

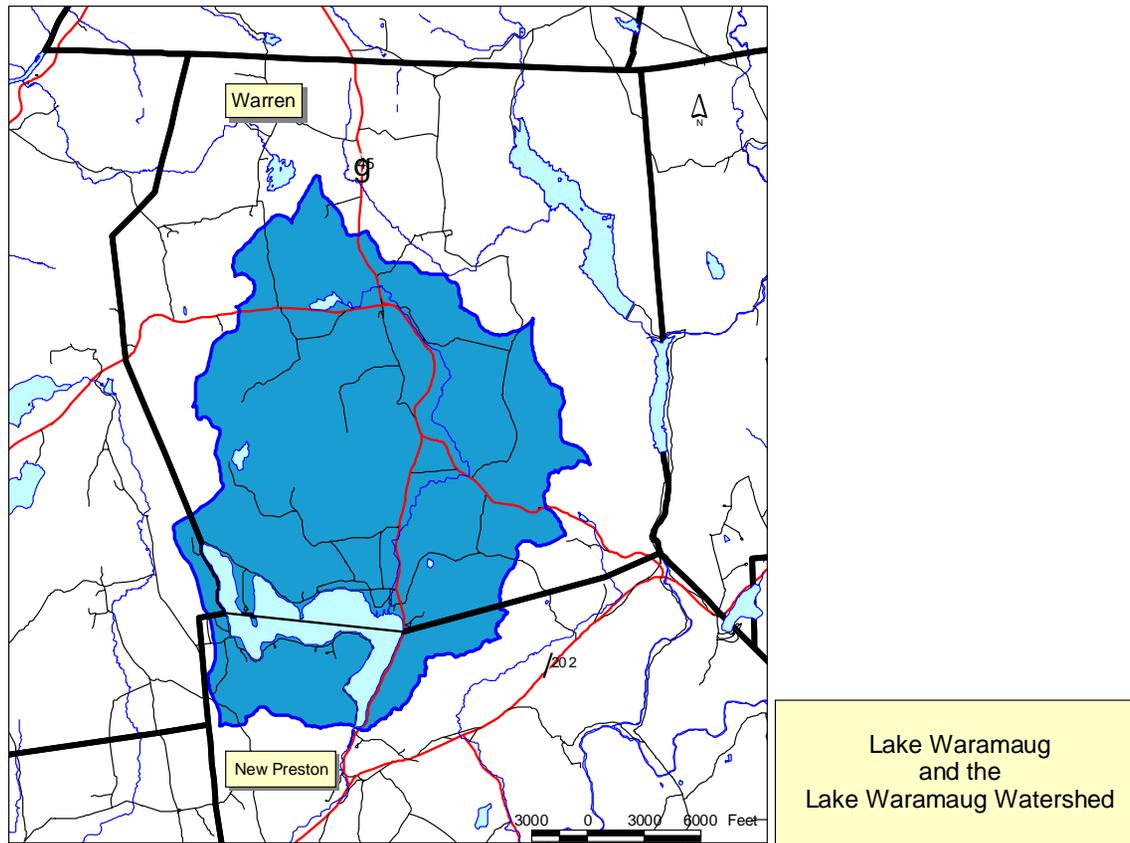
# LAKE WARAMAUG TASK FORCE 30 YEARS OF SUCCESSFUL LAKE RESTORATION



# LAKE SHORE BORDERS WARREN, WASHINGTON AND KENT



# WATERSHED 14 SQ. MILES SURFACE - 692 ACRES



# LAKE HAS THREE "BASINS"



Lake Waramaug  
Towns of Warren, Washington, and Kent



# LAKE WARAMAUG STATE PARK MOST POPULAR INLAND PARK



# WARMAUG PARK BEACH



# 3,000 FT OF LAKE SHORELINE



# EXTENSIVE CAMPING FACILITIES



# PICNICING



# 1975

After many years of decline by 1975 lake water clarity was 3 – 4 feet and algae was present on the lake surface all summer.

Ct. Agriculture Experiment Station says Lake is in advanced stage of “eutrophication” & there is “No Quick Fix”! Says phosphorous from watershed and “internal loading” of phosphorous is feeding explosive algae growth & lake is “killing itself”.

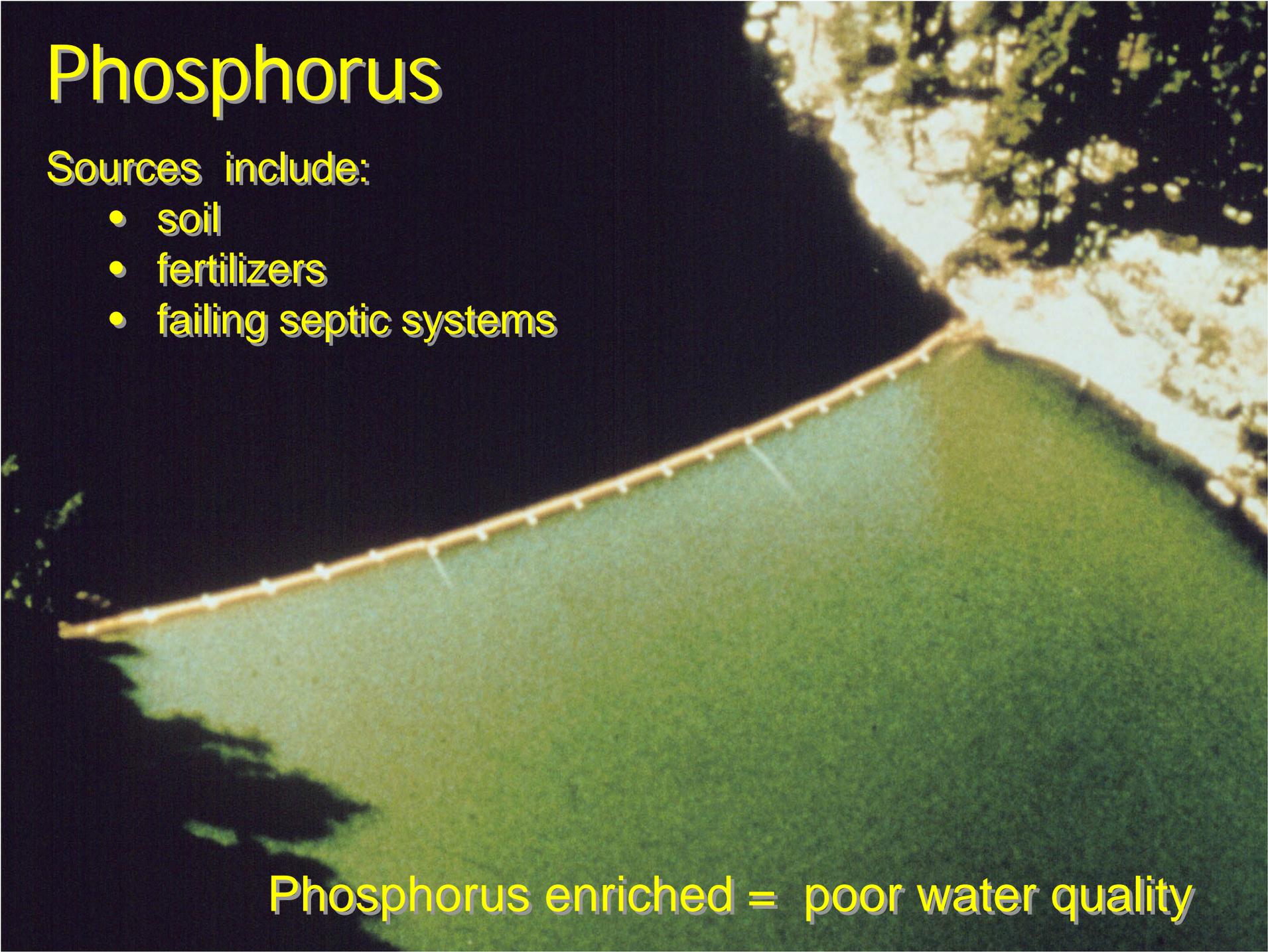
**LAKE WARAMAUG TASK FORCE FORMS TO**  
***Save the Lake***

