



# Iowa Stream Restoration Leadership Toolkit

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SOUTH SKUNK RIVER  
AMES, IA

# Iowa Stream Restoration Leadership Toolkit

## What and Who This Document is For

This toolkit provides a summary for elected officials and city staff on how streams become degraded in populated areas and natural design methods used in Iowa for streambank stabilization and stream restoration. It can also be used by local leaders to educate residents. In addition, it includes questions that local leaders can ask design professionals if they are presented with project proposals that include streambank stabilization and restoration. Examples of commonly used practices for stabilization and restoration are included and case studies of stream projects in Iowa communities.

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## Part 1: Restoring Your Community's Most Valuable Asset



Photo of Upper Bee Branch Creek Restoration, Dubuque, IA.

### Why are streams important in your community?

While clean streams can be a beautiful natural element to communities, the value they provide goes deeper than aesthetics. Iowa communities rely on streams for a multitude of functions, including:

- Clean drinking water (public health & safety benefit)
- Recreational amenity (economic development benefit)
- Flood mitigation (hydrological benefit)
- Wildlife habitat & nature conservation (environmental benefit)



Clean, healthy streams have major implications on the local economy and environment.

## What happens when streams in the community start to become unstable?

Streams are dynamic systems that are constantly changing. When streams experience too much stress from excessive drainage, flooding, and water pollution they become unstable and cause bank erosion. If stream instability is allowed to continue unchecked, it can result in further stream degradation that can turn a community asset into a costly liability.

Degradation from stream instability can lead to:

- More frequent localized flooding (clean-up efforts stretch departmental budgets)
- Property damage and devaluation in flooded areas (affects property tax revenue)
- Eroded banks that threaten infrastructure (add expensive capital improvement projects)
- Increased costs to treat polluted water (requires costly treatment upgrades)
- Decreased recreational uses (lost revenue to local economy)
- Loss of aquatic habitat and life (reduces important ecological function)
- Community perspective changes from amenity to eyesore (behavioral changes such as increases in illegal dumping, pollution, crime, etc.)



Examples of stream degradation: Protecting property from flood damage, eroding stream banks, fish kill.

## What causes stream instability?

Communities have built stormwater drainage infrastructure that is extremely efficient at moving stormwater away from developed areas as quickly as possible. In doing so, a significant increase in the volume and the speed of stormwater gets discharged directly into streams. Additionally, the infrastructure does not provide any treatment to remove the pollutants that stormwater carries on its way to streams.

The result is that streams are inundated with a greater amount of water that is being released over a shorter period and carrying with it sediment and other contaminants. For more in depth explanation on how stormwater affects streams, refer to [Part 3](#) of this document.

## How do communities fix unstable streams?

The health of streams can be improved by understanding the drivers of instability and implementing appropriate management actions to reduce them. It takes a combination of best management practices (BMPs) on the land and in the stream to correct instability.

Traditionally, communities have used gray infrastructure, which includes gutters, drains, pipes, and retention basins to manage stormwater. This system is designed to quickly move stormwater away from property through an underground sewer system. However, some communities in Iowa are incorporating green infrastructure BMPs into their stormwater management programs.

Green infrastructure is a watershed management approach that treats and slows the flow of stormwater in a way that more closely mimics the system's natural function. [Part 2](#) of this document outlines several green infrastructure practices that communities can use, which often provide multiple benefits and lessen detrimental impacts to nearby streams and lakes.

### Stormwater Management Approach

Many cities in Iowa have flood management requirements that use green infrastructure BMPs such as detention and retention ponds. Other BMPs that are used to treat stormwater include stormwater wetlands, bioretention cells, bioswales, rain gardens, and permeable pavers among others.



Examples of BMPs include rain gardens, permeable pavers, and stormwater wetlands.

### Natural Area Restoration & Reconstruction Approach

Other types of green infrastructure include the restoration and reconstruction of natural areas, especially those near streams, such as wetlands, oxbows, prairie, and woodlands. Local policies such as stream buffering and post construction stormwater management are important too.

### Stream Restoration Approach

The third approach is stream restoration that includes engineered BMPs used to return function and health to streams by addressing eroded banks and channels along a stream or river corridor



using proven natural methods. It can include grade controls, floodplain restoration, streambank stabilization, stream buffering, and vegetation restoration.

