Your Best Teacher
Is Your Last Mistake...
or Success!

FRANKLIN COUNTY’S
LESSONS LEARNED

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For our purposes, let’s revise this quote:

“The best teacher is sharing our successes and the lessons learned from our projects.”
Franklin County

- 70,382 population (2016)
- 724 square mile area
- 97 people/mile², most rural area of the state

Land Use:

- 78% Forest and Open Land
- 8% Agricultural
- 7% Water and Wetland
- 4% Residential
- <1% Commercial/Industrial
- Other Uses
Franklin County

Issues:
• No strong county government (abolished)
• Home Rule state
  • Towns adopt and enforce land use regulations
  • Enforce state Wetlands Protection Act
• No $$ and towns are run by dedicated volunteers
• Much of the undeveloped land is in private ownership
• Many of the rivers and streams are Cold Water Fisheries
• Town centers and much of the transportation network are located along rivers
Like many areas, stormwater runoff is one of the leading causes of water quality impairments.
Riverfront Park
Brownfield Site to LIDsville!

- Typical of the type of development along the bigger rivers in Franklin County.
- See these issues, but at a smaller scale along major tributaries.
- Lack of riparian buffer.
- Minimal to no treatment of stormwater.
- Extensive impermeable surfaces.
- Recreational and redevelopment opportunities.

Low Impact Development (LID) Demonstration Site 2005
Riverfront Park

context
Riverfront Park connections

- Linkage to Downtown
- Possible future linkage to Peace Park/Riverfront
- Potential overlook location with access to docks
- Existing stone retaining wall
- Future bike path potential
- Possible park expansion
- Lid potential wood art incorporation
- Gateway
- Steep bank wetland line at bottom of bank
- Future development potential
- Approximate location of land use restriction (impervious)

RIVERFRONT PARK
Orange, MA

Legend:
- Good View
- Undesirable View (screening required)
- Pedestrian linkage
Riverfront Park
existing conditions
Riverfront Park
LID design elements

A – Porous Pavement
B – Gravel Dust
C – Lawn Rings
D – Soil Amendments
1 – Bio-Retention Swales
2 – Rain Gardens
3 – Rain Barrels
4 – Cistern
5 – Interpretive Signage

RIVERFRONT PARK – LOW IMPACT DESIGN ELEMENTS
Orange, MA

FINAL CONCEPT PLAN
May 25, 2005
Riverfront Park
post-construction
Riverfront Park
post-construction
Riverfront Park

Lessons learned

- The LID techniques accommodated the existing site conditions and fit within the budget for redeveloping a Brownfield site.

- LID enhanced the park and buffered the heat, noise and unsightly landscapes that typically surround a former Brownfield site.

- Maintenance: Friends of Riverfront Park help the town with the upkeep of the park and the LID structures.

- More frequent site visits by the design engineers during the installation process can help prevent decisions being made “on the fly” by contractors.
Stormwater BMPs for unpaved roads

In Franklin County and other rural areas of the state, unpaved roads are an integral part of a landscape that is treasured by many residents.

While quaint and picturesque, unpaved roads pose many maintenance challenges to highway departments.
In Franklin County and other rural areas of the state, unpaved roads are an integral part of a landscape that is treasured by many residents.

When unpaved roads run alongside rivers and streams, which they often do, the erosion and sediment from uncontrolled stormwater runoff can cause significant water quality problems.
Sediment-laden runoff is flowing into the Four Mile Brook and being deposited in the lowest reaches of the brook and the Connecticut River.

Four Mile Brook
BMPs selected

- Riprap/rock lined channels and swales
- Check dams
- Natural stone headwalls
- Ditch turnouts
- Culvert inlet/outlet protection
- Gabion baskets
- Level spreader
Four Mile Brook

sites 2, 3, & 4 before
Four Mile Brook

Stormwater BMPs installation

Terminal end of swale on south side of road

Swale leading into upgraded culvert

Culvert outlet with gabion baskets and completed level spreader.
A combination of low-tech structural BMPs and non-structural BMPs are the most sustainable strategy for reducing sediment pollution from unpaved roads.

