# Creating Resiliency at Marsh Lake: Reverting a Shallow Freshwater Lake from a Turbid to Clear Water State

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Marsh Lake is located on the Minnesota River, near its headwaters and about 300 river miles upstream of its confluence with the Mississippi River. Originally this was a river floodplain lake created by a delta at the terminus of the Pomme de Terre River. The river was dammed in the 1930s as a project under the Federal Works Progress Commission, creating a shallow 2,000-hectare pool with submersed and emergent vegetation important for migrating waterfowl. Initial conditions after impoundment were indicative of a clear-water state, generally supportive of wildlife and fish. However, the environment degraded over some 80 years driven by, among other things, elevated wind and wave action, sediment loading, infestation by common carp and static water levels. By the early 1990s, the system transitioned to a turbid water state, resulting in a near complete loss of aquatic and emergent vegetation. The Marsh Lake Dam embankment also moved the mouth of the Pomme de Terre River upstream and into the pool, resulting in the loss of over 2 kilometers of the river and blocking seasonal fish passage.

After a lengthy planning process, the Corps of Engineers, in cooperation with the Minnesota Department of Natural Resources and the Upper Minnesota River Watershed District, designed modifications to the dam intended to restore ecosystem processes that included a water control structure, rock arch rapids fishway, embankment breach, re-route of the Pomme de Terre River channel, and shoreline stabilization. Despite challenges with record high flows, construction of the $13 million project occurred between 2017 and 2020. This was followed by two consecutive years of an intentional pool-wide drawdown under drought conditions. This resulted in drying most of the lakebed, thus compacting sediment and exposing important seed beds. In 2022, the water surface elevation was restored, and the pool became dominated by emergent and submersed aquatic vegetation that act to damper wave action and filter nutrients, thus improving water clarity. In the two years post-drawdown, aquatic vegetation continues to dominate and a clear water state persists. In addition, fish passage through the dam has been greatly enhanced, and flow through the historic Pomme de Terre River channel has resulted in colonization by mussels.

These features and the future management thereof, will simulate a more natural hydrologic regime to sustain aquatic vegetation critical as a food source and cover for migrating waterfowl, colonial waterbird, and shorebird populations. Over the long term, improvements in water clarity and fish passage will benefit native fish populations in the pool to the detriment of invasive carp. The project was recently handed over to the local sponsor with the responsibility of implementing an operational plan. An adaptive management team has been assembled to monitor performance and make recommendations for maintaining the system's resiliency and maximize project success.

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