### Stream Stabilization of the Past

A common “quick fix” approach still used today is to place loads of broken concrete and riprap in areas with severely eroded banks. Typically, this is done without any stream assessment to determine the best restoration approach. This often fails after a few rainfall events.



Placement of riprap is often used to stabilize streams and protect nearby infrastructure.

### Stream Stabilization and Restoration in the Future

Many communities are shifting their approach to include stabilization and restoration methods that address natural stream function. Projects begin with a comprehensive stream assessment to identify suitable BMPs that emphasize the incorporation of natural materials, such as logs, stone, and live plantings. Some of the more commonly used practices include longitudinal peaked stone toe protection, j-hook vanes, rock arch rapids, oxbows, riparian corridor restorations, and tree/shrub plantings.



Practices such as rip rap used in the past.



Practices such as bendway weirs used in the future.

Stabilization of the Past	Stabilization & Restoration of the Future
<b>Benefits</b> <ul style="list-style-type: none"> <li>• Can be implemented quickly</li> <li>• Simple to install</li> <li>• Easy to source material</li> </ul>	<b>Benefits</b> <ul style="list-style-type: none"> <li>• Based on tested, engineering methods</li> <li>• Addresses the unique characteristics of each stream</li> <li>• Incorporates natural materials into design</li> <li>• Enhances wildlife habitat</li> <li>• Provides flood mitigation</li> <li>• Vegetation filters and infiltrates stormwater</li> </ul>
<b>Drawbacks</b> <ul style="list-style-type: none"> <li>• No assessment to determine causes of degradation</li> <li>• Prone to failure after large rainfall events</li> <li>• Does not provide flood mitigation or treatment of stormwater runoff</li> <li>• Continuous repair needed</li> </ul>	<b>Drawbacks</b> <ul style="list-style-type: none"> <li>• Not all practices may be feasible in constrained areas such as narrow urban stream corridors</li> </ul>

## Part 2: Introduction to Stream Restoration

The purpose of stream restoration is to mitigate or correct damaging impacts of stormwater discharges to streams. Stream restoration best management practices include:

1. Grade control
2. Vegetative restoration
3. Riparian buffering
4. Floodplain restoration
5. Streambank protection/stabilization
6. Dam mitigation
7. Culvert adjustment

**Grade control** – Grade control refers to practices that provide vertical stability in a restored stream. Such practices can also prevent relatively stable sections of upstream channel from becoming degraded, which can lead to years or even decades of excessive erosion.



Photos from Iowa's River Restoration Toolbox, IDNR.

**Vegetative restoration** – Vegetative restoration provides stream bank stability while improving the ecological function of both the stream and riparian area. Vegetative restoration is preferred because it slows water flow, provides natural beauty, and creates habitat.



Photos from Iowa's River Restoration Toolbox, IDNR.

**Riparian buffering** – Riparian buffers are areas of vegetation located adjacent to streambanks. They typically consist of native trees, shrubs and plants that provide a link between terrestrial and aquatic ecosystems. They improve bank stability, aquatic and terrestrial habitat, biodiversity, and water quality.



Photos from 2030Palette.org

**Floodplain restoration** – Floodplain restoration provides floodwater storage during rain events, provides ecological and recreational benefits, helps regulate peak flows, helps recharge groundwater, and prevents erosion.





Photos from Iowa's River Restoration Toolbox, IDNR.

**Streambank toe protection** – The toe is the area of the streambank located below the ordinary high water mark that is susceptible to erosion. Stabilization techniques protect streambanks from high velocity flows and provide near bank stress reduction. Streambank toe protection and stabilization techniques include a variety of structures.



Photos from Iowa's River Restoration Toolbox, IDNR.

**Dam mitigation** – Many dams constructed in Iowa are aging and/or at risk of failing, which can be a public safety hazard and economic liability. Others may be no longer functional or causing unintended issues such as impeded sediment transport, reduced aquatic habitat, barriers to fish movement, and diminished recreational activities. Dam removal, the addition of rock ramps, or the creation of recreational structures can alleviate these issues and add benefits for a community.



Photos from Iowa Whitewater Coalition of South Skunk River Dam Mitigation, Ames, IA.

**Culvert adjustment** – Culverts designed and constructed in an ecological manner provide floodwater conveyance while maintaining transport of sediment, ecological connectivity, and fish passage. A properly designed culvert can reduce maintenance, prevent erosion, which in turn results in cost savings over time.