# Phosphorus

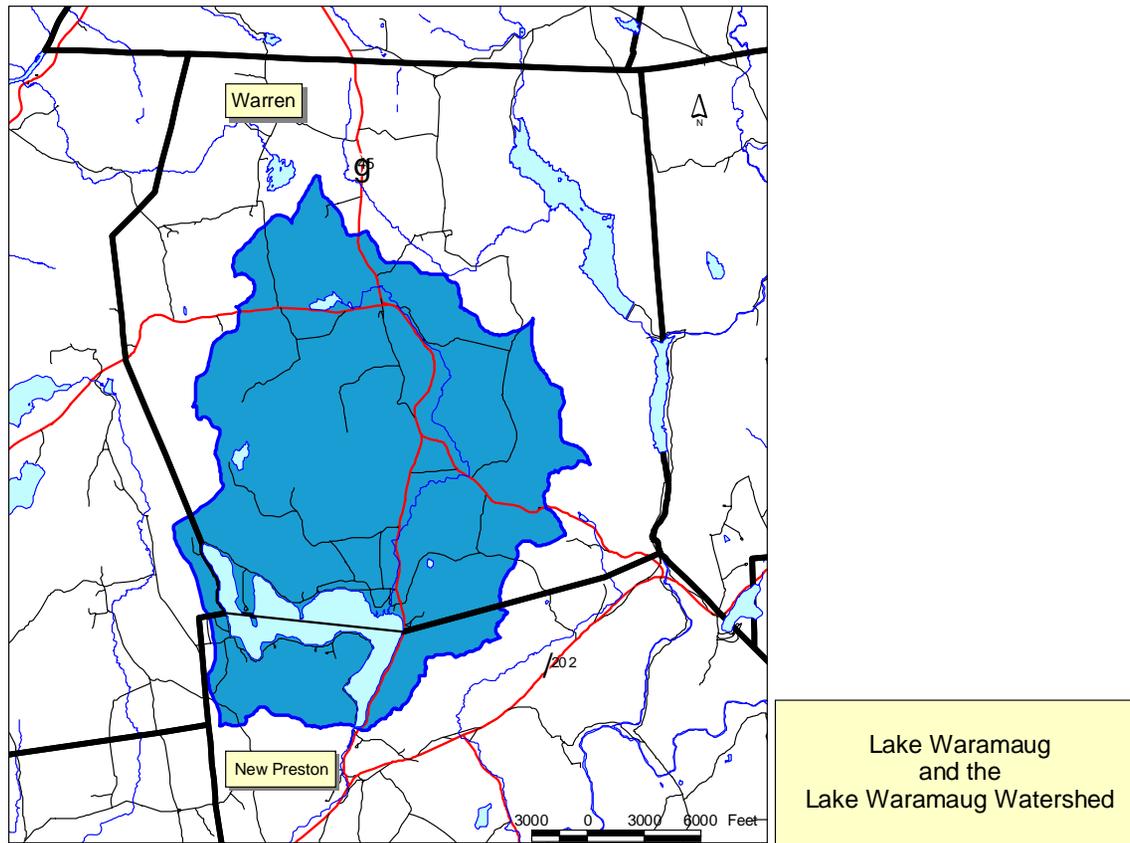
Sources include:

