Integrating Water Quality Management and Natural Hazard Resilience through Nature Based Solutions

Tuesday, May 24, 2022, 1:00pm – 3:00pm Eastern

Speakers:

- **Kathleen Dennis**, Mill Creek Watershed Association
- **Abby Hall,** US Environmental Protection Agency
- **Joel Miller,** Town of Nolensville
- **Fouad Jaber,** Texas A&M AgriLife Extension
- **David Reazin,** US Environmental Protection Agency Region 6
- **Paul Parson,** Trout Unlimited
- **Eric Trum,** Montana Department of Environmental Quality

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Watershed Academy Webcast

- The slides for today's presentations are posted on the Watershed Academy webpage.
- A recording of the webcast will be posted within the next month.

www.epa.gov/watershedacademy

2

Webcast Logistics

- **To Ask a Question** – Type your question into the "Questions" tool box on the right side of your screen and click "Send."
- **To Report any Technical Issues** (such as audio problems) – Type your issue in the "Questions" tool box on the right side of your screen and click "Send" and we will respond by posting an answer in the "Questions" box.

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Audience Polling

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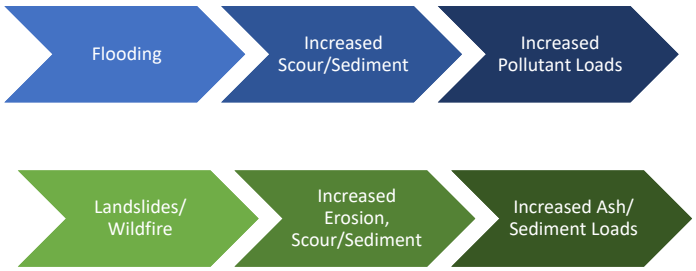
Natural Hazards & Water Quality and Quantity

Natural hazards drive changes in water quality and quantity



- Natural hazard events (i.e., flood, drought, etc.) can have impacts on water quality and quantity
- As with water quality, human activities and land use can exacerbate the impacts of natural hazards
- Environmental factors make different regions more vulnerable to specific natural hazards

Introduction to Nature-Based Solutions

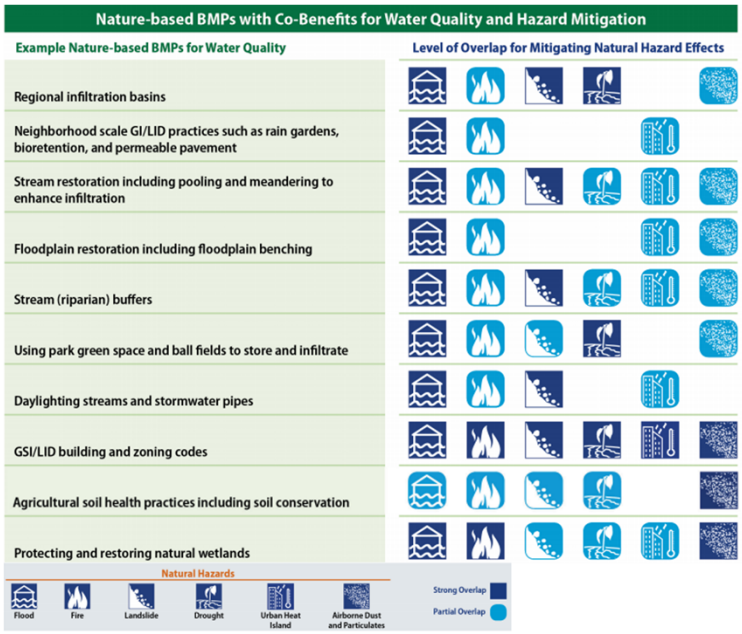
Nature-based solutions may be used to protect water quality, reduce natural hazards, and improve overall quality of life in the areas they are implemented. May include:

- Preserving and restoring uplands, streams, and floodplains for flood risk reduction
- Using swales, enhanced-soil infiltration basins, trees, and other approaches to replicate predevelopment runoff volume and control flow during storm events
- Restoring native vegetation for erosion, wildfire, and drought mitigation
- Green infrastructure (e.g., green roofs and trees) to mitigate urban heat island effects
- Managing agricultural land use practices can enhance soil health and improve infiltration and retention.

Nature-based Practices with Hazard Mitigation Co-Benefits

Nature-based practices are commonly implemented in water quality programs and can meet multiple goals by increasing resilience to impacts from natural hazards while protecting, managing, and restoring natural or modified ecosystems.

The examples are not intended to be a complete list of nature-based solutions or mitigation practices.



Benefits of Collaborating Across Hazard Mitigation and Water Quality Programs

Today's Speakers

- **Kathleen Dennis**, Mill Creek Watershed Association
- **Abby Hall,** US Environmental Protection Agency
- **Joel Miller,** Town of Nolensville
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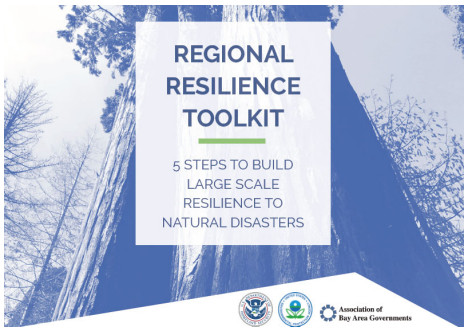
Building Regional Resilience Nolensville, Tennessee

Abby Hall, U.S. EPA
Kathleen Dennis, Mill Creek Watershed Association
Joel Miller, Town of Nolensville

