



—MARION COUNTY—  
**SOIL AND WATER**  
—CONSERVATION DISTRICT—



# STREAM STEWARD GUIDE

— A RESOURCE FOR RIPARIAN PROPERTY OWNERS —





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*Image from Central Indiana Land Trust*

# INTRODUCTION

According to the Merriam-Webster dictionary, the definition of stewardship encompasses “the careful and responsible management of something entrusted to one’s care.” While we play a part in being good stewards of all of our natural resources, protecting and caring for our water quality is foundational to all. Every day we can make choices in our homes, yards, and workplaces which will help guard and improve this valuable resource.

Remember the poster from your old school days of the water cycle? The never-ending circle of the life of a water drop: Precipitation – Infiltration – Overland Flow – Evaporation – Transpiration. Stewardship of our water resources encompasses protecting both surface and groundwater. Both are vital and they are dependent on each other.

Indiana has over 35,000 miles of rivers and streams which provide vast benefits to our state including economic, recreation, fish and wildlife habitat, and ecological functions. The health of these bodies of water directly affects our own economic, physical, and emotional health. Unfortunately, natural and man-made influences have had a detrimental effect on our water quality over the years.

Both individual landowners and land developers can make substantial improvements by the decisions they make. When land developers use best management practices, maintain erosion control throughout their developments, include green space and green infrastructure, landscape with native plants and trees,



FISRWG 2011

and allow ample room for wide buffers along streams which run throughout their developments, many of the water management problems we often experience can be avoided.

This Stream Steward Guide is funded by the Nina Mason Pulliam Charitable Trust’s Partners for the White River initiative and was developed in partnership with Friends of the White River. The purpose of this guide is to help citizens understand how to care for our water resources, from those listening to raindrops on their roofs to landowners living on the White River. Armed with good information, we all can play a part, small or large, to improve & protect this important resource. So join us in becoming a good steward of our water resources.

*Marion County Soil and Water Conservation District is an equal opportunity provider and employer. Contributions to this guide were provided by various member organizations of Circle City CISMA as well as Kevin Tungesvick from Eco Logic, LLC.*

# HEALTHY STREAM



## 1 SETBACKS AND NATURAL BUFFERS

This stream has a wide, healthy riparian corridor that filters pollutants and keeps the stream cool. Very few structures/buildings located close to the streambank allow the stream to connect with its floodplain and give streams room to spread out and balance sediment loads.



## 2 COMPLEX STREAM CHANNEL FEATURES

Healthy streams have a variety of riffles, runs and pools that create habitat for fish, insects and invertebrates that can only survive in waterways with high water quality.



## 3 MEANDERING STREAM CHANNEL SHAPE

Healthy stream channels meander as streams balance their sediment loads and gradually move across the floodplain, a feature often observed in a natural setting where streams have not been artificially straightened.