- soil
- fertilizers
- failing septic systems

Phosphorus enriched = poor water quality



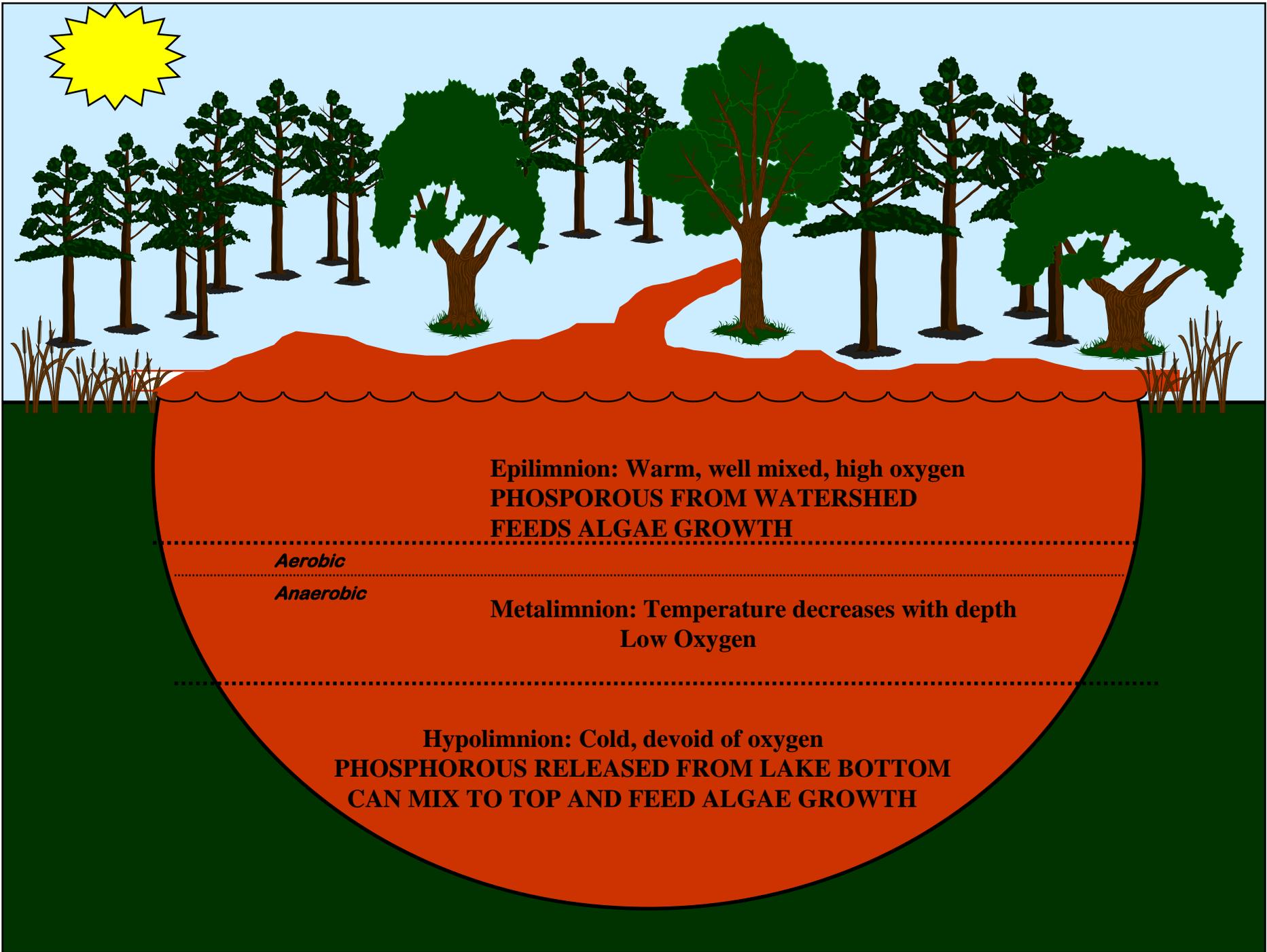
# WATERSHED 14 SQ. MILES SURFACE - 692 ACRES



# SUCKER BROOK MAIN FEEDER STREAM





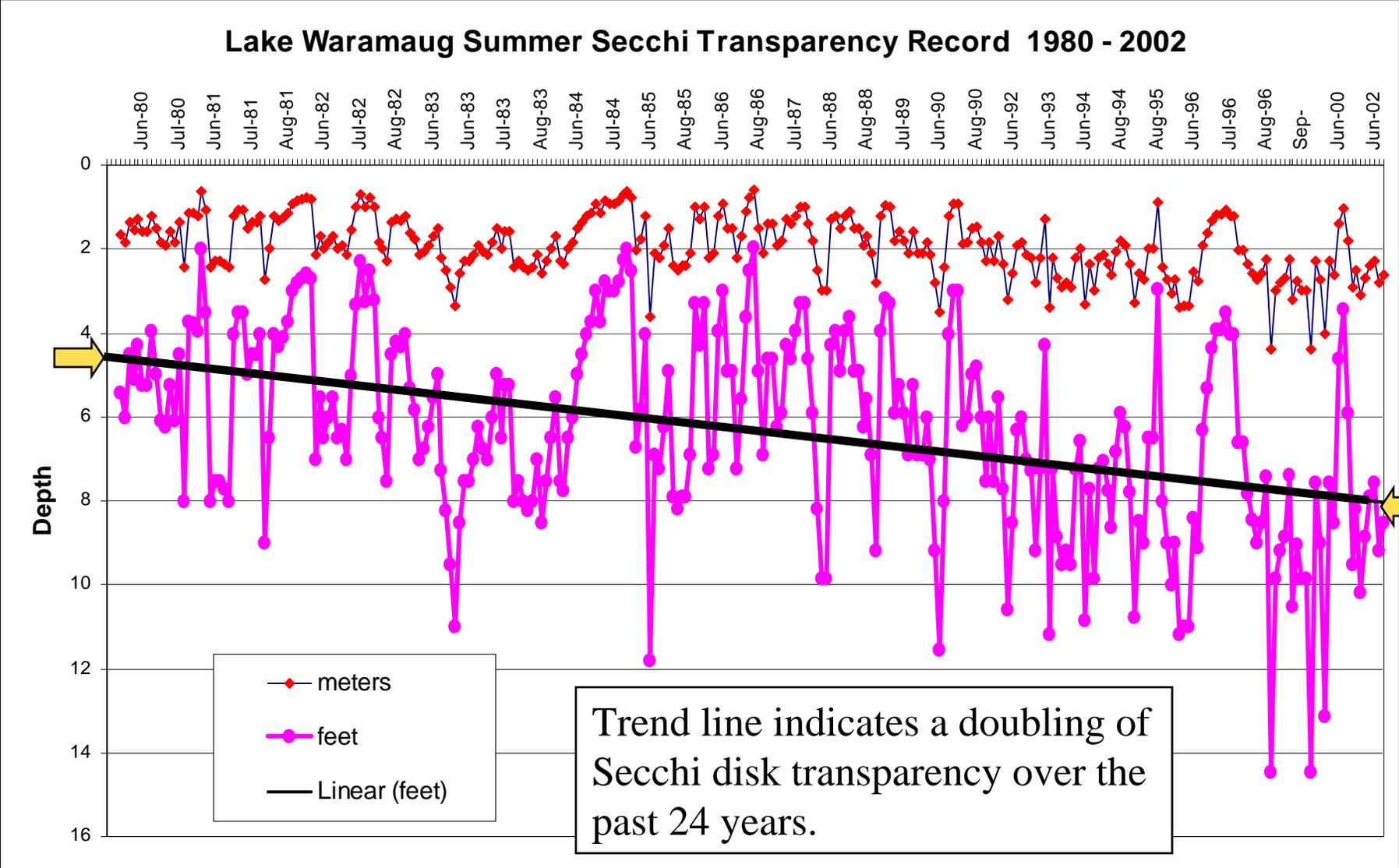


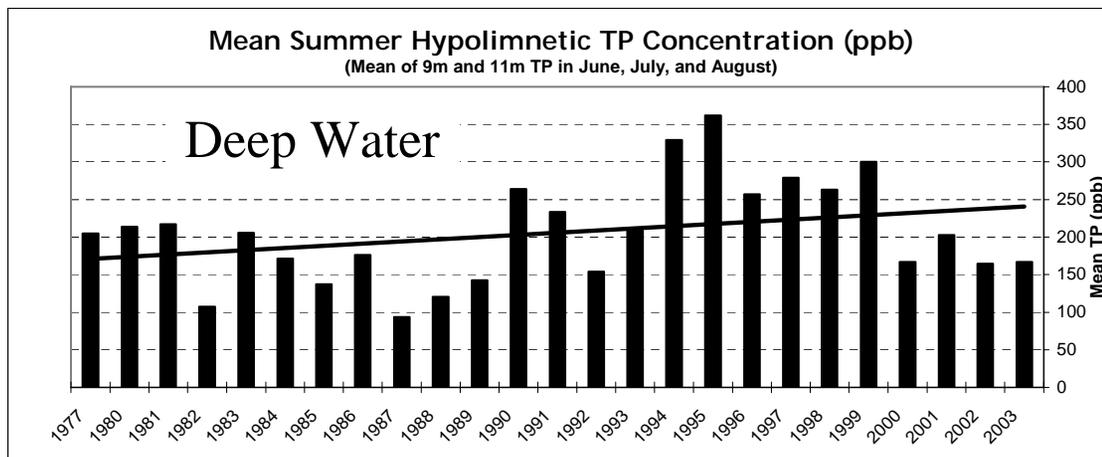
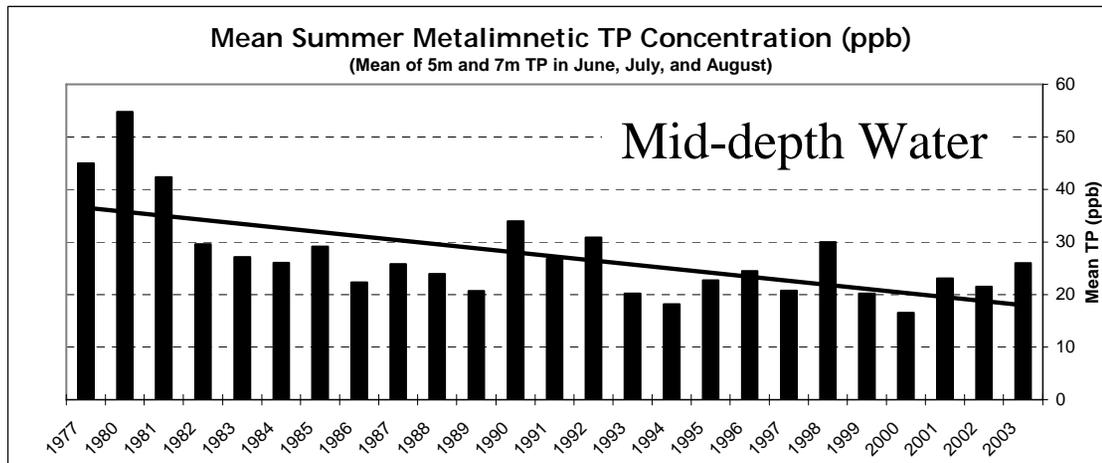
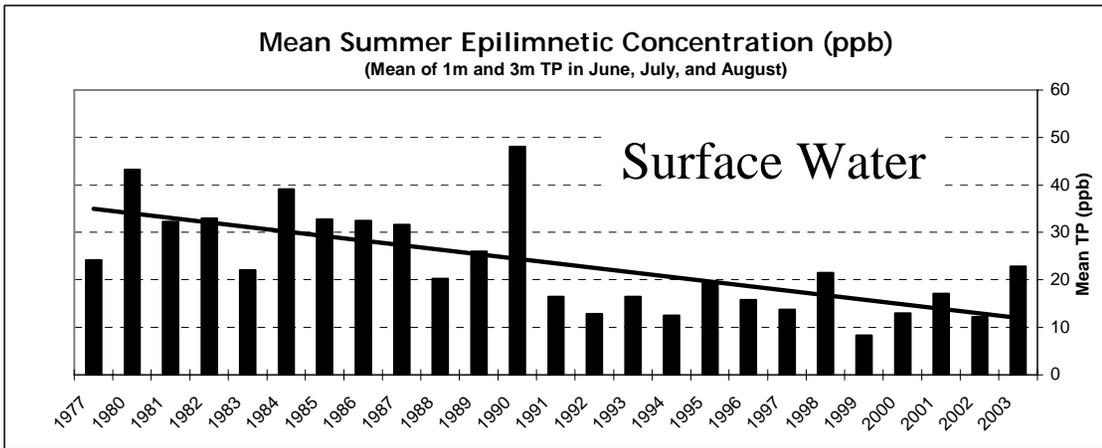
# RESTORATION OBJECTIVES