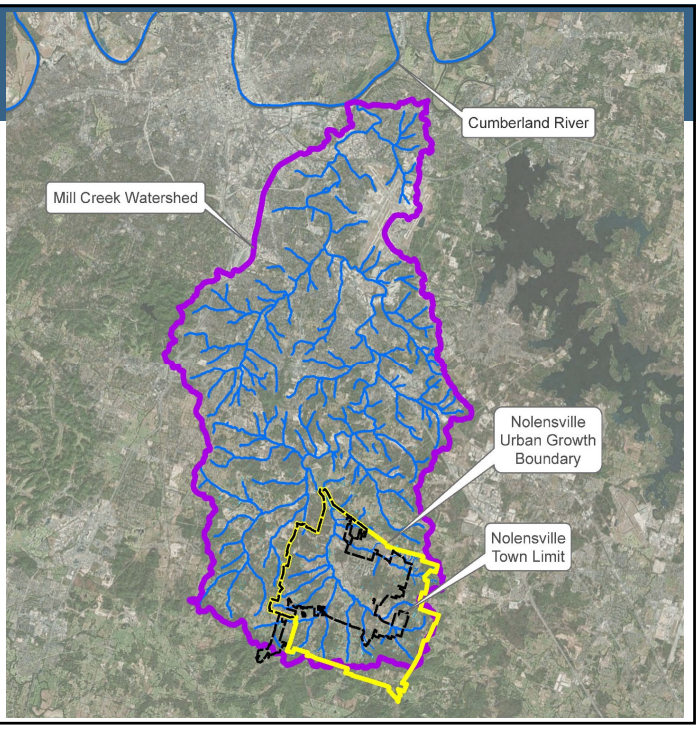
Building Blocks for Regional Resilience



- Free technical assistance from U.S. EPA using the Regional Resilience Toolkit
- Aligns with different plan requirements
- Emphasizes the need for action, not process.
- Brings partners to the same table to create a common action plan and next steps.
- Coordinates local action to amplify disaster resilience within a regional context.

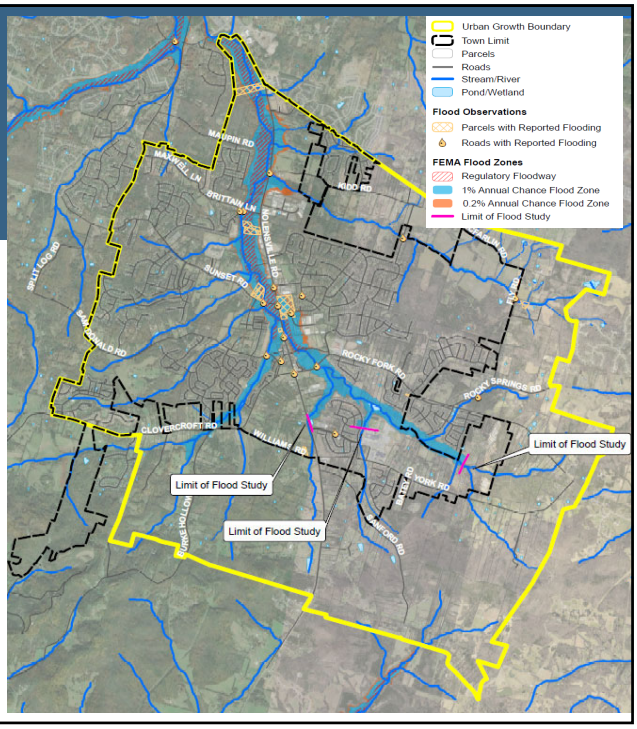
Partnership

- Mill Creek Watershed Association + Town of Nolensville
- Nolensville is at the headwaters of the Mill Creek Watershed



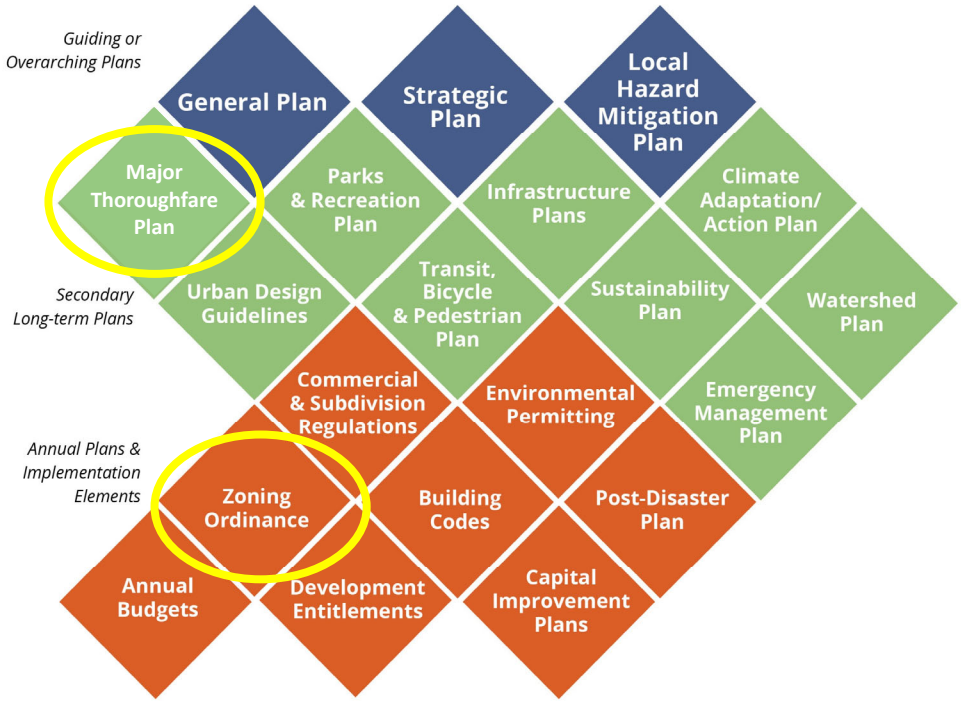
Changes in Climate & Land Use

- Increases in extreme precipitation, plus more impervious surfaces, is expected to increase the frequency and severity of flood events in the Mill Creek Watershed.
- Projections show up to a 39% increase in the number of days with historically high flow by 2050.



