habitat that will be affected. This more thorough discussion is based on additional research concerning the potential mitigation efforts, summarized in a Mitigation Plan. The final analysis and decision concerning the mitigation areas will be completed during the design phase, when a supplemental Environmental Assessment will be conducted.

2. Provide more robust discussion regarding mitigation for wetland resources.

**USACE Response: Not Adopted.**

No wetland resources were identified as being directly impacted due to the selected plan, and therefore no mitigation has been proposed. Impacts to water willow beds downstream of the dam will be mitigated as part of the overall aquatic mitigation plan, and upstream wetlands that could be indirectly impacted will be monitored as part of the long-term vegetation monitoring plan. This has been clarified in Section 5.3 and 5.4 of the Final Supplemental Environmental Impact Statement. In the unlikely event that wetland areas are impacted by the selected plan, a full analysis of the wetland areas will be conducted and proper mitigation will take place.

3. Provide more robust discussion on disposal and management of dredge material as noted above.

**USACE Response: Adopted.**

**Action Taken:** A more thorough discussion has been included in the Final Supplemental Environmental Impact Statement in Sections 1.1.1 and 3.4.2 to support the conclusion

that there are potential disposal sites for future use that would not have significant environmental impacts. This document's ongoing investigations pertaining to disposal sites, included the potential for the beneficial use of this material. The final analysis and decision concerning the disposal areas will be completed during the design phase, when a supplemental National Environmental Policy Act (NEPA) document will be conducted.

**8. Medium/High Significance - It is not clear from the SDEIS (Supplemental Draft Environmental Impact Statement) whether Cumulative Impacts have been adequately considered.**

This comment includes one recommendation, which was adopted.

1. Provide more robust discussion regarding cumulative impacts within the SDEIS, including a more comprehensive inclusion of areas potentially impacted and/or influenced by the operation of the dam.

**USACE Response: Adopted.**

**Action Taken:** A more thorough discussion has been included in Chapter 6 of the Final Supplemental Environmental Impact Statement regarding the potential for cumulative impacts (or impacts from the selected plan together with any impacts from past, present, and reasonably foreseeable future actions, regardless of who undertakes the actions). While cumulative impacts in additional areas were considered, the large majority of resource impacts due to implementation of the selected plan would be limited to Reconnaissance Areas 1 and 2 (as defined in Chapter 6), where cumulative impacts have been fully assessed.

**9. Medium Significance - The reservoir operating scenario and rule curve, which may help reduce premature scour on the penstock basin, that is recommended to be prepared in the modeling report is not referenced in any document provided to the Panel to date.**

This comment includes four recommendations, all of which were adopted.

1. Clarify the conditions that were used for the selected design as discussed above.

**USACE Response: Adopted.**

**Action Taken:** Additional narrative has been added to Appendix D, Hydrology and Hydraulics, of the Dam Safety Modification Report to clarify the conditions assumed when modeling the effects of the Inflow Design Flood and in the design of the selected plan. Because of the potential need to restrict releases, the reservoir was assumed to be already filled to a high elevation prior to the occurrence of the potential storm event.

2. Prepare an Operating Rule Curve for the Gated Spillway and the Penstock areas of the dam.

**USACE Response: Adopted.**

**Action Taken:** Revised operating rules for the Gated Spillway and Penstock areas to reduce the potential for scour will be included in the update to the Water Control Manual that is currently under development.

3. The final design of the project should have a defined plan for resolution of eddy currents on the spillway section and the penstock section.

**USACE Response: Adopted.**

**Action Taken:** The final design will include a plan to prevent eddy currents. During initial physical model experimentation in July 2016, a preliminary operational procedure was identified which achieves adequate performance, eliminating the conditions which could induce eddy currents. During preconstruction, engineering and design (PED), the second phase of physical modeling, additional conditions will be modeled to ensure adequate performance for all possible operational scenarios. Results will inform the revised operating rules.

4. If additional modeling is needed to resolve the potential for scouring beneath adjacent structures, it should be performed during the final design phase and prior to construction.

**USACE Response: Adopted.**

**Action Taken:** During PED, additional physical modeling will be conducted prior to construction to resolve the potential for scouring beneath adjacent structures.

**10. Medium Significance - The evacuation mobilization rates used in the risk analysis do not seem well integrated with the hydrologic model results.**

This comment includes two recommendations, both of which were adopted.

1. Include a more thorough discussion in the main report regarding the total timeline (in hours) expected for flood control pool filling followed by possible dam failure followed by dam-break flood wave routing. An illustration or figure would be essential to explain the timeline.