- REDUCE FLOW OF NUTRIENTS (ESPECIALLY PHOSPHOROUS) FROM WATERSHED TO LAKE
- REDUCE “INTERNAL LOADING” CYCLING OF NUTRIENTS FROM LAKE BOTTOM TO SURFACE
- RESTORE LARGE (ALGAE EATING) ZOOPLANKTON

# Water Clarity Record at Lake Waramaug 1980 to 2004

(Meters in Red; Feet in Purple; Black Line is the Linear Statistical Trend)





Total Phosphorus  
Concentration at  
Lake Waramaug  
1977 to 2004

# WHAT WE DID

- REDUCE NPS WATERSHED SOURCES
- Major erosion sites on Feeder stream and Park shoreline
- Whole dairy farm waste collection & treatment system = 25% P reduction
- Conversion of dairy to vineyard and wine waste lagoon

# EDUCATION AND REGULATION

- Newsletters, talks, “personal visits” on best management practices
- Model demonstrations eg. Native landscape shoreline buffer as alternative to lawn
- New Zoning Regulations for lake watershed and shoreline development

# IN-LAKE RESTORATION

- Inlake restoration systems reduce internal loading of phosphorous, improve habitat for zooplankton and brown trout and fix phosphorous to naturally available iron
- Stock lake with brown trout to reduce excessive alewife population
- Seed lake with zooplankton to help restore population

# HOW WE DID IT

- Tremendous volunteer Task Force Board
- Strong leadership and Fundraising
- Tiered Organizational Structure Spreads the Responsibilities:
  - Task Force – Research and Development
  - Interlocal Commission – Operation Cost
  - Lake Association – Support and Education

# PROFESSIONAL GUIDANCE

- Ecosystems Consulting Services – since 1980 Dr. Robert Kortmann
- U/Conn Dr. Peter Rich
- Dr. Robert Carlson – Kent State Univ
- Dr. Gurtrude Nurnberg, Canada Ministry on Environment
- Conn. Agriculture Experiment Station

# SUPPORT ORGANIZATIONS

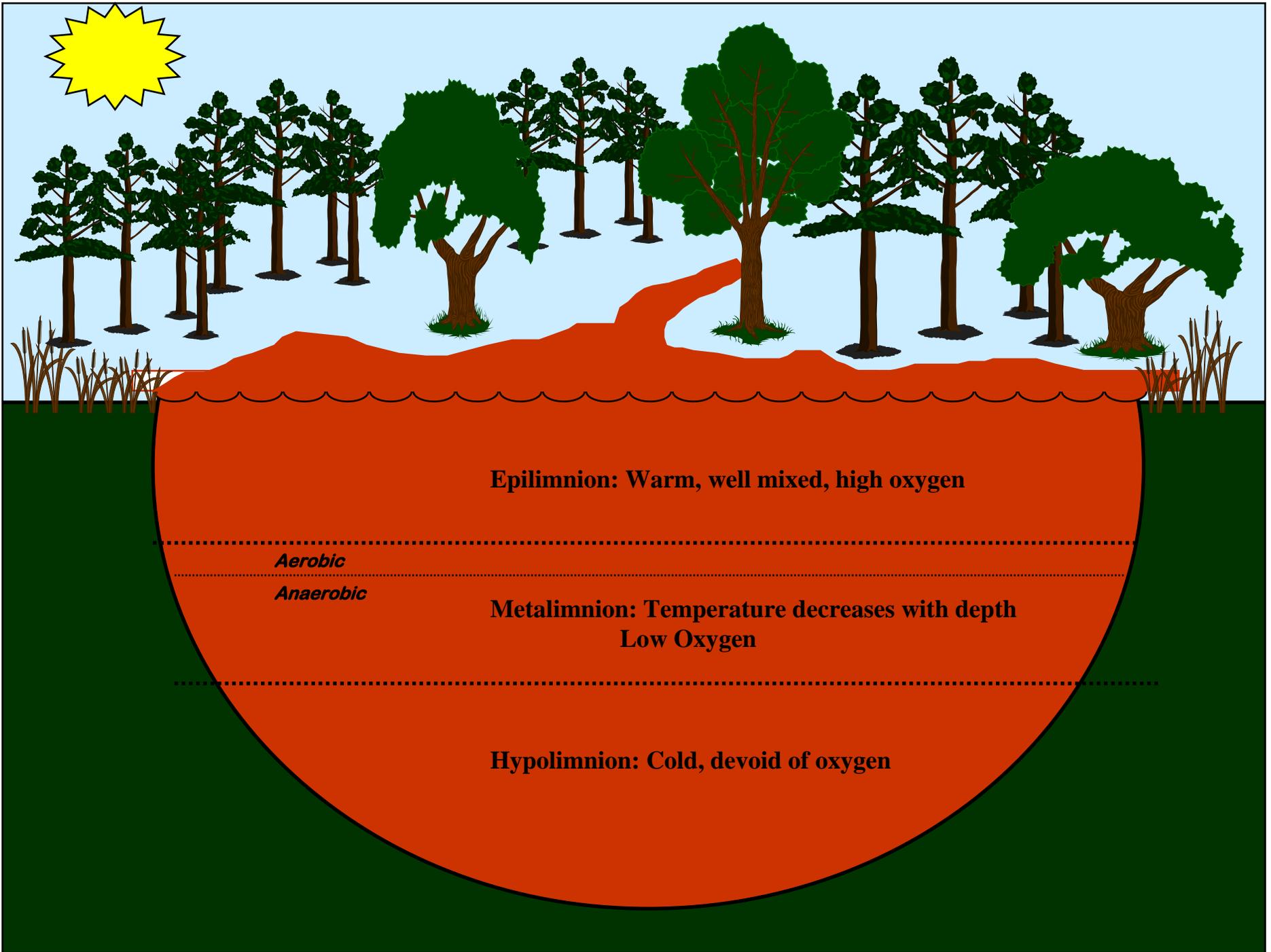
- Northwest Conservation District
- U.S. Dept. of Ag. Natural Resource and Conservation Service
- Connecticut Department of Environmental Protection
- Local Planning, Zoning, Wetlands and Conservation Commission
- Local and Area NPO Environmental Orgs.