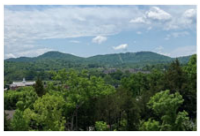
Nolensville's Resilience Goals

1. Protect the integrity of Mill Creek and its tributaries
2. Mitigate flood risk
3. Provide open space accessibility and connectivity
4. Preserve a sense of place and community character in Nolensville



Soak up the Rain

Protect Stream and Wetland Buffers



Conserve Land

Make Room for the River

Activate and Celebrate Mill Creek

Open Space and Conservation Planning

- Develop an open space and conservation plan that identifies current and future areas targeted for active and passive recreation, habitat conservation, and floodplain and headwaters protection.
- Partner with conservation agencies and organizations, such as TDEC and TennGreen Land Conservancy, to pursue land conservation through acquisitions and conservation easements.
- Coordinate with statewide projects, such as the upcoming update to the Mill Creek Conservation Opportunity Areas (COA) as part of the State Wildlife Action Plan.

Transportation Planning

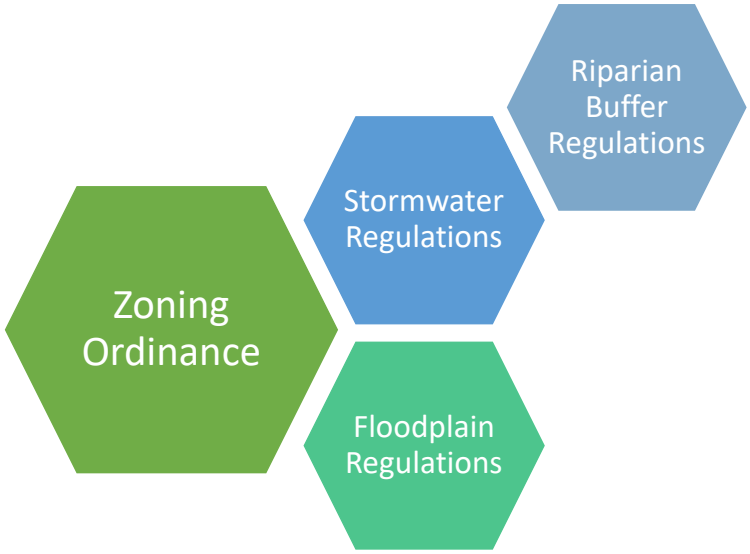
- Current and future transportation challenges
- How siting and design of transportation infrastructure can better reflect resilience goals.

Green Infrastructure Retrofits

- Update map of municipal drainage infrastructure
- Identify public open spaces that could be retrofitted with green infrastructure
- Example: Riparian buffer pollinator garden at the Nolensville High School

Roy Arthur Stormwater Park in Knoxville features rain gardens, wetland ponds, riparian buffers, interpretive signs along paths, and a kayak/canoe launch.

Regulatory Alignment



Green Corridor Overlay

- Design standards for:
  - Trees and plants
  - Trails, viewpoints, seating, water access points, and interpretive and wayfinding signage.
  - Buildings, where permitted.
- Requirements for contiguous natural open space
- Lower allowable impervious cover ratio, compared to the base zone allowance.
- Use restrictions for setbacks from floodplain and waterway natural area boundaries.
- Incentives for dedication of additional public amenities, greenway provisions, additional conservation land and/or additional restoration.

THANK YOU!

Abby Hall
hall.abby@epa.gov

Joel Miller, Commissioner
jmiller@nolensvilletn.gov

Kathleen Dennis, Director
millcreekwatershedassociation@gmail.com

Incorporating Green Infrastructure/Low Impact Development, Open Space, and Nature Based Systems into Hazard Mitigation Plans: Denton County Case Study

Fouad H. Jaber, PhD, PE
Professor and Extension Specialist
Biological and Agricultural Engineering
Texas A&M AgriLife Extension
Dallas Research and Extension Center

David Reazin
Physical Scientist
EPA Region 6
Dallas, TX

What is Green Infrastructure?

- **Green infrastructure (GI)**
  - nature-based approach to water management
  - engineered natural solutions
- Benefits :
  - flood reduction
  - water quality improvement
  - improved aesthetics,
  - habitat for wildlife
  - property loss prevention
  - recreational opportunities
  - carbon sequestration
  - etc.

Natural Hazard Mitigation Plans

- Risk assessment
- Mitigation strategy
- Action items
- Implementation and monitoring strategy

How is GI Flood Hazard Mitigation?

- **Flood hazard mitigation** aims to reduce or eliminate the long-term risk associated with flooding.
- Green infrastructure projects are localized, pre-disaster management practices that hold floodwater, **lessening the severity of flooding for the contributing watershed.**

NYT,

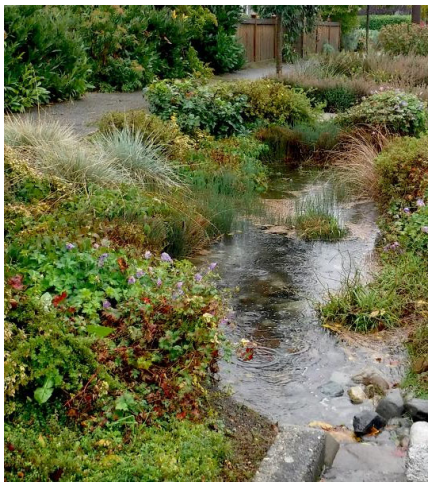
Why include GI in a Hazard Mitigation Plan?

- **GI** is based on **natural practices**
- Over the last century, advances in technology have moved communities to embrace **gray infrastructure**.
- **Gray infrastructure is not working**. Especially in rapidly developing areas, we see more and more localized flooding due to the increase in impervious surface cover.