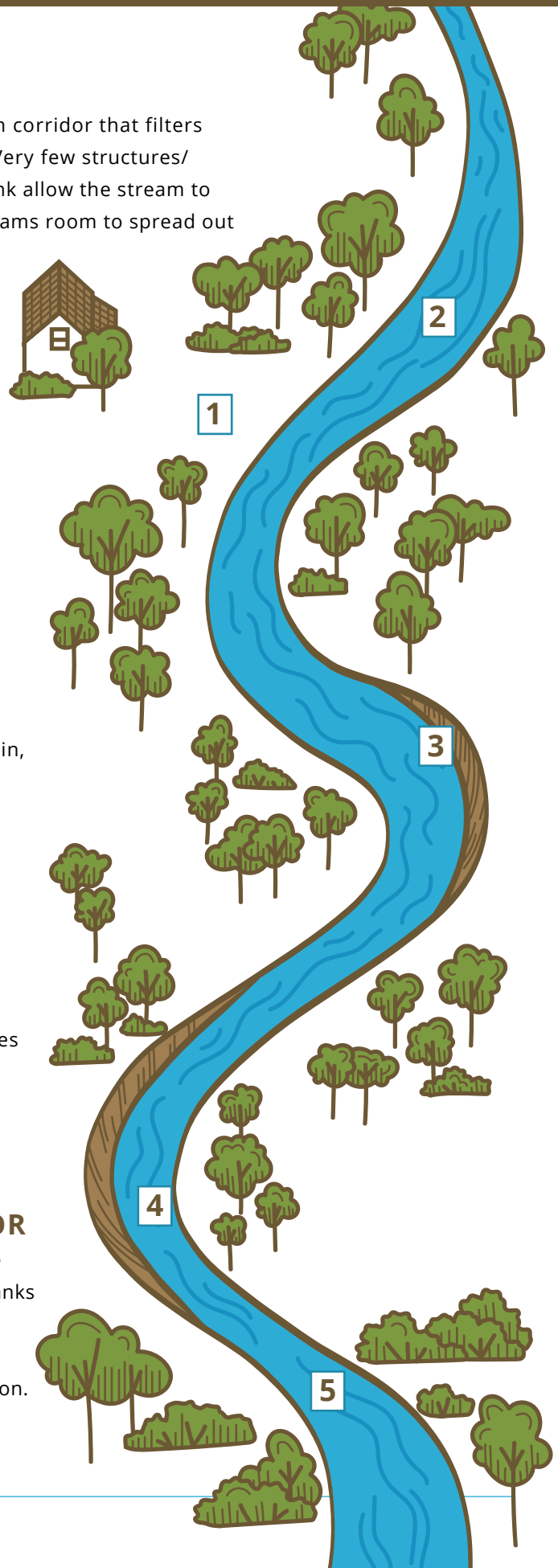
## 4 GENTLE, STABLE STREAMBANK SLOPES

Gentle slopes promote floodplain connection and reduce stress on banks which contribute to erosion that pollutes waterways and clogs streambeds.

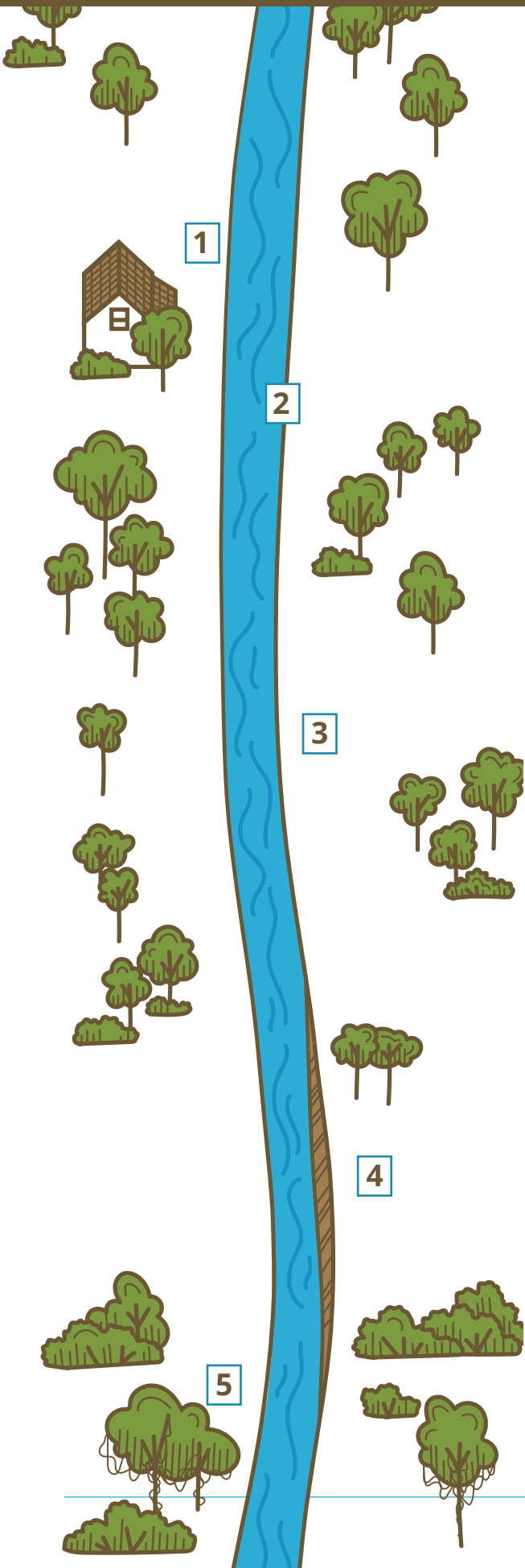


## 5 NATIVE VEGETATION IN RIPARIAN CORRIDOR

Healthy streams have a variety of native trees, shrubs and vegetation on their banks and in the areas adjacent to the stream corridor, helping support wildlife, filter stormwater runoff and preventing erosion.



# UNHEALTHY STREAM



## 1 LACK OF SETBACKS AND BUFFERS

Water quality suffers when structures are allowed to be built too close to streams, occupying areas that perform critical ecosystem services related to flooding and pollutant filtering.



## 2 LACK OF STREAM CHANNEL COMPLEXITY

Streams without riffles, runs and pool complexes speed flow velocity and increase water temperature which reduces water quality.



## 3 STRAIGHTENED STREAM CHANNEL

Many streams and waterways have been straightened to accommodate urban development and agriculture needs, often resulting in downstream erosion and flooding.



## 4 STEEP, UNSTABLE STREAMBANK SLOPES

Steep slopes are subject to erosion and can threaten property while contributing unhealthy pollutant loading to streams.



## 5 INVASIVE VEGETATION IN RIPARIAN CORRIDOR

Invasive vegetation often occupies riparian areas of streams and leads to erosion due to the shallow root systems of these plants and their ability to prevent the growth of native trees, shrubs, wildflowers and grasses by altering growing conditions and soil chemistry.