**USACE Response: Adopted.**

**Action Taken:** A figure has been added to Section 3.2.3.9 of the Dam Safety Modification Report clearly portraying the timeline of events involved with a potential dam breach. The amount of warning time and the arrival time of high flow for Charleston, WV has been highlighted. A more thorough discussion has also been added to Section 3.2.3.9 of the Dam Safety Modification Report to explain the total timeline, how the model incorporates the evacuation mobilization rates, and how those relate to water flow.

2. Compare the assumptions used for the EOE (Expert Opinion Elicitation) regarding mobilization times/rates and determine if the expert Panel assumptions were consistent with the expected full timeline in a PMF (Probable Maximum Flood)-like event [e.g., are 8-hour and 24-hour mobilization percentages presented (in unnamed tables on page 72 of the main

Draft DSMR (Dam Safety Modification) report) logical when looking at the whole picture]. If significant differences in EOE understanding/assumptions are identified, discuss work to be completed during PED (the design phase) to revise mobilization tables and revise the risk analysis.

**USACE Response: Adopted.**

**Action Taken:** The assumptions used in the Expert Opinion Elicitation (which makes up a portion of the risk assessment) have been compared to the expected full timeline in a large storm event like the Probable Maximum Flood, and no inconsistency has been identified. During ongoing outreach and risk communication efforts with local and state emergency managers, the team will continue to discuss the mobilization rates to confirm that they are consistent with the expectations of the experts involved in the Expert Opinion Elicitation. However, any changes to the mobilization ranges would not likely have a significant effect on the risk estimate, because the model already accounts for a wide range of uncertainty around the mobilization rates.

**11. Medium Significance - The nonstructural component of the selected plan RMP #6, risk communication, should be revised and expanded to include comprehensive flood warning communications from USACE to the public at risk.**

This comment includes four recommendations. Three recommendations were adopted and one was not adopted.

1. Develop a detailed final risk communication plan as part of PED (the design phase) — including all passive measures and appropriate active measures—to inform and warn the public of danger. Ensure that the plan is well explained and discussed.

**USACE Response: Adopted.**

**Action Taken:** The risk communication conducted to date, while robust, in cooperation and partnership with the West Virginia Division of Military Affairs and Public Safety and West Virginia Division of Homeland Security and Emergency Management, has been ad hoc, and during the design phase will be formalized into a specific plan to ensure continued engagement and success. The plan will include discussion of protocols to alert local and state emergency management officials who are authorized to transmit warnings to the public.

2. Consider development of a real-time flood warning model during PED to establish warning communication thresholds defining when there should be broadcasts to stakeholder agencies and directly to residents. Determine if the existing HEC-RAS dam break model can be modified and used for such a purpose. Integrate the flood warning model with the proposed new Water Control Plan.

**USACE Response: Adopted.**

**Action Taken:** The Corps Water Management System which is currently used provides daily lake and stream forecasts for the Kanawha River Basin. This real-time forecasting is utilized for operational decisions and to inform the appropriate state and local officials of

any damaging releases forecasted from the project. In cooperation with our partners, we maintain protocols for alerting state emergency management officials of any potential damaging non-breach or beach discharges. Any broadcast efforts directly to residents would continue to be the responsibility of appropriate officials at the state and local levels in conjunction with the National Weather Service.

3. Undertake further coordination with state, city and county emergency managers in order to improve the new risk communication plan as well as bring important stakeholders together (e.g. FEMA, USACE, State, City, County, private companies) to identify concrete actions and long-term, sustainable funding sources.

**USACE Response: Adopted.**

**Action Taken:** The inclusion of charrettes and formal meetings with stakeholders will be considered in the development of a more formalized risk communication plan during the design phase. Existing channels of communication, including the Corps' led Silver Jacket's program and other outreach efforts, will be used to ensure state and local officials are aware of other USACE continuing authorities that may be of interest to them, including the Sec 22 of the Water Resources Development Act (WRDA) of 1974 Planning Assistance to States (PAS). Much of this communication is already occurring in the context of recovery and mitigation efforts resulting from the floods in the Kanawha River Basin in the June 2016.

4. With the new, more-detailed risk communication plan in place, reconvene the expert elicitation Panel regarding evacuation and mobilization rates to investigate the benefit of proposed risk communication measures in regards to adopting higher mobilization rates in the final PED risk calculations, potentially lessening the need for structural measure risk reduction at the dam.

