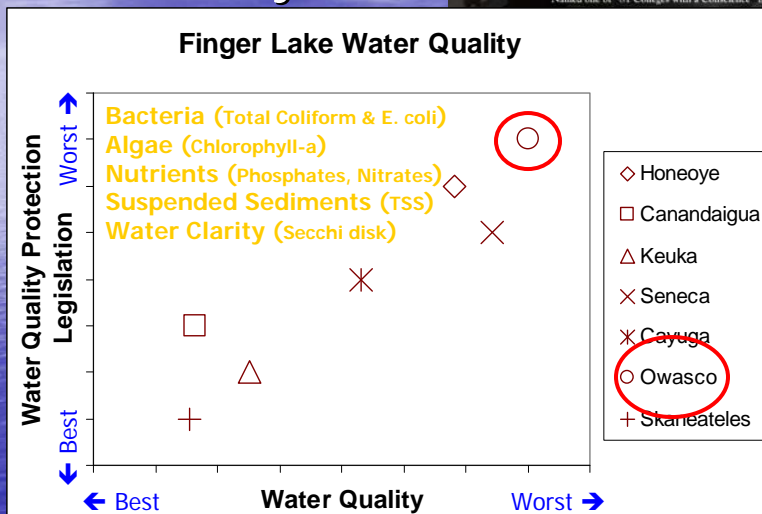


Owasco Lake / Watershed 2011 Water Quality Survey

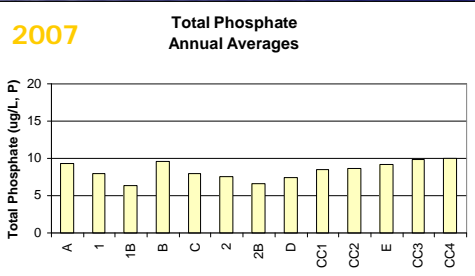
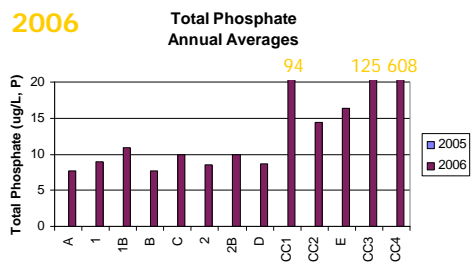
John D Halfman
Environmental Studies Program
Department of Geoscience
Finger Lakes Institute

Background: 2005 Water Quality & Its Protection

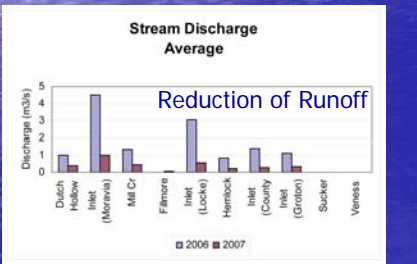
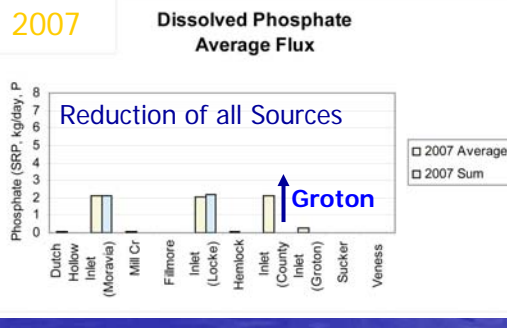
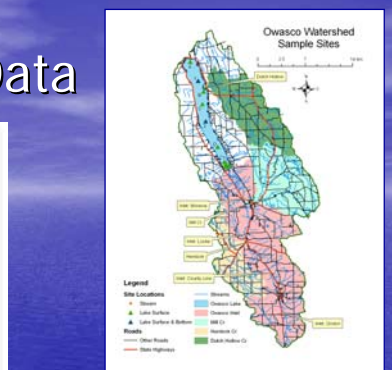
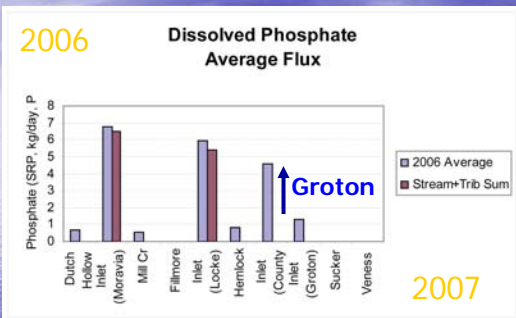


Bush, 2006, Undergraduate Honors Thesis

Owasco Lake Phosphates (TP)



