Managing Urban Lakes and Ponds

Special Challenges Facing Lake Managers

Stephen J. Souza, Ph.D.
Clean Waters Consulting, LLC
Ringoes, New Jersey
SJSouza.CWC@gmail.com


Nash Rd
Pond
New Bedford
MA
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My little piece of boyhood heaven


New Bedford
Nash Rd
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1995
41°40'12.97" N 70°55'38.55" W elev 56 ft eye alt 5071 ft
But in reality!

An "Oasis" In a Land of Concrete

Urban lakes provide an array of services and functions… some of which can be conflicting –

- Contact and non-contact water-based recreation.
- Aesthetic backdrop for active/passive land-based recreation.
- Living classroom
- Stormwater and flood management
- Wastewater management

} These uses conflict with beneficial uses

Challenging Environmental Conditions

Difficult to consistently meet expected community services and functions due to:

- Inconsistent hydrology – rely largely on stormwater
- Poor quality of inflow, high concentrations of nutrietns, sediments, bacteria and pollutants
- Subject to sediment infilling
- Compromised by invasive aquatic plants and algae

Restoration Challenges

- Often relegated to a lower tier relative to large, public recreational lakes… as a result
  - Less directed funding
  - Less attention
  - Less protection
- Considered part of stormwater / flood management system rather than recreational waterbody
- Impacted by "past sins" tied to past development activities and practices… history of social injustice.

Deal Lake, NJ

- Largest of NJ's coastal lakes.
- Once an estuary, created in late 1800s by erecting of a dam.
- Still receives some inflow from ocean.
- 155 acres, 27 miles of shoreline.
- Abutted by 7 towns.

Historic Postcards Early 1900s

An Urban Lake In Trouble

WQ impairments typical of any lake located within densely urbanized watershed.

- Highly eutrophic, subject to HABs and invasive aquatic plants.
- Very turbid due to sediment influx from eroded streams.
- Large amounts of floatables and particulates enters during storms.

WQ and ecological problems directly linked to inadequate stormwater management.

General Land Use/Land Cover Categories in the Deal Lake Watershed.		
LU/LC Category	Acres within the Deal Lake Watershed	**Percentage of total watershed area**
High/Medium Density Residential	1,843.78	**41.85%**
Commercial	493.96	**11.21%**
Forest	483.65	**10.98%**
Wetlands	374.15	**8.49%**
Low Density/ Rural Residential	355.01	**8.06%**
Other Lands	286.77	**19%**
Total Watershed Area	**4,406.16**	**100%**

TP Loading by Subwatershed

Subwatershed	Total Acreage	% of total watershed area	TP Load (lbs /year)	% TP load
1-Main Lake Basin	2,224.13	50.47%	472.36	47.28%
2-Harvey Brook	971.53	22.05%	203.78	20.40%
3-Lollypop Pond	204.14	4.63%	58.34	5.84%
4-Colonial Terrace	149.82	3.41%	53.01	5.31%
5-Tributary	464.88	10.55%	139.46	13.96%
6-Hollow Brook	391.66	8.89%	72.03	7.21%
Total Watershed	4,406.16	100.00%	998.98	100.00%

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TSS Loading by Subwatershed

Subwatershed	Total Acreage	% of total watershed area	TSS Load (lbs /year)	% TSS load
1-Main Lake Basin	2,224.13	50.47%	642,547.92	47.04%
2-Harvey Brook	971.53	22.05%	343,361.98	25.14%
3-Lollypop Pond	204.14	4.63%	62,183.55	4.55%
4-Colonial Terrace	149.82	3.41%	65,269.47	4.78%
5-Tributary	464.88	10.55%	147,498.00	10.80%
6-Hollow Brook	391.66	8.89%	105,133.84	7.69%
Total Watershed	4,406.16	100.00%	1,365,994.76	100.00%

