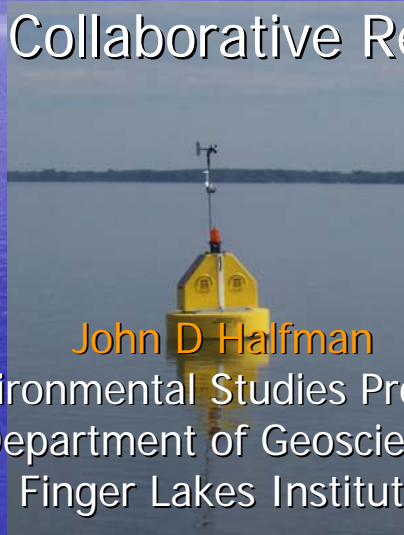


Owasco Watershed Water Quality FLI & Collaborative Research



John D Halfman

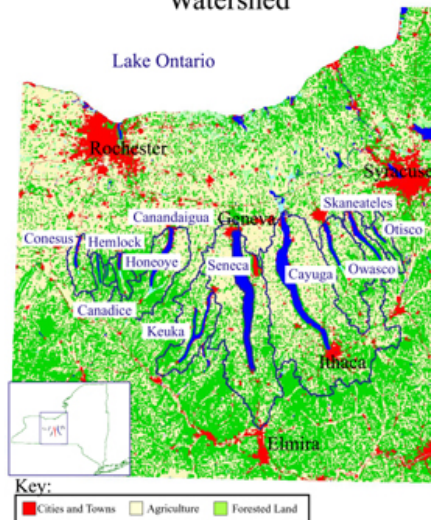
Environmental Studies Program
Department of Geoscience
Finger Lakes Institute

Background Information

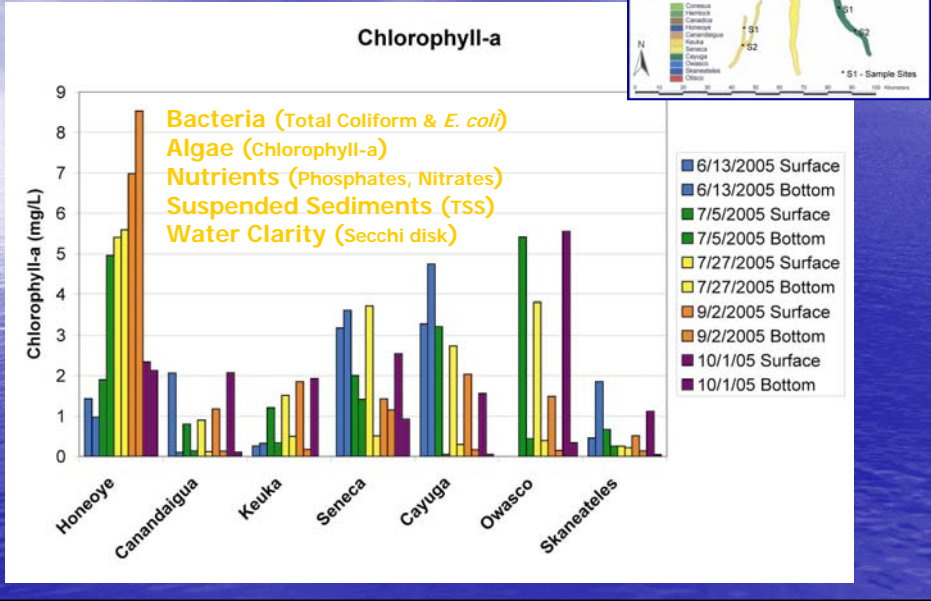
Finger Lakes Importance:

- Tourism
- Agriculture
 - Wineries
- Class AA Drinking Water
 - Seneca Lake
 - ~100,000 Residents
 - Skaneateles & Otisco
 - Syracuse
 - Hemlock & Canadice
 - Rochester