## WHY STREAMS ERODE



Homeowners often are concerned as they notice changes in the stream that passes through their property. Over the years they may have “lost” part of their yard as the stream has widened or moved from where it was when they first purchased the property. What has happened?

In their natural state, streams are dynamic systems, meandering across their floodplains, cutting on the outside of a curve and depositing on the opposite side. This process of erosion and deposition lengthens the stream and naturally slows the water down. However, streams in urban settings are artificially restricted by development and infrastructure. Confining a stream causes instability and interruption in the natural dynamic equilibrium that would otherwise allow the stream to change slowly and maintain a stable shape over time.

Land-use changes throughout the watershed can lead to stream instability due to changes in the watershed’s **hydrology**. An increase in discharge, water velocities, or sediment load can all contribute to excessive erosion. Urbanization decreases green space, wetlands, and woodlands, which act as natural storage causing streams to accept water that previously had been retained onsite.



Changes in the amount or types of vegetation can also contribute to streambank instability. Deep, dense rooted, and flood-tolerant native vegetation stabilize banks and slow water flow creating a natural erosion control. Loss of native vegetation due to deforestation, farming, construction, or invasive plant species can accelerate erosion and allow banks to become weak and unstable.

In-channel changes disrupt stream balance by causing **aggradation** and **degradation**. Ditching and channelizing a stream straightens it, steepens the slope, and removes roughness increasing the speed and erosiveness of the water. This process affects the stream both above and below the channelized section. Upstream the channel will begin to incise a **nickpoint** forming a **headcut** that migrates upstream. Over time the streambed deepens and the entire stream reach becomes disconnected from its floodplain because it has deepened to a point where floodwaters can no longer reach the top of the stream bank.

Accelerated erosion upstream causes channel aggradation downstream. Sediment is deposited along the flatter valley reaches making the channel too shallow or overly wide. Over time the channel becomes increasingly shallow, laterally eroding the banks and more readily causing flooding. This accelerated erosion not only affects water quality, it also is detrimental to fish and wildlife health and habitat.

## DEFINITIONS

### HYDROLOGY

The scientific study of water on the earth, especially its movement in relation to the land.

### AGGRADATION

Sedimentation of the stream to such a degree that an increase in elevation results.

### DEGRADATION

Lowering of a stream or river bed over time due to erosional processes. Degradation causes several problems including bank instability of the channel and its tributaries.

### INCISED CHANNEL

A stream channel in which the bed has dropped and as a result, the stream is disconnected from its floodplain. Incised channels are often referred to as degraded channels (Stage II, III, and IV in Schumm's CEM).

### NICKPOINT

A part of a river or channel where there is a sharp change in channel slope.

### HEADCUT

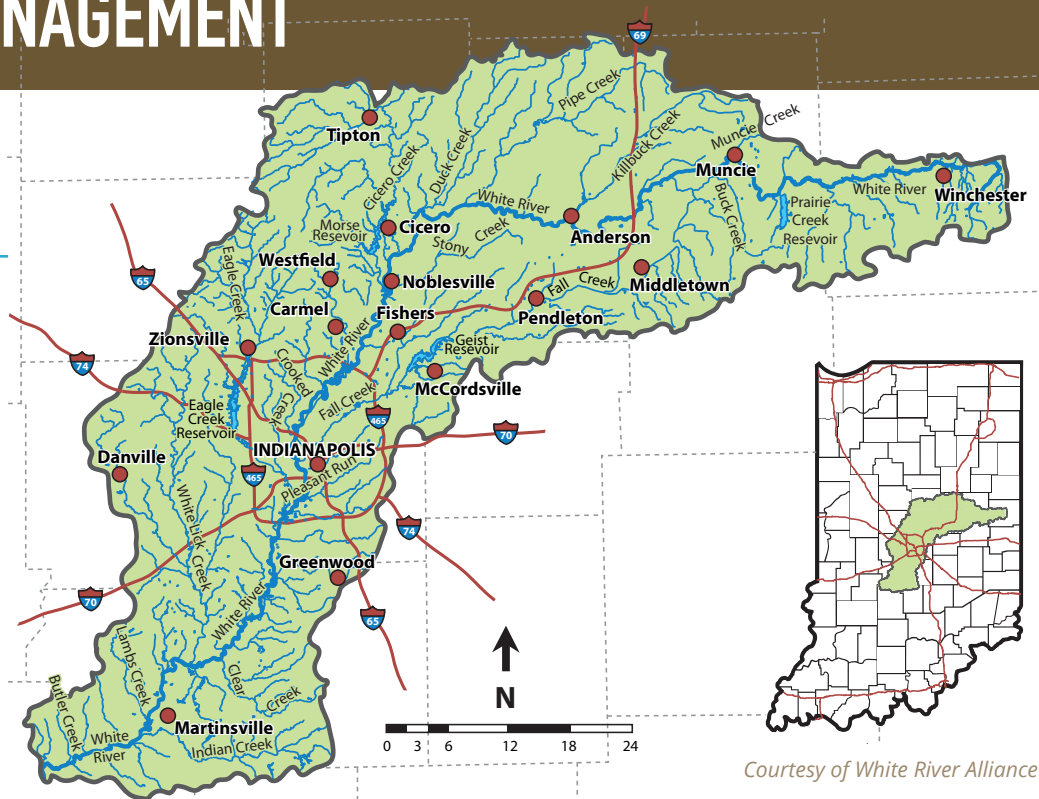
The identifiable point of an active incision where a break in grade occurs from a lower to a higher elevation. An active headcut point migrates in an upstream direction.

