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

CECW-LRD

MAY 30 2018

MEMORANDUM FOR RECORD

SUBJECT: City of Independence, Ohio Flood Risk Management Feasibility Report, Continuing Authorities Program, Section 205

1. An Independent External Peer Review (IEPR) was conducted for the subject project in accordance with Section 2034 of the Water Resource Development Act (WRDA) of 2007, EC 1165-2-209 (superseded by EC 1165-2-214, 15 December 2012), and the Office of Management and Budget's Final Information Quality Bulletin for Peer Review (2004).

2. Battelle Memorial Institute, a non-profit science and technology organization with experience in establishing and administering peer review panels for the U.S. Army Corps of Engineers (Corps), was engaged to conduct the IEPR for the City of Independence, Ohio Flood Risk Management Feasibility Report and its supporting documentation. The IEPR consisted of four members with expertise in civil engineering, economics and planning, environmental/National Environmental Policy Act, and hydrology and hydraulics.

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 Corps 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 Catherine Shuman, Deputy Chief, Great Lakes and Ohio River Division Regional Integration Team at 202-761-1379.

Encl

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

City of Independence, Ohio Flood Risk Management Project
Continuing Authorities Program, Section 205
Flood Risk Management Feasibility Report

U.S. Army Corps of Engineers Response to
Independent External Peer Review
May 2018

Independent External Peer Review (IEPR) was conducted for the City of Independence, Ohio Flood Risk Management Project under the Continuing Authorities Program, Section 205in accordance with Section 2034 of the Water Resources Development Act of 2007, the USACE peer review policy (currently, EC 1165-2-217) 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.

Battelle Memorial Institute (Battelle), a non-profit science and technology organization with experience in establishing and administering peer review panels for the USACE, was engaged to conduct the IEPR for the *City of Independence Flood Risk Management Feasibility Report*, and it's supporting documentation. The IEPR consisted of four members with expertise in civil engineering, economics and planning, environmental/National Environmental Policy Act, and hydrology and hydraulics.

Battelle issued its Final Independent External Peer Review Report on September 07, 2017. The review resulted in 10 Final Panel Comments. Of these, one was identified with Medium/High Significance, four with Medium Significance, and five with Medium/Low Significance.

The USACE concurred with nine comments and non-concurred with one comment. As a result of the Panel Backcheck and subsequent USACE responses, there were 21 suggested recommendations. Of these 21 recommendations, 16 were adopted and 5 were not adopted.

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

1. Medium/High Significance - The information provided in the Environmental Assessment Report is insufficient to determine whether avoidance of Stream 3 is feasible and whether such avoidance would impact the proposed borrow area.

One recommendation was made with this comment. It was adopted.

1. Assume avoidance of Stream 3 in the proposed borrow area in determining whether implementation of the recommended plan as designed would be feasible. Additional text should be added to the EA reflecting that avoidance of Stream 3 in the proposed borrow area will be assumed for the recommended plan.

USACE Response: Adopted.
Actions to be Taken: The following text will be added to the DPR/EA (p. 15, subsec.3.2.7): The capability of the proposed borrow site to yield suitable borrow material for levee construction will be determined once geotechnical studies of the area are completed during the pre-construction engineering and design (PED) phase of the proposed project. To the extent practicable, it is assumed that Streams 2 and 3, with sufficient buffers, will be avoided as sources of borrow material for the recommended plan. In the event, the use of these areas is necessary, then appropriate steps will be taken to minimize and mitigate the adverse effects on these waterbodies.

2. Medium Significance - The estimate of the 100-year flood flows utilized in the design of the levee system is not supported by the flow data and the trend analysis.

This comment includes two recommendations. This first recommendation was adopted. The second recommendation was not adopted.

1. Run the HEC-RAS model with the 1-percent AEC flood derived from the 1975-present record and determine changes, if any, in the levee height.

   USACE Response: Adopted
   Actions Taken/Actions to be Taken: A flow frequency analysis using Bulletin 17B was completed for the period of record (1975-present); the new frequency flows obtained from the analysis was incorporated in the HEC-RAS model; and the model was re-run. Then, re-run HEC-RAS model output was fed to the HEC-FDA model to calculate the revised economics. As a result, the B/C ratio increased substantially, but the levee height that maximizes National Economic Development (NED) benefits remained the same. Consequently, numerous tables, figures and portions of text need to be revised. Instead, a new section will be added to the end of the main report regarding this change. This new section will include a qualitative description of the findings from the re-run of the HEC-RAS model, as discussed above. Final flows from the above frequency analysis will be documented in the detailed design report.

2. Determine the cost associated with the increased height of the levee.

   USACE Response: Not Adopted
   With the new flows from frequency analysis, the levee height, which maximizes NED benefits, remains the same. As a result, the cost of the project will remain the same.

3. Medium Significance - The period of record used for the risk-based analysis in Section 2.3 (Appendix I) may not have yielded scientifically sound results.

This comment includes two recommendations. Both recommendations were adopted.

1. Run the HEC-FDA program with the dataset from 1975-present.

   USACE Response: Adopted.