Photos from Iowa's River Restoration Toolbox, IDNR.

## Part 3: How Stormwater Affects Streams

### What is stormwater runoff?

Historically when it rained in Iowa, most of the rainfall soaked into the organic rich soils found in prairies. Streams were fed mainly through groundwater recharge.

Now, as ground surfaces in our communities are paved over or built upon, the rainfall has few areas to infiltrate into the soil. The water that drains off impervious surfaces such as streets, parking lots, driveways, roof tops and compacted soils is called stormwater runoff.

The concern with stormwater runoff is how it is managed locally for water quality and quantity or flood control. Most stormwater is released directly into a stream without any treatment. Some communities use detention (dry basins) and retention (wet basins) to temporarily hold back stormwater during major rainfall events and release it more slowly to a stream to minimize localized flooding impacts.

### **What are stormwater impacts in populated areas?**

Once 10% of a watershed (drainage basin) has been converted to impervious surfaces, significant changes occur. The increase in stormwater runoff from development is quickly collected into the storm sewer drainage system and discharged. This results in impacts such as:

1. Groundwater is no longer recharged
2. Surface water in rivers, streams and lakes becomes polluted
3. Streambanks and channels are degraded
4. More frequent localized flooding occurs

#### **Less Groundwater Recharge**

The slow infiltration of rainfall into the surface of the soil and downward percolation through the soil profile is essential for replenishing groundwater stored in underground aquifers. When development occurs, impervious surfaces prevent rainwater from infiltrating into the soil and decreases groundwater recharge rates. Most Iowans depend on groundwater as a source of drinking water, so it's important to replenish groundwater supplies when possible.

#### **Water Pollution**

Stormwater can carry many pollutants that have negative impacts on water quality. Some of these pollutants include sediment from eroded streambanks and unprotected construction sites; bacteria from animal waste and failing septic systems; excess fertilizer and pesticides from lawncare; chlorides from salt and deicers used in the winter; fuel and heavy metals from leaking vehicles; trash; and even thermal pollution.





**Stormwater runoff carries pollutants directly to the stream without any treatment.**

### **Streambank Erosion**

Stormwater runoff empties into our streams causing flashy flows during heavy rains. That exposes the bed (bottom) and bank (sides) of a stream to highly erosive flows more often and for longer periods of time. Streams typically respond to this change by getting wider and/or deeper. This adds to greater amounts of sediment in streams. Streams try to correct the influx of sediment by trying to find a state of equilibrium, which results in the stream changing its shape. This often causes undesirable impacts to nearby properties and aquatic life within the stream.



**Streambank erosion in developed areas often threatens nearby infrastructure.**

### **Flooding**

Streams are historically sized to handle only so much water. When more water is generated than a stream channel can handle, the water spill over the adjacent areas bordering streams called the floodplain. When development occurs in the floodplain, damages to property and downstream drainage structures can occur. Developed areas are especially prone to “flash” floods, as the water comes and goes quickly, and can be destructive to structures and aquatic life in streams.