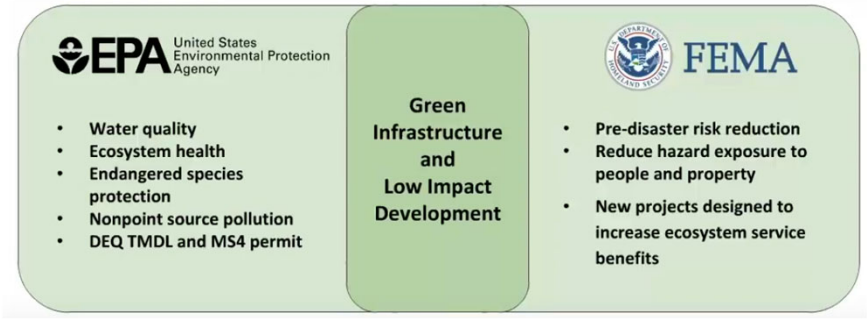
April 24, 2007

GI/Hazard Mitigation Strategy

- Currently GI is not in the tools considered to mitigate floods and other natural hazard risk
- Integration in National Hazard Mitigation Planning (NHMP) institutionalizes GI/LID for hazards
- Provides mechanism to leverage funds to be directed to GI/LID
- Promotes GI/LID co-benefits



EPA and FEMA Objectives



Objectives of this study

- To study the feasibility of integrating GI/LID in Natural Hazards Mitigation Plan (NHMP) for Denton County green belt jurisdiction.
  - analysis of the current status of NHMP, GI/LID ordinances/regulations
  - working with stakeholder groups
  - developing tools (GIS) to enhance GI/LID adoption in NHMP
  - developing recommendation for the implementation of the GI/LID NHMPs

Stakeholders

- Traditional: Emergency managers, public works, fire specialists, and law enforcement
- This project adds: Natural resources managers, floodplain specialists and water quality specialists
- Increase communications between the stakeholders that traditionally work with FEMA and TDEM and stakeholders that work with EPA and TCEQ/TSSWCB

Co-benefits

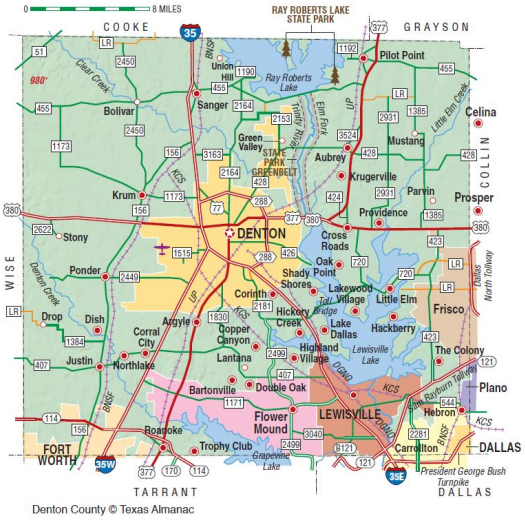
- Reduce flood and improves water quality
- Improves community benefits
- Reduce fire hazards
- Economic benefits:

  "Society saves $6 for every $1 spent through mitigation grants funded by … federal agencies…"

  The National Institute of Building Sciences

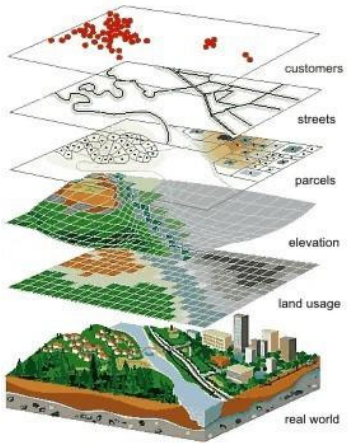
Jurisdictions

Town of Argyle, City of Aubrey City of Corinth, Town of Cross Roads, City of Denton, Town of Double Oak, Town of Flower Mound, Town of Hickory Creek, City of Highland Village, City of Justin, City of Krugerville, City of Krum, City of Lake Dallas, City of Lewisville, Town of Little Elm, City of Pilot Point, Town of Ponder, City of Roanoke, City of Sanger, Town of Shady Shores, City of The Colony.

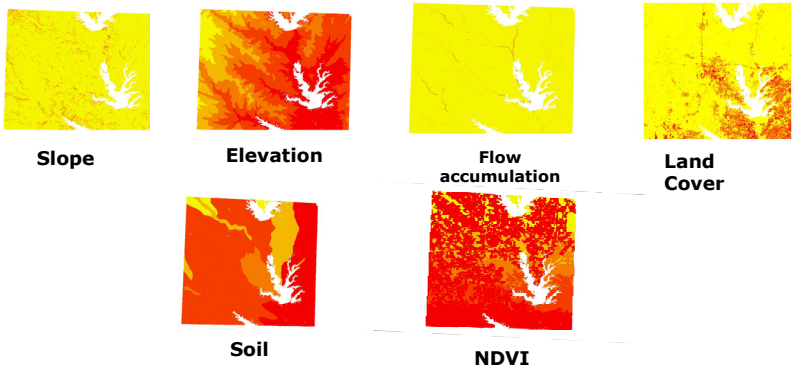


GIS Tool (1)

- Will allow various cities to identify the most critical locations for GI/LID implementation
- Slope, Elevation, Soils, Land use, NDVI, flow accumulation and ranked from 1 to 5.

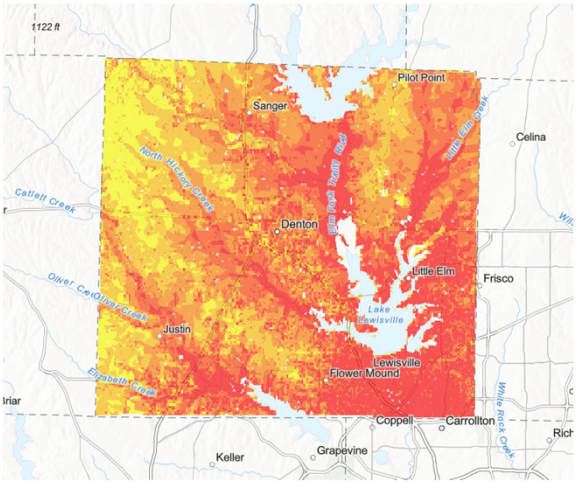


GIS Tool (2)