Actions Taken/Actions to be Taken: Updated hydrology and hydraulic analysis revised the Water Surface Profile (WSP) for Without-Project Condition (WOPC) pursuant to "basis for comment" above. This updated WSP for WOPC only needed to be used in HEC-FDA to analyze the expected annual benefits of the levee alternatives. The HEC-FDA model was re-run using the updated WSP, the expected annual benefits were calculated and were subsequently compared with the average annual costs. The conclusion of this new analysis determined that the #1-B levee (609.5) was still the recommended plan. Although the recommend plan remains the same, project benefits and overall BCR was increased. The revised economics based on the revised hydrology and hydraulic analysis will be documented in the new section of the main report.

2. Reassess the expected annual damage and benefit based on the HEC-FDA results.

USACE Response: Adopted.
Actions Taken: HEC-FDA results were reassessed, and the recommended plan remains the same; #1-B (609.5).

4. Medium Significance - Life safety hazards associated with the recommended plan are not analyzed in the Environmental Assessment Report.

This comment included four recommendations. All four recommendations were adopted.

1. Conduct a qualitative assessment of the recommended plan's residual risk that includes life safety hazards.

USACE Response: Adopted.
Actions to be Taken: The report will be revised to reflect the residual risk that included life safety hazards. Section 6.9, Risk and Uncertainty will be expanded to include a qualitative discussion on residual risk which includes life safety.

2. Determine the location(s) of potential breach (es) where life safety hazards may occur.

USACE Response: Adopted.
Actions to be Taken: The report will be revised to reflect the residual risk that included life safety hazards. Section 6.9, Risk and Uncertainty will be expanded to include a qualitative discussion on the potential locations of where life safety hazards may exist. It will be also referenced in the report that an access road is in place that would provide an alternative exit route, if needed.

3. Discuss in the Environmental Assessment Report how rapidly rising water would change life safety factors.

USACE Response: Adopted.
Actions to be Taken: The report will be revised to reflect the residual risk that included life safety hazards. Section 6.9, Risk and Uncertainty will be expanded to include a qualitative discussion on how rapidly rising waters would change life safety. The report

will be revised to have include a qualitative discussion on the flood warning system and the access road which leads to a higher elevation which serves a means to further reduce life safety risks.

4. Describe why the recommended plan remains the best option while acknowledging that any residual risk poses a threat to human life and safety.

   USACE Response: Adopted.
   Actions to be Taken: The report will be revised to acknowledge the recommended plan is the best plan for reducing risk and acknowledge that with any plan residual risks with respect to life safety are associated with any plan. This comment will be addressed in the Recommended Plan.

5. Medium Significance - The selected downstream boundary condition (i.e., normal depth) for the hydraulic model does not account for potential impacts to water levels at the project area caused by varying Lake Erie levels.

There were three recommendations for this comment. One recommendation was adopted. Two recommendations were not adopted.

1. Calibrate the HEC-RAS model based on Lake Erie levels during the historical events used for model calibration.

   USACE Response: Not Adopted.
   The HEC-RAS steady flow model was revised to use the average lake level during the 22-24 June 2006 flood event (i.e. 571.8 ft NAVD88; conversion from IGLD85 to NAVD88 is to add 0.03 ft at Cleveland). The model results from 2006 flood event indicated that the water surface elevations are the same for both conditions – i.e., Lake Erie level boundary condition and normal depth boundary condition.

2. Because the lake levels can vary significantly during the course of a day, vary the lake levels within the range of historical records in the model and determine whether water surface elevations change within the project area.

   USACE Response: Adopted.
   Actions Taken: Per the NOAA Lake Level Viewer (https://coast.noaa.gov/llv/#/lake/erie), the historic recorded high elevation on Lake Erie was 574.3 ft IGLD, and historic low elevation was 568.2 ft IGLD. HEC-RAS model results for the 10-yr and 100-yr events were nearly the same (within 0.01 ft) under the normal depth boundary condition. Similarly, HEC-RAS model results were nearly identical (within 0.01 ft) under the historic low elevation.

3. If the water surface elevations at the project area vary significantly, incorporate the variability in lake levels into the feasibility study and final design.

   USACE Response: Not Adopted.
   As shown above in #2, incorporating Lake Erie water level variability did not indicate any changes for the 10- and 100- year events.

6. Medium/Low Significance - Wetlands are not yet characterized, and the impacts of the project alternatives on wetland areas and potential mitigation are not yet analyzed, in the Environmental Assessment Report.

There was one recommendation for this comment. It was adopted.

1. Complete the wetland characterization for the project area as soon as is feasible, and update the Environmental Assessment Report.

   USACE Response: Adopted.
   Actions to be Taken: Wetland characterization is planned to be completed as soon as possible during the design phase of the project. Impacts to wetlands will to avoided or minimized as much as possible in the final alignment and cross-sections design during the design phase. At that time, the final alignment and cross section of the levee/floodwall will be determined, appropriate rights-of-entry for affected lands will be acquired, and a complete delineation and field verification of any potentially impacted wetlands and waters of the United States will be finished. In compliance with the Clean Water Act, this information will be incorporated into Section 404(b) (1) Evaluation and application for Section 401 Water Quality Certification. This documentation will be included as an appendix to the Detailed Design Report.