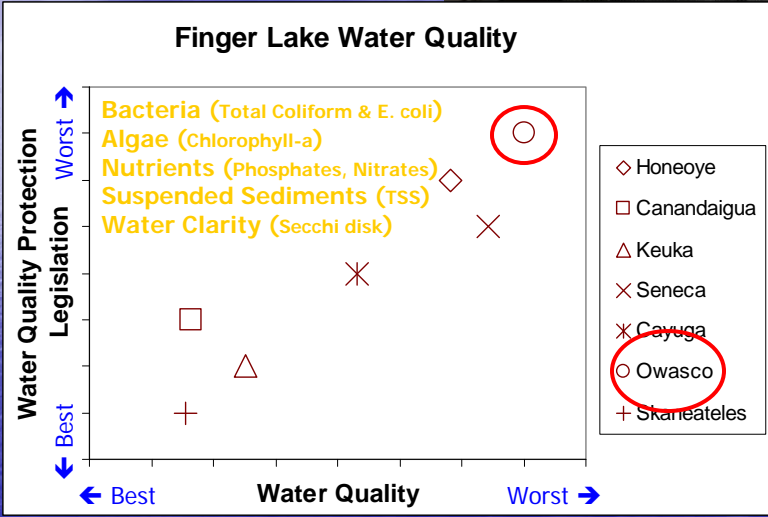
The Finger Lakes Watershed



2005: Algae (TSS, Secchi)



Water Quality & Its Protection

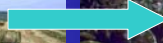


Bush, 2006, Undergraduate Honors Thesis

Water Quality Concerns

Runoff

- **Human Wastes**
 - Municipal Wastewater
 - On-Site Septic Systems
- **Animal Agriculture "CAFO" Operations**
 - Steroids & Antibiotics
 - Animal Waste
- **Plant Agriculture**
 - Fertilizers, Pesticides
 - Soil Erosion