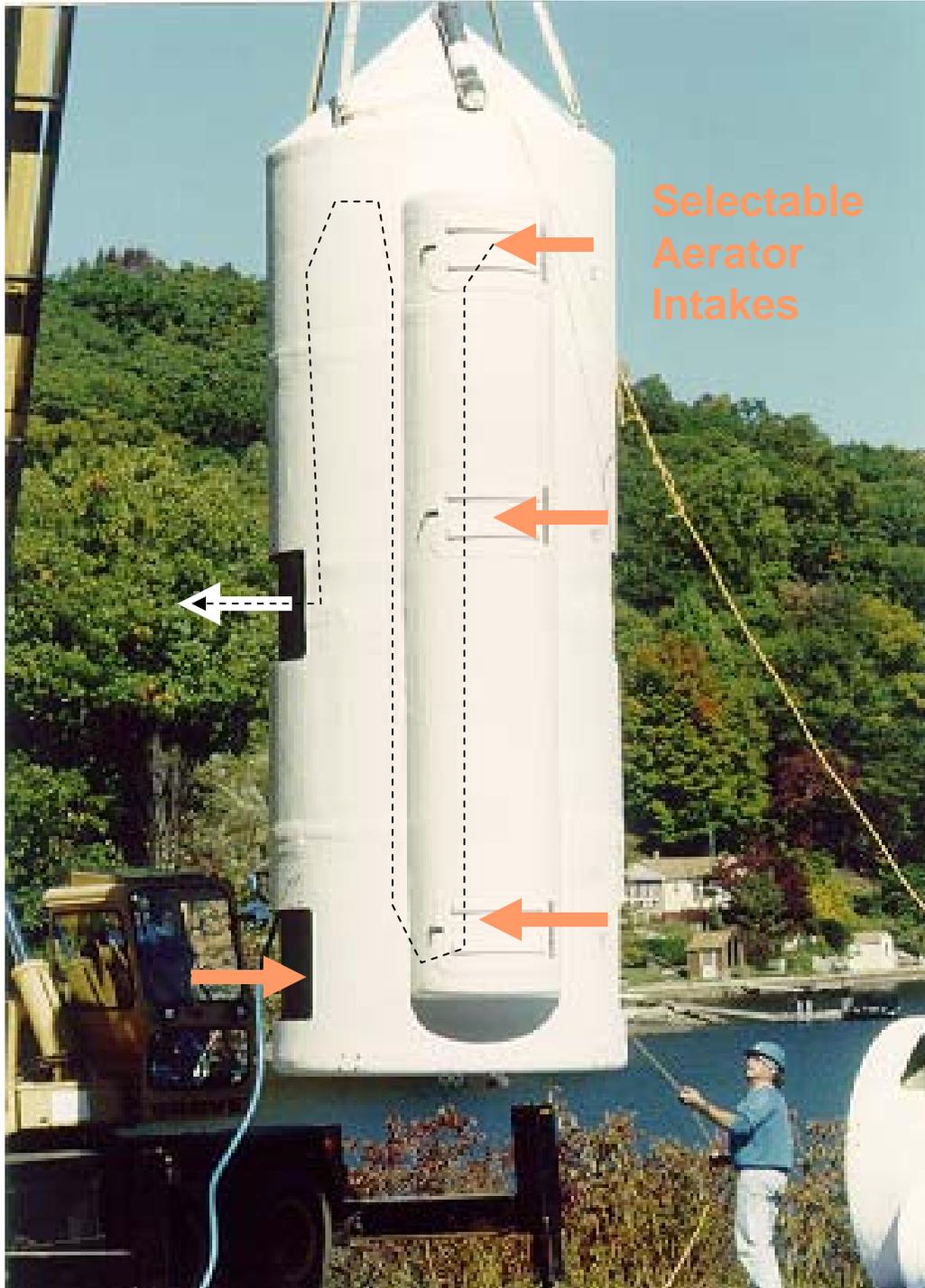
# ECOSYSTEMS CONSULTING SERVICES – TASK FORCE LAKE SCIENCE ADVISORS



DR. KORTMANN DESIGNS  
UNIQUE IN-LAKE “LAYER AIR”  
RESTORATION SYSTEM  
SYSTEMS INSTALLED IN 1989  
AND UPGRADED IN 2003  
MIXES MILLIONS OF GALLONS  
OF WATER EACH DAY  
FROM JUNE TO  
SEPTEMBER



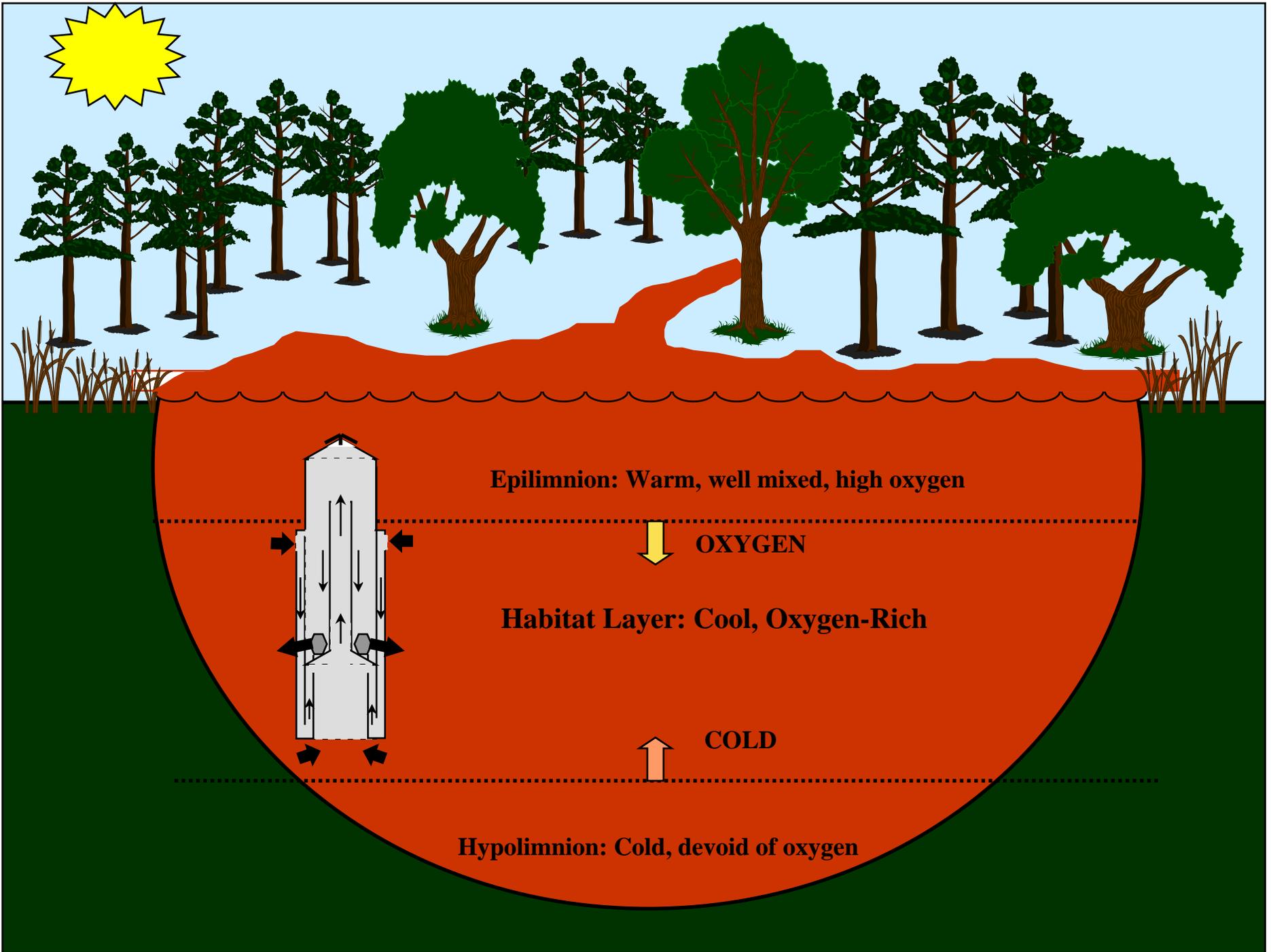




## Lake Waramaug Layer Aeration

**Layer Aeration** is similar structurally to hypolimnetic aeration. However, water is selectively drawn into the aerator from several depths, aerated, blended, and returned at an intermediate depth. Hence, returned aerated flow is at an intermediate temperature (between temps of aerator intakes) and is neutrally buoyant. This is useful for creating a distinct aerobic water layer for cold water fish, zooplankton refuge habitat, etc.

Air diffusers inside the aeration tower pumps, aerates, and blends water from selected depths.



# RESTORING ZOOPLANKTON

- In 1975 no large zooplankton found in Waramaug...State alewife stocking in 1960's decimated zooplankton population.
- Large zooplankton feed on algae...nature's defense against excessive algae growth
- Task Force stocks brown trout to eat alewife and restore balance of nature.