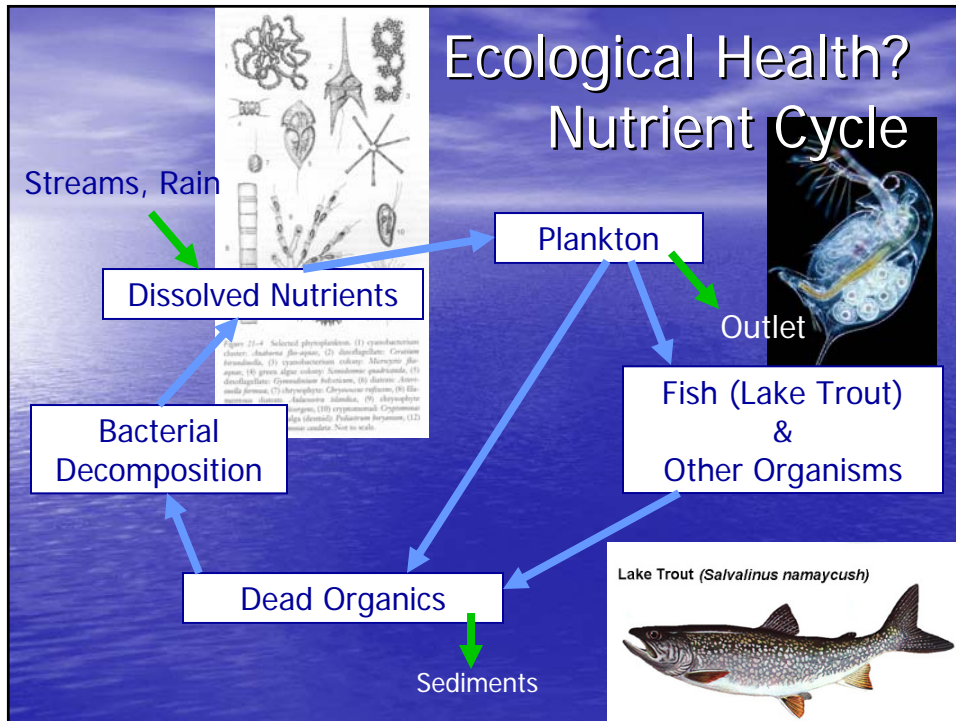
2006 & 2007 Stream Data

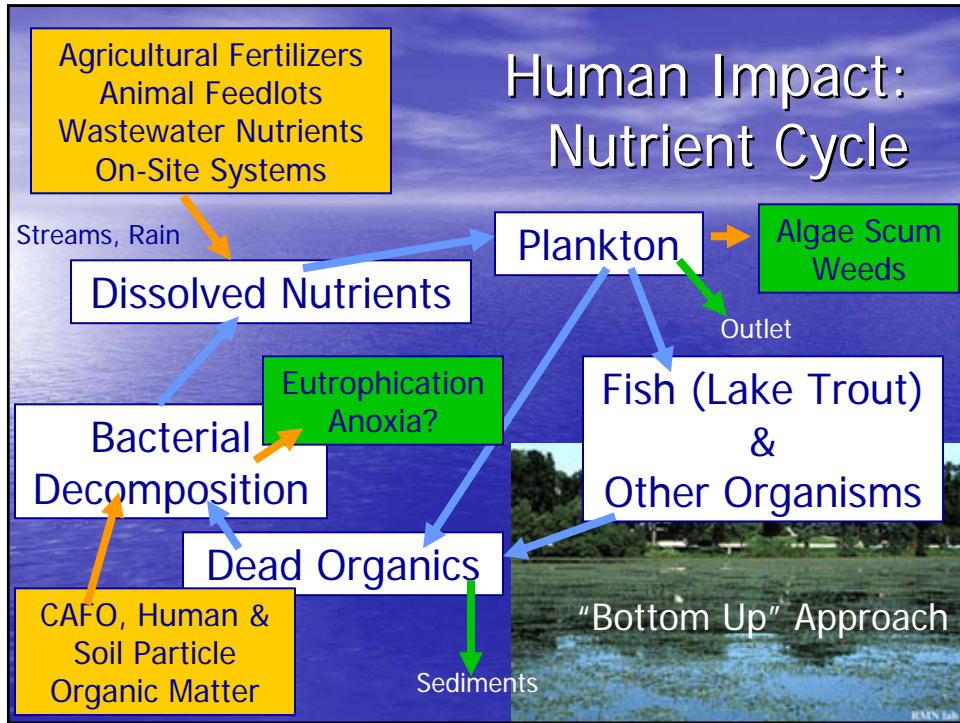


Water Quality Concerns

Runoff

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





2011 – Funding




- **Watershed Bi-Monthly Monitoring**
 - Lake, Dutch Hollow Brook & Owasco Inlet
 - Lake Status & Stream Segment Analysis
 - Cayuga County Legislator, Peter Tortorici - Chairman
- **Detailed Analysis of Dutch Hollow Brook**
 - Timing of Nutrient Delivery
 - OWLA, Charlie Green – President
 - Underwritten by Local Foundations
- **Both due to the Persistence of Dr. Joe Wasileski**

