So You Have an Impervious Cover TMDL, Now What?

Chris Bellucci
Connecticut Department of Environmental Protection

and

Chet Arnold
Center for Land Use Education and Research
University of Connecticut

34th Annual Meeting
New England Association of Environmental Biologists
Newport, RI
March 17-19, 2010

Acknowledgements

EPA 319 Program

Town of Mansfield

CTDEP

CENTER FOR WATERSHED PROTECTION

UCONN

Horsley Witten Group
Sustainable Environmental Solutions

Outline

- Background
- From paper to implementation
- Field work for TMDL implementation project
- Fixes along the way
- Roadmap to implementation
- Next steps

Background

- Federal Clean Water Act requires CTDEP to develop Total Maximum Daily Loads or TMDLs for “impaired waters”

- TMDLs are clean up plans that provide goals to achieve water quality objectives

- CTDEP developed a method to address impairments caused by storm water runoff using impervious cover

- Eagleville Brook was the first location to get an impervious cover TMDL

- Implementation of the TMDL is underway

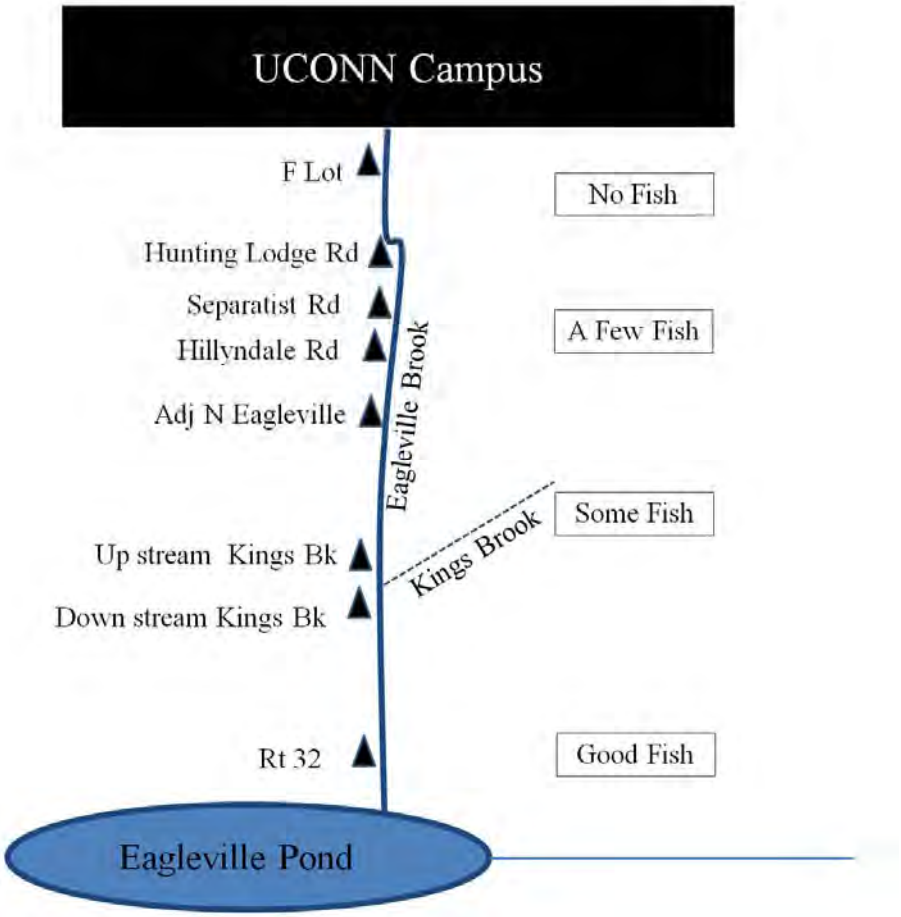
Why Focus on Eagleville Brook?