Since 1986 almost 50,000 brown trout stocked in lake by Task Force



Trout feed on alewife allowing more  
zooplankton to survive and eat  
algae



Tanner Farm source of 25% of total phosphorous loading to Waramaug



# 225 cows near Sucker Brook and farm run-off overloads lake with phosphorous



# Task Force and USDA fund “whole farm” waste management system



Lined lagoon holds all farm run-off  
for pumping to fields away from  
Brook



# DAIRY FARM CONVERTED TO WINERY



# HOPKINS VINEYARD



# WINE WASTE LAGOON



# LAGOON AND VIEW OF VINEYARD



In 1980 5 major erosion sites  
stabilized on Sucker Brook  
New erosion sites are developing





# Sediment build up in Waramaug from Sucker Brook remains serious concern to lake water quality



# Model Lake shore plant buffer installed to show benefit to lake water quality and clarity



# Lawn is converted to bermed native plant buffer



# Create bio-filter to treat culvert storm water runoff



Instead of discharging direct to lake  
culvert water is filtered in basin



# Lawn is converted to bermed native plant buffer



# FIRST YEAR OF PLANTING



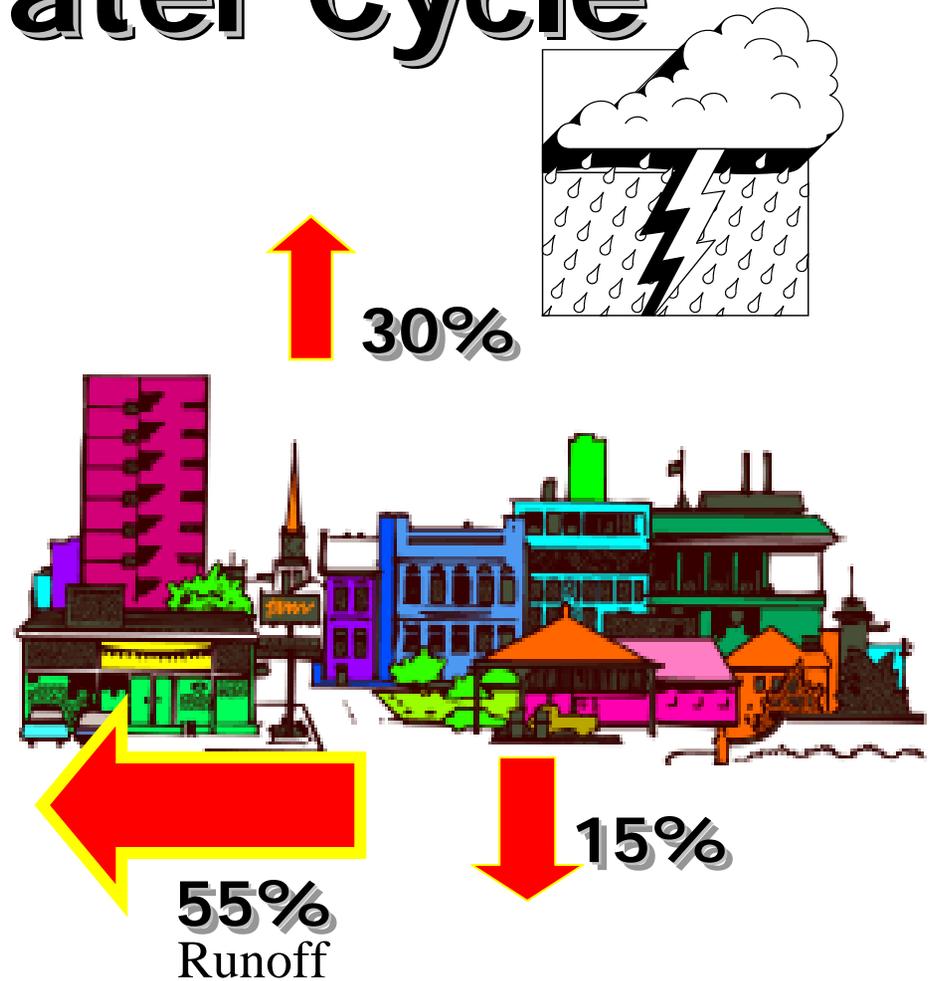
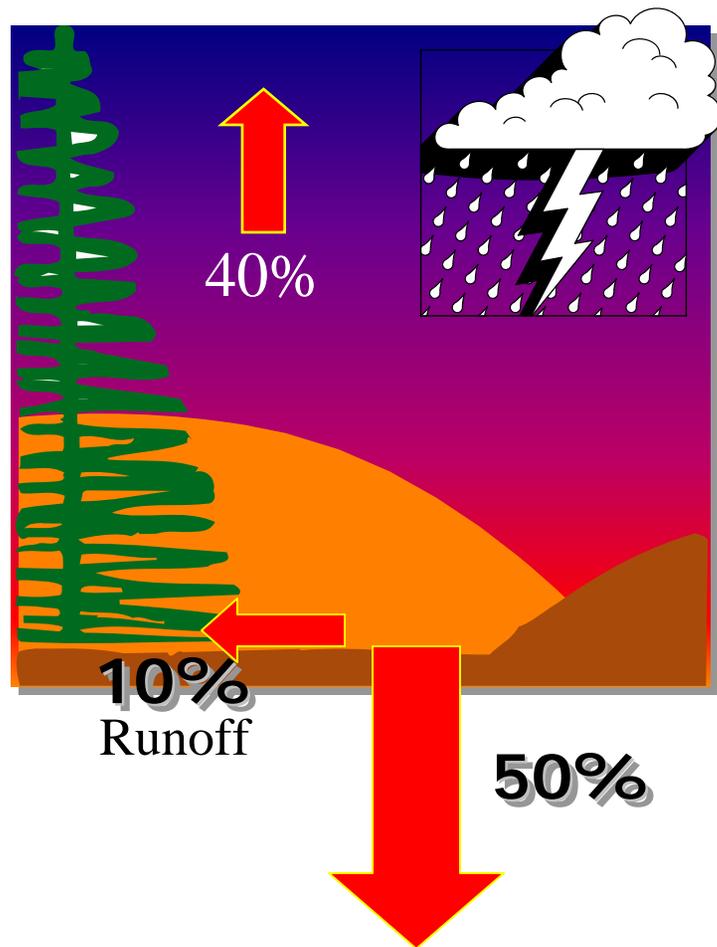
# Native wetland plants filter runoff in bio-filter basin