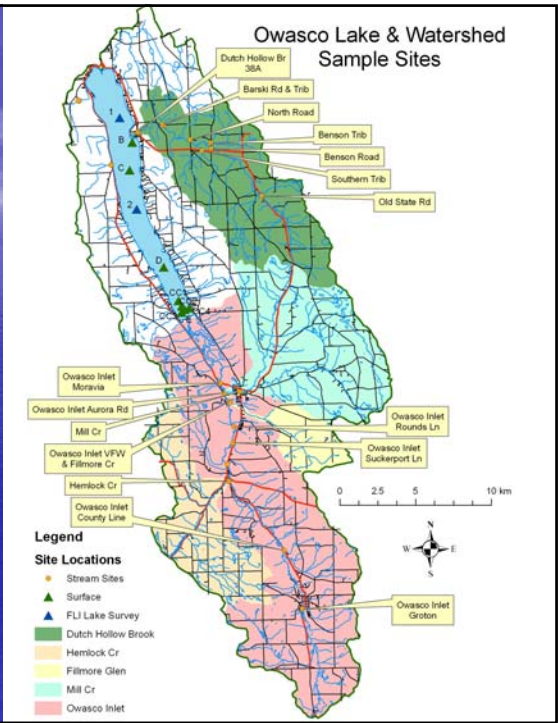



**Dutch Hollow Autosampler
3 Water Samples/Day**

**Dutch Hollow
Hourly Readings
Stage, Cond., Temperature**

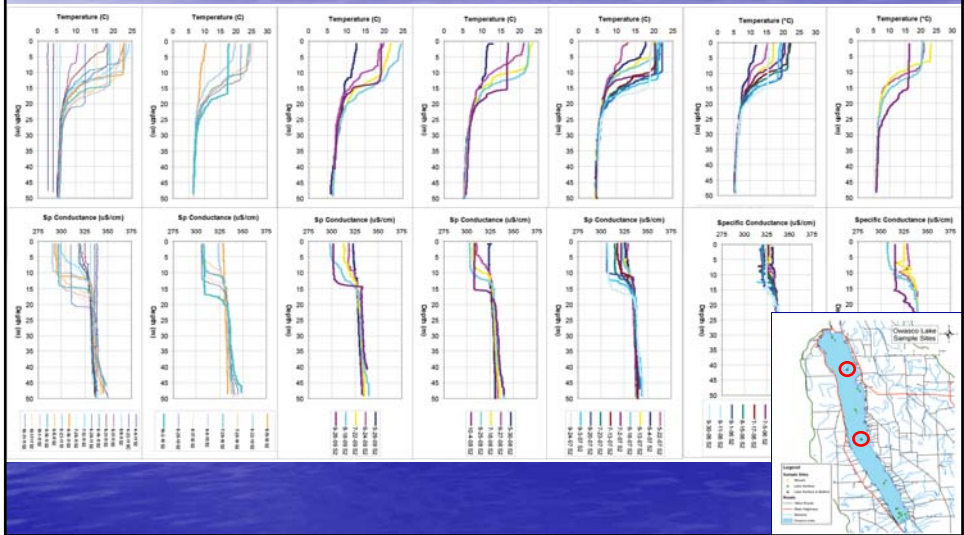
The Plan:

- **Lake**
 - Sites 1 & 2
 - Trends over Time
- **Watershed**
 - Two Tributaries
 - Dutch Hollow Brook
 - Owasco Inlet
 - Nutrients
 - Locate Source(s)
 - Timing of Delivery
 - Events
 - Seasonal
 - Estimate Loading



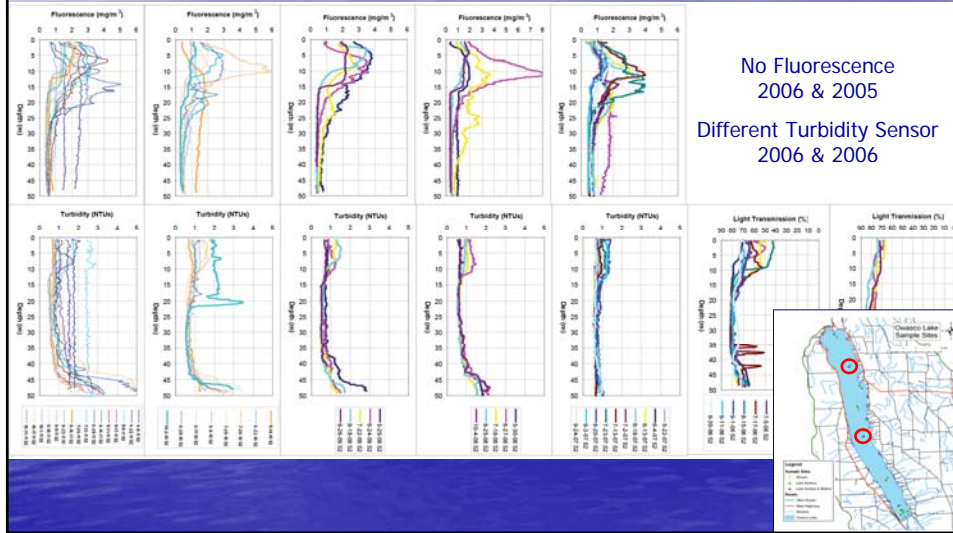
Lake Results: Temperature & Salinity

2011 2010 2009 2008 2007 2006 2005



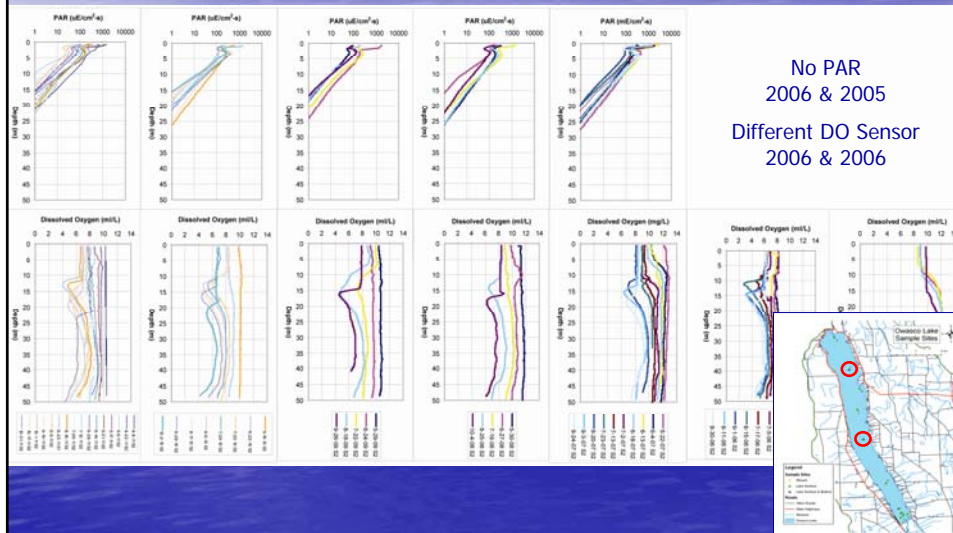
Lake Results: Fluorescence & Turbidity

2011 2010 2009 2008 2007 2006 2005



Lake Results: PAR & Dissolved Oxygen

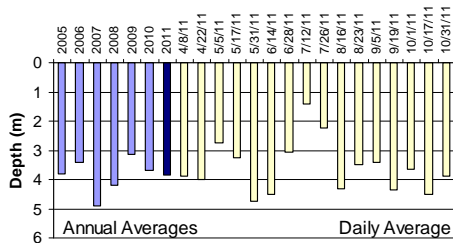
2011 2010 2009 2008 2007 2006 2005



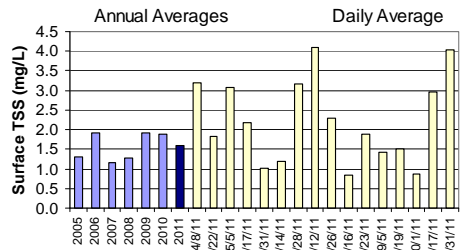
Lake Results: Secchi Disk Depths and Suspended Sediment