7. Medium/Low Significance - The analysis of flood damages in the Environmental Assessment Report does not appear to have investigated a range of damage categories.

There were two recommendations for this comment. Both recommendations were adopted.

1. State clearly in the Environmental Assessment Report that damages to structures and their contents are the only damages used in the analyses.

   USACE Response: Adopted.
   Actions to be Taken: Typically, in USACE flood risk management studies, structural/content damages avoided to commercial/residential/industrial structures

represent the largest benefit category. A cursory analysis was performed early in the study process to quantify additional benefit categories, including: 1/Variable vehicle operating costs avoided (with-project, road flooding is mitigated and vehicles do not have to detour), 2/NFIP administrative costs avoided, and 3/Road damages avoided. These categories were small relative to structure/content damages avoided, and were not expected to significantly affect the BCR or recommended plan selection. The Project Delivery Team determined not to pursue quantifying the additional benefit categories as these categories were not required realize a project alternative with positive net benefits, and a benefit-cost ratio greater than one.

Automotive damages avoided were mentioned in Appendix I – Economic Analysis, but they were not included as a benefit category in the analysis. The Project Delivery Team has removed all references to automotive damages avoided in Appendix I – Economic Analysis, and the main report.

Damages to structures and their contents are the only damages considered in this analysis. This is stated throughout the main report/economic appendix.

2. Explain why other damage categories are not included.

USACE Response: Adopted.
Actions to be Taken: An analysis of damages to structures and their contents satisfies the requirements for a feasibility-level planning study, so it is not unreasonable to exclude other categories. Damages to structures and their contents are the only damages considered in this analysis. This is clearly stated throughout the report.

8. Medium/Low Significance - The number of iterations used in the HEC-FDA runs is not identified, raising the issue of whether the Monte Carlo sampling in HEC-FDA effectively converges on the distributions being modeled.

There were two recommendations for this comment. Both recommendations were adopted.

1. Provide the number of iterations in each simulation run in HEC-FDA.

USACE Response: Adopted
Actions to be Taken: The number of Monte Carlo iterations is not selected by the user. HEC-FDA automatically selects the number of Monte Carlo iterations required (for each damages reach), which is a function of the uncertainty parameters identified for key econ/H&H variables (e.g. – depth damage function, first floor elevation, and flow exceedance probability uncertainty). The more uncertainty in modeling inputs, the more iterations required to generate a statistically significant result.

The number of Monte Carlo iterations for the analyses at sites #1-B (15,000) and #3-A (15,000) will be included in the economic appendix. This data was pulled from the HEC-FDA "Monte Carlo Analysis Summary" report.

2. Briefly explain why these iteration counts were selected, and describe the reasons for selecting different iteration counts if the study modeled subsystems.

   USACE Response: Adopted
   Actions to be Taken: Iteration counts were not selected by the user. HEC-FDA automatically selects the number of iterations. The explanation provided in section 8.1 will be included in the economic appendix, to illustrate how HEC-FDA model data was generated for the report.

9. Medium/Low Significance - The base year for the economic period of analysis is not explicitly specified; therefore, the rationale for its selection and timing of annual cash flows from benefits and costs cannot be verified.

There were two recommendations for this comment. Both recommendations were adopted.

1. Identify the base year in Appendix I, Economic Analysis.

   USACE Response: Adopted.
   Actions to be Taken: The base year, and period of analysis is documented in Appendix I – Economic Analysis, Section 3.3 – Planning Assumptions.

2. Briefly explain the rationale for its selection as the year when project operations are expected to be under way.

   USACE Response: Adopted.
   Actions to be Taken: The rationale for base year selection is documented in Appendix I – Economic Analysis, Section 3.3 – Planning Assumptions

10. Medium/Low Significance - It is unclear if the sample sizes for structures mentioned in Appendix I of the Environmental Assessment Report are representative of the population of structures at risk of flooding.

There were two recommendations for this comment. Both recommendations were not adopted.

1. Apply the formula below to test the sample sizes used in data collection.

$$\frac{\frac{z^2 \times p(1-p)}{e^2}}{1+\left(\frac{z^2 \times p(1-p)}{e^2 N}\right)}$$

USACE Response: Not Adopted.
The Independence Structure Inventory was not developed by "randomly sampling sets of structures believed to be representative of the population of structures exposed to flood risk". Appendix I – Economic Analysis does not make reference to this approach. A USACE Buffalo District geospatial expert conducted an Arc-GIS analysis to identify all land parcels that fell within the 1% existing condition floodplain. The sole criteria for structure inventory inclusion was whether its land parcel is expected to be inundated during the 1% existing condition flood. It is the opinion of subject matter experts within the USACE that this approach yields a sufficient sample size for modeling purposes.

2. Present the statistical calculations and briefly discuss in Appendix I how the sample size is reasonably representative of the population.

USACE Response: Not Adopted.
The current approach/analysis contains a representative sample size.