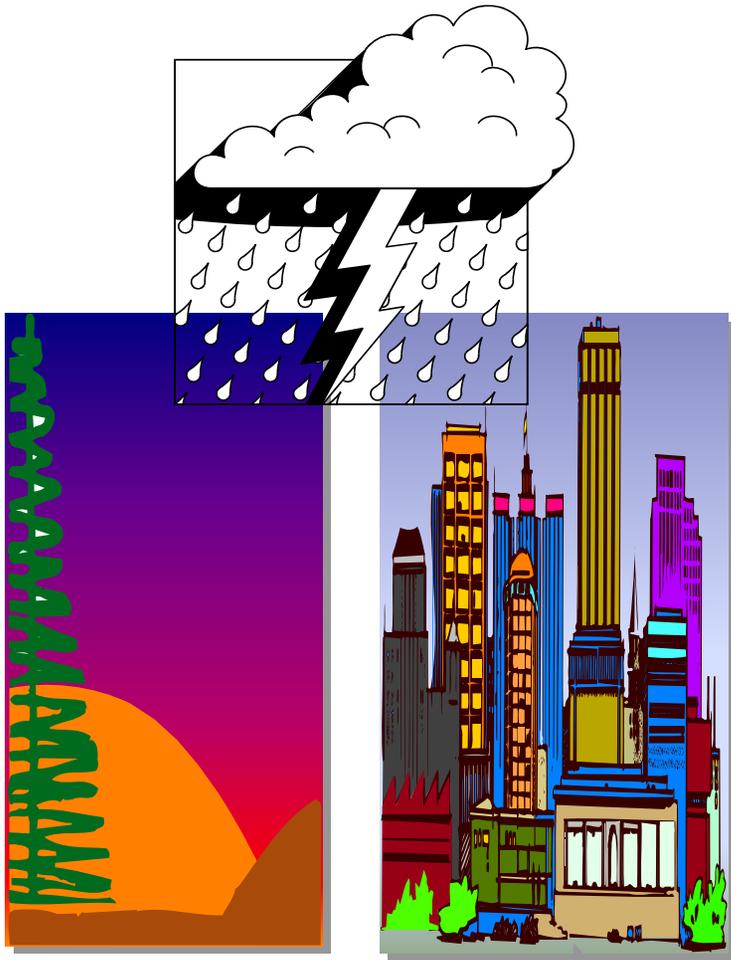


Native plants and shrubs trap water and treat it before reaching lake



# Development Impacts on the Water Cycle





# Development Impacts on Water Quality

Nutrients

Pathogens

Sediment

Toxic

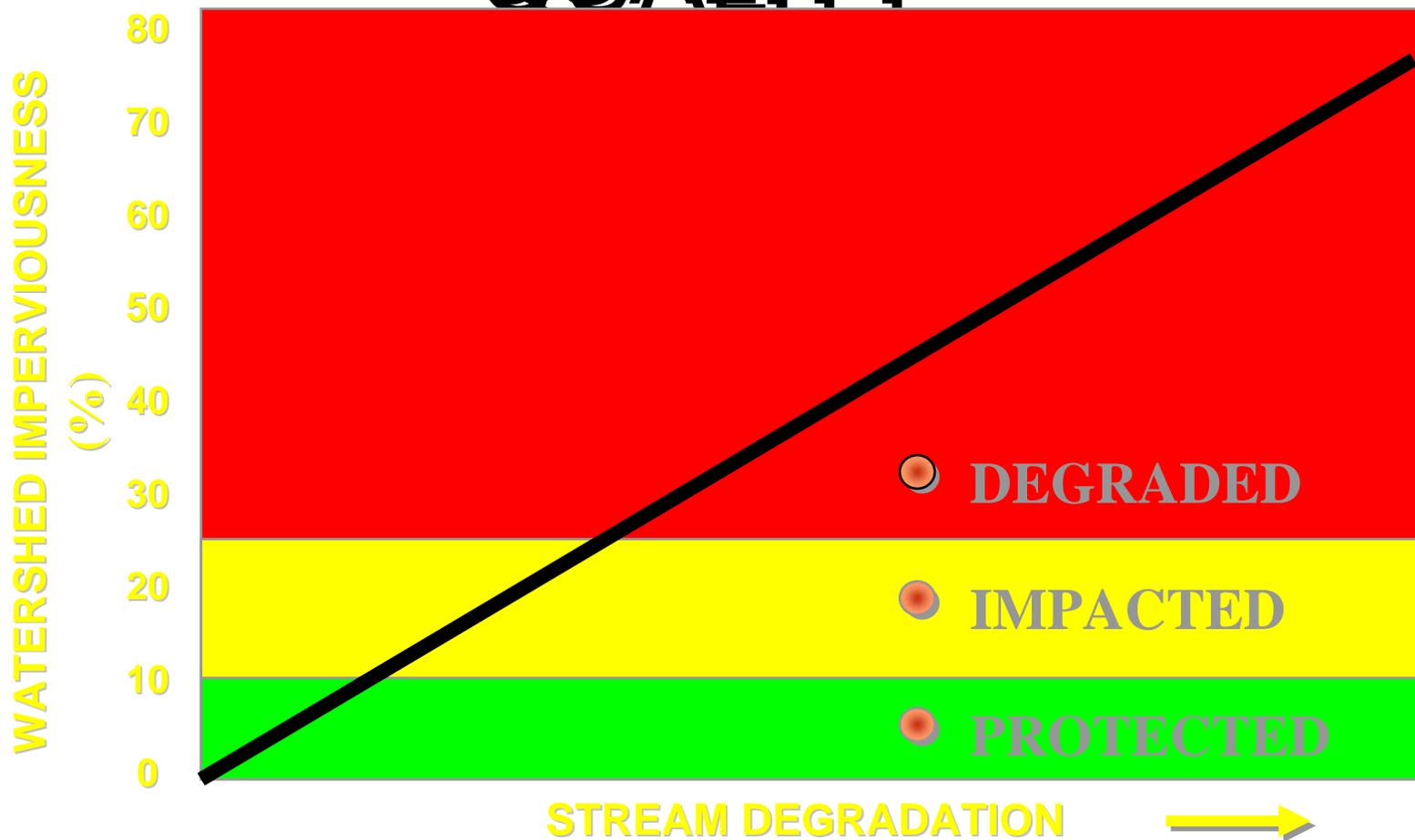
Contaminants

Debris

Thermal Stress



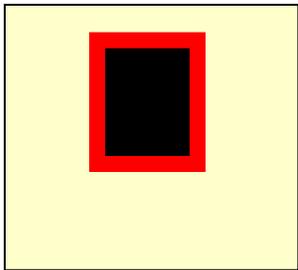
# IMPERVIOUS SURFACE COVERAGE - WATER QUALITY



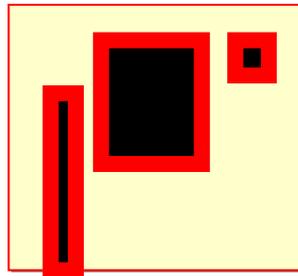
ADAPTED FROM SCHUELER, ET. AL., 1992

# Lot Coverage

Most regulations address  
roof coverage ONLY!



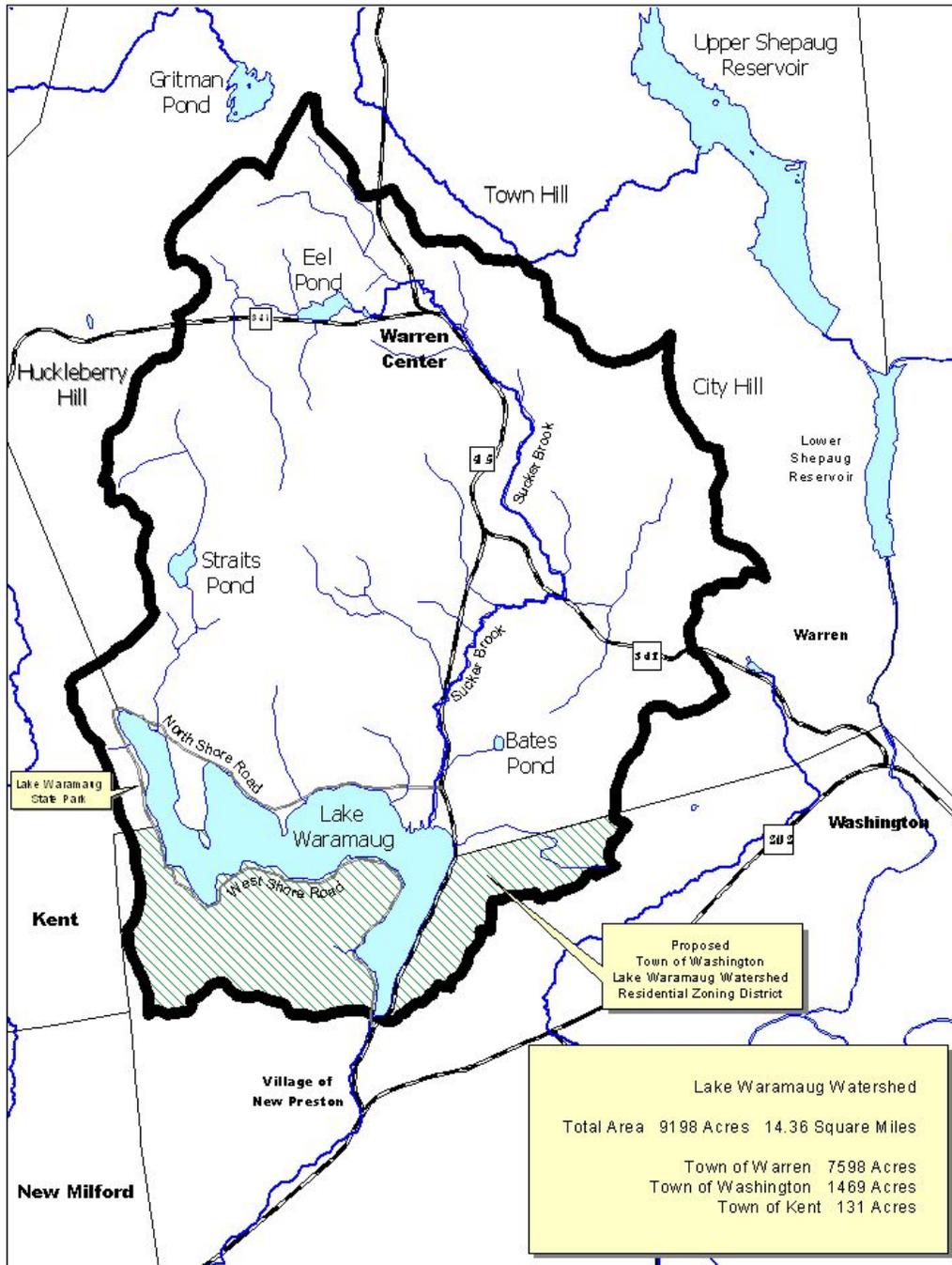
Coverage  
= Roof



Coverage  
= All I.S.