# WATERSHED MANAGEMENT

## WHAT IS A WATERSHED?

No matter where you are, you are in a watershed. A watershed is all of the land areas which drain to a common point. For instance, if you live in a neighborhood with a retention pond, the rain that washes off your lawn may drain down the street into a storm sewer that is connected to your retention pond. Your yard is part of the watershed for that pond. Your pond, in turn, may overflow and drain into a nearby stream where the water from other neighborhoods also drains.

Streams from your township in central Indiana will drain into the White River, eventually running into the Mississippi River via the Wabash and Ohio River systems and ultimately into the Gulf of Mexico. Almost all of Marion County is located in the Upper White River Watershed which covers parts of 16 counties. The White River flows in two forks across most of central and southern Indiana and is the largest watershed contained entirely within our state. The West Fork of the White River flows through Marion County and begins in a farm field in Randolph County, flowing through Muncie and Anderson before flowing south through Noblesville, Indianapolis, Martinsville and Spencer. The remaining portion of Marion County not included in the Upper White River watershed drains to Buck Creek, a subwatershed of the Driftwood River watershed, which meets the Flatrock River in the city of Columbus to form the East Fork of the White River. The two forks of the White River meet in southwestern Indiana before journeying 52 miles to the Wabash River.



Courtesy of White River Alliance

## HOW DOES THE URBAN LANDSCAPE AFFECT THE WATERSHED?

In urban areas, roads, parking lots and rooftops create a lot of impermeable surfaces which drain water off very quickly. This can cause increased flooding and erosion downstream, as well as increased water temperature. Water quality is also affected by urbanization from various sources of pollution entering the waterways. Water quality can be adversely affected by a number of sources such as vehicle fluid leaks, road salt, lawn fertilizers and herbicides, leakages from sanitary sewers and septic systems, combined sewer overflow, soil erosion, and trash. Many pollutants attach to sediment and are easily transported downstream by the erosion process.

An MS4 (Municipal Separate Storm Sewer System) is the network of storm drains, ditches, and pipes that carries rainwater from our streets directly to local streams and rivers. Stormwater in an MS4 system is not treated. Whatever washes off the landscape—like oil drips, lawn chemicals, litter, pet poo, or sediment—can go straight into our waterways. Because of this, cities with MS4 systems must follow state and federal rules to reduce pollution, keep storm drains clean, and educate the public about how everyday actions affect water quality.



To find which watershed you live in use the IDEM HUC Finder tool:  
**Indiana HUC Finder**

## WHAT CAN HOMEOWNERS DO TO IMPROVE WATER QUALITY IN THEIR WATERSHED?

While improving water quality is a huge undertaking on a large scale, small steps taken by individual homeowners, when combined with small steps taken by neighbors and neighborhoods, can make significant improvements over time. Here are a few ideas of small steps to get you started:

- Keep your vehicles in good repair – watch for leaks.
- NEVER pour anything into a storm drain – they drain directly into ponds and streams.
- Mow high to discourage weeds and limit or eliminate the use of lawn chemicals, especially products containing Phosphorus. Natural or organic alternatives are readily available.  
[View SWCD Lawn & Garden web page](#)
- Properly maintain and regularly check for bleed-outs over your septic system. Check your utility bill from Citizens Energy Group to see if there is a charge for sanitary sewer service. If this charge is missing your home is likely on a septic system. Home sale disclosures should also indicate if the property is served by a septic system.  
[View SWCD Septic Maintenance guide](#)
- Protect your soil from erosion. Even your garden can be a source of sedimentation. Check out ways to improve soil health on our website:  
[View SWCD Soil Health Initiative](#)
- Use a commercial car wash or, if washing at home, use biodegradable, phosphate-free, water-based cleaners only and wash in a grassed area or on another permeable surface.
- Dispose of pet waste properly –in the trash, buried 12" deep, or disposed of at a pet waste station.
- Never place lawn clippings in or near streams. Instead, compost, locating the compost pile away from the stream. Also do not blow grass clippings into the street where they can wash down into storm drains.