Ecological Health? Nutrient Cycle

Streams, Rain

Dissolved Nutrients

Bacterial Decomposition

Dead Organics

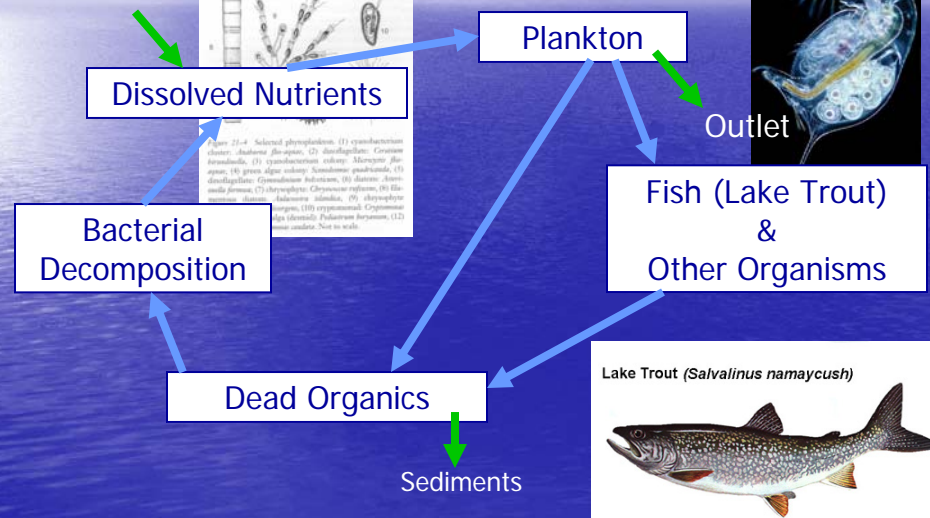
Sediments

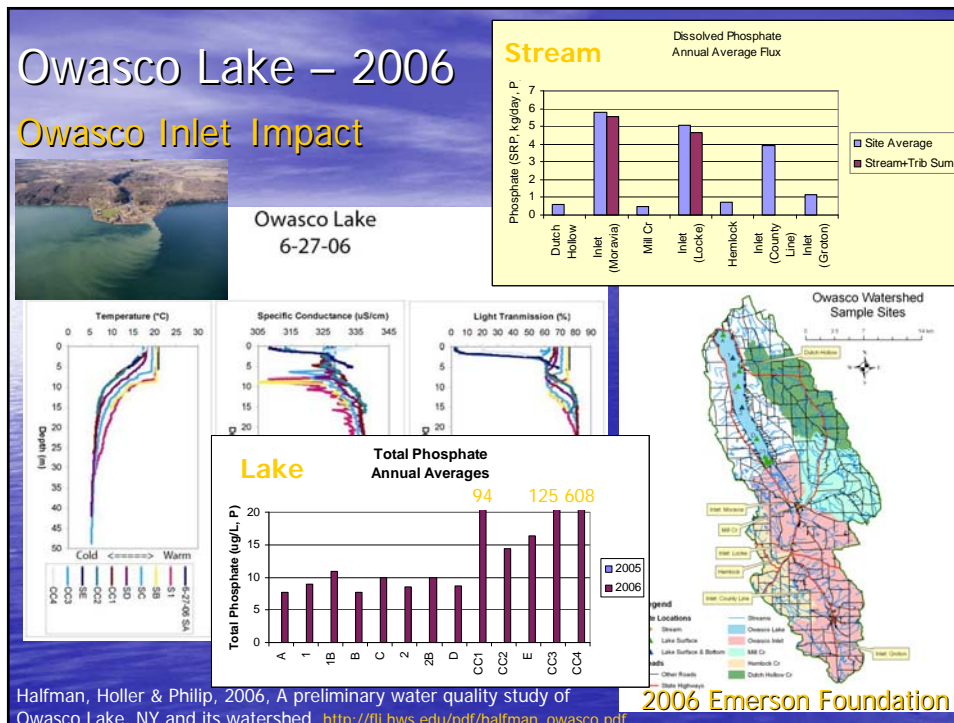
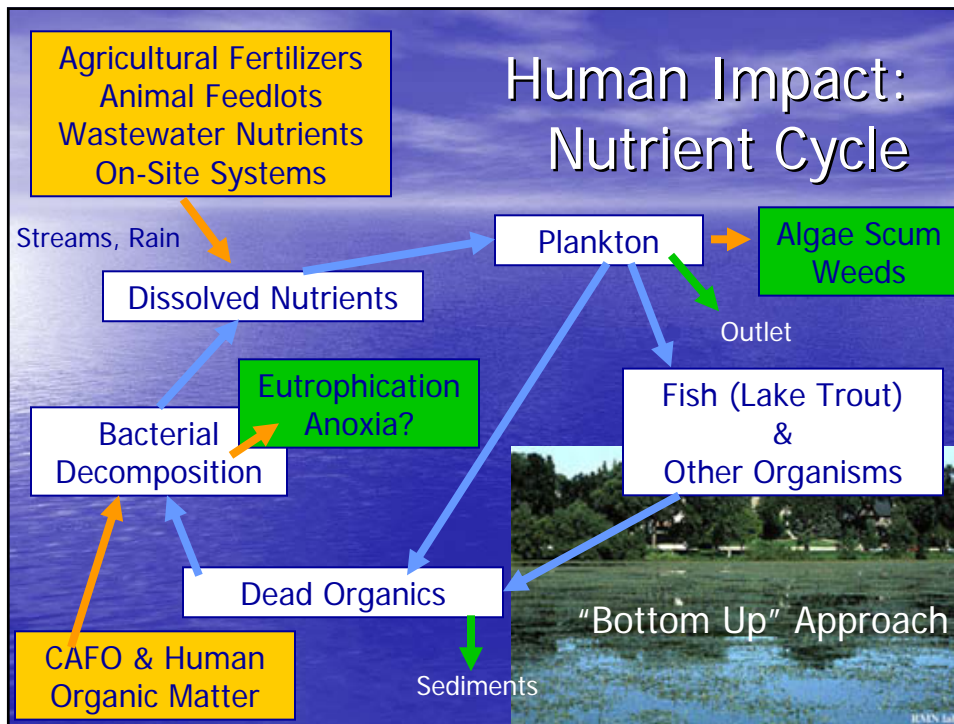
Plankton