- walkways
- patios
- sidewalks
- driveways
- tennis courts
- outbuildings
- compacted earth



# NEW LAKE REGULATIONS IN WASHINGTON AND WARREN PROTECT LAKE WATER QUALITY

# WASHINGTON LAKE ZONE REGULATIONS

- LIMIT TOTAL IMPERVIOUS SURFACES TO 10% OF TOTAL LOT AREA
- ALL NEW STRUCTURES MUST SET BACK 75' FROM LAKE SHORE
- ALLOW REDUCTION TO 50' WITH MITIGATING MEASURES, EG LANDSCAPE BUFFER
- ALL NEW DEVELOPMENT REQUIRES STORMWATER MANAGEMENT PLAN



## (1) Amendment to Warren Zoning Regulations

New Subsection:

Section 7.2 Lots on Major Waterbodies



## DEVELOPMENT ON MAJOR WATERBODIES

### Application and Statement of Purpose

Shoreline development on lakes, reservoirs, and ponds >5 acres:

Shepaug Reservoir

Lake Waramaug

Eel Pond

Sucker Brook shoreline

Upper Shepaug Reservoir

Fiddler's Pond (Gritman Pond)

Straits Pond

These requirements are in addition to the specifications of the underlying zone...

## Purposes of the Regulation:



- Protect drinking water supplies and prevent pollution
- Protect against eutrophication (excessive weed and algae growth)
- Avoid the need for a public sewer treatment system
- Protect important recreational resources

## Shoreline Setback Requirements



11.5.1 A dwelling or other principal building and accessory buildings shall be set back at least 75 feet from the shoreline with the following exceptions:

- repair and replacement of existing structures
- waterline rip-rap or structures necessary for shoreline or erosion stabilization
- docks and floats
- a pedestrian walkway to access shoreline
- a storage shed not to exceed 80 ft<sup>2</sup> in floor area or 12 feet in height

## Special Exception – Shoreline Setback



A principal or accessory building or structure may be permitted between 50 and 75 feet of the shoreline when approved as a Special Exception subject to the following requirements and those of Section 9:

### 11.6.1

Provide a landscape and stormwater management plan to reduce impact of stormwater runoff

Proposed construction shall be minimized within 75' of the shoreline

50% of the undeveloped portion of the 75' setback shall serve as a shoreline vegetative buffer

## Section 11.7

### Docks and Floats

Docks and floats are permitted provided that they are not permanent and are capable of seasonal removal.

## Section 11.8

### Minimum Shoreline Frontage

Minimum shoreline frontage shall be 100'

## Section 11.9

### Maximum Impervious Surface

Not more than 20% of the lot within 300 feet of a major waterbody shall be covered with impervious surfaces



# NEW LAND PRESERVATION FOCUS



**66 AC PROTECTED IN 2004  
7AC & 1,000 FT OF SHORELINE  
PROTECTED IN 2005**



# PENNINGTON PRESERVE

## 3.5 acres North Shore Road



# ALLURED PRESERVE

## 2.5 acres on North Shore Road



# VANCE FAMILY PROTECTS 65 ACRES IN 2006



# Comprehensive Invasive Aquatic Plant Prevention Program



Lake Waramaug  
Towns of Warren, Washington, and Kent

Key to Success - Cooperation between Towns  
and Lake Organizations

Lake Waramaug Task Force

Washington Parks and Recreation Commission

Lake Waramaug Interlocal Commission –

Warren Washington and Kent

Lake Waramaug Association





**Eurasian Watermilfoil**  
*Myriophyllum spicatum*



# WATERCHESTNUT - INVASIVE AQUATIC PLANT



# Eurasian Watermilfoil

*Myriophyllum spicatum*



## Description

Eurasian watermilfoil is an invasive, underwater aquatic plant accidentally introduced in the 1940s.

## Why is it a concern? Once established difficult and costly to eradicate

- Eurasian watermilfoil can disrupt the ecology of a water body.
- Interferes with shoreline access and recreational use
- Under severe conditions, property owners and lake

associations can expect increased costs:

Sturgeon Bay, WI spends over \$100,000 annually on the control of Eurasian watermilfoil.

# Comprehensive Invasive Aquatic Plant Prevention Program

## 5 Components:



### 1. EDUCATION

Posting signs

Publish newsletters

Conduct landowner seminars

### 2. MONITORING FOR AQUATIC PLANTS

Weekly invasives survey

Consulting Plant Scientists

# Comprehensive Invasive Aquatic Plant Prevention Program



## 3. EMERGENCY RESPONSE PLAN

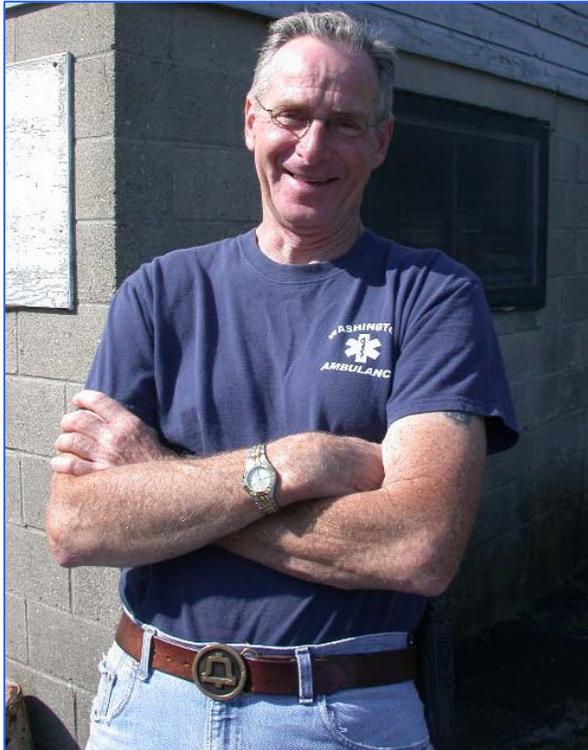
Growth suppression mats

Rapid approval for treatments

## 4. BOAT INSPECTION PROGRAM

Boats are the major vectors

## 5. STATE LEGISLATION BANNING INVASIVE PLANT SALE/TRANSPORT



**THE TOWN OF WASHINGTON  
HAS ESTABLISHED A BOAT  
INSPECTION PROGRAM AT ITS  
TOWN BEACH/BOAT LAUNCH  
AND RESIDENTS OF ALL THREE  
TOWNS ON THE LAKE ARE  
ASKED TO LAUNCH FROM THIS  
SITE AND BE INSPECTED BEFORE  
ENTERING THE LAKE.**

**WHAT WE INSPECT:**

Eurasian watermilfoil and other aquatic plants may become tangled in boat propellers, transducers, trim tabs, bow lines, fishing nets, and on trailers.

It is critical to the prevention of the spread of E. watermilfoil and other aquatic invasives that all boaters check and clean their craft before entering and after leaving Waramaug or any other lake.



# Comprehensive Invasive Aquatic Plant Prevention Program



## BOAT INSPECTION PROGRAM

Established at Washington Town Boat Launch, 1999

Was a volunteer program ... now with a full-time inspector

Town ordinance requires:

- No boat enters lake at launch without inspection

- All boats require a sticker



## HOW DOES EURASIAN WATERMILFOIL SPREAD?

### IN THE LAKE:

Runners in the lake bottom.

Fragmentation of plant parts.

### BETWEEN LAKES:

Via recreational motor boats.

Stems break easily & become tangled as boats are retrieved.

## INSPECTION PROCEDURES AT THE WASHINGTON TOWN BOAT LAUNCH



- **INSPECT** and **REMOVE** all aquatic plants and animals
- **DRAIN** water from motors, live wells and bait containers
- **DISPOSE** of unwanted live bait on land

# State Law Bans Invasive Aquatic Plants

- New legislation bans the sale and transport of 22 Aquatic invasive plants
- Includes all aquatic invasive plants found in Connecticut and other potential invasives
- \$100 fine for each plant offered for sale
- Vehicles on public roads must be clean of plant material
- Need to address enforcement mechanisms

# A CLEAR, CLEAN LAKE IS A HAPPY LAKE

