to make the NED plan not feasible. A success rate of 30% would be required to make the ND35K plan not feasible. The results of this are based on the hydraulic model calibrated to the 2006 event and Phase 2 hydrology, as described in Appendix A, hydrology. Although the sensitivity analysis was not refined using Phase 3 or Phase 4 hydrology, the newer information would likely make flood fight success less significant for feasibility.

3.10.4 Risk of Project Failure

The project will be designed using appropriate measures and factors of safety to ensure that the constructed system is robust and resilient. However, there will be a residual risk of a component failure or exceedance of the system's design capacity. The LPP includes an emergency spillway section as part of the County Road 17 tie-back levee that would allow floods in excess of the 0.2-percent chance event to flow to the west and north around the protected area. Neither the ND35K plan nor the FCP include a similar ability to redirect extreme events. In the case of a flood event that exceeded the design capacity of the system, the tie-back levees of the ND35K plan and FCP could be overtopped, allowing a sudden influx of flood waters within the protected area. An overtopping or breach of a tie-back levee, storage area levee, or failure of a control structure in any of the alternatives could allow flood water into the protected area during any flood event in which the failure occurred. The effects of such a failure could be catastrophic, depending on the magnitude and timing of the stage increases within the protected area. A loss of life analysis was completed for the LPP to determine the impacts if a catastrophic failure were to occur. This analysis is included in Appendix D, Other Social Effects. The results of this analysis indicated that if there was a catastrophic failure with a 1-percent chance event, 31 people could lose their lives and for an event twice as large as a 0.2-percent chance event (500-year times two) the loss of life could be up to 350 individuals.

The LPP and ND35K plans both include control structures on the Red and Wild Rice rivers and aqueduct structures on the Sheyenne and Maple rivers that could be affected by ice or debris during a flood event. These structures include features to deal with ice and debris within the diversion channel and the natural river channels, but there will remain a risk that these structures could be partially blocked by ice or debris which could raise water surfaces upstream of the structures. Research on ice effects associated with the project is being conducted by U.S. Army Cold Regions Research and Engineering Laboratory (CRREL). Although the research is not completed yet, preliminary results show that for period of record, using the unified degree-day method (UDDM), 38 ice-outs occurred before the peak water stage, while 28 occurred after. For the known flood years of 2001, 2009 and 2010, UDDM predicted ice-out at Fargo before the time of peak water stage is in agreement with observations. The UDDM results do agree with the observations that, for many years, particularly ones with floods, ice-out occurs before or during the peak stage event. Addition research and modeling will be addressed through study efforts during the design and implementation phase. The effort includes study of ice at the gated structures, ice in the diversion channel, and the effect of lower flows on ice in the benefited area. The effort also includes the study of similar flood risk management projects under ice conditions (e.g. Winnipeg diversion).

It is assumed that during floods larger than the 1-percent chance event, the non-federal sponsors would augment the LPP, FCP and ND35K plans using existing flood damage reduction projects