## Part 4: Stream Restoration Case Studies

### City of Dyersville – Bear Creek Restoration Project



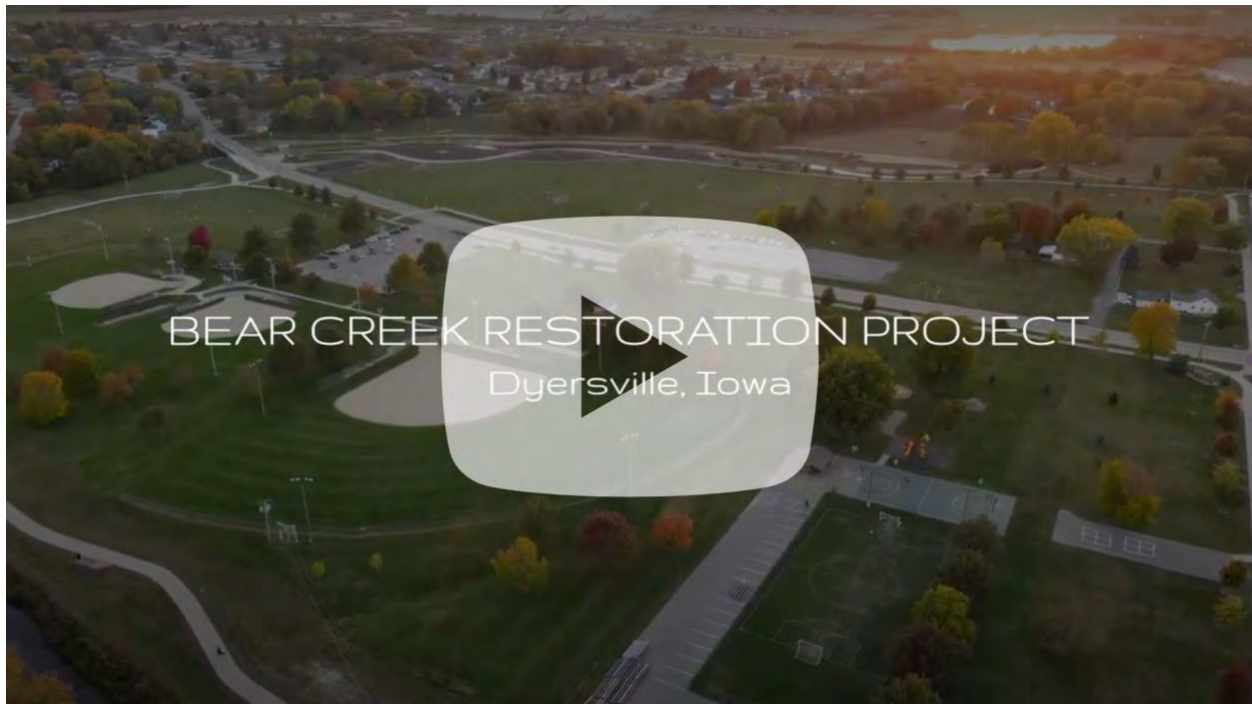
Photo and image from Impact 7G.

The City of Dyersville Bear Creek Restoration project included assessment of approximately 2,500 linear feet of Bear Creek using Iowa's River Restoration Toolbox. The finished project, completed in 2019, included 4.2 acres of riparian buffer seeded with Iowa native plants, a half-acre of oxbow restoration, and over 1,500 linear feet of stream restoration practices (fish habitat improvements, inner streambank benches, cross vanes, and j-hooks). [Additional details can be found on the project website.](#) Construction costs (not including assessment, planning & design) were roughly \$900,000.



[Watch the video](#) to learn more about:

- Impacts of stream instability (Before scenario)
- Financial / Economic statistics
- Stream assessment used to select BMPs
- How the project ties into the Field of Dreams Watershed Plan
- Benefits / Successes of project (After scenario)



### Polk County Iowa – Four Mile Creek Watershed Project



Photo from Polk County of recent stream restoration completed along Lower Fourmile Creek.