- Hard structures that require a fixed foot-print are not practical for rural roads that have a narrow right-of-way.
- Instead, use low-tech, flexible BMPs that can be designed to fit within the road right-of-way.
- The BMPs used were are low maintenance.
- Minor design modifications and additional work can be done in the field.
- Many objectives can be met – safety, reducing maintenance costs, improving water quality, reducing downstream flooding.
- Non-structural BMPs also make sense for rural road maintenance.
Four Mile Brook

non-structural BMPs

lessons learned

- Plan new projects carefully:
  - Decrease existing runoff
  - Eliminate unnecessary increases in runoff
  - Reduce erosion and sedimentation problems

- Maintain existing drainage structures:
  - The cost of routine maintenance is typically less than replacement cost

- Maintain as much of the natural vegetation and existing drainage patterns as possible
  - Infiltrates and cleans runoff
  - Reduces the velocity of the runoff

- Minimize the creation of steep slopes

A combination of low-tech structural BMPs and non-structural BMPs are the most sustainable strategy for reducing sediment pollution from unpaved roads.
Using LID Techniques
to manage stormwater runoff in Greenfield

Project Partners:

- The Franklin Regional Council of Governments
- The Town of Greenfield
- Greening Greenfield

Project funded by the Town of Greenfield, HUD-CDBG Program, MA DEP s319 Nonpoint Source Pollution Grants Program, the Massachusetts Environmental Trust and Greening Greenfield
Greenfield LID

scope of work

1. **Retrofit with LID** the Chapman/Davis parking lot and Olive Street

2. **Incorporate LID into regulations/policies** by working with the Greenfield Planning Department and DPW to identify opportunities to do so

3. **Conduct public education and outreach**
Greenfield LID

Chapman St. parking lot

- Bioswale added
- Shade trees added
Bioswales were designed and constructed for two sites in the parking lot.
Gaps in the curbing allow water to flow into bioswales in the parking lot.
Native river rock was incorporated into swales planted with ornamental grasses and native perennials and shrubs.
Greenfield LID

Olive St. traffic-calming bump-outs and rain gardens

Context: Olive St. connects two busy streets in a commercial district comprised primarily of parking lots and buildings, uphill from the Green River.
Greenfield LID

Olive St. traffic calming bump outs and rain gardens

Three rain gardens were constructed on Olive street, located in an area of primarily impervious surfaces.
Greenfield LID

Olive St. traffic calming bump outs and rain gardens

Before construction

After construction
Greenfield LID

Olive St. traffic calming bump outs and rain gardens

Perennials in the rain gardens include coneflower, butterfly weed, prairie dropseed grass and winterberry.
During heavy rains, stormwater that overflows the pooling areas in the rain gardens is captured by a storm drain.
Greenfield LID
public education and outreach

TOWN OF GREENFIELD

Low Impact Development:
A Developer’s Guide to Innovative Stormwater Management Techniques

SITE PLANNING

Low Impact Development site planning seeks to minimize the amount of stormwater runoff from the development in the first place. Basic principles include building on previously disturbed sites, reducing impervious surface area (design narrower, shorter roads and driveways, avoid excessive parking, use permeable pavement/porous asphalt, etc.), minimizing tree clearing and grading, and maintaining the natural topography of the site by minimizing cut and fill. New subdivisions should site homes in the least environmentally sensitive areas.

Guide included references to recommended changes to subdivision regulations and zoning.
Interpretive signs were installed at both project sites, providing context and education for the public.
Greenfield LID

public education and outreach

The Greenscape Challenge helps residents to make positive changes on their properties to slow or stop stormwater runoff.

Take the Greenscape Challenge:
https://www.surveymonkey.com/r/GreenscapeChallenge

For more info:
www.fr cog.org
www.greenfield-ma.gov

Pet waste & water quality FACT SHEET

What's the problem?
Scooping your pet's poop isn't just a nice thing to do for those walking behind you; it is also the healthy and environmentally sound thing to do. Pet waste can be a source of water pollution. When pet waste is not properly disposed of, it can be carried by rain or melting snow runoff into storm drains. Storm drains in our streets and neighborhoods usually flow directly into our streams and rivers.

Animal waste can become a source of harmful bacteria and nutrients in water; just as we don't want human sewage in our water, it is important to prevent pet waste from being carried into our streams and rivers.

