Urban Stream Restoration Case Studies

Chapel Hill & Carrboro, NC

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NC STATE UNIVERSITY Bio&Ag ENGINEERING Stream Restoration Program

DIVISION OF WATER QUALITY DWQ

TOWN OF CARRBORO NORTH CAROLINA

TOWN OF CHAPEL HILL

Project Partners

Town of Chapel Hill
Town of Carrboro
Orange Water and Sewer Authority
Chapel Hill – Carrboro Public Schools
North Carolina State University
North Carolina Cooperative Extension Service
North Carolina Division of Water Quality
United States Environmental Protection Agency
Private Landowners

NC State University A&T State University COOPERATIVE EXTENSION Empowering People · Providing Solutions

NC STATE UNIVERSITY Bio&Ag ENGINEERING Stream Restoration Program

Project Background

Funding: Town of Chapel Hill and Town of Carrboro received two EPA 319 Grants to implement watershed restoration practices and water quality monitoring in the Bolin Creek watershed

Design: North Carolina State University Department of Biological & Agricultural Engineering

Scope:
3 stream restoration projects
4 stormwater bioretention areas
1 water harvesting project
water quality monitoring

Bolin Creek Watershed Restoration Project

Baldwin Park (2011)
500 ft stream restoration
Bioretention stormwater treatment

McDougle Middle School (2010)
Bioretention stormwater treatment
Cistern water harvesting

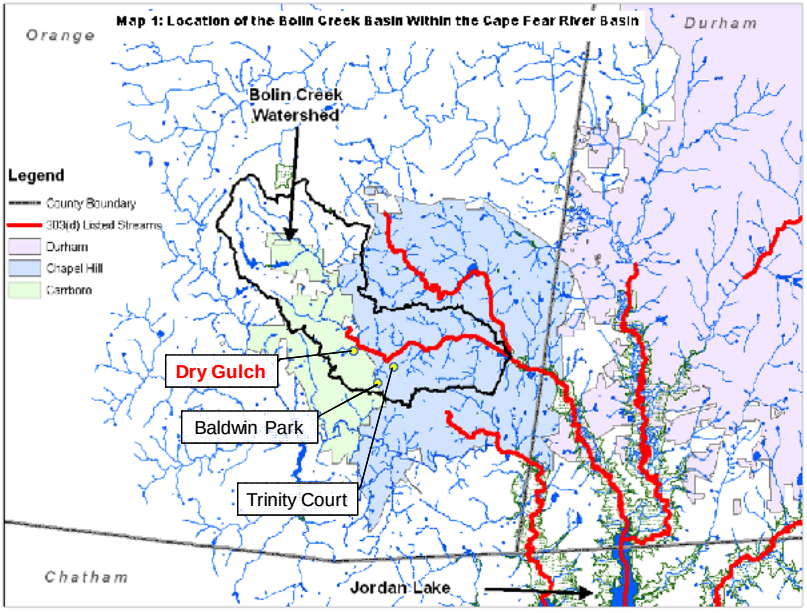
Town of Chapel Hill Parks (2012)
2 Bioretention stormwater treatments

Dry Gulch (2012)
500 ft stream restoration

Trinity Court (2012)
320 ft ephemeral stream restoration
(Regenerative Stormwater Conveyance)

Bolin Creek Watershed

Chapel Hill and Carrboro, Orange County, NC



Dry Gulch Problems

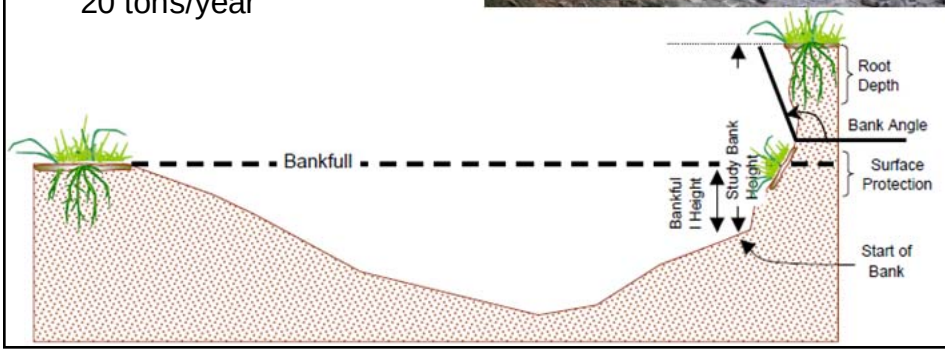
- Streambank erosion & poor water quality
- Channel cutting into hillside
- Poor riparian vegetation (invasives)
- Poor habitat due to sediment and plain bedform

Dry Gulch Problems

- Channel cutting into adjacent sewer line
- Channel incised and over-wide
- Unstable sewer easement crossing
- Eroding stormwater outfall from adjacent development

Dry Gulch Pre-Construction BEHI

- Bank Erosion Hazard Index
- Values ranged from low to extreme
- Estimated sediment loss due to bank erosion: 20 tons/year



Project Conditions & Constraints

- Drainage area: 0.25 sq mi
- Longitudinal slope: 0.025 ft/ft
- Stream confined by steep slope and existing sanitary sewer

Project Goals

- Eliminate hillslope erosion & reduce streambank erosion
- Enhance riffle and pool habitats
- Invasive plant removal & replace with native riparian plants
- Provide educational opportunities for landowners