**USACE Response: Not Adopted.**

The USACE has hosted site-specific discussions on evacuation mobility rates with many state emergency planners and responders in order to better understand all factors affecting the evacuation of people during a potential flood warning in downstream areas. The expert elicitation panel took into account several possible future scenarios, including an assumption of increased risk awareness and more robust warning systems in the future, and found that changes to mobilization rates would not have a substantial impact on the magnitude of life loss estimates. Therefore, adopting higher mobilization rates would not lessen the need for structural measure risk reduction at the dam.

**12. Medium Significance - It is unclear as to what analyses were performed to determine the final precipitation distribution pattern used in the modeling for the TSP alternative (the selected plan). If the 1982 PMP (Probable Maximum Precipitation) temporal and spatial distributions were determined to be the best analysis, then it was not clearly stated in the report.**

This comment includes one recommendation, which was adopted.

1. If not already done, investigate if there is a more appropriate Temporal and Spatial Distribution on the watershed for the period 1982 to present. If the 1982 PMP temporal and spatial distributions are determined to be the best analysis then it should be clearly stated in the report.

**USACE Response: Adopted.**

**Action Taken:** Additional discussion has been added to Appendix D, Hydrology and Hydraulics, of the Dam Safety Modification Report to more clearly explain the way rainfall is distributed through time and across the region in the modeling of the Probable Maximum Precipitation storm event. The rainfall distributions used are more appropriate than the 1982 Probable Maximum Precipitation distributions because they account for the effects of the mountainous terrain.

**13. Medium Significance - There is no description in the reporting documents of a plan to periodically review or update the hydrology for the Project area in the future to consider updated precipitation data that may be the increasing trend of climate change.**

This comment includes one recommendation, which was adopted.

1. Both Planning and Hydrology and Hydraulics disciplines should periodically review any trends in increased precipitation and determine when the time is right to update the hydrologic and hydraulic analyses for the effects of climate change.

**USACE Response: Adopted.**

**Action Taken:** Precipitation trends will be re-evaluated as a part of the Periodic Assessments of the dam, which are scheduled at ten-year intervals. Text has also been added to Chapter 3 of the Dam Safety Modification Report to discuss how climate change impacts were incorporated into the current study.

**14. Medium Significance - The crest elevation for several components of RMP #6 (the selected plan) appear to be lower than required compared to the expected water surface profile generated from a PMF (Probable Maximum Flood) event.**

This comment includes three recommendations, two of which were adopted.

1. Review the proposed extent of concrete rock protection on the right outside of the right training wall. If USACE considers the proposed extent adequate, provide further justification in the main report and in Appendix C, "Civil Engineering". If USACE considers, like the Panel, that the extents should be expanded, modify the documents accordingly including estimated quantities in Appendix C.

**USACE Response: Not Adopted.**

The extent and design of proposed concrete protection on the right, outside of the right training wall, will be further refined during the design phase using measurements from the physical model. The current proposed limits of the concrete protection as included in

the selected plan were determined from visual observations and consultations between USACE and external hydraulic structure and scour experts.

2. Review the possible implications of overtopping the penstock training wall to determine if hydraulic function of the penstock section is reduced. Provide some text updates in the main report and Appendix D, "Hydrology and Hydraulics", to clarify the effects (if any) of the overtopping of the penstock training wall.

**USACE Response: Adopted.**

**Action Taken:** Documentation has been added to Chapter 6 and Appendix D, Hydrology and Hydraulics, of the Dam Safety Modification Report to clarify the implications of overtopping of the penstock training walls. This was assessed qualitatively through visual observations of the physical model, and further physical modeling during the design phase will allow the opportunity to refine operational procedures that can affect this overtopping.

3. Raise the proposed height of the new divider wall to be consistent with the top of proposed temporary coffer dam. Revise text in the main report and Appendix C indicating the new heights. Revise quantities in Appendix C. Revise all necessary drawings accordingly.

**USACE Response: Adopted.**

**Action Taken:** The proposed height of the divider wall has been raised to be consistent with the top of the proposed temporary coffer dam. The Dam Safety Modification Report text, quantities, and drawings in Chapter 6 and Appendices B and C have been revised accordingly.

**15. Medium Significance - The current design does not provide information regarding the discharge system required to ensure that water from the proposed drain system can be safely and continuously discharged under a range of upstream pool conditions.**

This comment includes two recommendations, one of which was adopted.

