storage, the cost would be $400 million. Corps of Engineers flood damage reduction and ecosystem restoration projects are typically cost-shared between the Federal government and non-Federal sponsors. Feasibility study costs are shared 50/50. Implementation costs (plans and specifications and construction) are usually shared 65% Federal and 35% non-Federal. Non-Federal sponsors must provide all lands, easements, rights-of-way and relocations as part of the non-Federal share.

4. The Corps of Engineers has authority to build ecosystem restoration projects based on ecosystem benefits. Ecosystem benefits are not quantified in dollars but are evaluated qualitatively. The determination of justification is based on significance of the habitat benefits provided and the reasonableness of the cost to achieve the benefits. Costs for recent Corps projects around the Nation have averaged about $20,000 per acre of restored habitat.

5. It is difficult to estimate the footprint of the proposed system of impoundments without having specific sites identified. Assuming an average flood storage depth of 6 feet and a total of 200,000 acre-feet of storage, the footprint would be 33,000 acres.

6. Assuming a cost of $1000 per acre-ft and an average 6 foot depth of storage, a 200,000 acre-foot project would create 33,000 acres of habitat at a cost of $6,060 per acre. This is well within the range of what has been considered reasonable on past Corps projects.

## VI. CONCLUSIONS

1. The following conclusions are intended to summarize the key findings of Phase 1 of the study:

- A system of multi-purpose impoundments has the potential to reduce the 100-year flood elevations in Fargo-Moorhead by as much as 1.6 feet.
- A system of multi-purpose impoundments would provide the greatest stage reductions for floods of the 10-year to 20-year magnitude.
- From a Federal justification perspective, flood damage reduction benefits in the Fargo-Moorhead area alone would probably justify 20-25% of the costs of constructing a system of impoundments.
- Agricultural flood damage reduction benefits and urban benefits outside of Fargo-Moorhead have not been quantified but would probably be significant.
- With careful design, it is likely that a system of multi-purpose impoundments could be justified largely by ecosystem restoration benefits.

2. Discussion with the Corps Mississippi Valley Division and HQ staff indicated that the conceptual plan described in this report is sound. Significantly more work will be needed to quantify both economic (flood damage reduction) and ecosystem benefits in order to justify Federal involvement. Phase 2 must address significant ecosystem issues early in order to identify and describe ecosystem needs and to be sure that the flood damage reduction and ecosystem restoration features are compatible.

3. The project management plan for the study calls for a decision between the completion of Phase 1 analysis and the beginning of Phase 2 work. This report is intended to provide the information necessary to make an informed decision.