

# NH LLMP Testing and Sampling:

- Environments monitored:
  - Groundwater, Lake or Pond, Land, Reservoir, River or Stream, and Wetland.
  - Physical/chemical monitoring:
    - Chloride, Conductivity, Dissolved Oxygen, Hardness, Hydrocarbons, Nitrogen, pH, Phosphorus, Rainfall, Salinity, Secchi transparency, TSS/TDS, Turbidity, and Water temperature.
  - Biological monitoring:
    - Aquatic vegetation, Bacteria, Chlorophyll, Fish, Habitat assessments, Macroinvertebrates, Phytoplankton, Wildlife, Exotic / Invasive species, and Algal toxins.

# Alum Treatment:

- What is Alum and how does it work?
  - Aluminum sulfate which is a nontoxic material commonly used in water treatment plants to clean drinking water.
  - Alum is used primarily to control the internal recycling of phosphorus from the sediments of the lake bottom. On contact with water, alum forms a fluffy aluminum hydroxide precipitate called floc.
  - Aluminum hydroxide binds with phosphorus to form an aluminum phosphate compound which is insoluble in water under most conditions so the phosphorus in it can no longer be used as food by algae organisms.

# Alum Treatment Cont'd:

- Advantages:
  - In lakes it can be used to reduce the amount of nutrient phosphorus in the water.
  - Reducing phosphorus concentration can be used to limit algae production in a given body of water and prevent blooms.
  - Minimizes release of phosphorus from sediment.
  - Can work rapidly and cause a major decrease in available phosphorus.

# Alum Treatment Cont'd:

- Disadvantages:
  - Can be expensive with treatment costs ranging from \$280/acre to \$700/acre (Willand Pond is 76 acres).
  - May modify the natural eutrophic state of the pond.
  - May kill fish and invertebrates due to low pH environment.
  - Alum floc may resuspend in shallow turbulent areas redistributing phosphorus and other nutrients.

# Selective Draining:

- What do you mean by “selective” draining?
  - Water could be removed from the pond during periods of excessive rainfall that may lead to flooding.
  - Anoxic bottom layer is pumped from the pond since it is more susceptible to having higher nutrient levels.
  - Water could be filtered and drained into nearby wetland or placed in city water treatment.
  - Allows for a consistent water level that can be monitored and maintained throughout the year.

# Selective Draining Cont'd:

- Advantages:
  - May reduce the available nutrients within the pond.
  - Can be used as a flood control utility.
  - Draining will allow for trail and structural repairs along the shoreline to be made.
- Disadvantages:
  - Possible impact on wetlands on north edge of pond.
  - May create greater nutrient availability if pumping is done inadequately
  - Possible overwinter level variation.
  - Costs of maintaining and monitoring

# Constructing an Outlet:

- Where and how?
  - An outlet could be constructed on the northern end of the pond going into wetlands.
  - Pond water level can be lowered for construction or a wet construction can be done.
  - Advantages:
    - Can be used for flood control.
    - The retention time of nutrients would be decreased since more water would be leaving the pond than entering.
    - Lower water level may decrease amount of phosphorus and other nutrients in pond

# Constructing an Outlet Cont'd:

- Disadvantages:
  - Lower water level may actually increase nutrient concentration within the pond.
  - Increased water and nutrient flow may have negative impact on wetlands.
  - Possible for overwinter water level variation.
  - Initial cost of constructing the outlet.



# Hypolimnetic Aeration or Oxygenation:

- What it is and how it works:
  - Addition of air or oxygen at varying depth to provide oxic conditions.
  - Advantages:
    - Promotes binding and sedimentation of phosphorus.
    - Counteraction of anoxic conditions improves habitat for fish and invertebrates.
    - Also reduces buildup of dissolved iron, manganese, and ammonia along with phosphorus in pond.

# Hypolimnetic Aeration or Oxygenation Cont'd:

- Disadvantages:
  - May disrupt thermal layers important to fish and invertebrate communities.
  - May promote supersaturation with certain gases harmful to fish and other life in the pond.
  - A permit is generally required.

# Decreasing External Phosphorus Sources:

- Phosphorus enters the water either externally, from run-off or ground water, or internally, from the nutrient rich sediments on the bottom of the lake.
- Major sources of external phosphorus in Willand Pond:
  - Run-off from impervious surfaces surrounding the pond (structures, roads, parking lots).
  - Run-off from residential lawns using fertilizers containing phosphorus.