Outlet

Fish (Lake Trout) & Other Organisms

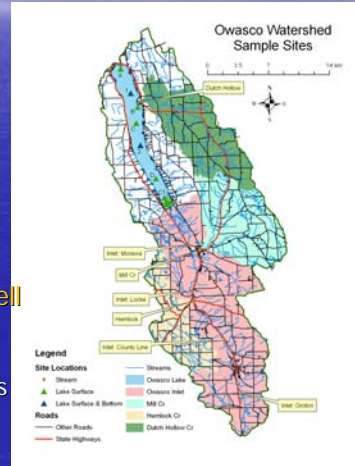
Lake Trout (*Salvelinus namaycush*)





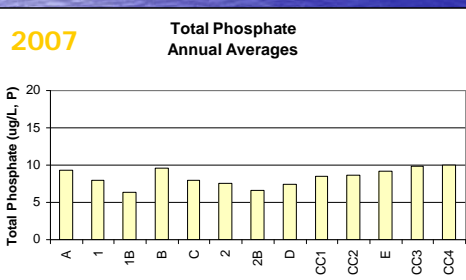
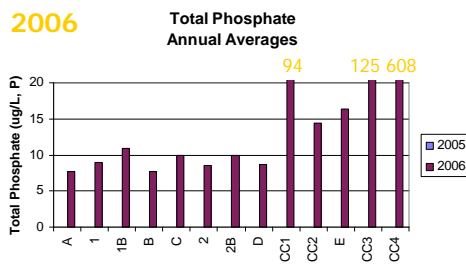
2007 Scientific Research Team

- **John Halfman, Hobart & William Smith Colleges**
 - Lake and Stream Water Quality
- **Tim Sellers, Keuka College**
 - Limitations Productivity (Nutrients, Light)
- **Meghan Brown, HWS**
 - Zooplankton Impact & Historical Record
- **Bruce Gilman & Bin Zhu, FLCC & FLI**
 - Macrophytes & Shallow-Water Biology
- **Jim Ryan, HWS**
 - Personal Care Products, Estrogen, etc.
- **Susan Cushman, HWS**
 - Stream Benthic Ecology
- **Dawn Dittman & Jim Watkins, USGS & Cornell**
 - Zebras, Diporeia & Deep-Water Biology
- **Tara Curtin, HWS**
 - Historical Sediment Record – Sediment Cores
- **Bob Brower & David Carr, IAGT**
 - Nutrient Loading Models
- **Marion Balyszak, FLI – HWS**
 - Comparative Watershed Protection Legislation



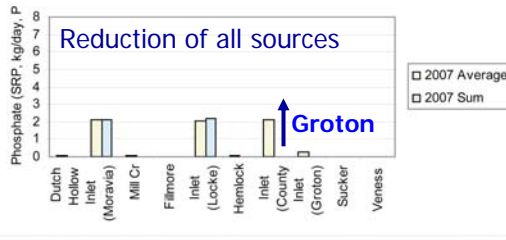
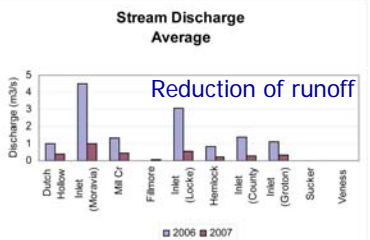
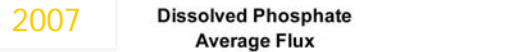
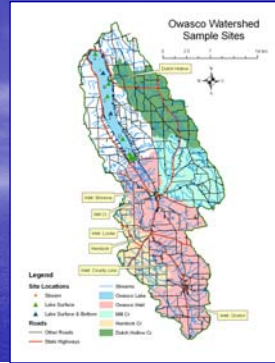
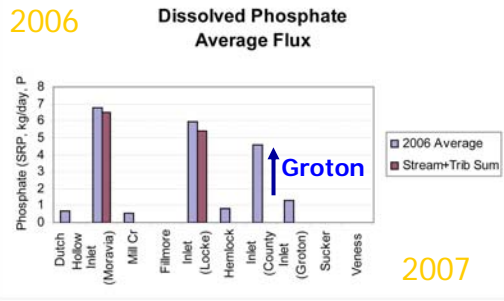
NY State Funds