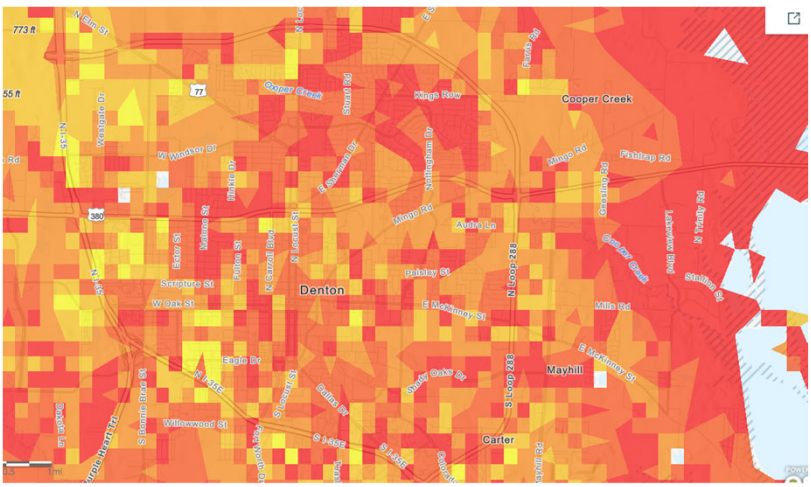


- Resulting map will indicate flood prone areas. These areas will be overlaid with a landuse map and opportunities to propose optimal locations for GI. Map available in ESRI story Maps.
- The critical areas will be connected to hazard mitigation by providing simple analysis that can demonstrate the impact of GI in Flood mitigation.
- Up to three recommended actions will be developed.

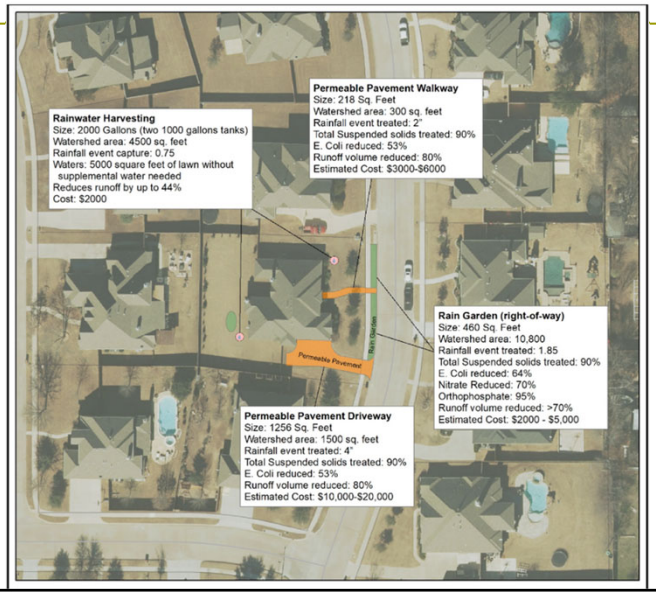
Denton County Flood Priority Map



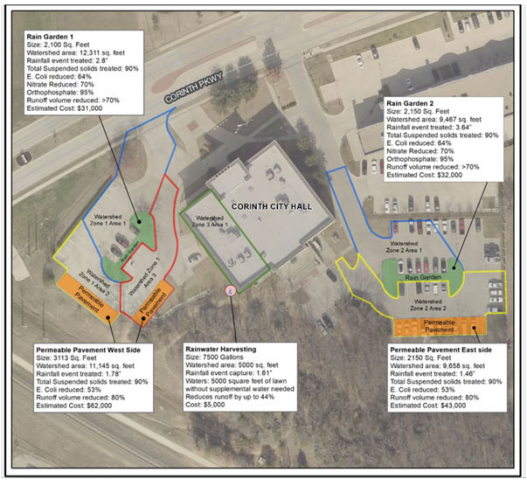
City of Denton Flood Priority



Residential design example



Commercial Design Example



Integrating GI/LID into Hazard Mitigation Plans

- Hazard Mitigation Plan: 44 CFR Part 201.6
  - Include localized flood areas as well as areas affected by bank overflow of streams.
  - Include programmatic/non-structural language that may include smart growth policies and practices
  - List specific practices and include in Action Plan Template (List and description of practices and Template provided in Report)

Hazard Mitigation Plan

- Planning Process
- Risk Assessment
- Mitigation Strategy - includes Action Plan
- Plan Maintenance Process
- Documentation

Mitigation Strategy

- Mitigation Goals to reduce long-term vulnerabilities
- Identifies and analyzes a comprehensive range of specific actions and projects
- Action plan how actions will be prioritized, implemented, and administered
- Multi-jurisdictional plans – actions specific to the jurisdiction requesting FEMA approval

Cost of GI to include in Action Plan

- Example of size and number of practices:
  - 10% of parks and open areas bioretention areas
  - 34% of parking lot and street medians, commercial sidewalks and plant strips bioretention areas
  - rainwater harvesting tank of 1000 gallons per house
  - A 200 square feet rain garden per backyard
- Other practices such as tree boxes can be integrated in commercial sidewalks
- Existing detention ponds can be transformed into constructed wetlands
- Structurally capable buildings can integrate a green roof
- Parking lots can be built with permeable paving materials

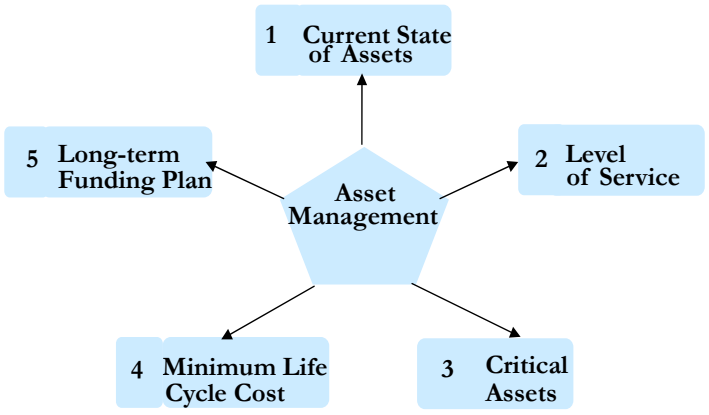
Average Cost of Practices in Literature

	Bioretention Area	Rain Garden	Rainwater Harvesting	Permeable pavement	Green Roof
Cost	$15/sq. ft.	$10.5/sq. ft.	$1.75/gallon	$20/sq. ft.	$25/sq. ft