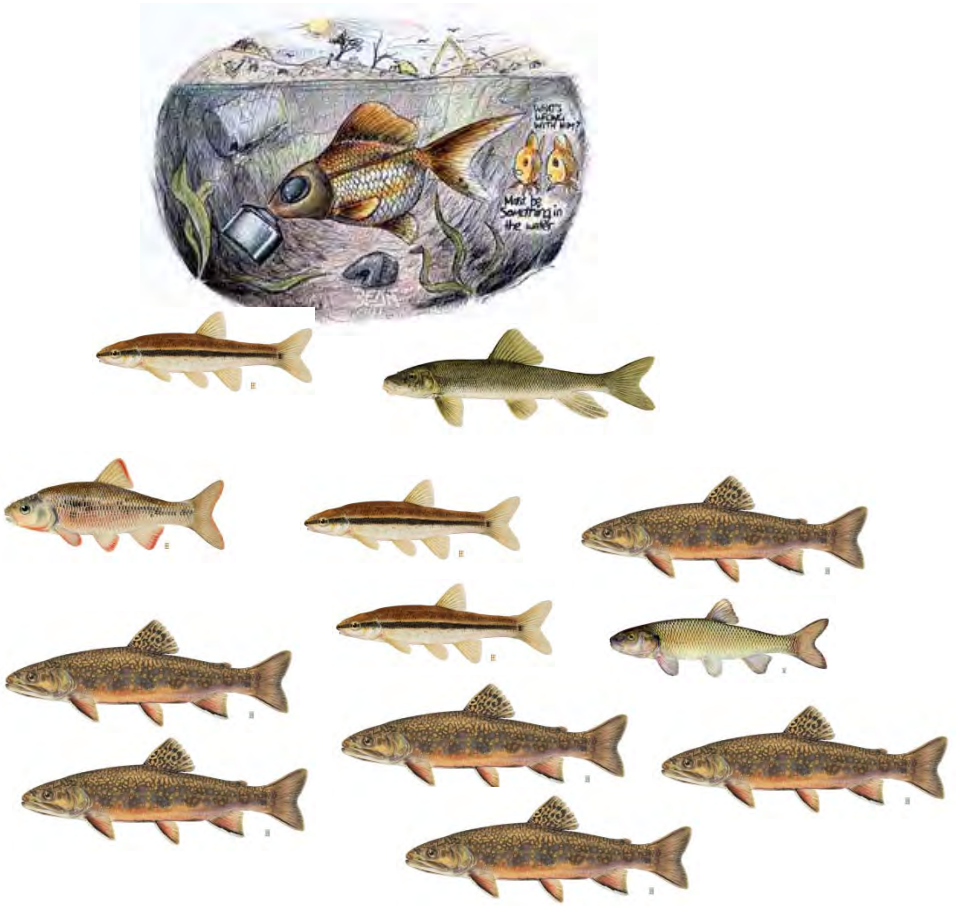
- Listed on ***CT 2002 Impaired Waters List*** for not meeting aquatic life use goals – Cause Unknown

- Obvious impacts from sedimentation and altered flow

Why Focus on Eagleville Brook?

• Biology in the brook severely impacted- extremely low numbers and diversity of fish and macroinvertebrates



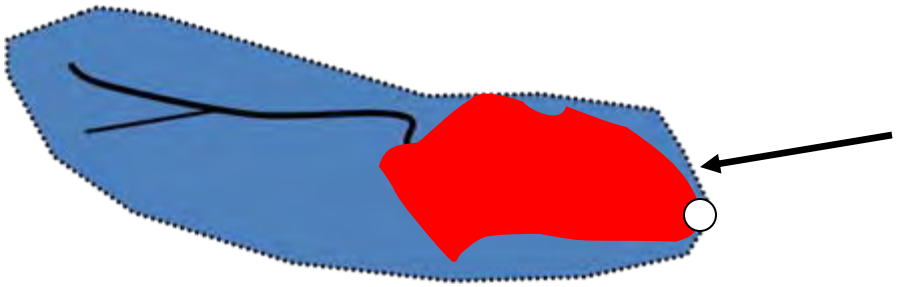


Why Do an Impervious Cover TMDL ?

DEP Stressor ID Study identified a complex array of pollutants generated from storm water runoff as most probable cause of impairment

- Simplifies complex impacts but based on good science
- Good correlation between IC and stream health
- IC data available statewide
- Measurable and generated by local land use
- We can do something about better land use decisions and storm water management

How Does the TMDL Work ?