More Solutions,  
Future Land Use Recommendations,  
and Community Involvement

# Impervious Surfaces in the Shoreland and Watershed

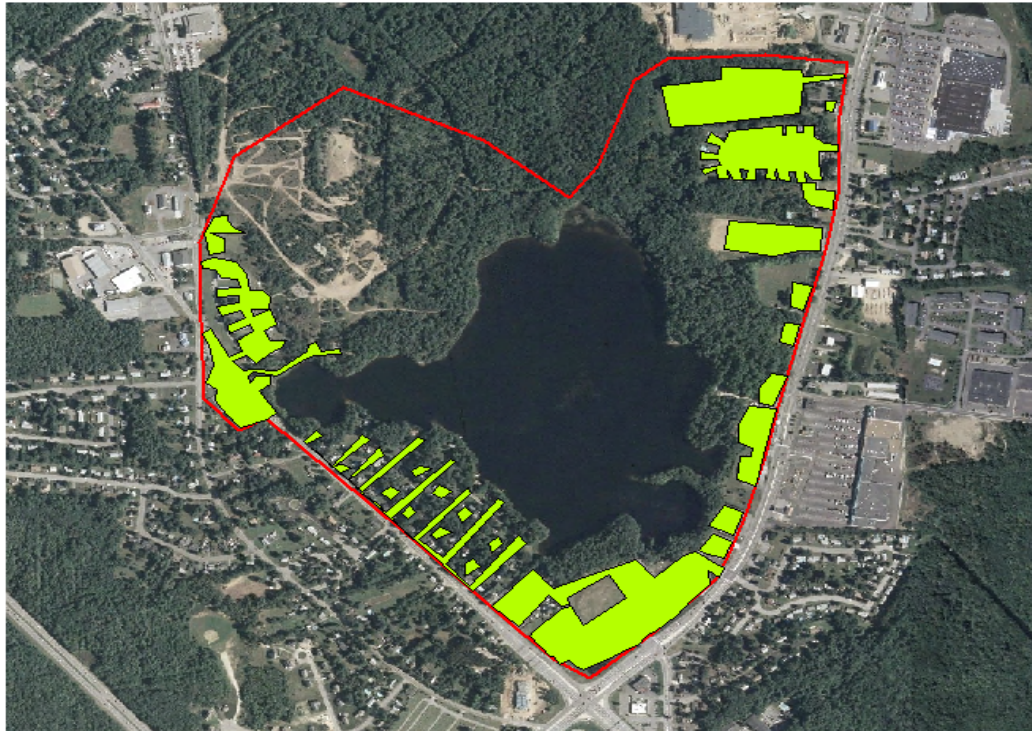
- 19.4% of a 60.6 acre 250ft buffer around the pond is impervious surface
- 16.6% of the 273.2 acre watershed is impervious surface
- Every impervious surface in the watershed increases the amount of run off and storm water that needs to be dealt with, and potentially increases Phosphorus runoff





# Impervious Surfaces Map

- 16.6% of the watershed is impervious surface
- This exceeds the 10% maximum of a healthy watershed
- This percentage was measured using GIS mapping and an aerial photo

**Impervious Surfaces In Willand Pond Watershed**



 Impervious surfaces2.shp  
 Watershed.shp

# Ecologically sound practices for Run-off and Stormwater

- Current retention basins decrease sediment and volume, but our recent samples showed that phosphorus still enters the lake from retention basins in high concentrations
- There are many options that filter nutrients, decrease runoff, pollution, and flooding, and improve appearance of the shore land



More information is available at:

<http://erg.unh.edu/lid/index.asp>

Through the UNH stormwater center

# Bioretention Systems



A well vegetated basin produces a thick root mat which removes nutrients and reduces stormwater volume through transpiration.

This system has two basins: the first removes sediment and the second filters nutrients using native plants, soils, and sand.





# Integrated stormwater management at the Milford Rd. Retail Development in Amherst, NH

- Gravel wetlands treat run off from areas with impervious surfaces
- The tree well treats further runoff. The two infiltration swales will accept overflow from the rain gardens via a hydraulic connection.
- Rain gardens are located within the center portion of the parking lot, and act as attractive vegetative islands while simultaneously dealing with any runoff from the parking lot itself, in addition to the stormwater from the roof.
- The roof's stormwater drains down and is piped into the rain gardens, which address any potential pollutants accompanying the stormwater.
- The pervious pavement covers all paved areas on the site, save two areas where the leach fields are located and heavy-traffic

# Green Roofs

- Reduce runoff
- Filter runoff
- Require little maintenance
- Reduce energy costs for heating and cooling



# Porous surfaces

Non point source pollution from run-off is one of the greatest threats to water quality



Pervious Concrete compared to Impervious (conventional) asphalt at UNH

## Advantages

- Allows snowmelt and rain to drain through
- Reduces the need for salt and sand
- Removes sediments, heavy metals, and petroleum products
- Reduces the volume of runoff significantly
- Lasts for twice as long as conventional asphalt

## Disadvantages

- More expensive initially
- Cannot be used on heavily travelled roads
- Cannot be used in areas where there is a risk of hazardous spills (like gas stations)
- Costs 20-25% more than traditional pavement
- Requires continued vacuum sweeping

# Residential Solutions to Flooding and Runoff

- Residents can do a lot to reduce the amount of run off and nutrients entering the pond
- They can construct swales that direct run off and gutter water into rain gardens and they can stabilize exposed soils on their land with plants, rocks, or mulch
- Rain gardens (shown below) are attractive ways to absorb water and nutrients while diverting water away from the lake and houses
- Redirecting run off can reduce the risk of basements flooding
- Residents may also choose to replace their driveways with gravel or porous concrete in order to decrease the amount of impermeable surfaces