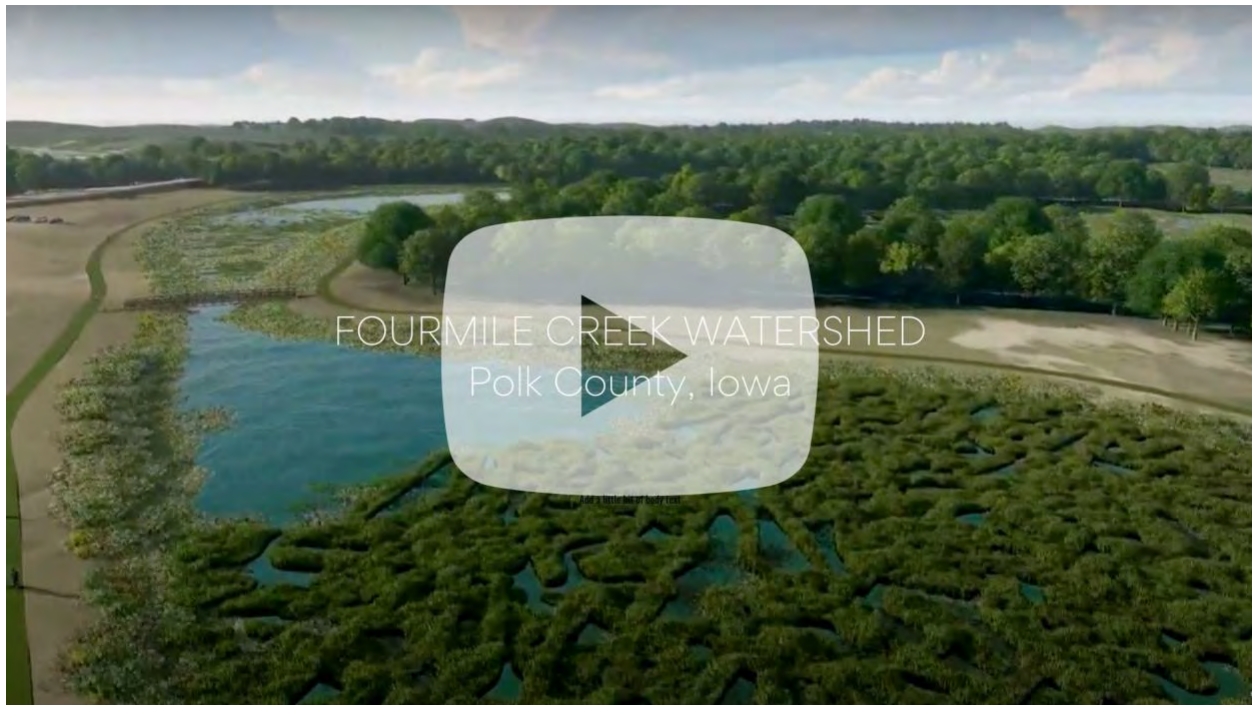


Image from Fourmile Creek Greenway Master Plan.

Polk County Conservation, along with its many partners, has a plan to transform the Fourmile Creek Greenway. The vision consists of a corridor of natural areas that provides wildlife, water quality, and flood reduction benefits in the heart of Des Moines. Restoration efforts in the stream and surrounding landscape are currently underway and scheduled to continue over the next 5-7 years. [For additional information on restoration plans visit the Fourmile Creek Greenway website.](#) Estimated construction cost for stream restoration is around \$300-\$500 per linear foot.

[Watch the video](#) to learn more about:

- Impacts of frequent flooding (Before scenario)
- Assessment used to select BMPs
- How stream restoration fits into the Fourmile Creek Greenway Plan
- Project timeline
- Benefits / Successes of project (After scenario)



## Part 5: Iowa's River Restoration Toolbox

The Iowa Department of Natural Resources (IDNR) created [Iowa's River Restoration Toolbox](#), in partnership with Iowa Rivers Revival (IRR) and other organizations. The goal of the toolbox is to provide a consistent approach on how to conduct stream assessments and correct streambank erosion using effective and reliable BMPs.

The toolbox is used to guide multidisciplinary teams involved in stream stabilization and restoration projects. It consists of an assessment tool with interactive spreadsheets, BMP selection process and reviewable design checklists to aid decision making. Detailed drawings and specifications are also provided to assist with project bidding. All practices are adapted to Iowa conditions.



**Stream assessment includes measuring channel dimensions, degree of bank and slope erosion, bed materials, and vegetation health and diversity.**

The use of the toolbox ensures that appropriate, cost-effective BMPs are used for each unique stream system and will serve as a guide for local communities. All the BMPs discussed in [Part 2](#) of this document are included in the toolbox.

Funding programs such as the IDNR State Revolving Fund Sponsored Projects require the use of the toolbox as an eligibility requirement. [Part 8](#) of this document includes a comprehensive list of funding opportunities for stream restoration projects.

Improvements and refinements continue to arise in the stream and watershed restoration fields. Therefore, it is recommended that city/county staff, design engineers, and project managers complete periodic training offered by IRR/ISWEP to stay up to date on how to effectively implement the toolbox BMPs.

## Part 6: Questions Local Leaders Should Ask

Stream restoration is complex and requires collaboration among a multidisciplinary team. While local leaders may not have the same level of technical expertise, they can and should ask thoughtful questions about appropriate management actions to correct stream instability.