27% IC in Watershed

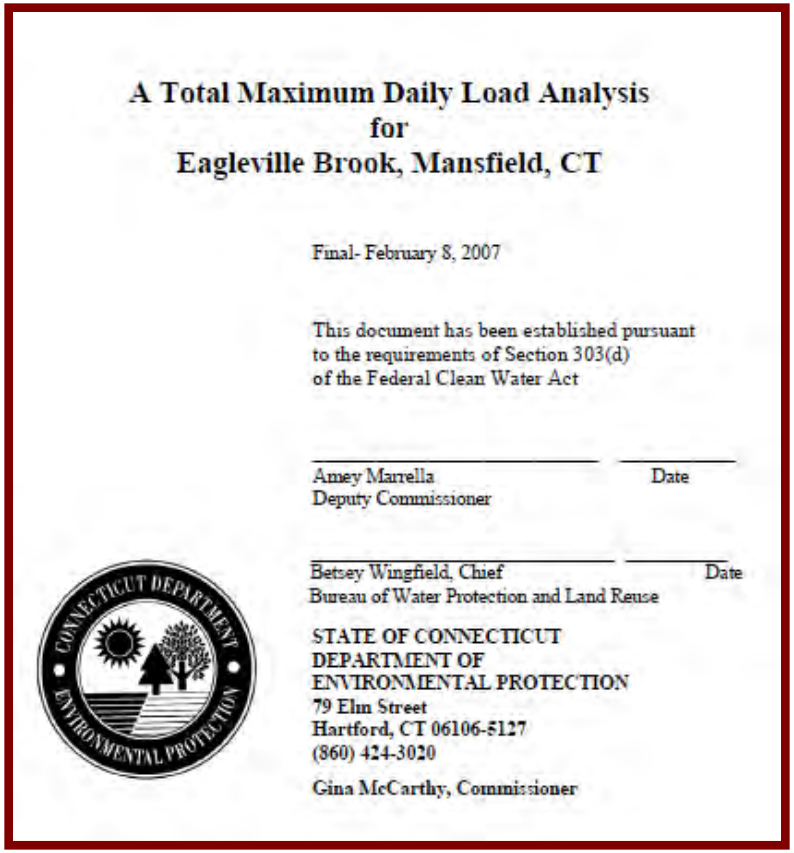
Target is 12 % IC

- Assembles watershed folks to ID opportunities to reduce the effect of IC in the watershed
- Implement fixes based on local knowledge and expertise
- Progress will be measured by assessing aquatic life

Goal *Is Not* to Reduce the % IC in the watershed per se, but to Reduce the *Impact* of IC through *Storm water Management* to Levels Equivalent to < 12% IC .

It's all about *Runoff Reduction* !!!

From Paper to Implementation



A Total Maximum Daily Load Analysis
for
Eagleville Brook, Mansfield, CT

Final- February 8, 2007

This document has been established pursuant
to the requirements of Section 303(d)
of the Federal Clean Water Act

Amey Marrella — Date
Deputy Commissioner

Betsey Wingfield, Chief — Date
Bureau of Water Protection and Land Reuse

STATE OF CONNECTICUT
DEPARTMENT OF
ENVIRONMENTAL PROTECTION
79 Elm Street
Hartford, CT 06106-5127
(860) 424-3020

Gina McCarthy, Commissioner

- Implementation Plan will guide restoration efforts and serve as template for other IC TMDLs

Eagleville Brook Impervious Cover TMDL
http://www.ct.gov/dep/tmdl

Basic Concepts of IC TMDL Implementation

- The emphasis is on runoff (volume) reduction, but opportunities to improve water quality will not be neglected
- Implementation will take place during the course of ongoing UConn and Mansfield activities, as opportunities occur at the site level
- Implementation will be coordinated with the Master Plan, Master Landscape Plan, and Master Drainage Plan at UConn
- The goal is to apply implementation concepts to all of campus and town, not just the Eagleville watershed