Owasco Averaged Secchi Depths



Owasco Averaged Total Suspended Solids



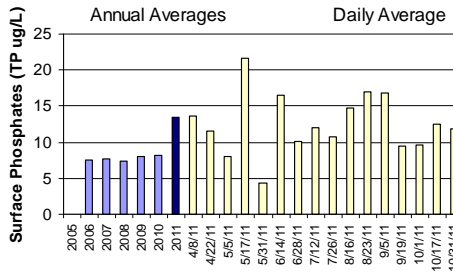
< 2 m Depth – Eutrophic Lake
 > 4 m Depth – Oligotrophic Lake



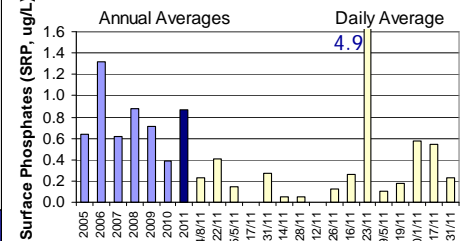
Lake Results: Total and Dissolved Phosphates



Owasco Averaged Total Phosphates

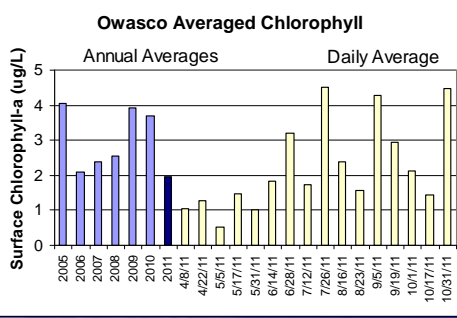


Owasco Averaged Dissolved Phosphates

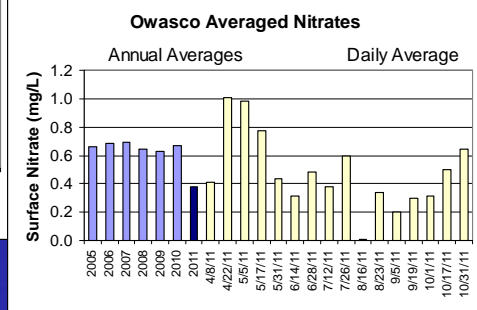


> 20 ug/L TP – Impaired & Eutrophic Lake
 < 10 ug/L TP – Oligotrophic Lake

Lake Results: Chlorophyll and Nitrates



> 10 ug/L Chlorophyll-a – Eutrophic Lake
 < 4 ug/L Chlorophyll-a – Oligotrophic Lake



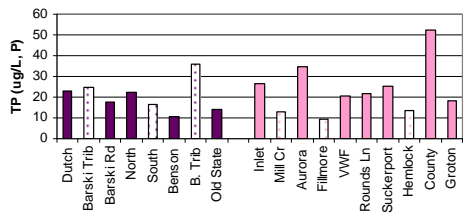
> 10 mg/L Nitrate – Impaired Lake
 > 5 mg/L TN – Eutrophic Lake
 < 2 mg/L TN – Oligotrophic Lake

Streams

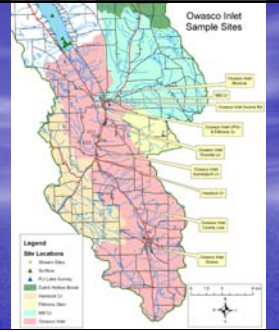
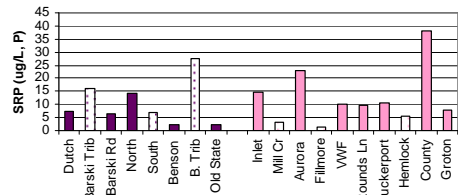


Stream Concentration Data Nutrient Sources: Total & Dissolved Phosphate

**2011 Total Phosphate
Annual Average Concentration**

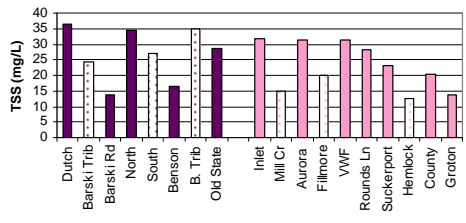


**2011 Dissolved Phosphate
Annual Average Concentration**

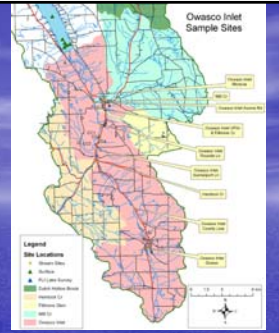
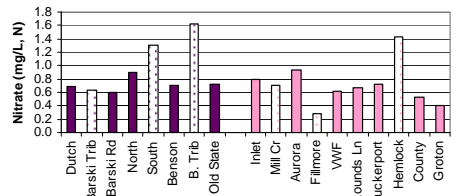


Nutrient Sources: Suspended Sediments and Nitrates

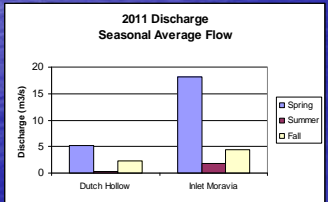
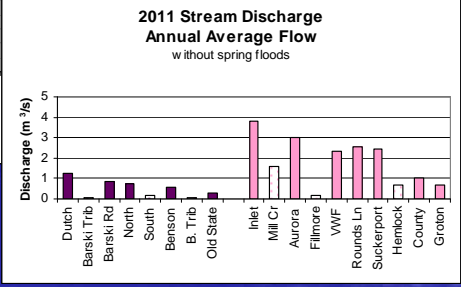
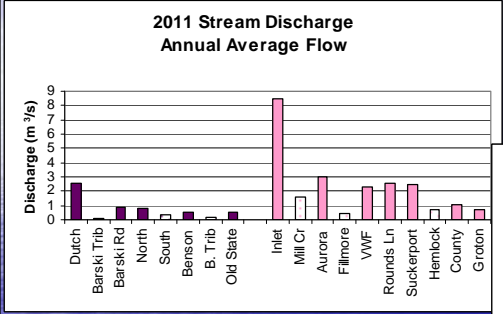
**2011 Total Suspended Solids
Annual Average Concentration**