Halfman: Owasco Lake Phosphates (TP)

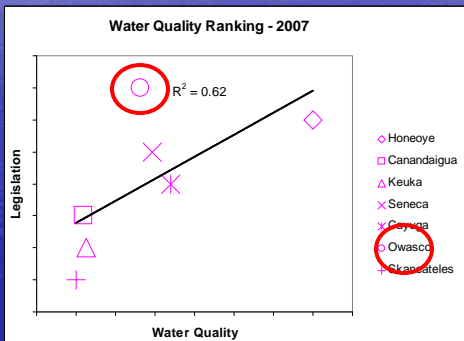
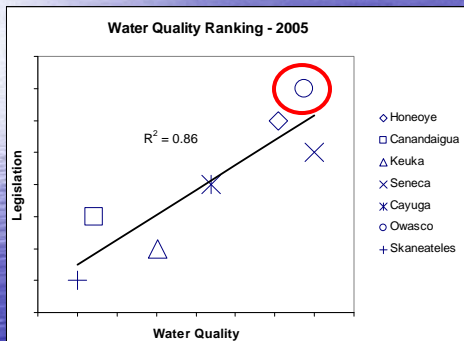


2007 NYS Funds – Senator Nozzolio

2007 Stream Data

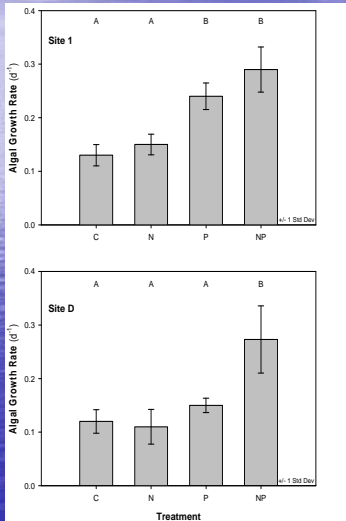


Water Quality Ranking 2005 vs. 2007 Results



2007: Less Rain – Less Nutrient Runoff - Impacts Faster Residence Time Lakes

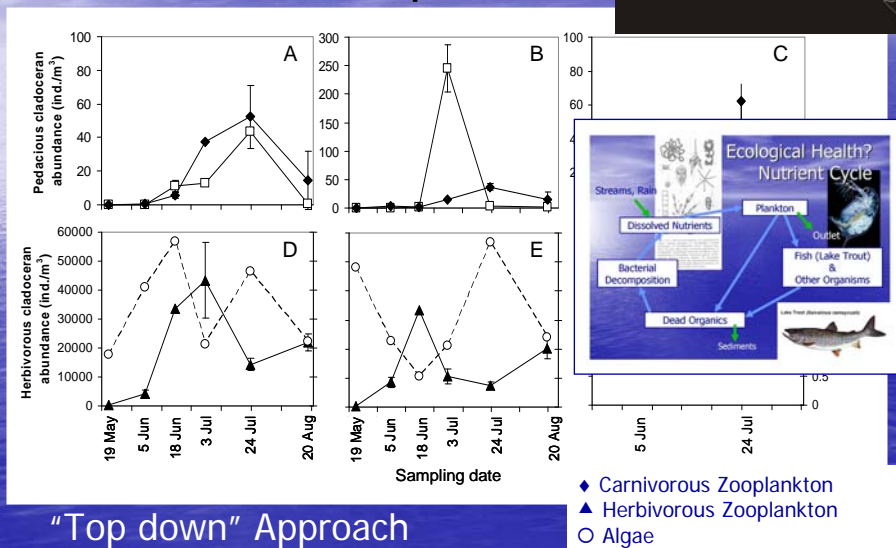
Tim Sellers (Keuka College): Limiting Nutrient for Algal Growth