Eagleville TMDL Implementation

Technical Meetings on Implementation Strategies and Opportunities

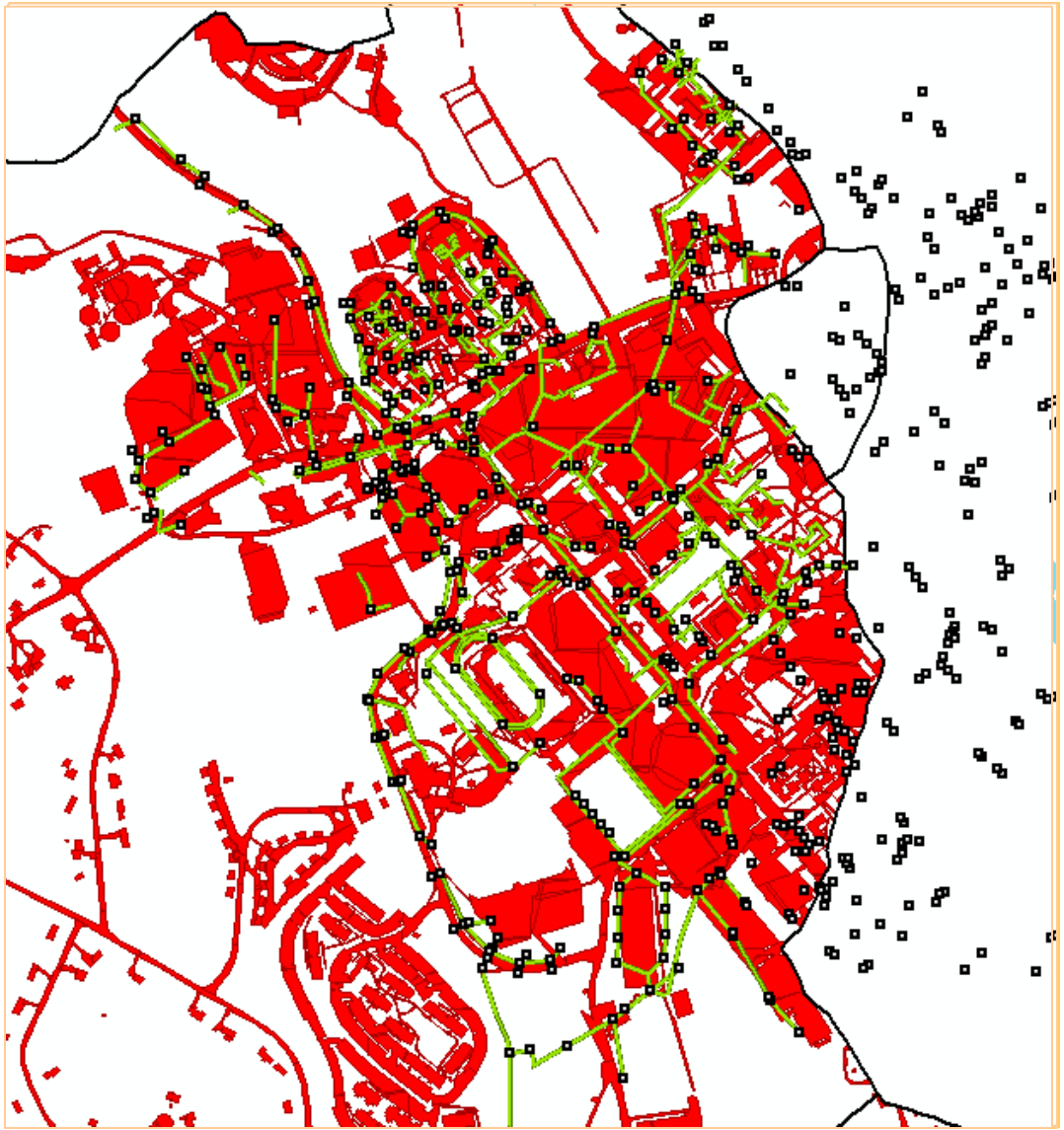
- For future development
- For existing development

Eagleville Bk TMDL Implementation

- Clean Water Act 319 Grant for project to map 50 opportunities for improvement in the watershed
- Top 10 will have detailed cost estimates and site plans
- Field work completed, website running, report in prep

Eagleville TMDL Implementation

Data Collection and Watershed Mapping



Eagleville TMDL Implementation

Tracing

Flow Paths

Eagleville TMDL Implementation

ID Retrofit Opportunities

Eagleville TMDL “Quick fixes”

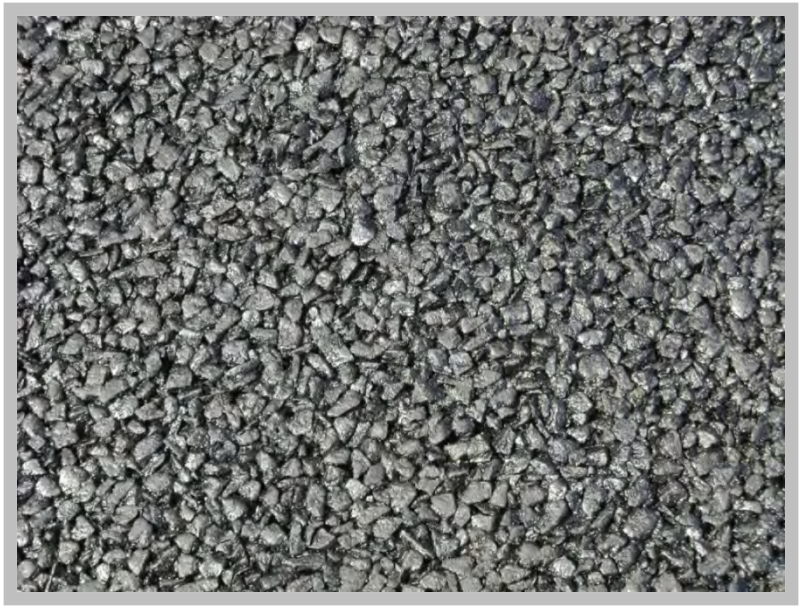
Disconnect IC from the brook !