1. Develop a preliminary, conceptual design for the current Draft DSMR (Dam Safety Modification Report) describing how water from the proposed drain system can be safely and continuously discharged under a range of upstream pool conditions.

**USACE Response: Not Adopted.**

The current design is based on a similar system already in place at Bluestone Dam that has a long history of successful operation. Adequate confidence in the safe and continuous operation of the system exists with the current design assumptions due to past experience with this type of system.

2. Carry the discharge conceptual design developed for the current Draft DSMR forward in the detailed design stage. Include estimates of the drain flow under extreme flood events as a basis of hydraulic and pump design in development of a final design.

**USACE Response: Adopted.**

**Action Taken:** A more detailed design of the pumping system will be performed during the design phase to include an estimate of expected drain flow and appropriate factors of safety for all flood events.

**16. Medium Significance - The hydraulics of the proposed pumping scheme for the spillway stilling basin underdrain system requires further evaluation and description.**

This comment includes two recommendations, both of which were adopted.

1. Better develop the design concept for the spillway stilling basin underdrain system during the next design phase.

**USACE Response: Adopted.**

**Action Taken:** The design of the spillway stilling basin underdrain system will be fully developed and optimized in the preconstruction, engineering and design phase.

2. Evaluate extending the underdrain system downstream so that it can drain by gravity or using an eductor system to remove the drain water.

**USACE Response: Adopted.**

**Action Taken:** The use of piping downstream of the weir to potentially allow for gravity flow will be considered during the design phase.

**17. Medium Significance - Cleaning and maintenance of the lateral drains in the stilling basin slabs will be very difficult, if not impossible due their very long length.**

This comment includes two recommendations. Both were adopted.

1. Further evaluation of the cleaning and maintenance of the spillway stilling basin lateral drains should be completed during the next phase of the design.

**USACE Response: Adopted.**

**Action Taken:** The USACE has verified the ability to clean and maintain piping of this length, but this ability will continue to be a primary consideration for any design refinements to the system during the design phase.

2. Potential failure of the drain cover plates should be evaluated during the next phase of the design.

**USACE Response: Adopted.**

**Action Taken:** Design of the drain covers will be further evaluated for robustness, long-term performance and operability issues, and constructability in the design phase, and will utilize data from hydraulic modeling to evaluate the appropriateness of all locations where they might be used.

**18. Medium Significance - The stability load case with zero drain efficiency for all drains has not been considered to ensure the dam and stilling basin structures are stable for full uplift.**

This comment includes one recommendation, which was adopted.

1. Check the stability factors of safety for zero drain efficiency for all of the structures to ensure that they are stable if the drains become plugged over time.

**USACE Response: Adopted.**

**Action Taken:** Preliminary analyses have been performed with the assumption that none of the drains perform their intended function (zero drain efficiency for all drains). This has been documented in Appendix B of the Dam Safety Modification Report. Additional analyses and any necessary design refinements will be undertaken in the design phase to ensure appropriate factors of safety for this case.

**19. Medium Significance - Using roller-compacted concrete for the lower portion of the conventional concrete in the 10-foot-thick apron slab of the stilling basin could reduce the cost of materials and time required for construction.**

This comment includes two recommendations, both of which were adopted.

1. Consider using RCC (roller-compacted concrete) for the lower 5 to 6 feet of the apron covered with conventional concrete.

**USACE Response: Adopted.**

**Action Taken:** The feasibility of utilizing roller-compacted concrete for the lower placements of the proposed apron slabs will be investigated during the design phase.

2. Compare the costs and schedules for construction using all conventional concrete versus a combination of conventional concrete and RCC for and the stilling basin apron slabs.

**USACE Response: Adopted.**

**Action Taken:** If it is determined that roller-compacted concrete (RCC) is feasible for the new apron slabs, the costs and schedules for conventional concrete versus a combination of RCC and conventional concrete construction methods will be compared.

**20. Medium Significance - The decision for the use of supercavitating baffle blocks as compared with conventional designed spillway configuration baffle blocks is not clearly stated or justified. The basis of determination that there will be a supercritical bubble around the baffle blocks to deter cavitation is not clearly stated in the report nor in the modeling report.**

This comment includes five recommendations. One of these was adopted.

1. Design of the supercavitating baffle blocks is a critical component of this remediation and the USACE needs to be certain that the design is correct and effective. If necessary, additional modeling with the proposed alternative and some variations of the design option might be warranted during the PED phase (the design phase) to determine if there is a better dimensional option.