- Remove trash, old tires, and other debris from the stream regularly and report any illegal dumping to:

### City of Indianapolis-Mayor's Action Center

#### View Mayors Action Center

Phone (317) 327-4622

### City of Indianapolis-Department of Business and Neighborhood Services

#### Visit Business and Neighborhood Services

Phone (317) 327-8700

### Marion County Public Health Department - Division of Environmental Health:

#### Visit Marion County Health Department

**Environmental Emergencies such as an active chemical spill or fish kill should be reported to IDEM's 24-Hour Emergency Spill Line at**  
Phone (888) 233-7745

#### Environmental Emergency Response

## SLOW THE AMOUNT OF RUNOFF LEAVING YOUR PROPERTY BY:

- Installing rain barrels.
- Create a rain garden.
- Replace ditches with Bioswales.
- Allow buffer strips of native vegetation along ditches & ponds. (Information on these practices can be found at [Streams and Ponds](#).)
- Plant native plants and trees to improve infiltration rates, air quality and provide wildlife habitat.
- Consider permeable options – instead of using traditional concrete on a new patio or driveway project check out permeable options such as permeable pavers and pavement.



# WHAT TO CONSIDER WHEN PURCHASING A RIPARIAN PROPERTY

Water features, be it a pond, a gently flowing stream, or a river, add value and aesthetic benefits to a property and can be a big selling point for properties on the market. But buyers must be aware of the responsibilities and considerations that need to be made before making this big decision.

All streams erode and meander. Even in a wooded area, a stream will slowly erode, naturally cutting its bank on one side and depositing sediment on the other creating a snake-like meandering which helps to slow the water down and reduce flooding downstream. As a riparian property owner, it is important to understand this dynamic and keep it in mind when making building site choices.

The width of the **floodplain** is an important consideration when making land-use decisions. Approximately 18 percent of Marion County is in the 100-year and 500-year floodplains and 31% of this floodplain area is along the White River. Streams will often run out of bank and exceed the channel width during large storm events. Landowners are often shocked by the amount of water the stream takes on and the force of the rushing water. Rocks, limbs, debris, and even whole trees will sometimes be washed down onto your property from upper areas of the



watershed. Depending on the size of the watershed, numerous permits may be required to do any work on the streambank or building nearby. In addition, flood insurance can be expensive if the home lies within the floodplain boundaries.

It is best not to build anything within the floodplain boundaries or attempt to contain the stream with berms. Even a shed or fence can be damaged during large storm events. Filling in part of the floodplain will adversely affect other areas.

## OTHER THINGS TO CONSIDER:

- Erosive soil types are often found along creeks. These may have low strength or have steep slopes.
- The cost of erosion control practices can be extremely high. Evaluate your level of concern with your budget limits.
- Will you need flood insurance for the home? How much would this add to your monthly home expenses?
- Future changes over time – both changes in weather patterns that bring large and long-lasting storms and the amount of potential change from development in the future of the watershed may impact the size and needed capacity of the stream and floodplain in the future.
- The current condition of the slope and the condition of other properties in the watershed may have an adverse effect on the stability of the stream.
- Evaluate the type and condition of the vegetation in critical areas. A predominance of invasive species or hazard trees that could potentially come down are red flags as they are detrimental to the stability of creekbanks.
- How easy is it to access the stream?
- If erosion control measures are needed, can workers, materials, and equipment easily access the site? Could they get access from adjoining neighbors?
- Does the property encompass both sides of the stream or is it the property border? Neighbors may need to work together to control streambank erosion.
- How are other neighboring properties affected?
- Is the home on a septic system? If so where is it located? You will need to take this into account so that any work done will not harm the function of the septic. Heavy equipment should never be allowed to run over or be parked on the septic field.



## DEFINITIONS

### FLOODPLAIN

The flat area adjoining a river or stream channel constructed by the river/stream in the present climate and overflows during moderate flow events. In Marion County the 100-year floodplain can be one to two miles wide. The connection of this area to the stream channel reduces the volume carried by the channel.

### FLOODWAY FRINGE

Portions of the floodplain beyond the floodway.

### FLOODWAY

Consists of the stream channel and adjacent areas of the floodplain. It is the most hazardous area of the floodplain experiencing the greatest depths and velocities of floodwaters.

### FLOOD HAZARD AREA

The area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year.