Field House Pervious Concrete Lot

Eagleville TMDL “Quick fixes”

Disconnect IC from the brook !

Towers Complex Pervious Asphalt Lot

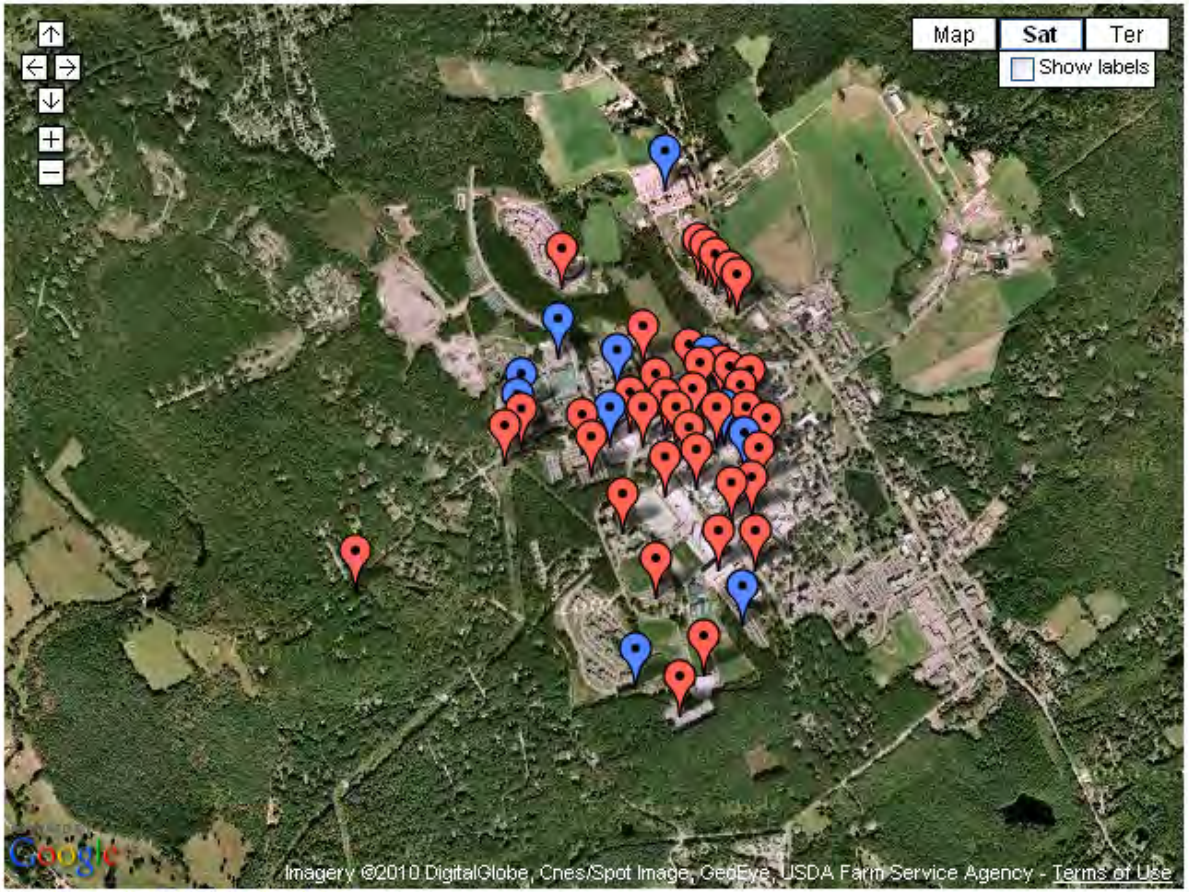


Road Map to IC TMDL Implementation

http://clear.uconn.edu/eagleville/Eagleville_TMDL

Road Map to IC TMDL Implementation

Potential Sites for Impervious Disconnects or Treatment



View Eagleville TMDL Project Sites in a larger map

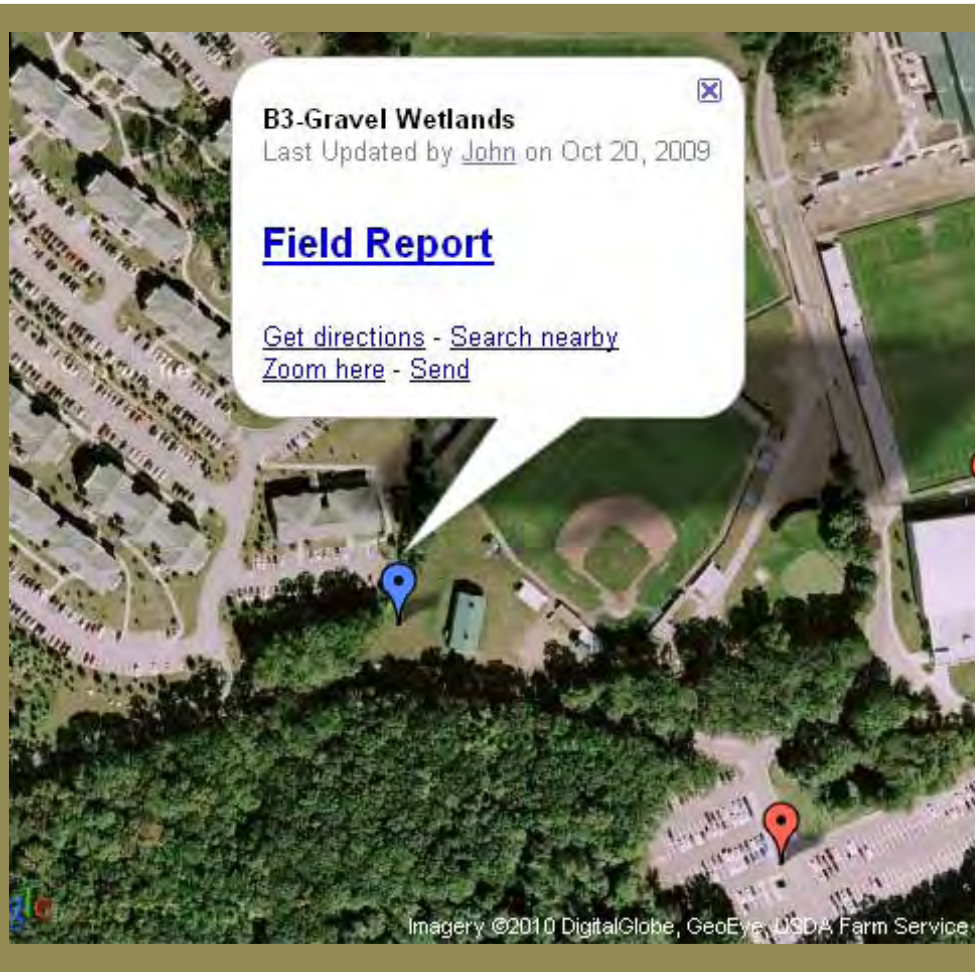
BLUE shows projects that will be advanced to 25% design stage

RED shows other identified projects

Road Map to IC TMDL Implementation

Road Map To IC TMDL Implementation

Peripheral areas: athletic complex



Retrofit Reconnaissance Investigation **RRI**

WATERSHED: EAGLEVILLE BROOK	SUBWATERSHED:	UNIQUE SITE ID: B-3	
DATE: 7/14/09	ASSESSED BY: RC/KC/LL (B-TEAM) JR/ET (DEP)	CAMERA ID: OLYMPUS RC'S PENTAX	PICTURES: 41-48 AND 1978-1981 (PENTAX)
GPS ID: N/A	LMK ID: N/A	LAT: N/A	LONG: N/A

SITE DESCRIPTION

Name: Christian Field – Adjacent to batting cages.
Address:

Ownership: ☐ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT X Other: UConn

Corresponding USSR/USA Field Sheet? ☐ Yes ☒ No If yes, Unique Site ID:

Proposed Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Road ROW
- ☐ Other:
- ☐ Above Roadway Culvert
- ☒ In Conveyance System
- ☐ Near Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Underground
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Other:

DRAINAGE AREA TO PROPOSED RETROFIT

Drainage Area ≈ 55.0 ac
Imperviousness ≈ 27.4 % (all sites) %
Impervious Area ≈ 15.1 ac (all sites)