Growth Stimulated by:

- Nutrient Availability
 - Especially Phosphorus
- Light Availability
 - Suspended Sediments

Meghan Brown (HWS): Carnivorous Zooplankton



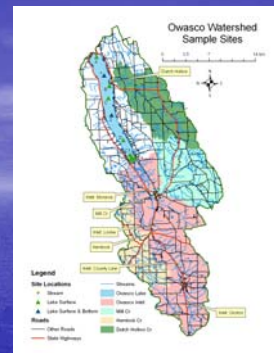
Jim Ryan (HWS): Toxic Compounds (MCL, mg/L)

- Bacteria
 - Total Coliform Bacteria
- Inorganics
 - Arsenic (0.01)
 - Iron (NA)
 - Lead (0.015)
 - Mercury (0.002)
 - Sodium (NA)
 - Alkalinity (NA)
 - Chloride (250)
 - Hardness (100)
 - Nitrate, N (10)
 - Sulfate (250)
 - TDS (500)
- Trihalomethanes
 - Bromoform (NA)
 - Chloroform (NA)
 - Total THMs (0.08)
- Organics
 - Alachlor (0.002)
 - Atrazine (0.003)
 - Chlordane (0.002)
 - Dieldrin (NA)
 - Lindane (0.0002)
 - Methoxychlor (0.04)
 - PCBs (0.0005)
 - Simazine (0.004)

No Toxic Metals, trihalomethanes, PCBs, pesticides, herbicides detected.
Due to low runoff?

Susan Cushman (HWS): Stream Benthic Ecology

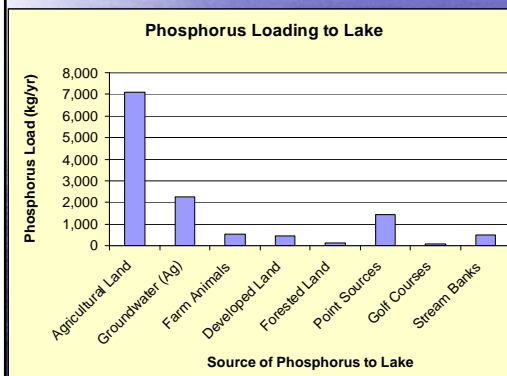
- **Stream Benthic Biotic Integrity**
 - Generally Good
- **County Line Site – Most Impaired**
 - ~70% pollutant tolerant species
 - Site just downstream from Groton
- **Consistent with findings by earlier study**



Bruce Gilman (FLCC) & Bin Zhu (FLI): Lake Benthic Ecology

- **Lake Benthic Diversity**
 - Similar to other Finger Lakes
- **Macrophyte Communities Indicate**
 - Nutrient Enrichments esp. Southern End
 - Productivity & Biomass at High End for Finger Lakes
 - Plant Introductions role in Community
- **Consistent with findings by earlier research**