What are other water pollutants?
Dog waste is only one of many pollutants from our neighborhoods that can be washed into storm drains by rain water: lawn fertilizers, motor oil, driveway sand and salt, and soapy water from washing cars in driveways commonly end up in streams and rivers. Tell friends and neighbors about the effect of animal waste on the environment and our health. Encourage them to clean up after their pets and to dispose of the pet waste properly.

Here's what you can do:
- Carry plastic bags with you when you walk your dog. Re-use a plastic newspaper or grocery bag works well. Or, carry a pet waste scooper.
- Use the bag like a glove and pick up the pet waste, turn the bag inside out around the waste, seal the bag, and dispose of it in a trash can. Or flush un-bagged pet waste down the toilet.
- Don't place the bagged or un-bagged pet waste in a storm drain, as storm drains flow directly to our rivers and streams.
- If you have a large yard, you may bury un-bagged pet waste in a hole at least 6 inches deep and away from vegetable gardens and waterways.

For more info:
www.fr cog.org
www.greenfield-ma.gov
Greenfield LID

lessons learned

• **Design**
  – Professional advice/assistance is helpful
    • Plant density & type; location
    • Site conditions/constraints
    • Drainage during different storm events – treating the “first flush” or ½” to 1” of rain

• **Maintenance**
  – Contractor warranty
  – Watering/Weeding
  – Fall/Spring clean-ups
  – Volunteers

• **Public Education & Outreach**
  – Engagement of stakeholders
Develop a new framework for projects in Franklin County
  • What is a healthy watershed?
  • What types of impairments are we seeing?

[Image of a watershed diagram]

https://www.floods.org/PDF/ASFPM_TNC_Active_River_%20Area.pdf
Only small percentage of the river miles in Franklin County are listed as Impaired Waters (Integrated List; 303d List)

FRCOG work focused on assessing and implementing projects to address these documented impairments
Most of Franklin County’s rivers meet this definition if we define healthy as not listed on the Integrated List of Waters.

What are the attributes of a healthy river and a healthy watershed?

What are we working to protect and restore in impaired rivers?
2005 TS Tammy dropped 7-10” of rain across Franklin County. Severe inland flooding resulted in $6.5 million in damage.

2007 fluvial geomorphology study completed for a section of the CT River.

2008, FRCOG completed a multi-year assessment project for the Deerfield River watershed, which included detailed work in the larger tributary watersheds – North, Chickley, Green, and South River.

Significant bank erosion identified in these 4 watersheds.
Infrastructure, homes, agricultural lands, habitat have been damaged or are threatened by the major erosion occurring in these watersheds.

Significant amounts of money have been spent to repair damaged infrastructure and in some cases, several repairs at the same site have been needed.

What is healthy? What is impaired?

Watershed Scale
Fluvial geomorphology: the study of the form and function of rivers and the interaction between rivers and the landscape around them.

According to the USGS, “understanding river-channel responses to various human-caused and natural disturbances is important for effective management, conservation, and rehabilitation of rivers and streams to accommodate multiple, often conflicting, needs.”
Fluvial Geomorphic Assessments
for two subwatersheds
Fluvial Geomorphic Assessments

goals for South and North River projects

1. Collect baseline habitat and fish community data.
2. Identify and prioritize potential restoration projects for the watershed.
   a. Address site specific concerns (eroding banks, threatened infrastructure)
   b. Address water quality concerns (sediment)
3. Develop conceptual designs and identify river and land use management techniques that are consistent with river processes.
Fluvial Geomorphic Assessments

findings

Natural Influences:
• Narrow, steep valleys
• Silt & clay-rich glacial sediment
Fluvial Geomorphic Assessments

findings (cont.)

Historic and recent land use:
- Land clearance
- Development
- Riparian buffers
Fluvial Geomorphic Assessments

findings (cont.)