Summary of Problems As Per Monitoring Data

- Elevated TP concentrations (mean > 0.07 mg/l
- Algae blooms and HABs
- Floatable and trash
- High fecal coliform
- Deeply incised stream channels
- Large inn-stream sediment bed loads
- Re-suspension of fine lake sediments during storms, creating high turbidity conditions within lake

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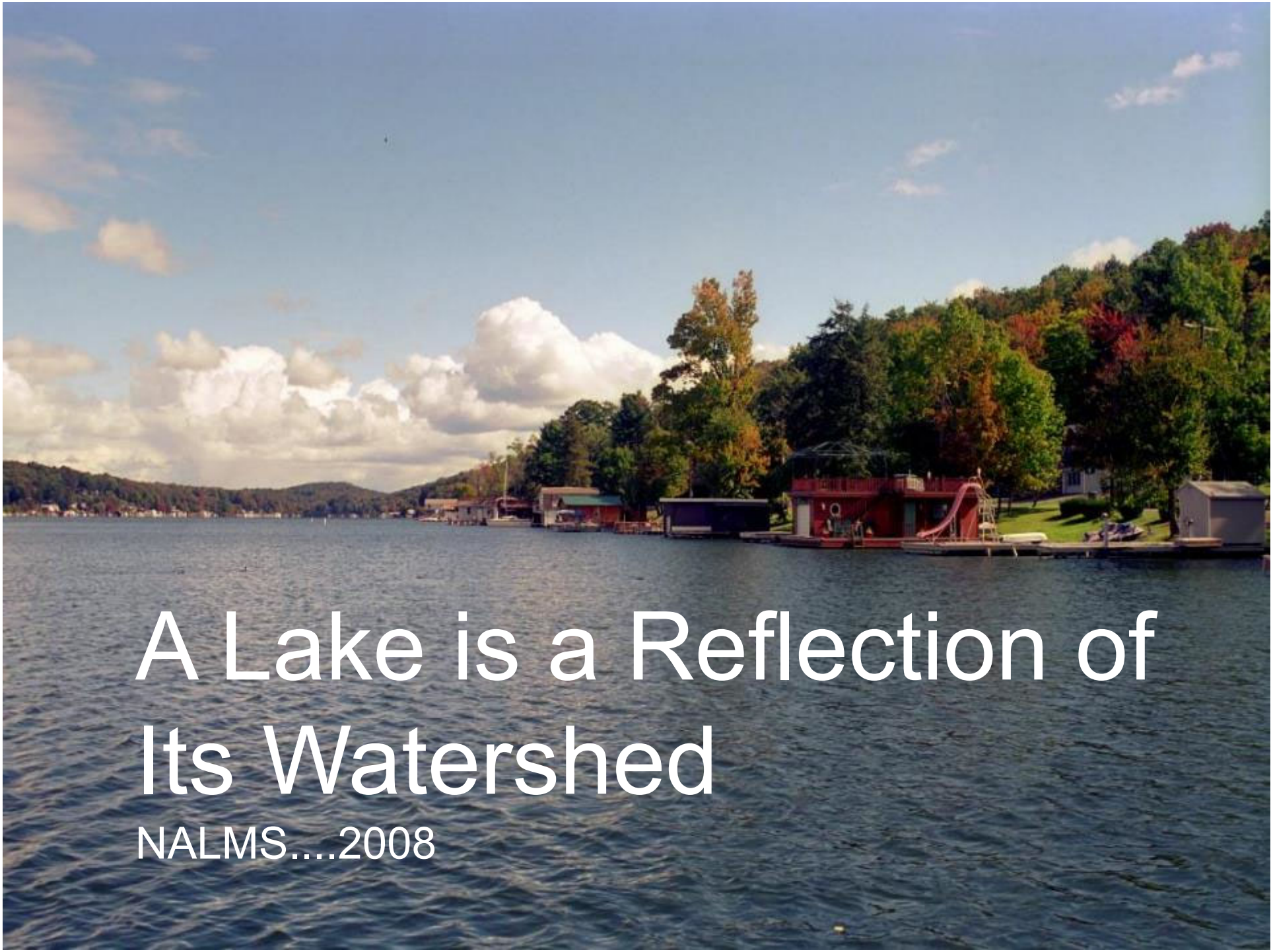