**2011 Nitrates
Annual Average Concentration**

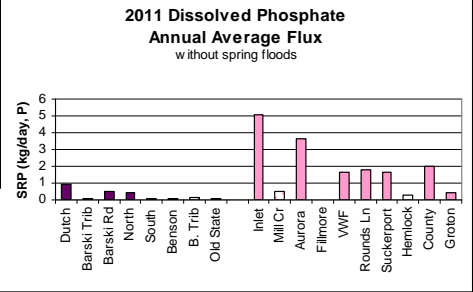
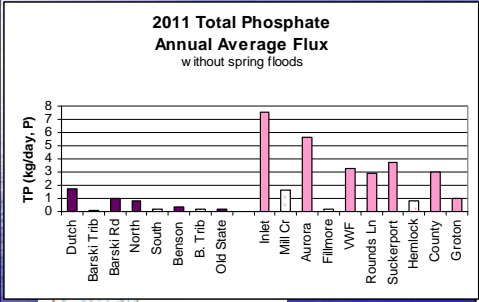


Nutrient Fluxes: Discharge – Spring Floods



Ignored Early March Spring Floods

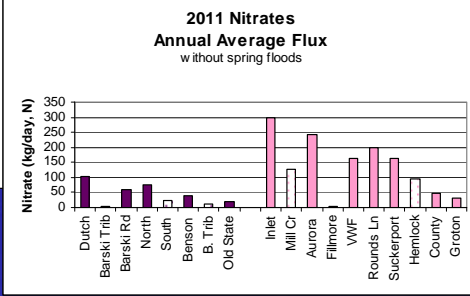
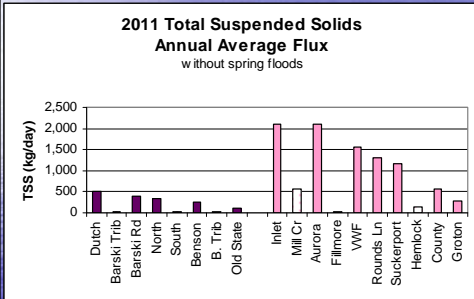
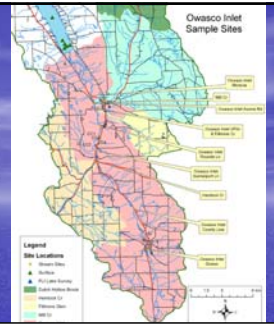
Nutrient Fluxes: Total & Dissolved Phosphate



Ignored Early March Spring Floods



Nutrient Fluxes: Sediments and Nitrates

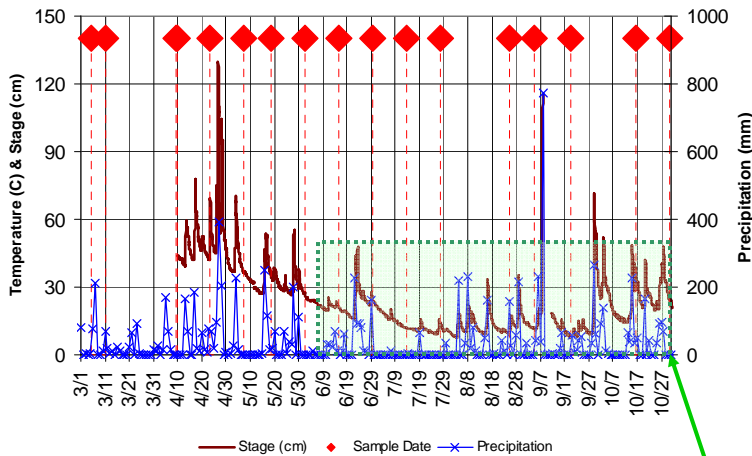


Ignored Early March Spring Floods

Dutch Hollow Flow



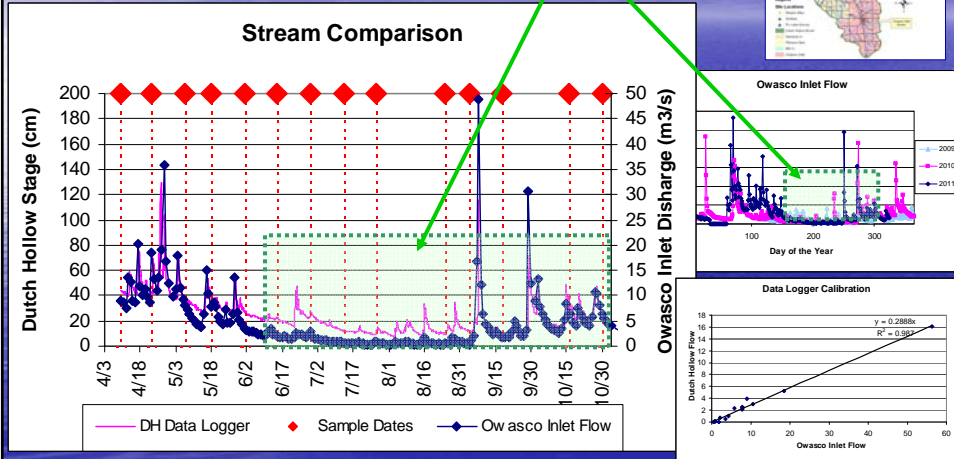
Dutch Hollow Brook - Rt 38A Site - Data Loggers