Channel modification:
- Channel straightening
- Mill dams, ponds, and channels
  - Legacy sediments
- Encroachments & berming
Fluvial Geomorphic Assessments

findings: impacts to infrastructure and property

End result of channel modifications, encroachments and other development.
Fluvial Geomorphic Assessments

findings: impacts to habitat and water quality

End result of channel modifications, encroachments and other development.
Fluvial Geomorphic Assessments

findings: site-specific problems and watershed-scale causes
Fluvial Geomorphic Assessments

findings: site-specific problems and watershed-scale causes
South River
sediment management and restoration project

#1 priority project identified in the fluvial geomorphic assessment.
Legacy sediments are eroding and being deposited into stream beds, impacting water quality and habitat.
South River

the legacy of channel straightening & berming

The river was highly manipulated – straightened and bermmed – to accommodate all the mills on the river.

Images courtesy of the Conway Historical Society
South River

Allowing the river to access its floodplains in upstream areas could reduce damage to downstream agricultural fields.

Site experiences repeated erosion and damage. Approach had been to repeatedly armor it, rather than work upstream, holding the floodwater and reducing velocities.
South River

#1 priority project identified in the fluvial geomorphic assessment.
South River

potential project benefits

• Project identified in previous geomorphic & habitat assessment
  – Reduced flooding and erosion on Town’s property as well as upstream and downstream
  – Reduced downstream sediment loading
  – Habitat improvements
  – Improved aesthetic/recreation resources
  – Leverage limited funding
South River
permitting & final design process

- Project funding from US EPA, MassDEP s.319 Nonpoint Pollution Competitive Grant Program and Town of Conway, Community Preservation Act fund
- Long list of required permits/approvals
  - Natural Heritage & Endangered Species Program
  - Conway Conservation Commission
- Landowner buy-in
South River
reconnecting the river to its floodplain

New floodplain area provides a safety valve which reduces velocities and allows sediment deposition.
South River
floodplain lowering
South River

bank stabilization and habitat improvement structures

Boulder Deflectors

Woody Materials
South River

boulder deflectors

Because of site constraints, construction was done from the river rather than from the top of bank.
South River

woody material
South River

post construction
South River

post construction (cont.)
Lessons Learned:
Skepticism about restoration design from regulatory agencies and landowners
Environmental permitting was costly and took a long time
The Friends of the South River group provided invaluable support – before, during and after the project

Next Steps:
Develop a holistic framework for assessing and identifying projects in healthy and impaired watersheds
Add to our “toolbox”

The Friends of the South River group provided invaluable support – before, during and after the project

Goals of the project were met: Restoration of habitat and geomorphic function, and protection of infrastructure
Healthy or Impaired Watershed

- River Functions
- Storm-water runoff
- Flooding & Fluvial Erosion
- Green Infrastructure
- Degraded Habitat & Water Quality
- Threats to Infrastructure
- Local land use/planning
- Climate Change

A Holistic Watershed Framework
A Holistic Watershed Framework

**Benefits**

- Builds on the concepts of the EPA’s Healthy Watersheds Initiative to manage watersheds as systems
- Identifies mitigation, restoration, preservation and avoidance projects/strategies to:
  - Protect the healthy waters
  - Restore impaired waterbodies and
  - Increase the watershed’s resiliency to climate change
A Holistic Watershed Framework

FRCOG’s project for the Deerfield River Watershed

- Integrates the 9 elements of a s.319 Watershed-Based Plan, the tenets of EPA’s Healthy Watersheds Initiative, and Climate Change Adaptation planning
- Focus on Green Infrastructure - cost effective adaptation strategy
- Develop projects and tools that address multiple problems and provide multiple benefits
  - Minimize the threat of flooding and fluvial erosion
  - Protect water quality and habitat and working lands
  - Improve air quality, manage stormwater and cool urban environments.
- Recommendations that apply to various scales – Deerfield Watershed, its subwatersheds and the 14 towns.
A Holistic Watershed Framework

Interactive Scenario Exercise

Healthy or Impaired Watershed

- River Functions
- Storm-water runoff
- Flooding & Fluvial Erosion
- Green Infrastructure
- Degraded Habitat & Water Quality
- Threats to Infrastructure
- Local land use/planning
- Climate Change

strategies

- Protect and/or restore river corridors
- Protect large blocks of land for multiple benefits
- Manage stormwater with Low Impact Development/Green Infrastructure
- Protect and/or floodproof critical infrastructure
- Conduct public education
- Improve stormwater infrastructure
- Reduce impervious surfaces
Scenario #1: Moderately developed road along river