A Lake is a Reflection of Its Watershed

NALMS....2008

Urban Lakes Require Focus On Watershed Management

- **Must intercept and treat stormwater to decrease impacts of eutrophication.**
- **Decreased phosphorus loading = less productivity and HAB prevention**
- **Decreased sediment and floatable loading = improved aesthetics**

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Stormwater Management Critical Part of Urban Lake Restoration

- Proactive… address root cause of lake impairments.
- Reduces pollutant and sediment loading.
- Reduces runoff volume and flow thus decreasing stream bed and bank erosion.
- Corrects “past sins” of inadequate stormwater management linked to historic land development.
- Protects lake from future development driven stormwater problems.
- Protects lake restoration efforts and gains.

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Green Infrastructure and Urban Lake Management

- A holistic means of managing stormwater runoff.
- Treats stormwater as a resource not as a waste.
- Can achieve
  - Peak flow mitigation
  - Reduces runoff volume
  - Increases recharge
  - Excellent sediment and phosphorus removal
- Major part of managing urban waterbodies

EPA Definition of Green Infrastructure

- An adaptable term…
- Stormwater management systems that mimic nature by soaking up and storing water.
- Array of products, technologies, and practices that use natural systems or engineered systems that mimic natural processes.
- Use of vegetation, soils, and natural processes to infiltrate, evapotranspirate, and/or recycle runoff.
- Create healthier environments.

Green Infrastructure
Its Role in the Restoration of Deal Lake

- Goal – address the causes of eutrophication and sediment infilling.
- Use GI SW techniques that are suitable for urban setting…
  - Work with limited amount of "available land",
  - Manage high rates and volumes of runoff,
  - Ensure accessibility for maintenance,
  - Replicable… use techniques that can be implemented throughout watershed.

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Reduce Phosphorus Loading

- Address problem at its source – Source Control Strategies
  - Pet waste management (pick-up after your pet)
  - Wise use of fertilizer
  - Proper lawn waste management
  - Maintain/restore riparian vegetation
  - Control Canada geese (urban lakes often impacted by geese)
- Address stormwater runoff - Delivery Control Strategies
  - Reduce runoff volume and amount of SW discharged to lake
  - Infiltrate run off when/where possible… decreases rate and volume of runoff and the transport of pollutants
  - Attenuate phosphorus using Green Infrastructure SW techniques

