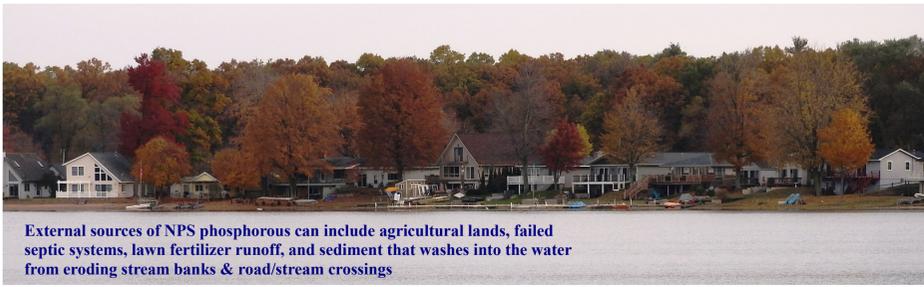


# Bear Creek / Bear Lake Nutrient Reduction - Wetland Project



External sources of NPS phosphorous can include agricultural lands, failed septic systems, lawn fertilizer runoff, and sediment that washes into the water from eroding stream banks & road/stream crossings



Twin Lake outlet into Ribe Drain



Agricultural lands comprise 1,111 acres, or 5.8%, of the total land area in the watershed

## What's the Problem? Whose Problem is it? What's the Answer? What's Being Done?



Urban Runoff



Bank Erosion



Private Drainage and Agricultural Runoff



Bank Erosion



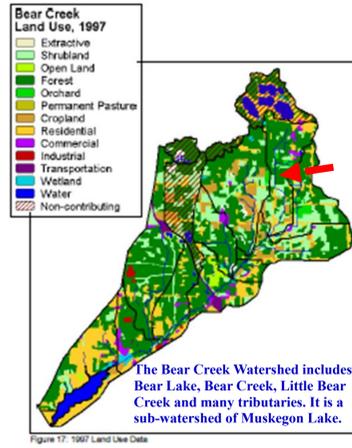
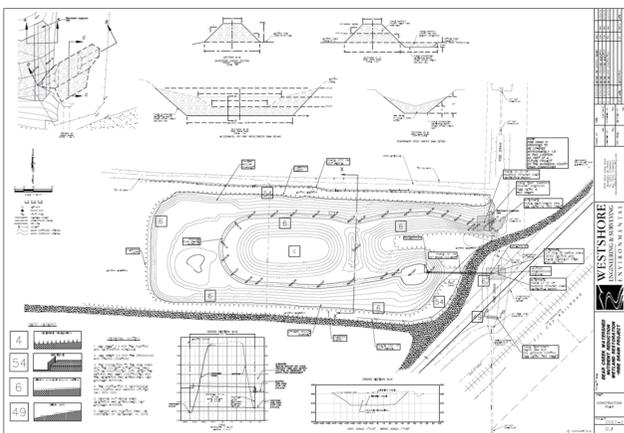
Road Runoff



This project will allow the Delta Institute and a coalition of community organizations to reduce sediment and nutrients in the 19,058-acre Bear Creek and Bear Lake watershed of the Muskegon Lake Area of Concern in Muskegon County, Michigan.

The Bear Creek and Bear Lake Watershed Management Plan identifies Ribe Drain as a major source of phosphorus contributing to nutrient loading in Bear Creek and eventually to Bear Lake, a part of the Muskegon Lake AOC.

The watershed plan, which is approved by the State of Michigan and meets EPA 319 criteria, was developed as a comprehensive nonpoint source management plan.



Clearing



Grubbing



Shaping and Excavation



Contouring



Temporary Drainage



Putting it all together



Replacing topsoil



Finishing topsoil



Ready for planting

### Project Highlights: Assistance in removal of Eutrophication and Degraded Habitat BUIs with habitat restored, removal of Muskegon Lake from the list of AOC hot spots

**Background of the Area of Concern (AOC)**  
Within the lower Muskegon River watershed, lies the Muskegon Lake AOC, a drowned river mouth lake that flows into Lake Michigan at a shoreline that is part of the world's largest assemblage of freshwater sand dunes. Muskegon Lake was designated an AOC in 1985 due to ecological problems caused by industrial discharges, shoreline alterations and the filling of open water and coastal wetlands. Since 1992, community groups, governmental and nongovernmental organizations have worked collaboratively to remediate contaminated sediments and to restore and protect fish and wildlife species and their habitats. Historic sawmill debris, foundry sand and slag filled 798 acres of open water and emergent wetlands in the AOC. Nearly 25% of Muskegon Lake's open water and shallow wetlands were filled. Approximately 74 percent of the shoreline was hardened with wood pilings, sheet metal, foundry slag and concrete. This resulted in the loss and degradation of shallow water benthos communities, isolation and fragmentation of coastal wetlands, and the associated degradation of water quality and fish and wildlife populations. With completion of this and several other projects in development, including nutrient reduction from tributaries like Bear Creek, the U.S. Environmental Protection Agency (U.S. EPA) now expects to remove Muskegon Lake from the list of Great Lakes "toxic hotspots" by 2020.



The Bear Creek / Bear Lake watershed is an integral part of the Muskegon Lake watershed and Area of Concern. Nutrient contribution to Bear Lake from upstream sources and Bear Lake's immediate watershed provides conditions that promote the growth of Blue green algae and other exotic aquatic species. Blue green algae can create severe toxic conditions that impact fish, wildlife, and human health. Exotic aquatic species such as Eurasian Water Milfoil and a plethora of others degrade fish and wildlife habitat and diminish water quality and recreational opportunities as well as property values of landowners.

### Community Benefits

- Improved surface and ground water quality
- Higher aesthetic values
- Partnership / stakeholder interaction

### Economic Benefits

- Increased recreational opportunities
- Reduced environmental Impacts
- Contributes to delisting of the Muskegon Lake Area of Concern designation which will have a positive economic benefit to all of Muskegon County

### Environmental Benefits

- Nutrient Reduction**
  - Allows plant uptake of Phosphorus and other nutrients
- Stormwater Retention**
  - Limits flashy storm flows reducing stream bank erosion
  - Increases infiltration time and plant nutrient uptake
- Increased Flood Storage**
  - Lowers first flush flood water volumes and provides slow release
- Erosion and Sediment Reduction**
  - Helps lower stream velocities and mitigates erosive force of storm flows
  - Traps sediments (and nutrients that cling to soil particles)
  - Improves water clarity and quality
- Improved Fish and Wildlife Habitat**
  - Removal of invasive Scotch Pine and replacement with native species
  - Creation of high value shallow water wetland habitat
  - Higher flora and fauna biodiversity