Notes:

Drainage Area Land Use:
- ☐ Residential
  - ☐ SFH (< 1 ac lots)
  - ☐ SFH (> 1 ac lots)
  - ☐ Townhouses
  - ☐ Multi-Family
- ☐ Commercial
- ☒ Institutional
- ☐ Industrial
- ☐ Transport-Related
- ☐ Park
- ☐ Undeveloped
- ☐ Other:

EXISTING STORMWATER MANAGEMENT

Existing Stormwater Practice: ☐ Yes ☒ No ☒ Possible
If Yes, Describe:

Existing drainage pipe system collects runoff from pervious and impervious surfaces and discharges to Red Brook.

Describe Existing Site Conditions, Including Existing Site Drainage and Conveyance:

Ex 24 inch Pipe runs along open area of fields with inlets, likely under baseball field, across Stadium Road.

Clearly part of conveyance is a former stream, thus should have shallow depth to groundwater.

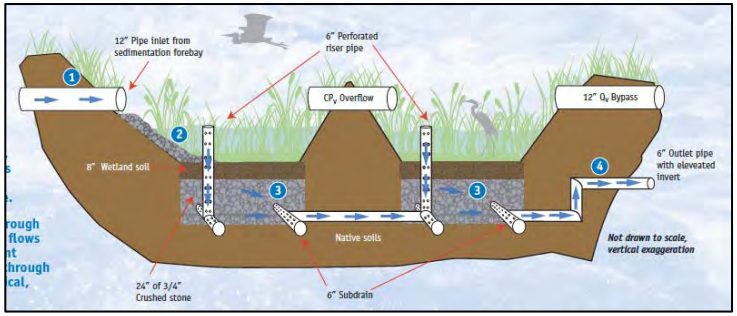
Existing Head Available and Points Where Measured:

Unable to locate final inlets or manholes in vicinity of site, but pipe invert at outfall less than 5 feet.

Road Map To IC TMDL Implementation

Peripheral areas: athletic complex

Innovative biological stormwater BMPs to reduce impact of runoff from athletic fields & facilities



"The gravel wetland does an exceptional job of removing nearly all of the pollutants commonly associated with stormwater treatment performance assessment."

Univ. of New Hampshire Stormwater Center

Road Map To IC TMDL Implementation

Site B3: Christian Field/Batting Cages

Gravel-based Wetland System

Project Summary

Parameter	B3
Impervious Cover Treated (acres)	15.1 acres
Runoff Reduction Volume (cu ft per 1" rain event)	0
TN Removal (lb/yr)	49.19
TP Removal (lb/yr)	13.28
TSS Removal (lb/yr)	2,262.73
Estimated Cost	$250,100

Site Description

The proposed retrofit concept is located by the baseball fields and batting cages in the southeastern portion of the UConn Campus.

Existing Conditions

Existing drainage pipe system collects runoff from pervious and impervious surfaces for 55 acre drainage area and discharges into Red Brook (Figure 1). Existing 24 inch pipe runs along open field areas with inlets, likely under baseball field and across Stadium Road. Some of this area is currently managed by upgradient stormwater BMPs. Because a portion of this conveyance appears to have been a former stream, there is likely a shallow depth to groundwater. The location of inlets or manholes in the vicinity of the site were not found. The pipe invert at the outfall is less than 5 feet.

Proposed Concept

Proposed installation of a gravel based wetland system with forebay, designed offline with approximately 5,050 sq ft of available surface area (Figure 2). Use a diversion manhole to divert flows from existing drain line into pretreatment forebay with outlet structure that discharges into bottom of chambered, gravel wetland system. Flows are forced up through gravel filters to a vegetated wetland surface where additional pollutants can be removed via plant uptake. Overflow from the wetland is discharged back into existing stormdrain. An emergency spillway drains into existing low area/wetland to the southwest.

This project is feasible and very attractive, as few locations on campus offer the ability to manage significant volumes of runoff and impervious surfaces. Available surface area limits available treatment capability; however additional retrofit projects in the drainage area (i.e, B5u/b) may help reduce sizing requirements.

Figure 1. Drainage areas to proposed gravel wetland system include additional proposed retrofits.

Figure 2. Gravel based wetland system with underground chambers, pretreatment sediment forebay, and retaining wall.