# FLOODPLAIN, FLOOD FRINGE,

# OR FLOOD HAZARD AREA

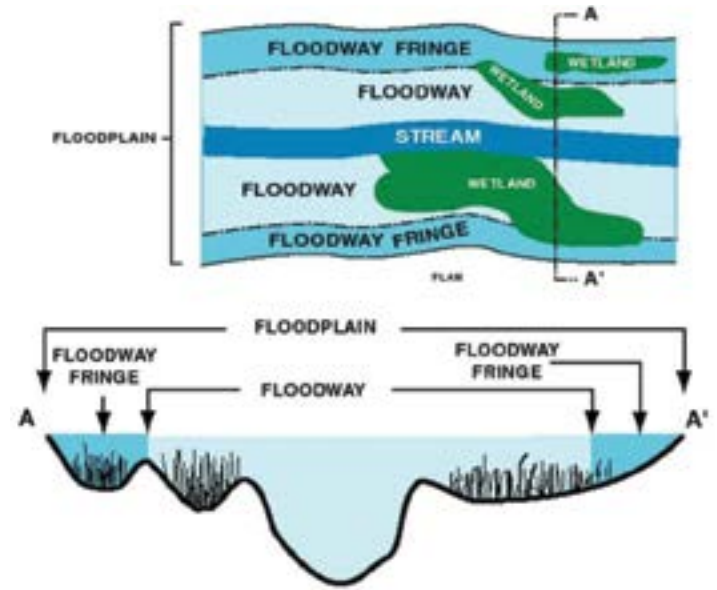
Homes and other structures that flood or are in danger of being undermined by streambank erosion are within the riparian area. Homeowners are responsible for damages and the costs associated with protecting these structures; therefore, buyers must be aware of the boundaries of the flood hazard area. Building close to a stream to have a great view is not worth the cost. The City's current zoning ordinance prescribes a 25-100' stream protection corridor depending on uses and stream location and this width is measured parallel to the top of the bank. More information on these requirements is available in Chapter 744, Article II of the City's current zoning ordinance available here:

## Indianapolis Zoning Ordinance

Properties containing or in the vicinity of rivers and streams may require flood insurance. Understanding the terms, insurance rates, and chances of a home being affected by a flood is important to every homeowner. Flood maps do change over time as land use and weather patterns change. Updated studies approved by IDNR Division of Water for planning purposes only (not insurance rates), can be found on the data layer "Best Available Flood Hazard Area";

## Indiana Floodplain Mapping

Floodplains consist of two parts. The channel itself, called the **floodway**, may have a constant flow of water or may be dry during parts of the year (called an ephemeral stream). The **flood fringe** lies beyond the actual floodway out to the limits of the 100-year floodplain.



USDA Natural Resource Conservation Service

The Indiana State Board of Health does not allow septic systems for new homes in the 100-year flood plain or floodway, areas subject to ponding, or wholly or partly located in a drainage way (410 IAC 6-8.3-70). In some instances, to be determined by the local health department, an existing system may be replaced in the floodplain due to failure. Check the home's purchase disclosure statement to determine if a home is on a septic system. Homes on septic systems will only be billed for city water usage, not for sewage treatment.

# STREAM INVESTIGATION CHECKLIST

- What is the size of the watershed?**  
Watershed size determines which erosion control structures and practices will work and also which permits will be needed.



Watershed Information

SWCD Watershed Page

- Is the watershed fully developed/urbanized or are there large areas of farmland, woods, or other vacant ground within the watershed?**

Runoff may increase as land is converted to urban use.

- Is the house well above the floodplain elevation? Are there other structures within the floodplain?**

Homes built in the floodplain will flood periodically and will require flood insurance.

- Are there trees along the bank which are in poor condition?**



Diseased, stressed, or trees with much of their root system exposed by erosion are in danger of falling which often causes large root wads to be pulled off of the bank. These trees should be cut, leaving the stump and roots in tack to continue to help hold the bank while new vegetation is becoming established.

- Is there ample room for the stream to move without affecting structures, fences, etc.?**

Wide buffers extending to the reaches of the floodplain allow the stream to naturally adjust to changes in weather and the watershed to regain equilibrium and stability.

- Are there excessive amounts of woody debris or a log jam consisting of fallen trees, rocks, sediment, and trash obstructing and diverting the flow of the stream & eroding the bank?**



- Is there evidence of slope failure due to mass wasting?**

Mass wasting is the mass movement of banks by slumping or sliding, suddenly dumping large volumes of sediment into the stream.

- What quality is the bank vegetation?**

Very Poor – no vegetation? Poor - mowed turf to the stream edge or primarily invasive species? Good – a dense variety of native trees, shrubs, grasses & wildflowers?

- Has the stream been artificially contained or straightened?**

Channel changes make streams unstable and prone to erosion.

- Is there evidence of excessive sedimentation or erosion at the bottom of the stream?**

Both an incised stream and excessive deposition are evidence of instability. Sandbars with no vegetation indicate that sediment is being deposited regularly.

- Are the streambanks steep and high or gently sloping?**

Steep high banks are unstable, often poorly vegetated, and are prone to erosion.

# STREAMBANK EROSION CONTROL PRACTICES



When it comes to addressing streambank erosion, it's important to remember that change is the only constant. Streams are dynamic natural systems and a streambank stabilization measure implemented on one property might negatively impact downstream conditions. Common streambank erosion control practices include bank stabilization, grade control, and toe protection. Several of the most commonly used practices in Marion County are described below and more information is provided in the list of additional resources.