Detailed "R.D." Samples

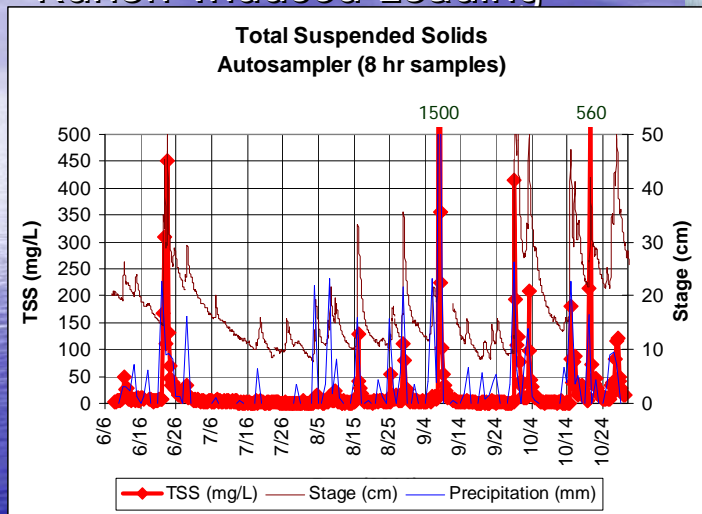
Discharge Estimates: Spring Floods

Detailed "R₂D₂" Samples

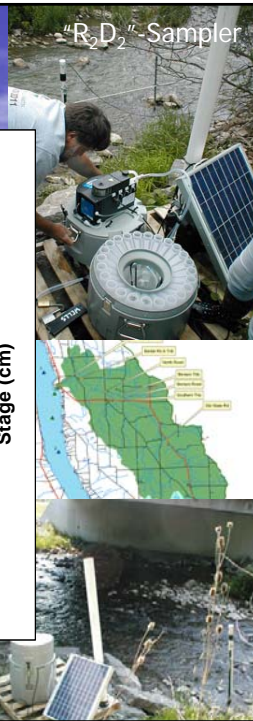


Estimated Dutch Hollow Spring Discharges from Owasco Inlet USGS Gauge For Flood Events, Discharge Information only at Stream Terminus

Sample Every 8-Hours : Runoff Induced Loading



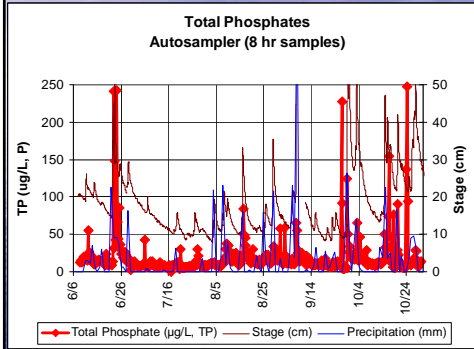
Runoff Flux ~ 24,400 kg / day
Base Flow Flux ~ 110 kg / day
Mean Flux ~ 8,700 kg / day



Sample Every 8-Hours: Runoff Induced Loading

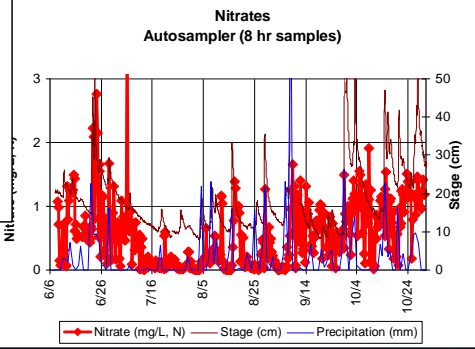


Runoff Flux ~ 180 kg N / day
Base Flow Flux ~ 20 kg N / day
Mean Flux ~ 75 kg N / day

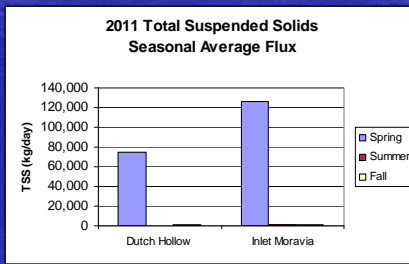
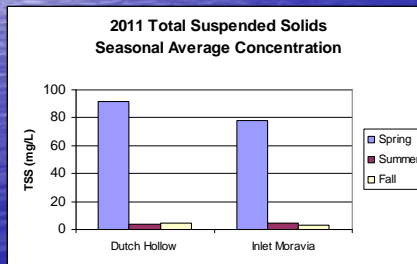
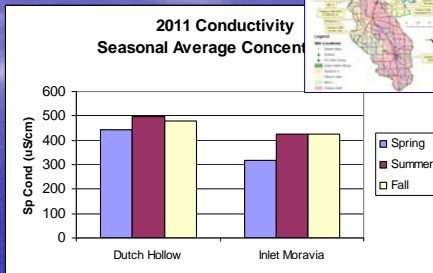
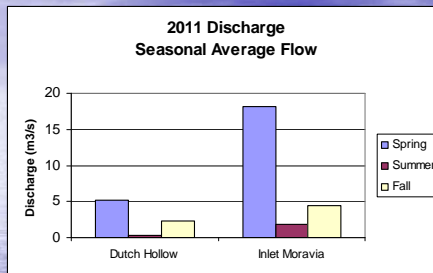


TP Runoff Flux ~ 6.9 kg P / day
Base Flow Flux ~ 0.4 kg P / day
Mean Flux ~ 2.7 kg P / day