**USACE Response: Adopted.**

**Action Taken:** USACE is in agreement that the supercavitating baffle blocks are a critical component, therefore, additional optimization in the form of physical modeling will be performed during the design phase.

2. If the proposed design has not been tested in Low Ambient Pressure Chamber (LAPC), similar to the Folsom Dam model in Reclamation's hydraulic laboratory, and there is insufficient data to support the certainty that the supercritical bubble around the baffle blocks is being formed, then it is recommended that such a test be performed during the PED phase of the Project.

**USACE Response: Not Adopted.**

The Low Ambient Pressure Chamber testing for Folsom Dam is directly applicable to the current project due to the very similar flow characteristics. This modeling is therefore appropriate to apply to both projects. Sufficient information exists to ensure the super-cavitating baffle blocks will perform as expected.

3. Verify that supercavitating baffle blocks are indeed necessary and that conventional baffle blocks that may be structurally enhanced are inadequate.

**USACE Response: Not Adopted.**

The super-cavitating baffle blocks are necessary for this design, primarily based on the high water velocities expected in the stilling basin. Additional explanation has been added to Appendix D, Hydrology and Hydraulics, of the Dam Safety Modification Report.

4. The USACE should clearly document the process that was developed in the selection of the use of the supercavitating baffles along with the cost justification.

**USACE Response: Not Adopted.**

Selection of the super-cavitating baffle blocks (and ramps between the blocks) was justified based on performance requirements, and was informed by the results of studies conducted for the recent Folsom Dam spillway as well as 2016 physical model experiments for Bluestone's stilling basin. As substantiated by the physical model experiments, damage caused to conventional baffle blocks under the expected high water velocities would compromise the performance of the stilling basin. Additional narrative has been added to Appendix D, Hydrology and Hydraulics, of the Dam Safety Modification Report.

5. If the recommendation for the use of supercavitating baffles is not able to be substantiated, then alternatives should be considered.

**USACE Response: Not Adopted.**

Additional stilling basin alternatives have been considered. However, in order for the selected alternative to maintain adequate performance during the design discharge, super-cavitating baffle blocks are required due to the extreme loading conditions.

**21. Medium Significance - There is limited discussion in the main report regarding potential for cost-growth risk of the project or the prospect of minimizing potential costs of RMP #6 (the selected plan) during Planning, Engineering, and Design (PED).**

This comment includes two recommendations. Neither recommendation was adopted.

1. Revise the main report to add a section discussing possible efforts to be undertaken during PED design optimization that would focus upon cost reduction and economy.

**USACE Response: Not Adopted.**

A cost and schedule risk analysis was developed and included in Appendix I of the Dam Safety Modification Report. This includes opportunities for cost reduction as well as threats to cost growth. This analysis is intended to capture all the features subject to optimization that could have impacts on construction cost and schedule.

2. Evaluate several permutations of RMP #6 during design optimization such that the “with project” FWAC f-N chart position plots exactly (or as close as practical) on the TRL (Tolerable Risk Limit) rather than considerably below it; thereby minimizing total cost.

**USACE Response: Not Adopted.**

As with the ranking of risk management plans in the Dam Safety Modification Report, the design optimization of the stilling basin features for the selected plan will be risk-informed. Tolerable risk guidelines are used in risk management to guide the process of examining and judging the significance of estimated risks obtained using risk assessment. The results of the risk assessment in relation to a Tolerable Risk Limit make up only a part of the considerations in the risk management decision process. For example, in order for risks to be considered tolerable, they must be lowered below the Tolerable Risk Limit as informed by the as-low-as-reasonably-practicable (ALARP) considerations. ALARP considerations take into account the cost-effectiveness of further risk reduction.

**22. Medium Significance - It is not clear from the Draft DSMR (Dam Safety Modification Report) or the SDEIS (Supplemental Draft Environmental Impact Statement) whether material dredged during implementation of the project has or will be analyzed for contaminants (HTRW) including heavy metals and organic contaminants. Further, in the event the material is analyzed and found to be “clean”, it is unclear whether it could be used beneficially rather than placed in disposal.**

This comment includes two recommendations, both of which were adopted.

1. Better specify any requirements for dredge and fill material analysis as it pertains to HTRW (Hazardous, Toxic, and Radioactive Waste).

**USACE Response: Adopted.**

**Action Taken:** Text has been added to the Final Supplemental Environmental Impact Statement to better specify requirements for analysis of dredge, fill, and excavated sediment during construction as it pertains to Hazardous, Toxic, and Radioactive Waste. The ability to sample and analyze the material in the stilling basin prior to construction activities is limited due to water flow during operations, so the construction contract will include these requirements.