Example:

- **Bioretention: for 10,000 sq. foot park, a 1,000 sq. feet bioretention would cost:**
  - **1,000 sq. feet x $15/sq. ft = $15,000**
- **Rain Garden: for each back yard a rain garden would cost:**
  - **200 sq. feet x 10.5/sq. ft = $2,100**
- **Rainwater Harvesting: For each house, a rainwater harvesting system would cost:**
  - **1,000 gallons x $1.75/gallon = $1,750**
- **Permeable pavement: Each 200 sq. foot parking space would cost:**
  - **200 sq. feet x $20/sq. ft = $4,000**
- **Green roof: a 1,000 sq. foot of green roofs would cost**
  - **1,000 sq. feet x $25/sq. ft = $25,000**

Overview: Green Asset Management Project



EPA Publication - Asset Management: A Best Practices Guide EPA 816-F-08-014 April 2008

Conclusions

- GI is a nature-based solution to flooding
- GIS tool (can be replicated) for Denton to assess risk of flooding
- Stakeholder meetings helped guide the process
- Step by Step Guide for integrating GIS in Hazard mitigation plan developed

https://agrilife.org/lid/projects/incorporating-gi-lid-nature-based-systems-hazard-mitigation-plan/

Contacts

TEXAS A&M AGRILIFE RESEARCH | EXTENSION

Fouad H. Jaber, PhD, PE
Professor and Extension Specialist
Biological and Agricultural Engineering
Texas A&M AgriLife Extension
Dallas Research and Extension Center
f-jaber@tamu.edu
972-952-9672

EPA Region 6

David Reazin
Physical Scientist
reazin.david@epa.gov
214-665-7501

Ninemile Creek Restoration – Reducing Sediment and Increasing Resilience

Paul Parson, PE
Trout Unlimited – Clark Fork Project Manager
Eric Trum
Montana NPS Management Program

EPA Watershed Academy
May 24, 2022
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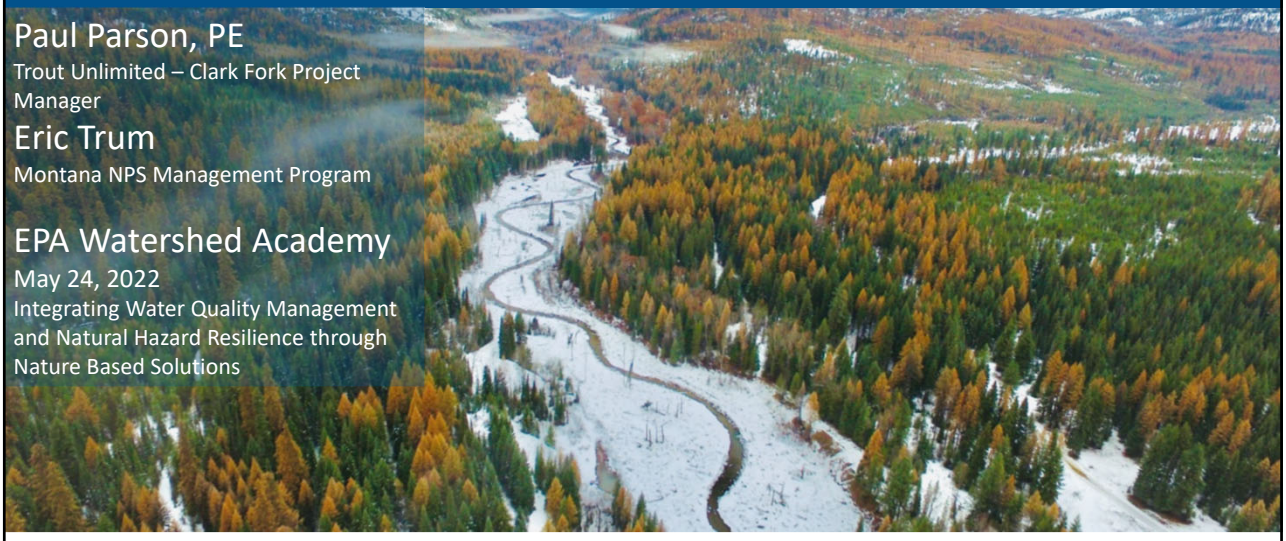

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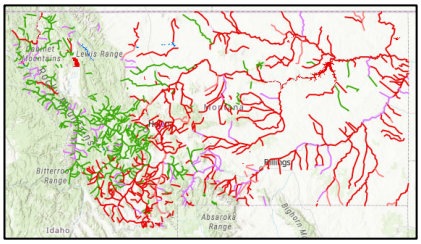
2020 Integrated Report - Impairments

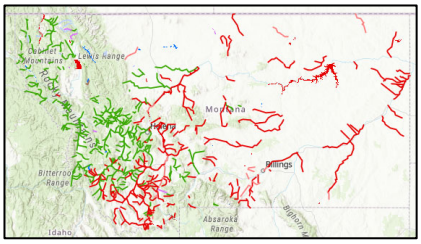


All Impairments

Table 7. Common Causes and Cause Groups

Cause or Cause Group	Total River Mileage Impaired by Cause	% of River Miles that have been Assessed that are Listed as Impaired by Cause*	% of Perennial Rivers Excluding ORW and Tribal Waters that are Listed as Impaired by Cause*	Total Lake Acreage Impaired by Cause	% of Lake Acres that have been Assessed that are Listed as Impaired by Cause*	% of Named Lakes 5 Acres or Larger Excluding ORW and Tribal Waters that are Listed as Impaired by Cause*
Habitat (4C)	10,226	49%	21%	9,446	2%	2%
Metals	7,524	36%	15%	392,132	78%	66%
Mercury	1,663	8%	3%	311,192	62%	52%
Nutrients	7,231	35%	15%	111,479	22%	19%
PCBs	75	0.36%	0.15%	60,622	12%	10%
Salinity	2,919	14%	6%	16,191	3%	3%
Sediment	8,220	40%	17%	10,948	2%	2%
Temperature	2,717	13%	5%	0	0%	0%

*An assessed AU is an AU with at least one use support determination.