CHALLENGES

River constrained by roads on either side
Little to no buffer between farm field and river
Critical facilities and compacted ground sited adjacent to the river
Tributary runs off hill, often carrying debris into river
Possible erosion along riverfront

Critical facilities and compacted ground sited adjacent to the river
Scenario #1: Moderately developed road along river

**POTENTIAL STRATEGIES**

- Increase culvert size
- Protect large blocks of forested land
- Manage stormwater runoff with LID

- Protect land along rivers to provide space for flooding
- Provide incentives to restore floodplains

- Flood-proof critical facilities
- Use LID to slow runoff
- Manage stormwater by planting trees
Scenario #2: Rural farmland along river corridor

CHALLENGES

- River constrained by roads on either side and flowing under the bridge, a choke point
- It can be difficult to preserve large blocks of intact forest and/or ensure the use of sustainable forestry techniques
- Little to no buffer between farm fields and river
Scenario #2: Rural farmland along river corridor

**POTENTIAL STRATEGIES**

- Provide incentives for riverfront easement
- Protect upland parcels of land that provide storage of heavy rainfall
- Restore buffer along river
- Protect large blocks of land
- Manage the land for multiple benefits
Scenario #3: Heavily developed area along Millers River

CHALLENGES

Little to no buffer between the buildings/parking lot and river

Large impervious areas (parking lots, buildings, roads, driveways)

Densely settled residential area upslope from river
Scenario #3: Heavily developed area along Millers River

**POTENTIAL STRATEGIES**

- **Provide public education on stormwater runoff, rain gardens, rain barrels, trees**
- **Manage stormwater runoff with rain gardens and trees**
- **Provide incentives to reduce impervious surfaces**
A Holistic Watershed Framework

**Challenges**
- Towns in charge of land use
- Volunteer boards
- Staff turnover
- Tight budgets
- Inertia
- Our “healthy” watersheds are impaired

**Strategies**
- Update regulations and create new land use management tools
- Provide technical support to towns
- Be creative about sources of match
- Engage key stakeholders & outreach
- Institutionalize the use of LID
- Find and exploit the multiple benefits of these projects
- Apply FGM principles and a holistic watershed approach
- Integrate GI into transportation projects

**Lessons learned**
A Holistic Watershed Framework

lessons learned (cont.)

- Much of the cutting-edge river assessment and management work we are doing is modeled on the VT Agency of Natural Resources’ Dept. of Environmental Conservation, Watershed Management Division.
- The major tributaries and smaller headwater streams in the Deerfield Watershed are adjusting to decades, even centuries, of human manipulation of the river and the watershed lands.
- FRCOG’s cost-effective model fluvial geomorphic and habitat assessment methodology can be applied in other similar watersheds.

Don’t reinvent the wheel – just realign it to your needs!
Anthony J. D’Angelo
A Holistic Watershed Framework

Lessons Learned (cont.)

- We are missing a specific set of tools to protect healthy watersheds and restore impaired systems.
- We need to identify river corridors using fluvial geomorphic principles.
- Then develop corridor management tools to protect these areas:
  - River Corridor Protection Overlay District
  - River Corridor Easement
Fluvial geomorphic-based land conservation and corridor management is a new paradigm in river restoration and protection in Massachusetts.

These river management tools can address a need that river restoration projects can’t address.

Corridor mapping represents a landscape-scale framework for identifying a new class of projects and strategies that cross town boundaries.
money money money money, MONEY!

Lessons Learned

Grants
- 604b
- 319
- Mass Environmental Trust
- HUD CDBG
- Mass LAND & PARC
- FEMA/MEMA PDMC & HMGP

Match!
- Community Preservation Act
- MassDOT
- Town projects – Ch. 90
- Work done by stakeholder groups
  - Greening Greenfield
  - Friends of the South River
  - CT River Watershed Council
  - Trout Unlimited

http://www.clipartkid.com/money-tree-cliparts/
Looking to the Future

• See an untapped opportunity to incorporate GI into transportation projects.
• Develop a cost-effective and replicable assessment protocol and a set of templates for incorporating Green Infrastructure (GI) stormwater management techniques into transportation projects.
• Once built, these “Green Streets” can help improve water quality in Franklin County.