## RIPARIAN VEGETATION

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Streambanks are often highly erosive in part because of a lack of vegetation or lack of native vegetation which has strong and deep root systems that can help to protect banks and slow high water movement. Planting either seed with wildlife safe erosion control\*\* or planting plant plugs is a popular option because it can be done with hand tools and without needing to apply for permits. Vegetation is often a good option for smaller streams or in conjunction with other erosion practices for larger streams. Riparian buffers and streambank plantings create a root mass that provides several benefits, including shade, increased water oxygen levels & providing a food source for aquatic wildlife. Buffers improve water quality by filtering pesticides, fertilizers, and other pollutants and native vegetation help dry out saturated soils on streambanks via evapotranspiration. Unfortunately, invasive plants often dominate existing riparian vegetation and provide none of these benefits.

*\*\* Wildlife entanglement and death in plastic netting have been documented for birds, mammals, reptiles, and fish. Consult the IDNR for areas of concern. Wildlife safe netting is biodegradable (decomposes quickly compared to photodegradable) and has a rectangular, flexible (not welded) mesh weave.*

# INVASIVE PLANT ERADICATION

Invasive plants can grow rapidly in a variety of light and moisture conditions, thriving in disturbed areas via roots or seeds and greening up early in the spring-all of which hinders the ability of native vegetation to survive.

**The establishment of native riparian vegetation must consider long-term invasive control to be successful long term. Water-safe herbicide treatments are imperative to gain control of invasives and should be applied by a licensed applicator only.**



The most common invasive plants found along riparian corridors in Marion County are listed in the table below -note other invasives may be more prevalent in your area. Consult our district or the resources page of the

local Cooperative Invasive Species Management Area for more information about species characteristics and treatment methods, in particular, the Calendar of Control found under Eradicate here:



[CISMA Calendar of Control](#)

INVASIVE PLANT SPECIES ● (Common & Most Aggressive)	PLANT TYPE (Herbaceous/Woody/Vine/Grass)	METHOD OF SPREADING (Seed/Roots)
Canada thistle	Herbaceous	Seed and roots
Garlic mustard	Herbaceous	Seed
Goutweed	Herbaceous	Roots
Lesser celandine ●	Herbaceous	Seed and roots
Moneywort	Herbaceous	Roots
Reed canarygrass ●	Herbaceous	Seed and roots
Japanese hops	Vine	Seed
Oriental bittersweet	Vine	Seed
Porcelain berry ●	Vine	Seed
Wintercreeper ●	Vine	Seed
Asian bush honeysuckle ●	Woody	Seed
Autumn olive	Woody	Seed
Common buckthorn	Woody	Seed and roots
Japanese barberry	Woody	Seed
Japanese knotweed	Woody	Seed and roots
Multiflora rose	Woody	Seed
European black alder	Tree	Seed
Callery pear ●	Tree	Seed
Norway maple	Tree	Seed
Tree of heaven	Tree	Seed and roots
White mulberry	Tree	Seed
Border privet	Shrub	Seed
European cranberry viburnum	Shrub	Seed
Winged burning bush	Shrub	Seed
Common Reed	Grass	Seed and roots
Japanese stiltgrass	Grass	Seed

## NATIVE PLANTS

The best native plants for your project should be chosen based on soil type, the degree of erosion, stream size, and location, which takes into account the various water and flood conditions. The mature height and spread of native vegetation and seasonal bloom time should always be considered as well. A diversity of native species will help resist disease and provide more wildlife value than a single monoculture planting. Planting plugs may require staples or laying erosion control fabric to prevent erosion and uprooting, and note that all young plants need to be protected from browsing by wildlife, especially deer and rabbits.

Next are a few examples of native species commonly used along streams in Marion County and available through local native plant nurseries. For larger projects, we also recommend considering seed mixes from Spence Restoration depending on the goals of the planting. Links to appropriate seed mixes are provided in the “Additional Notes and Resources” section of this guide.



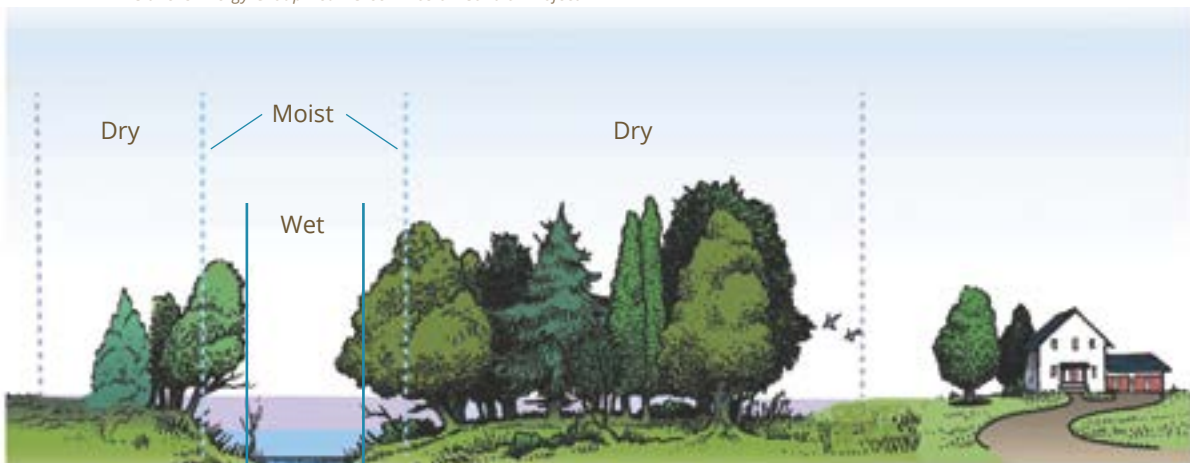
Citizens Energy Group Bean Creek Erosion Control Project

