2019

Lake Pontchartrain & Vicinity and West Bank and Vicinity GRRs Appendix D – Risk Assessment

U.S. Army Corps of Engineers,
New Orleans District

Non-Federal Sponsor: Coastal Protection and Restoration Authority Board

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NOTE: THE FOLLOWING IS A SUMMARY OF THE RISK ANALYSIS THAT WAS PERFORMED FOR THE STUDIES. THE DETAILED RISK ANALYSIS CONTAINS SENSITIVE INFORMATION AND IS CURRENTLY CONSIDERED PRE-DECISIONAL. THEREFORE IT IS NOT RELEASABLE TO THE PUBLIC.

Executive Summary

MVN District and the MVN Risk Cadre have completed a semi-quantitative risk assessment (SQRA) for the Lake Pontchartrain and Vicinity (LPV) project system and West Bank and Vicinity (WBV) project system in general accordance with published guidance in support of the general reevaluation reports (GRR), which will reevaluate the performance of the LPV project system and WBV project system given the combined effects of consolidation, settlement, subsidence, and sea level rise over time, and determine if additional actions are recommended to sustain the current 1% level of risk reduction for coastal storms.

Incremental Risks

The incremental risk (due to failure or breach) includes a consideration of both likelihood of failure and the incremental consequences. The likelihood of failure is a function of both the likelihood of the loading condition that could lead to the failure and the likelihood of failure given the loading condition. During the risk assessment, order-of-magnitude estimates were made for both likelihood of failure and incremental consequences for each risk-driver potential failures mode. The evaluation of each risk-driver potential failure mode was documented as well as the team's confidence in the order-of-magnitude estimates. Confidence describes the potential impacts to the risk characterization and the decision to take action to reduce risk or reduce uncertainty.

The best estimate of the existing condition average annual incremental life loss is 1E-04 lives per year for LPV and 3E-06 lives per year for WBV, which are considered tolerable from a societal perspective. All overtopping PFMs are below tolerable risk for the existing condition in LPV. The estimated total annual probability of failure (APF) for the existing condition is between 1E-06 and 1E-05 failures per year, which is below the societal tolerable risk line. Confidence in the magnitude of the APF (best estimate for failure likelihood) for these locations was moderate since the order of magnitude of the overtopping is unlikely to change though the team recognized some uncertainty in the ADCIRC modeling. Incremental life loss is primarily driven by the close proximity of the PAR to the landside toe of the levee.

For WBV, all overtopping PFMs are below tolerable risk for the existing condition. The estimated total annual probability of failure (APF) for the existing condition is between 3E-07 and 3E-06 failures per year, which is below the societal tolerable risk line. Confidence in the magnitude of the APF (best estimate for failure likelihood) for these locations was moderate since the order of magnitude of the overtopping is unlikely to change though the team recognized some uncertainty in the ADCIRC modeling.

The best estimate of the future without action condition (FWAC) average annual incremental life loss is 3E-02 lives per year for LPV and 1E-01 lives per year for WBV. For LPV, the estimated total annual probability of failure (APF) for the FWAC is between 1E-04 and 1E-03 failures per year, which is above the societal tolerable risk line. The largest source of incremental risk in LPV for the FWAC is the overtopping with breach due to overtopping with waves of the armored levees leading to breach in St. Charles Parish eastbank. This area is estimated to settle in the FWAC 3 ft and was analyzed with 1.8 ft relative sea level rise. This resulted in stillwater overtopping between the 1/50 and 1/100 year hurricane events. Confidence in the magnitude of the APF (best estimate for failure likelihood) for these locations was moderate based on uncertainty associated with the future hurricane modeling, duration of overtopping, settlement analysis, and unknowns with the performance of the armoring under real world loading. A breach associated with this failure mode would impact St. Charles Parish eastbank, which has residential and commercial areas behind the levee, with residential areas near the toe.

For WBV the estimated total annual probability of failure (APF) for the FWAC is between 3E-04 and 3E-03 failures per year, which is above the societal tolerable risk line. The incremental risk in WBV for the FWAC is mostly driven by overtopping with breach due to overtopping with waves of armored levees leading to breach in Ames, Westwego, and Belle Chase. These areas are estimated to settle in the FWAC between 2.3 and 3.3 ft and was analyzed with 1.8 ft relative sea level rise. This resulted in stillwater overtopping between the 1/100 and 1/200 year hurricane events for Belle Chase and less than the 1/50 year hurricane event for Ames and Westwego. Confidence in the magnitude of the APF (best estimate for failure likelihood) for these locations was moderate based on uncertainty with the future hurricane modeling, duration of overtopping, settlement analysis, and unknowns with the performance of the armoring under real world loading. A breach associated with this failure mode would impact Ames, Westwego, and Belle Chase, which has residential and commercial areas behind the levee. In the Ames and Westwego area residential are at the toe of the levee.