Project Elements

- 150 ft of channel relocation away from hillslope and sewer
- 11 boulder structures for grade control & bank stability
- Grade floodplain benches in incised areas to dissipate flood energy
- Stabilize sewer easement crossing with an improved ford
- Native riparian vegetation

Channel Relocation

- 150 ft of channel relocation away from hillslope and sewer
- Cut new channel in the dry
- Transfer gravels & cobbles to new riffles
- Turn stream flow into new channel & backfill old channel

Eroding hillslope prior to construction

Old channel filled in & stabilized

Biodegradeable matting, seed, straw

Early April, 2012

Late April, 2012
Day after bankfull event

J-Hook Vane

- Direct flow away from bank
- Grade control and scour pool
- Footer boulders & geotextile

Floodplain Benches

- Grade to 1 ft above channel
- Seed, straw, and matting
- Trees and shrubs to be planted Winter 2012

Sewer Easement Crossing

Steep banks prior to construction

Graded banks (5:1 slope) & stabilized with rock

Bolin Creek Watershed

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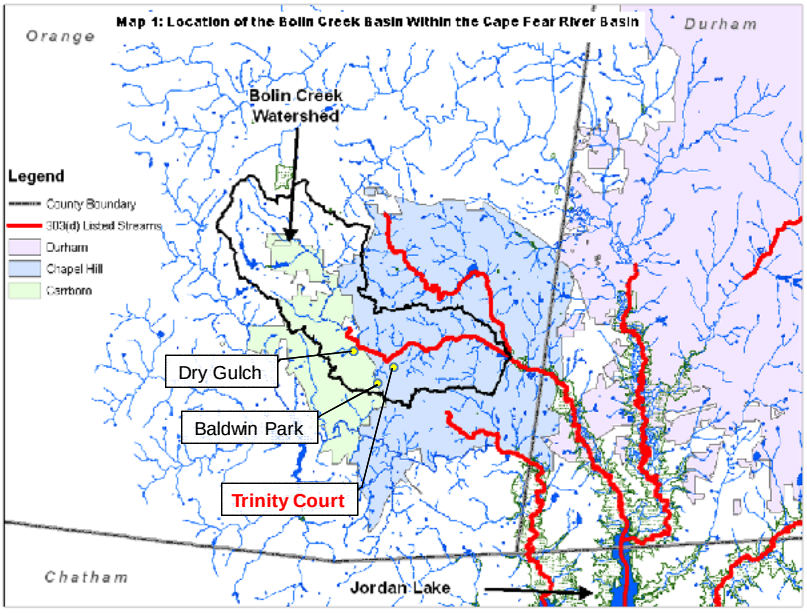
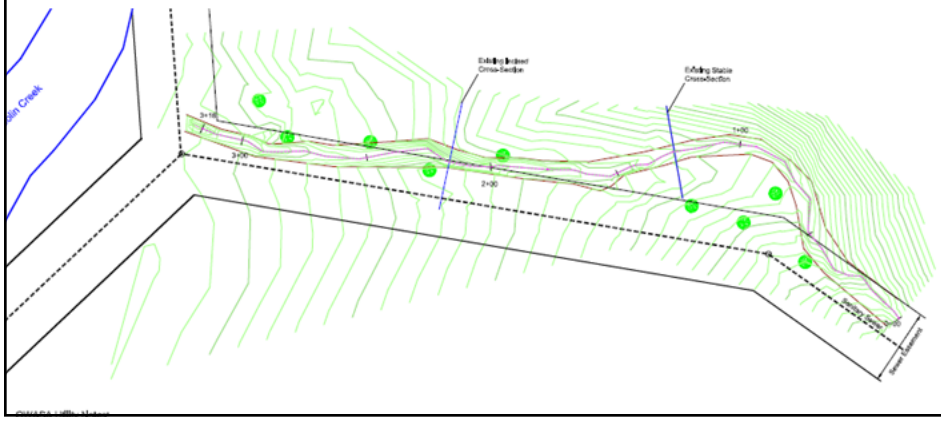


Trinity Court Problems

- Streambank erosion & significant channel incision
- Steep and eroding banks throughout reach
- Channel cutting into adjacent sewer line

Project Conditions & Constraints

- Drainage area: 11.5-acres (wooded and residential)
- Longitudinal slope: 0.07 – 0.10 ft/ft
- Stream confined by existing sanitary sewer and established forest



Project Goals

- Reduce streambank erosion
- Improve downstream water quality
- Improve floodplain connectivity
- Protect adjacent sewer line

Project Elements

- Maintain existing channel alignment
- Raise channel bed to increase floodplain connectivity
- 13 boulder steps installed to help raise the bed
- Engineered sand media used as fill for most incised portion of reach (Regenerative Stormwater Conveyance)
- New channel bed stabilized with existing gravels and cobbles and quarry stone

Setting Boulder Steps Prior to Placement of Sandy Media.

Boulder Steps Constructed on Riprap and Gravel Foundation
(0.5' - 0.7' Drop Between Steps)

Sand Media: 80% Sand 20% Fine Wood Chips

Backfill Sandy Media Between Boulder Steps

Install Splash Boulders Below Each Step

Install Layer of Rip Rap on Top of Media for Surface Protection

Two Weeks After Construction

Five Months After Construction

Lessons Learned in Bolin Creek

- Involve people and property owners throughout
- Be prepared for changes in the field
- Work with qualified and flexible contractors
- Prioritize highly visible sites

Thank you

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