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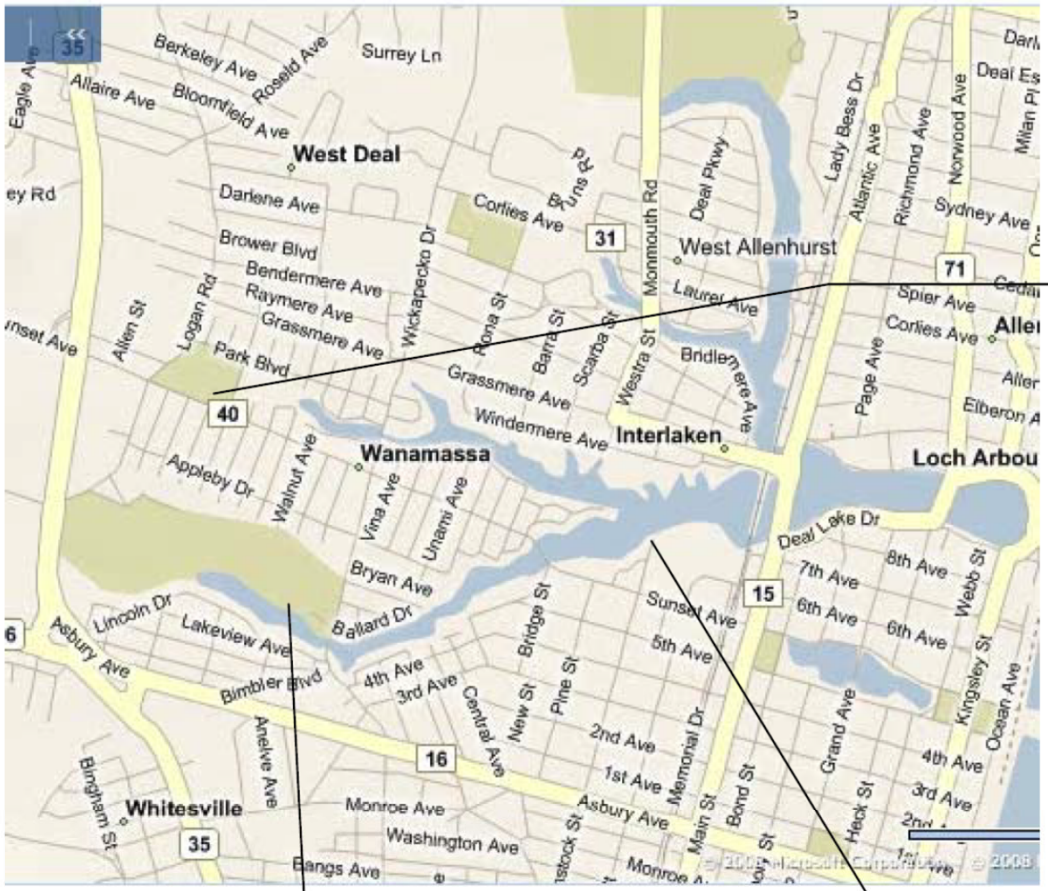
Reduce Sediment and Floatable Loading

- Decrease volume of runoff and mitigate peak flow rates …less steam scour and less sediment loading.
- Intercept and pre-treat runoff… decrease sediment and floatable loading
- Repair storm scoured and eroded stream banks.
- Prevent/reduce egregious clearing of lake shore vegetation.
- Restore riparian and nearshore vegetation and stabilize eroded lakeshore areas with native vegetation… also functions as a “filter” to passively treat overland runoff.