Sediment Impairments

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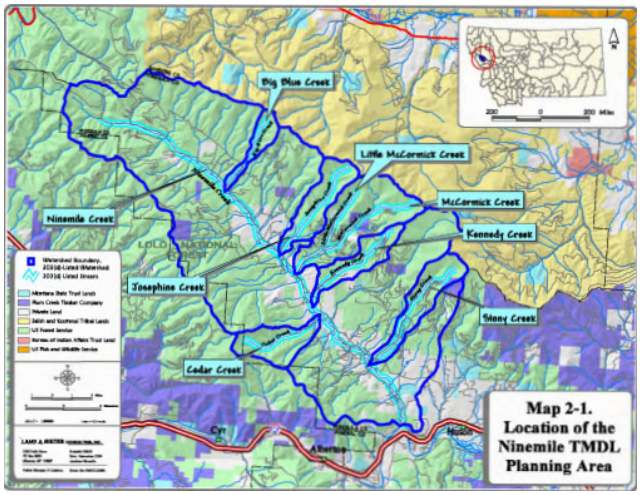
Ninemile Creek Watershed



TMDL Sediment Reductions

- Josephine Creek: 54.8 tons/year, 92.8%
- McCormick Creek: 164.5 tons/year, 92.2%
- Kennedy Creek: 49.9 tons/year, 93.8%
- Stony Creek: 55.9 tons/year, 28.8%
- Cedar Creek: 55.6 tons/year, 60.9%
- Ninemile Creek: 2,868 tons/year, 74.3%

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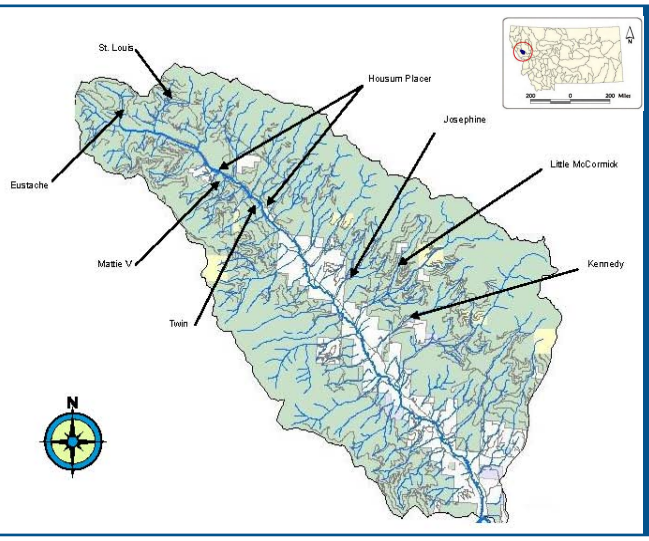
Project Timeline



- Impairments Identified – 1996
- TMDL Completed – 2005
- Eustache Creek - 2006
- McCormick Creek – 2009
- Mattie V Creek 2010
- St. Louis Creek – 2011
- Twin Creek – 2012
- WRP Completed - 2013
- Ninemile Creek - 2014
- Sawpit Creek – 2014
- Kennedy Creek - 2015
- Martina Creek – 2016
- Ninemile Creek Phase 2 – 2016
- Ninemile Creek Phase 3 – 2018
- Burnt Fork Creek – 2020
- Ninemile Creek Phase 4 – 2020
- Ninemile Creek Phase 5 – 2021
- Soldier Creek - 2021

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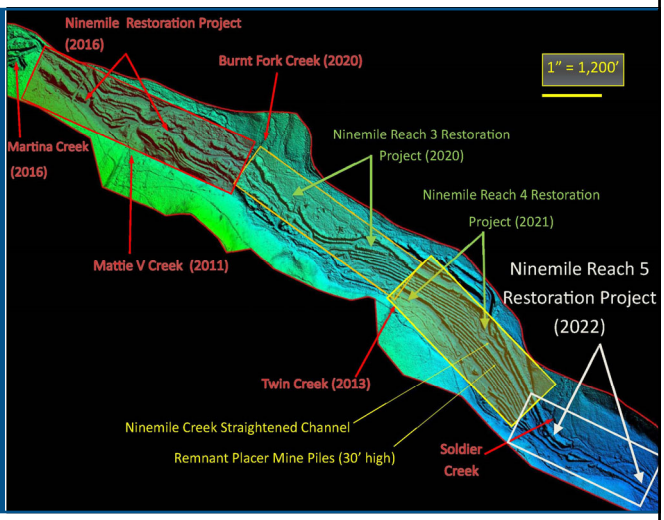
Ninemile Creek

Heavily impacted by historical mining

- Channelized
- Disconnected floodplain
- High eroding banks

➢ Impairment Causes
  - ➢ Sediment
  - ➢ Flow modification



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TIMELAPSECAM
25 AUG 2016 01:00 pm


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04 OCT 2016 04:00 pm


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2020 Integrated Report - Impairments