Preliminary Concept Designs

A 25% concept design for the proposed retrofit can be found in attachment B, which includes preliminary plan views, cross sections, and project details (Figure 3). These initial plans will require field survey and more information on drainage pipes, utilities, and soils (among other things) before going to construction plans.

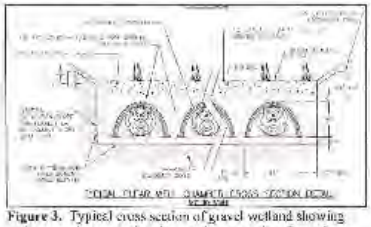


Figure 3. Typical cross section of gravel wetland showing underground storage chambers and vegetated surface where water pushed up from below is designed to pond.

Preliminary Hydrologic Calculations

Preliminary sizing of the gravel based wetland system was completed based on guidance provided in the *2009 Rhode Island Stormwater Manual (public review draft)* and are summarized in the table below.

Sizing calculations for Site B3	
Parameter	Value
Drainage Area, A (acres)	55.0
Imperviousness, I (%)	27
Volumetric Runoff Coefficient, Rv	0.30
Rainfall Depth, P (in)	
Water Quality Volume, WQv (cf)	39,345
Surface Area Required, Af (sq. ft)	8,386
Surface Area Provided (sq ft)	5,050
Treatment Provided (ScotPT)	60

Design Considerations

- Sizing of facility is constrained by space and grade. Note the height of retaining wall, depth of forebay, and available head driving upflow filter. Sizing of facility can potentially be reduced if additional retrofits are installed within the drainage area upgradient.
- Must verify location of all existing storm drain infrastructure. Double check potential utility conflicts (i.e., sewerline).
- Final design to include cleanouts for gravel wetland and maintenance access for forebay.
- May need to relocate existing fence and install guardrail along road.

Maintenance

Maintenance will generally be related to landscaping practices and sediment removal from pretreatment forebay to prevent clogging. Inspect semi-annually for the first year of operation and annually after the first year as well as after major storm events. The routine maintenance activities typically associated with gravel-based wetlands are summarized in the table below.

Maintenance Activities	
Activity	Schedule
Replant vegetation to original design standards if less than 50% of the original vegetation is established	After two years
Remove and replace ill-established, dead, or severely diseased plants	Annual
Inlets, outlets, and overflow spillway will be checked for blockage, structural integrity, and evidence of erosion	Routinely and after major storm events
Sediment build up at the cleanout pipe will be removed	
Clean and remove debris at cleanout pipe	As needed (if standing water is observed 48 hours after storm event)
Sub-surface storage chambers shall be flushed and/or snaked	

Cost Considerations

$30/sf, not including utility/ main drainage pipe relocation.

Benefits of IC TMDL

- Gets to the root cause of the problem
- Provides a streamlined template for future storm water TMDLs
- Meets State's obligations under Federal Clean Water Act
- Provides a framework for education
- Provides an opportunity to incorporate local knowledge into implementation plans
- It's all about motivating change by demonstrating our actions have an impact on the environment
- Change is not easy!!!!

Smoking

According to CDC, Smoking causes approximately

- 90% of all lung cancer deaths in men
- 80% of all lung cancer deaths in women
- 90% of deaths from chronic obstructive lung disease

Compared with nonsmokers smoking increases the risk of

- Coronary heart disease by 2 to 4 times
- Stroke by 2 to 4 times
- Men developing lung cancer by 23 times
- Women developing lung cancer by 13 times

Impervious Cover

According to Many Studies, Impervious Cover contributes to

- Poor water quality
- Stream habitat degradation
- Alteration of stream flow regimes
- Alteration of natural groundwater recharge
- Increased stream temperatures
- Degradation of fish and macroinvertebrate communities

Next Steps

- Draft project report is in the works
- Final project team & stakeholder's meeting in May 2010
- NEMO to work with Town of Mansfield over the summer on review of land use plans and regulations
- Final report & website by Fall 2010
- UConn: implementation will occur on site-by-site basis, led by UConn Office of Environmental Policy using guidance from the project recommendations
- There will be continuing involvement by CLEAR/NEMO & CT DEP
- Implementation guidance for future IC TMDLs in CT

Questions ???

Chris Bellucci (860)424-3735

christopher.bellucci@ct.gov

Department of Environmental Protection
Bureau of Water Protection and Land Reuse

Chet Arnold (860)345-5230

chester.arnold_jr@uconn.edu

Department of Extension
Center for Land Use Education and Research
University of Connecticut