Phase 1 of Implementation



Projects funded through NJDEP 319(H) grant

Asbury Park MTD Site

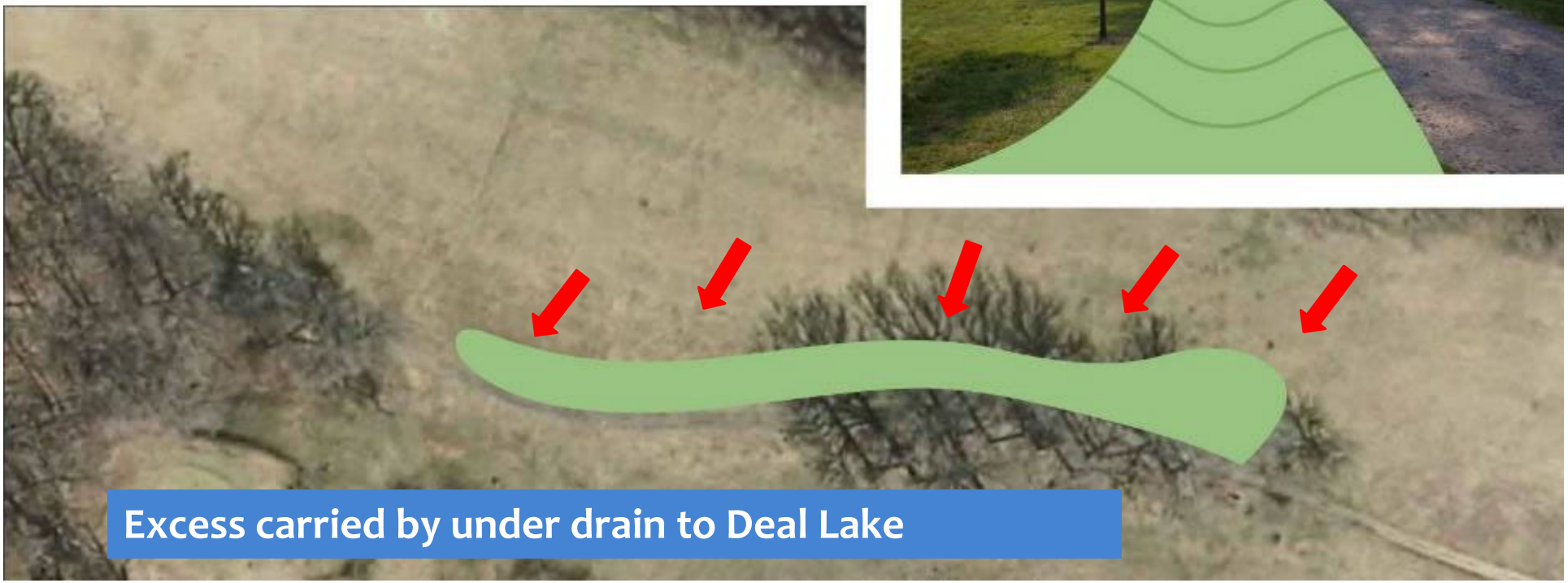
Colonial Terrace GC Site

Colonial Terrace Golf Course

Bio-infiltration swale

- **Slight narrowing of fairway**
- **Infiltration bunker collects and treats runoff from fairway and cart path.**

Runoff sheet flows into shallow vegetated swale



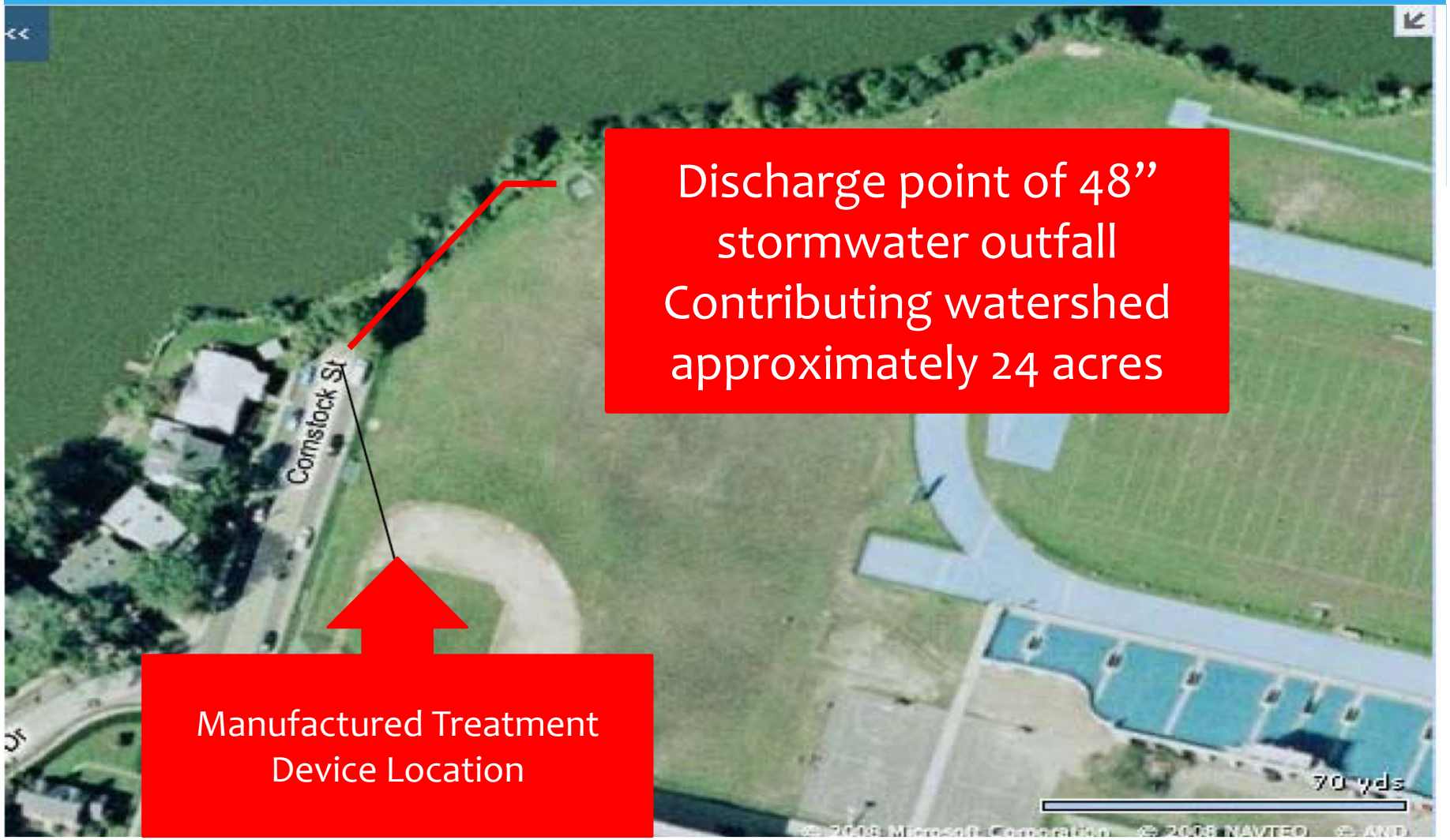
Excess carried by under drain to Deal Lake