# Shoreline Buffer

- Planting shrubs to create a buffer along the shoreline can be a very effective way of keeping excess phosphorus out of a lake



# Alternatives to Fertilizing Lawns with Phosphorus

- It doesn't take much P to ruin a lake!!
- Phosphorus free fertilizer: N-P-K, 15-0-10
- Apply fertilizer in the fall, and do not apply immediately before rainfall
- Leave grass clippings on lawn as fertilizer
- Use slow release organic fertilizer instead
- Use compost and mulch for gardens and shrubs instead of synthetic fertilizer
- Avoid having lawns near the shore
- Plant a buffer of shrubs next to the



# Public Education Campaign

- Raise awareness about the the causes of cyanobacteria blooms and phosphorus sources
- Provide simple solutions and support for reducing runoff and phosphorus contamination: provide workshops on buffer planting and free native shrubs and plants
- Target residents, businesses on the lake, and people who use the lake for recreation

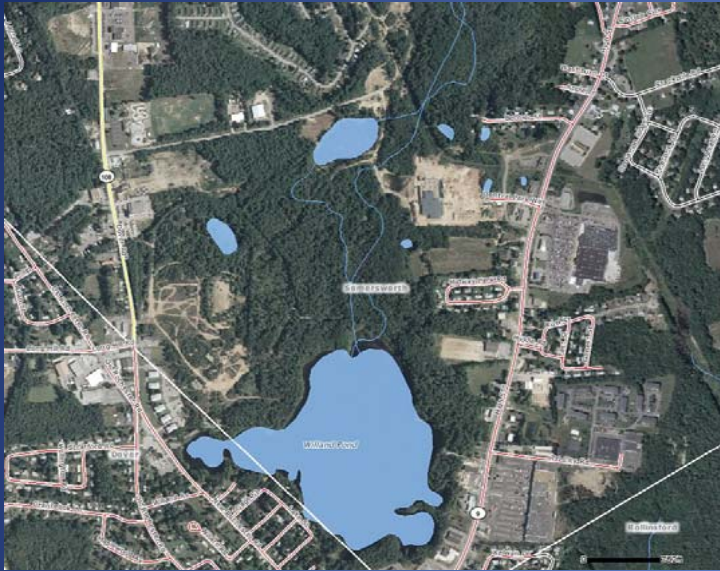


# Communication and Community Involvement

- Ad Hoc/ Friends of Willand Pond
- Newsletter
- Willand Pond has a great resource of concerned residents and recreators
- Foster communication among businesses, residents, and city officials
- Identify and use the most popular forms of communication: newsletters, newspapers, posted notices, local TV channels, radio broadcasts, workshops, town website, networks of people.



# Future Land Use



-When thinking about future land use, consider whether the development is necessary and ecosystem services the undeveloped land provides

-Maintain 250 ft. buffer around the pond where ever possible

-Use stormwater practices that reduce run off volume and nutrient content



-Consider whether the development detracts from the aesthetics of the area and quality of life.

-While there is an area around Willand Pond zoned recreational, its watershed also includes undeveloped areas zoned residential and commercial/industrial.

# Ecosystem Services and Recreation Uses

Ecosystem Services- a healthy ecosystem provides us with goods and services that cannot be replaced by technology and are essential to our welfare and survival

Willand Pond and the surrounding land provide us with:

- Maintenance of a high quality living environment
- Biodiversity
- Air and water purification
- Detoxification and decomposition of wastes
- Climate regulation
- Peace of mind, a place to relax, focus, and connect with nature
- A place to find energy, perspective, and inspiration
- Outdoor recreation such as boating, fishing, canoeing, kayaking, and walking or running



# Town Land Use Regulations to guide Commercial development

- If development is considered necessary, we recommend changing town land use regulations to require that the development works with the natural landscape
- This means the best possible storm water technology and visual integration to the landscape, maintenance of shoreline buffer, and consideration of wildlife habitat



## Conservation Land

- There are four parcels of land owned by the town of Dover on Willand Pond, because the pond was historically used as a drinking water supply. They are classified as Unofficial Conservation land and are > 50% natural cover, with extractive uses allowed.
- The area amounts to about 35 acres.
- The ratio of public to private land is about 60:40.
- The total shoreline is 9,709ft and 3,510ft are on conservation lands.

# Land Protection around the Pond



Protect water quality by placing a 250ft buffer under official easement.

Currently some is under unofficial conservation.

The town of Dover could begin by donating the development rights of the land it owns to Somersworth. The town of Somersworth could hold an easement on the land. Private landowners could be contacted and possibly donate or sell an easement on the property next to the lake.



Much of the undeveloped land around the pond is already zoned recreational, which limits some use. A conservation easement would be a more powerful protection.

# Questions?