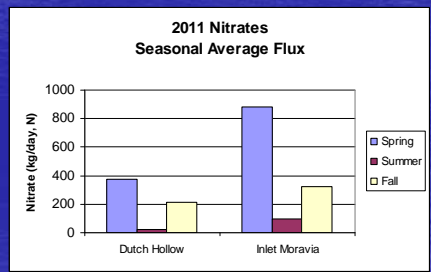
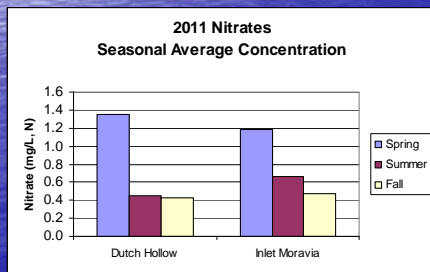
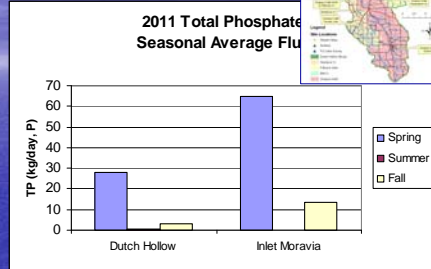
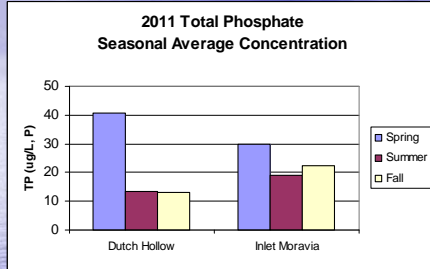
SRP Runoff Flux ~ 4.5 kg P / day
Base Flow Flux ~ 0.08 kg P / day
Mean Flux ~ 1.7 kg P / day



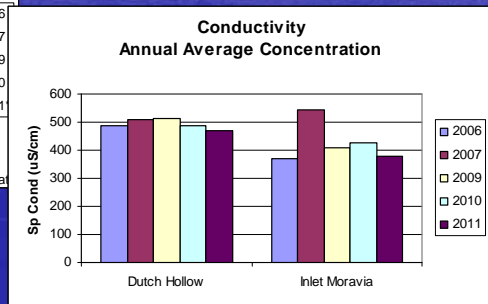
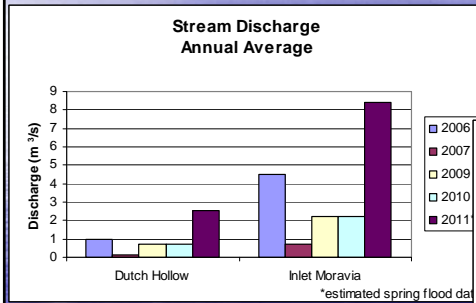
Seasonal Concentration & Flux:



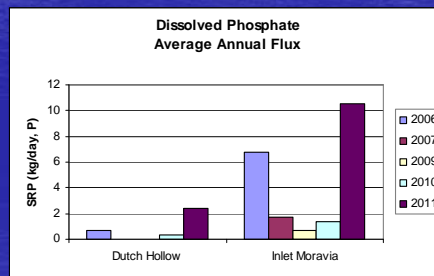
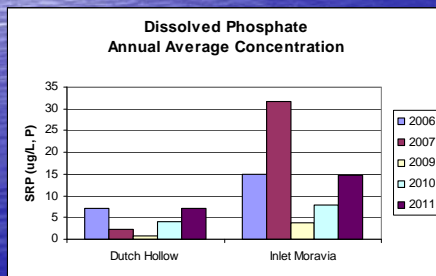
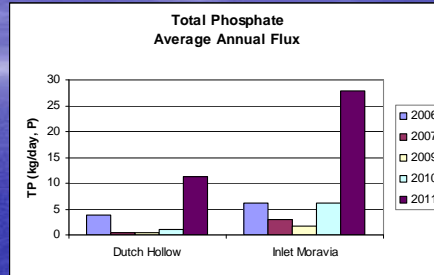
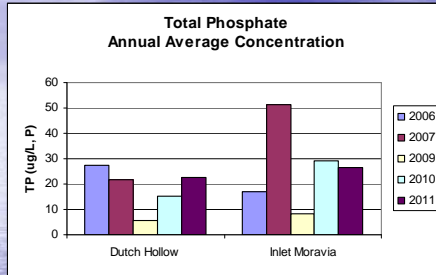
Seasonal Concentration & Flux:



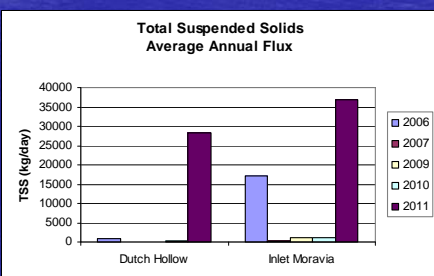
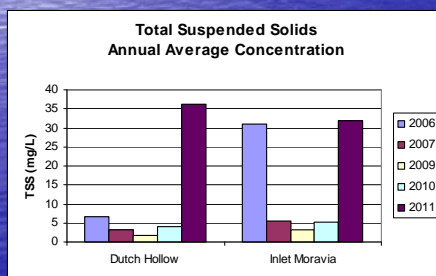
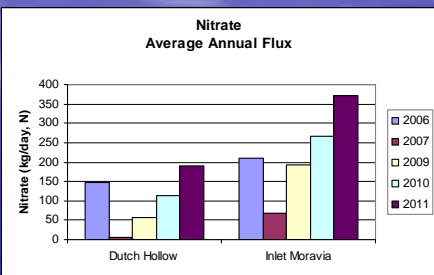
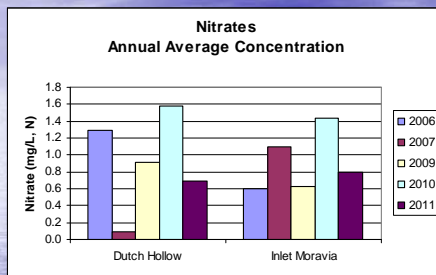
Stream Annual Averages: Flow and Conductivity