Two with project scenarios were evaluated for LPV and WBV for the future with project condition. Both scenarios are evaluated at the 1% storm, but the relative sea level rise varies between 1.8 ft and 3.4 ft. These ranges were chosen to cover what is predicted to be the normal relative sea level rise and also the maximum relative sea level rise to provide an alternative that would cover any chance for high variability in sea level rise in the future. The best estimate of the future with project average annual incremental life loss is 1E-04 lives per year for LPV and WBV for both the with project at 1.8 ft and 3.4 ft relative sea level rise. The estimated total annual probability of failure (APF) for the with project is between 1E-07 and 1E-06 failures per year for LPV at both 1.8 ft and 3.4 ft relative sea level rise, which is below the societal tolerable risk line. For WBV, the estimated total annual probability of failure (APF) for the with project is between 1E-06 and 1E-05 failures per year at both 1.8 ft and 3.4 ft relative sea level rise, which is below the societal tolerable risk line. Confidence in the magnitude of the best estimate for failure likelihood for these locations were moderate based on uncertainty with the future

hurricane modeling, duration of overtopping, settlement analysis, and unknowns with the performance of the armoring under real world loading.

Non-Breach Risk

There is no non-breach risk for the Existing Condition (EC) from stillwater overtopping up to the 1/500 year storm. For the FWAC the non-breach flood risks were calculated for both LPV and WBV. The likelihood of flooding was estimated to be between 3E-03 and 3E-02 floods per year for LPV and between 1E-02 and 1E-01 floods per year for WBV. The best estimate of average annual non-breach life loss is 3E+01 lives per year for LPV and 1E+01 lives per year for WBV. The non-breach inundation for the FWAC is extensive for both LPV and WBV. For the with project scenarios at 1.8 ft RSLR and 3.4 ft RSLR there is no non-breach risk up to the 1/500 year storm from stillwater overtopping, as the levels will not have stillwater overtopping at this event. Traditional breach modeling does not account for wave overtopping, but for the existing condition and with project scenarios the overtopping rates are low, even up to the 1/500 year storm. There was special modeling performed, which is contained in the H&H appendix that outlines non-breach wave overtopping inundation for all condition of the study.

Confidence and Major Uncertainties

The SQRA team was reasonably confident in the incremental risks described above. For the overtopping with waves of armored levees leads to breach, confidence in the magnitude of the APF (best estimate for failure likelihood) for these locations were moderate based on uncertainty with the future hurricane modeling, duration of overtopping, settlement analysis, and unknowns with the performance of the armoring under real world loading. The team chose a moderate confidence for consequences as there may be some work or variation in the consequence modeling that may or may not change the order of magnitude of the model. With long warning times most of the population would be out of harm's way before the hurricane impacts the area. Most of the parishes, however, have large numbers of low income and homeless populations. Surveys were sent to the parishes to gather evacuation information and evacuation plans from the parishes and state were reviewed to ensure warning times were correct. Even though a Mileti and Sorenson interview was not conducted with each parish, the survey and evacuations plans aided in understanding how the parishes would react and a full interview may not change the input parameters.

Recommendations

1. USACE should work with local sponsors and emergency management personnel to raise evacuation awareness. The local emergency management has a good hurricane specific evacuation plan for the parishes. USACE should work with the local sponsors and emergency management personnel and the communities to raise evacuation awareness.

2. Perform post storm inspection to monitor performance of system to identify how armored and unarmored levees and levee to floodwall tie-ins performed during wave overtopping. The Colorado State University (CSU) testing of armored and unarmored levees was ~ 3 hours. The levee to floodwall tie-in design has not been tested during a real world event. Inspection of levees after an event can better inform performance of the system.
3. Existing HPTRM testing was limited to 4 CFS/ft and did not result in a failure. This volume is well above the HSDRRS overtopping allowable 0.1 CFS/ft. Additional testing would be required to find the HPTRM's failure limit. However, this limit will be for a much lower frequency overtopping event than the 1/100 year event. Please note, Galveston District is considering testing on HPTRM. These test results could help understand HPTRM performance during higher flow rates and durations.
4. Monitor marsh platforms around the systems to better understand degradation and its effects on wave heights and surge levels. Marsh platforms provide protection to levees by reducing wave heights and surge levels. As the marsh platforms degrade this may affect the wave characteristics and surge levels in the future.
5. Perform periodic levee surveys to verify settlement. Settlement predictions need to be verified by periodic surveys to identify if settlement is actually occurring at the predicted rate.
6. Monitor settlement under levee floodwall tie-in. Settlement has occurred under the concrete that is part of the levee floodwall tie-ins. This needs to be monitored and repairs need to be made as needed to ensure proper function of the tie-in. If repairs are not made, this will affect the performance of the tie-in.
7. The MRL I-walls are not part of the LPV nor WBV system authorization. Due to the potential for hurricane storm surge above the 1/100 year level, it is possible that MRL I-walls could see loadings above their authorized design grade. For this, MRL I-walls above the existing crossover points should be reviewed further in a separate risk assessment where the full range of possible loadings are considered.
8. Loading conditions for LPV and WBV T-walls should be monitored for changes that could result in overstressing of foundation piles. If loading conditions change in the future, the T-walls should be re-evaluated accordingly.