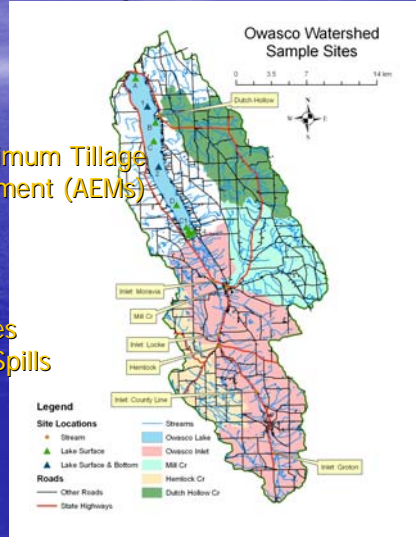
Barry Evans (Penn St – IAGT): Nutrient Modeling



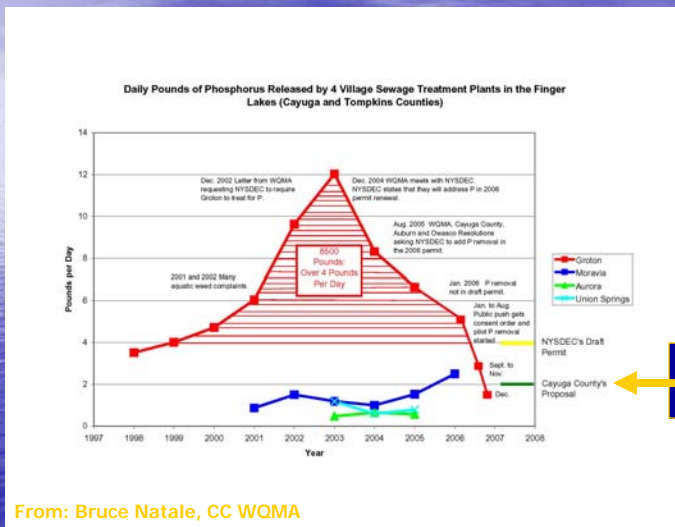
- **Primary P Sources**
 - Agricultural Land
 - Point Sources
- **Additional P promote Eutrophic State?**
 - Significantly More
- **Reduction in P promote Oligotrophic State?**
 - 25% Phosphorus Reduction
 - ~3,000 kg/year

Owasco Recommendations

- Update/Enforce Watershed Protection Legislation
 - Uniform Rules & Enforcement
- Groton Wastewater Facility
 - New Permit Process
- Agricultural BMPs
 - Contour Plowing, Buffer Strips, Minimum Tillage
 - Agricultural Environmental Management (AEMs)
- Owasco Inlet Floodplain
 - Remove Channelization
- Watershed Inspector
 - Inspects Onsite & Municipal Facilities
 - CAFO Manure Storage, Disposal & Spills
 - Information about BMPs
- Education, esp. K-12
 - Educate People so they Care!
- Monitoring
 - Water Quality Status
 - New Threats

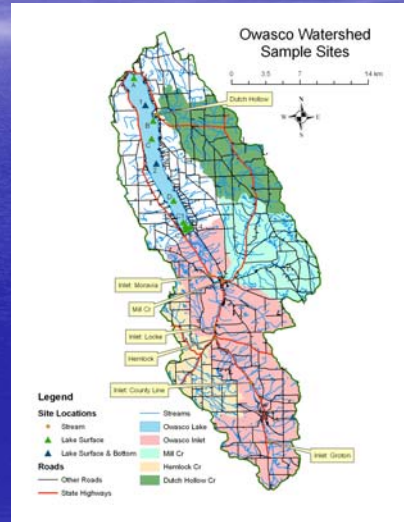


Groton Wastewater Treatment



My Future Plans: 2008 & Beyond

- 2008
 - Lake Water Quality Survey
 - Sites 1 & 2
- 2009 (or 2010?)
 - Lake & Stream Research
 - Lakes Sites 1, 2, A-E
 - Streams
 - Owasco Inlet Sites
 - Dutch Hollow
 - Sucker / Veness?
 - Event vs. Base Flow
 - Other Researchers?
- Time for Implementation
 - Results of Implementation



Questions?

John Halfman, HWS
email: halfman@hws.edu