2. Identify and discuss beneficial use options for the removed dredge material should it be suitable.

**USACE Response: Adopted.**

**Action Taken:** Additional information regarding potential beneficial use of material that is removed from the current stilling basin has been added to Section 1.1 of the Final Supplemental Environmental Impact Statement. Possible beneficial uses include maintenance of nearby gravel roads and creation of in-lake habitat as part of mitigation for impacts downstream. Further analysis will be completed during the design phase to identify other potential beneficial uses.

**23. Medium Significance - It is not clear from the Draft DSMR (Dam Safety Modification Report) whether there are standard onsite verifications/inspections for contractor compliance regarding implementation and maintenance of Best Management Practices (BMPs), pollutant discharge values, in-situ environmental quality, etc.**

This comment includes one recommendation, which was adopted.

1. Clearly identify a protocol or steps for monitoring contractor compliance with requirements for BMPs and verification that in-situ standards (i.e., water quality standards, etc.) are being met in the Draft DSMR and/or the SDEIS (Supplemental Draft Environmental Impact Statement).

**USACE Response: Adopted.**

**Action Taken:** Clear and prescriptive language regarding the Best Management Practices and all commitments from the Supplemental Environmental Impact Statement will be included in the contract specification documents for the construction contractor. USACE construction personnel will continually oversee the contractor's activities, and USACE environmental compliance personnel will perform periodic visits. Instructions will be developed for construction personnel to identify all protocols and processes to ensure full compliance.

**24. Medium Significance - The population per structure is less under FWAC (the Future without Federal Action Condition) than under existing conditions (without supporting**

rationale), which impacts the loss of life evaluations, but no explanation for the difference is provided.

This comment includes one recommendation, which was adopted.

1. Include in the report an explanation of why the population per structure is lower in the FWAC than it is in the baseline.

**USACE Response: Adopted.**

**Action Taken:** An explanation of why the population per structure is lower in the Future without Federal Action Condition has been added to Section 3.2.3.5 of the Dam Safety Modification Report. The population estimates per structure were adjusted by an index factor (developed from county population projections) to represent the population change over time that is projected for the downstream counties. The majority of the counties are expected to have slight decreases in the future.

**25. Medium Significance - In DSMR (the Dam Safety Modification Report), Appendix J, “Bluestone DSMS Consequences Analysis”, the loss of life associated with potential failures of Bluestone Dam is expected to be lower if the flood event occurs at night than if it occurs during the day, but no explanation is provided for the reason/logic for the difference.**

This comment includes one recommendation, which was adopted.

1. Include in the report an explanation of why the population per structure is lower in the FWAC (Future without Federal Action Condition) than it is in the baseline. (Note: Although this recommendation discusses the “population per structure”, the USACE assumes the intent was to recommend an explanation for why loss of life is lower for a flood occurring at night versus during the day, as described in the comment summary. The response regarding the “population per structure” can be found under the previous comment.)

**USACE Response: Adopted.**

**Action Taken:** An explanation of why the projected life loss is different for a nighttime versus a daytime event has been added to Appendix J of the Dam Safety Modification Report. The consequence modeling takes into account the higher populations in industrial and commercial structures (and lower populations in residential structures) during the day versus at night, as well as the change in a city’s population from day to night due to commuters from outside areas.

**26. Medium Significance - DSMR (Dam Safety Modification Report), Appendix A, “Risk Assessments”, Table 1-1 (pg 35), has a population that is lower for the Future Condition (FWAC) than for the Baseline Condition (BCRA) and Existing Condition (ECRA), which impacts the loss of life evaluations, but no explanation for the difference is provided.**

This comment includes one recommendation, which was adopted.

1. Include an explanation in the report of why the population is lower for the Future Condition (FWAC) than for the Baseline Condition (BCRA) and Existing Condition (ECRA).

**USACE Response: Adopted.**

**Action Taken:** An explanation for why the population is lower for the Future without Federal Action Condition has been added to Section 3.2.3.5 of the Dam Safety Modification Report. The population change between the Baseline and Existing Condition risk assessment and Future without Federal Action Condition (FWAC) risk assessment is based on county-level population projections to the year 2040. For most downstream counties, there is a projected decrease in population between the 2010 census and the 2040 projections, which results in an overall decrease in population between existing conditions and the FWAC.