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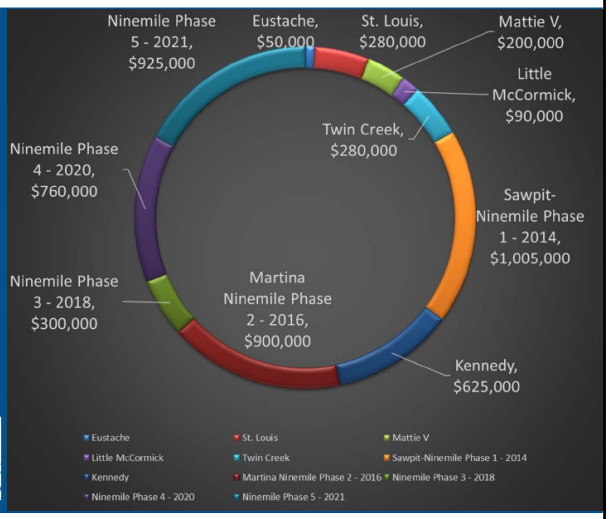
Funding

Total Cost - $5,415,000

- DEQ 319 - $1,175,000
- Lolo National Forest
- DNRC
- FWP
- FEMA/DES
- Ninemile Landowners
- Missoula County
- University of Montana
- Big Sky Brewing
- Turner Foundation
- NWF
- Northwestern Energy
- Tiffany & Co.
- River Design Group



Outcomes

Five Miles of Active Restoration

- Leveled 100 acres of floodplain
- Restored sinuosity
- Added floodplain roughness and habitat
- Reduce Sediment loading by over 1000 tons/mile
- Increase flood storage and late season flows

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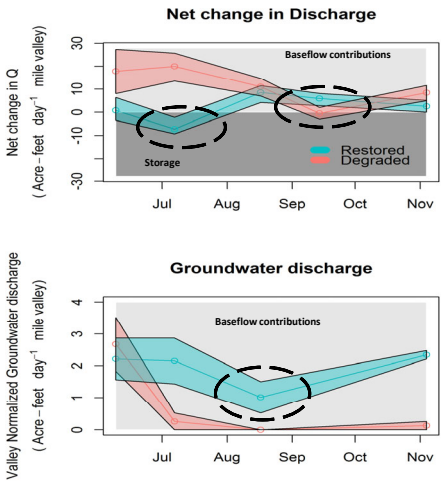

Flood and Climate Mitigation

- $1.2 million FEMA Pre-Disaster Mitigation Grant (PDM)
- This project will benefit community members by
  - decreasing peak runoff
  - providing floodplain storage
  - increasing drought resilience
- Agricultural landowners downstream will realize benefits associated with aquifer storage and increased late season flow

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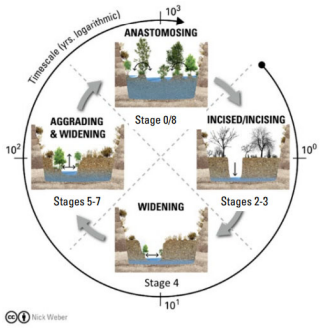
Restoring Natural Processes



DEQ Montana Department of Environmental Quality

TROUT UNLIMITED

Restoring Natural Processes

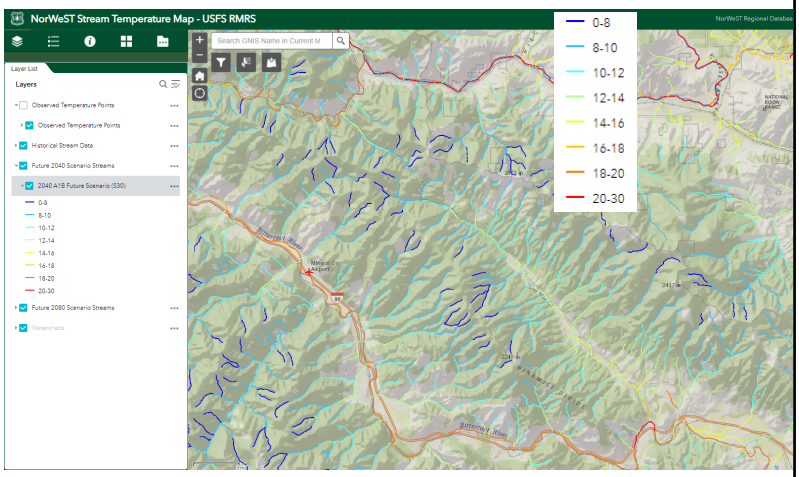


DEQ Montana Department of Environmental Quality

TROUT UNLIMITED

Addressing Climate Change

- Supporting temperature and flow monitoring efforts in Montana watersheds
- Protecting and restoring riparian areas with native vegetation
- Reconnecting rivers with their floodplains, providing additional groundwater storage
- Protecting and restoring wetland areas … contributing to groundwater recharge to streams and rivers
- Protecting and restoring cold water refuges, including deep pool habitat and cool spring and groundwater return flows to rivers and streams
- Supporting local and statewide efforts to increase drought resiliency



https://usfs.maps.arcgis.com/apps/webappviewer/index.html?id=bf3ff38068964700a1f278eb9a940dce

Questions?

Paul.parson@tu.org

Etrum@mt.gov

Participation Certificate

- If you would like to obtain a participation certificate you can access the PDF in the **Handouts** section of your control panel.

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Questions?

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Contact Information

- **Kathleen Dennis**, Mill Creek Watershed Association
  - millcreekwatershedassociation@gmail.com
- **Abby Hall,** US Environmental Protection Agency
  - hall.abby@epa.gov
- **Joel Miller,** Town of Nolensville
  - jmiller@nolensvilletn.gov
- **Fouad Jaber,** Texas A&M AgriLife Extension
  - fouad.jaber@ag.tamu.edu
- **David Reazin,** US Environmental Protection Agency Region 6
  - reazin.david@epa.gov
- **Paul Parson,** Trout Unlimited
  - paul.parson@tu.org
- **Eric Trum,** Montana Department of Environmental Quality
  - etrum@mt.gov

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Watershed Academy Webcasts

More webcasts coming soon!

The slides from today's presentations are posted on the Watershed Academy webpage.

A recording of the webcast will be posted within the next month.

www.epa.gov/watershedacademy

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Thank You!