Deal Lake Bio-Infiltration Swale

Project Cost
$98,00
2-swales


Colonial Terrace Golf Course
Post-Construction Conditions
Vegetated Bio-Infiltration Swales

Asbury Park High School Site



Deal Lake – MTD Installation

Project Cost
$125,000

Helical swirl condenser traps sediment, floatables and particulate phosphorus

Asbury Park Boat Launch
Rain Garden

Project Cost $5,000

Lake-Side Vegetated Buffers Riparian Area Restoration

Project goals:

- Stabilize eroded banks
- Passive mgmt. of overland runoff
- Easily replicable
- Low cost

After

Before

Project Cost $25,000 (600 ft)

Resulting Benefits

- The STEPL model predicted reduction efficiencies of 69% for TP, 56% for TN, and 89% for TSS
- Colonial Terrace Basins - no measurable stormwater discharge from basins… working as designed to infiltrate collected runoff
- Comstock Avenue MTD - data collected during three storms, measurable reductions in TP (53%), SRP (50%), *E. coli* (30%) and TSS (67%) realized.
- Comstock Basin – additional benefit 2-4 tons of debris trapped and removed (mostly floatable) per quarter!

More Stormwater Management For Deal Lake… Phase 2 Implementation

- Additional MTDs at 2 major stormwater outfalls (48” diameter SW pipes).
- Street-side Tree Boxes (Filtera units) at 4-6 locations.
- Vegetated parking lot swales and rain gardens
- Floating wetland islands.

Funding through NJDEP via 319(h) grant
$380,000

Summary

- Urban lakes are "expected" to meet a wide array of ecological and societal services and functions….some of which are conflicting.
- These lake ecosystems under constant stress.
- Most problems, including eutrophication, directly linked to inadequate or improper stormwater management.
- Green infrastructure stormwater management techniques play major role in urban lake restoration.

Summary

Green infrastructure stormwater management…

- Highly adaptive.
- High removal efficiency for sediment and phosphorus.
- Can be implemented within “tight areas” with limited “free/available” land.
- Can work with existing pipe network.
- Makes up for “past sins”.
- Social justice benefits.

Thank You

Stephen J. Souza, Ph.D.

Clean Waters Consulting, LLC
Ringoes, NJ 08551
SJSouza.CWC@gmail.com

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