Following is a list of questions local leaders should ask city/county staff and professional design consultants when discussing stream stabilization and restoration projects:

✓	<b>What are the goals of the community, watershed management authority, and/or watershed plan? (Quality of life, water quality, flood mitigation, habitat conservation, etc)</b>
✓	<b>Have city/county staff or consultants participated in Iowa's River Restoration Toolbox training?</b>
✓	<b>Have city/county staff reached out to the IDNR to ask their perspective on the project and its alignment with the River Restoration Toolbox best practices?</b>
✓	<b>Has the River Restoration Toolbox BMP Decision Tool been used to assess the stream and determine appropriate solution to stream instability?</b>
✓	<b>What are the expected results from the stream restoration project? What will the finished project look like?</b>
✓	<b>How will the stream restoration project impact neighboring properties?</b>
✓	<b>What methods will be used to communicate with affected property owners and community members?</b>
✓	<b>How much will the stream restoration project cost? What is the cost of doing nothing to correct stream instability?</b>



## Part 7: Talking Points for Local Leaders

Stream restoration projects are not well understood by all members of the community. Local leaders will face difficult questions from residents and businesses alike. To dispel common misconceptions about stream restoration projects and increase local buy-in and support for these projects, here is a list of talking points for local leaders.

1. **Streams are a natural asset that provide valuable benefits to our community:** Benefits include clean drinking water, flood mitigation, habitat conservation, economic development opportunities, as well as a place to meet and play with friends and family.
2. **Doing nothing costs more money in the long term:** Streams that experience too much stress from excessive drainage, flooding and pollution become unstable and have major implications for a community's finances. Taxpayers spend more money on flood response and cleanup, as well as expensive projects to protect and upgrade existing infrastructure. In addition, the local economy suffers when people stop using streams for recreational purposes.
3. **Flood mitigation and pollution control is important now:** Unstable streams are a consequence of redirecting rainwater using buried storm sewer pipes. When it rains, streams are inundated with a larger amount of faster, dirtier stormwater being released over a shorter period than it is meant to handle. Developed areas are especially prone to "flash" floods, as the water comes and goes quickly, and can be destructive to structures and aquatic life in streams.
4. **Stream restoration best practices improve quality of life for our communities:** Communities can implement a variety of best management practices that will better manage stormwater as well as protect and restore streams. Stream restoration involves constructing BMPs included in the Iowa River Restoration Toolbox. These BMPs return function and health to streams by addressing eroded banks and channels using proven natural methods. Common practices include grade control structures, floodplain restoration, streambank stabilization, stream buffering, and vegetation restoration.

## Part 8: List of Funding Resources

Once a community identifies the need for a stream restoration project, the next challenge is identifying how to pay for it. There are a variety of ways to fund a project. Applying for grants and loans are an option. Utilizing volunteers, soliciting donations, and fundraising provide additional ways to offset project costs.

In January 2020, the IDNR compiled an extensive list of funding opportunities for stream restoration projects. [The list of funding opportunities can be accessed on the IDNR River](#)

[Restoration website](#). Keep in mind that this list is not exhaustive and funding availability changes frequently.

## Part 9: Contact List of Partner Organizations

The formation of the Iowa Stream Restoration Leadership Toolkit is a collaborative effort between the Great Outdoors Foundation/ICON Water Trails, Iowa Rivers Revival, and the Iowa Stormwater Education Partnership. Additional support was provided by a Toolkit Leadership Task Force comprised of volunteers representing city government offices, county and state conservation leadership, and conservation groups. Members of the Task Force include:

Hannah Inman, CEO, [Great Outdoors Foundation](#)  
Maggie McClelland, Director, [ICON Water Trails](#)  
Cole Miller, Regional Coordinator, ICON Water Trails  
Luke Hoffman, Executive Director, [Iowa Rivers Revival](#)  
Pat Sauer, Executive Director, [Iowa Stormwater Education Partnership](#)  
Tiffany Wilson Lillard, Special Projects Coordinator, Iowa Stormwater Education Partnership  
Pat Boddy, President, 900 Views, LLC  
Anna Gray, Public Policy Directory, [Iowa Natural Heritage Foundation](#)  
Allison van Pelt, Senior Planner, [Des Moines Area Metropolitan Planning Organization](#)  
Britney Appelgate, Director, [Capital Crossroads](#)  
Johnathon Swanson, Water Resources Supervisor, [Polk County Public Works](#)  
Kate Hansen, Policy Associate, [Center for Rural Affairs](#)  
Nate Hoogeveen, River Programs Director, [Iowa Department of Natural Resources](#)  
Staci Williams, Strategic Development Director, [Bolton and Menk, Inc.](#)  
Tracy Peterson, Municipal Engineer, [City of Ames Public Works Engineering](#)  
Alicia Vasto, Water Program Director, [Iowa Environmental Council](#)

## Part 10: Additional Resources

[IRR River Resources](#)

[ISWEP Residential Guide to Living Near Streams](#)