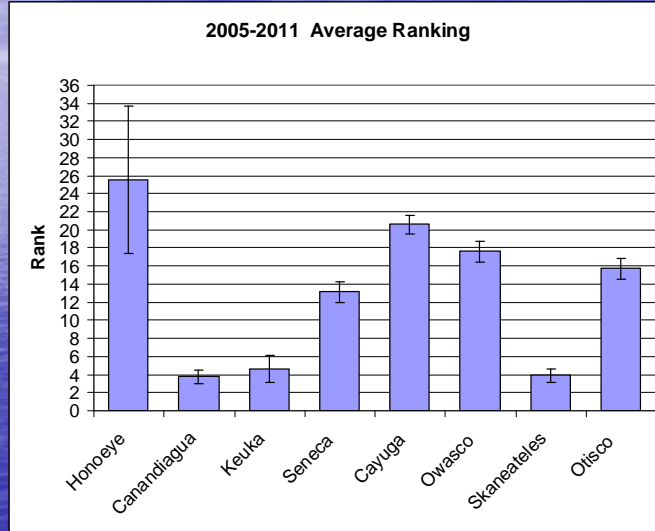
Annual Average: TP & SRP



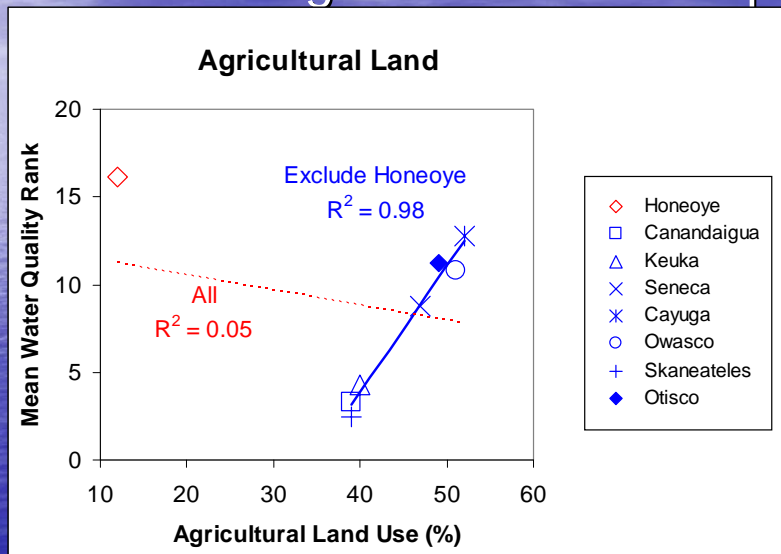
Annual Average: Nitrate & TSS

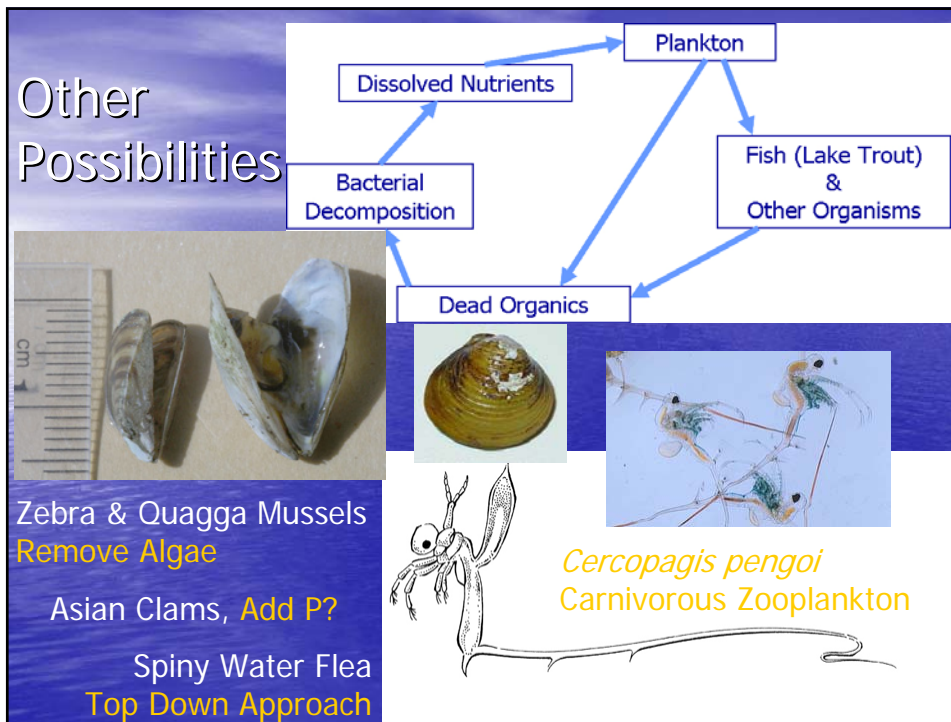


2005 – 2011 Finger Lake Rankings



Water Quality Protect Legislation PLUS Runoff Agricultural Landscape





Recommendations

- Watershed Protection Legislation
- Owasco Inlet Floodplain
 - Remove Channelization
- Agricultural BMPs
 - Contour Plowing, Buffer Strips, Minimum Tillage
 - Agricultural Environmental Management
 - J Wright, NRCS Conservation Innovative Proposal
- Watershed Inspector
 - Inspects Onsite & Municipal WW Facilities
 - CAFO Manure Storage, Disposal & Spills
 - Information about BMPs
- Education, esp. K-12
 - Educate People so they Care!
- Monitoring
 - Nutrient Fluxes:
 - “R₂D₂”, Stage & Flow Dutch Hollow & Owasco Inlet
 - Details of My 2012 Monitoring Proposal(s) Forthcoming
- New Threat – Marcellus Shale Drilling

Owasco Lake & Watershed Sample Sites

Legend

Site Locations

- Stream Sites
- ▲ Surface
- ▲ F.U. Lake Survey

Land Use

- Dutch Hollow Brook
- Pennock Cr.
- Owasco Inlet
- M&C Cr.
- Owasco Inlet

2011 Research Team

Questions?
John Halfman, HWS
email: halfman@hws.edu

Owasco Lake
Source Of Drinking Water For
The City Of Auburn
Best Tasting Drinking Water
In New York State
1997