**27. Medium/Low Significance - The SDEIS (Supplemental Draft Environmental Impact Statement), Section 4.14.2.2, Tables 4-17 and 4-18, appear to be missing some information that is important for a complete understanding of the Environmental Justice information presented.**

This comment includes two recommendations. Both were adopted.

1. Review and revise the SDEIS, Section 4.14.2.2, Tables 4-17 and 4-18, to include more comprehensive Environmental Justice information as noted above.

**USACE Response: Adopted.**

**Action Taken:** Tables 4-17 and 4-18 have been updated in the Final Supplemental Environmental Impact Statement to include the missing data on minority populations.

2. Include or reference a map (or maps) detailing distribution of Environmental Justice populations for, and (if possible) within the affected counties.

**USACE Response: Adopted.**

**Action Taken:** A map has not been added to the Final Supplemental Environmental Impact Statement depicting Environmental Justice population areas. However, additional county specific information regarding the Environmental Justice populations has been added to Section 4.17. There is a map in Section 3.2.2.6 of the Dam Safety Modification Report of the counties around the dam that has demographic information like % poverty, % minority, graduation rates, and median income.

**28. Medium/Low Significance - The use of an Automated Data Acquisition System (ADAS) to monitor the performance of the dam will not be employed after the construction is completed. The lack of an ADAS system will likely increase the time required to identify, evaluate and possibly remediate harmful conditions that could threaten the integrity of the dam.**

This comment includes one recommendation, which was adopted.

1. An ADAS system is currently planned to monitor the integrity of the dam and temporary structures during the construction phase. It is recommended that an ADAS system linked to the District office be considered for the permanent instrumentation.

**USACE Response: Adopted.**

**Action Taken:** Following implementation of the selected plan, the Instrumentation Observation Schedule for Bluestone Dam will be re-evaluated to determine if additional instruments (manually read or automated) and/or an increased reading frequency are required to safely operate and maintain the Dam under the new operating conditions. The Instrumentation Observation Schedule is designed to ensure suitable instrumentation is installed and read at the appropriate frequency to identify trends and address issues that could increase risk to the project.

**29. Medium/Low Significance - An increase in the depth of the key below the proposed supercavitating baffle block section would increase the overall stability of the section and also the global stability of the dam structures and result in the need for fewer anchors.**

This comment includes one recommendation, which was adopted.

1. Prior to final design, implement an economic and stability evaluation to optimize the depth of the baffle block key section in comparison to the anchors required to satisfy stability requirements.

**USACE Response: Adopted.**

**Action Taken:** During the design phase, design parameters will be reassessed and the design of the baffle block key and anchors will be optimized.

**30. Low Significance - The SDEIS (Supplemental Draft Environmental Impact Statement) provides no mention of the impacts to the North Carolina portion of the watershed—17% of the watershed—which is more than the 16% in WV.**

This comment includes one recommendation, which was adopted.

1. If there is no impact to the portion of the watershed in North Carolina, that should be stated in the SEIS along with the reasoning why there is no impact.

**USACE Response: Adopted.**

**Action Taken:** Discussion has been included in Sections 4.7.2.3 and 4.9.2.1 of the Final Supplemental Environmental Impact Statement regarding the portion of the watershed that is located in North Carolina. No additional information beyond the references mentioned above regarding the portion of the watershed located in North Carolina was added for reasoning found in Section 2.5.3, “No impacts on any resources in those areas outside of Reconnaissance Areas 1 and 2 are anticipated and thus were not discussed further in the SFEIS” as North Carolina is located outside of Reconnaissance Areas 1 or 2.

**31. Low Significance - The website that is intended to communicate the various aspects of the project to the public and stakeholders does not provide the required information.**

This comment includes one recommendation, which was adopted.

1. Provide a website that fulfills the requirements spelled out in the Community Relations Plan for Bluestone Dam Safety Assurance Project.

**USACE Response: Adopted.**

**Action Taken:** The website (<http://www.lrh.usace.army.mil/Missions/Civil-Works/Current-Projects/Bluestone-DSA/>) has been expanded under the “Proposed Phase 5 Investment” link to provide information from the Dam Safety Modification Report and Supplemental Draft Environmental Impact Statement. In accordance with the Community Relations Plan, this includes location maps, project history and status, figures portraying proposed construction of the selected plan, potential impacts from the selected plan, and contact information. Once the Dam Safety Modification Report is finalized, the website will be further expanded to communicate the current understanding of breach and non-breach risks and provide additional details on the selected plan to manage these risks.

**32. Low Significance - The Dam Safety Modification Main Report and relevant appendices include a number of important inconsistencies regarding dam dimensions, water surface elevations, or discharge capacities.**

This comment includes one recommendation, which was adopted.

1. Revise the main report and appendices to eliminate the text and figure inconsistencies.

**USACE Response: Adopted.**

**Action Taken:** The Dam Safety Modification Report and its appendices have been revised to eliminate the text and figure inconsistencies.

**33. Low Significance - The Draft DSMR (Dam Safety Modification Report), Appendix D, “Hydrology and Hydraulics”, Paragraph 2, pg 1, “*Runoff Conditions of the watershed were more efficient than previously estimated*”. The use of the term “more efficient” makes this a confusing statement.**

This comment includes one recommendation, which was adopted.

1. Rewrite the sentence to explain what is meant rather than using a phrase “more efficient”.

**USACE Response: Adopted.**

**Action Taken:** The sentence (from Appendix D, Paragraph 2 of the Dam Safety Modification Report) has been revised and further explanation has been added. The term “more efficient” refers to the fact that runoff from a rainfall event flows more quickly through the referenced watershed than previously estimated.

**34. High Significance - Public comments regarding potential environmental impacts due to increased frequency and duration of upstream inundation suggest substantive concerns that need to be better addressed in the SDEIS (Supplemental Draft Environmental Impact Statement).**

This comment includes one recommendation, which was adopted.

1. Public comments, as noted above, should be carefully considered, and revisions to the SDEIS made as warranted, perhaps including information noted by the USACE to the Panel during the 19 January 2017 Public Comment Addendum Midpoint Meeting.

**USACE Response: Adopted.**

**Action Taken:** All public comments, including those referenced, from the New River Conservancy and comments 4 and 6 from the US Environmental Protection Agency, have been carefully considered as part of the Supplemental Draft Environmental Impact Statement public comment review, and comments and responses have been included in Appendix A to the Final Supplemental Environmental Impact Statement. The information discussed in the mid-point meeting has been incorporated into the Final Supplemental Environmental Impact Statement, such as additional coordination, field surveys, and monitoring/adaptive management through the long-term vegetation monitoring plan.

**35. Medium Significance - Public comments regarding potential environmental impacts to downstream Category 1 habitat suggest substantive concerns that may need to be better addressed in the Supplemental Draft Environmental Impact Statement (SDEIS).**

This comment includes one recommendation, which was adopted.

1. Public comments as noted above regarding the Category 1 habitat should be carefully considered, and revisions to the SDEIS made as warranted, perhaps noting the proposed diversion measure and updated impact calculation as noted in the 19 January 2017 Public Comment Addendum Midpoint Meeting.

**USACE Response: Adopted.**

**Action Taken:** All public comments, including comment 3 from the US Environmental Protection Agency regarding Category 1 habitat, have been carefully considered as part of the Supplemental Draft Environmental Impact Statement public comment review, and comments and responses have been included in an appendix to the Final Supplemental Environmental Impact Statement. The information discussed in the mid-point meeting has been incorporated into Chapter 5 of the Final Supplemental Environmental Impact Statement, including additional information regarding the proposed diversion measures and updated impact calculations.

**36. Medium Significance - The Panel has reviewed the public comment submittals and the responses provided to the Panel by the USACE to the questions raised by the public. The Panel wants to ensure that the responses provided by the USACE during the Midpoint**

**Meeting to the Panel are conveyed to the public individuals or agencies that raised the questions, if they have not already been conveyed.**

This comment includes two recommendations. Both were adopted.

1. The USACE should provide written or verbal responses to each of the commenters who have not already been addressed in follow-up public or individual meetings, in addition to providing the updates and comments prepared in the updated environmental impact statement document.

**USACE Response: Adopted.**

**Action Taken:** All public comments have been carefully considered as part of the Supplemental Draft Environmental Impact Statement public comment review. These comments have been considered, formally addressed, and incorporated in a comment matrix in Appendix A of the SEIS. Letters will be sent to all commenters stating that all comments have been received, addressed, and included in the revised SEIS which will be made available to them.

2. Continue maintaining an open dialogue with the stakeholders during the remaining NEPA (National Environmental Policy Act) process.

**USACE Response: Adopted.**

**Action Taken:** The USACE has and will continue open dialogue with stakeholders throughout the National Environmental Policy Act process. Multiple phone calls, emails, letters, and face-to-face meetings have been conducted with stakeholders and agencies and this communication will continue as the project moves forward.