**COMPLEXITY:** Low

**COST:** Low to Moderate

**WILDLIFE BENEFIT:** Moderate to high

**CONS:** Maintenance for the first 5 years may be extensive, including weeding and watering; young plants may be damaged by wildlife or large storm events



Credit: Courtesy of the Penn State Extension Master Watershed Steward program

PLANT NAME (*Deer Resistant)	PLANT TYPE	PLANTING ZONE	MATURE HEIGHT	LIGHT PREFERENCE
*Virginia Wild Rye Northern Sea Oats Beak Grass Riverbank Wild Rye	Grasses	Moist/Wet	2-5'	Part Shade to Shade
*Big Bluestem *Little Bluestem Side Oats Gramma Switchgrass	Grasses	Dry/Moist	2-7'	Sun
Sweet Flag	Grass	Wet	2-4'	Sun to Full Shade
Soft Rush	Grass	Wet	2-4'	Sun
*Swamp Milkweed	Forb	Wet	2-5'	Sun
*Blue Flag Iris	Forb	Mesic/Wet	2-3'	Sun to Part Shade
*Cardinal Flower	Forb	Moist/Wet	2-5'	Sun to Part Shade
*Ironweed	Forb	Moist/Wet	3-6'	Sun
*Common Milkweed	Forb	Dry/Moist	2-3'	Sun
Rattlesnake Master	Forb	Dry/Moist	4-5'	Sun
*Beardtongue	Forb	Moist/Dry	3-5'	Sun
*Black Eyed Susan	Forb	Wet/Moist	2-4'	Sun
Wild Senna	Forb	Moist	3-6'	Sun
New England Aster	Forb	Moist	3-6'	Sun
Buttonbush	Shrub	Wet	12'	Sun to Part Shade
Elderberry	Shrub	Moist/Wet	5-12'	Sun to Part Shade
*Silky Dogwood	Shrub	Moist/Wet	12'	Sun to Part Shade
Smooth Alder	Shrub	Moist/Wet	10-20'	Sun to Part Shade
Summersweet	Shrub	Moist/Wet	4-5'	Sun to Part Shade
*Red Osier Dogwood	Shrub	Moist/Wet	9'	Sun to Part Shade
Winterberry	Shrub	Moist/Wet	12'	Sun to Part Shade
*Pussy Willow	Shrub	Moist/Wet	6-15'	Sun to Part Shade
*Spicebush	Shrub	Moist	6'	Sun to Part Shade
*Ninebark	Shrub	Dry/Moist	10'	Sun to Part Shade
Black Willow	Tree	Wet	30-60'	Sun to Part Shade
*Eastern Cottonwood	Tree	Wet	75-100'	Sun
*American Sycamore	Tree	Moist/Wet	75-100'	Sun
*Bald Cypress	Tree	Moist/Wet	75-100'	Sun
*River Birch	Tree	Moist/Wet	40-60'	Sun to Part Shade
Silver Maple	Tree	Moist/Wet	Up to 80'	Sun to Part Shade
Bitternut Hickory	Tree	Moist/Wet	Up to 90'	Sun to Part Shade
Shellbark Hickory	Tree	Moist/Wet	Up to 60'	Sun to Part Shade
Kentucky Coffee Tree	Tree	Moist	Up to 100'	Sun
Basswood	Tree	Moist	Up to 80'	Sun to Part Shade
*Sassafras	Tree	Moist	Up to 80'	Sun to Part Shade
Shagbark Hickory	Tree	Moist	Up to 100'	Sun to Part Shade
Swamp White Oak	Tree	Moist	50-60'	Sun
Northern Pin Oak	Tree	Dry/Moist	Up to 70'	Sun
Shumark Oak	Tree	Dry/Moist	Up to 40'	Sun
Downy Serviceberry	Tree	Dry	Up to 30'	Sun to Part Shade

## ADDITIONAL NOTES AND RESOURCES

### Native Plants, Trees and Shrubs:

Find more information about specific growing habits of the native plants, trees and shrubs provided above by using the Missouri Botanical Garden's plant finder database:



[View MBG's Plant Finder Database](#)

Consult the following seed mixes by Spence Restoration for your project as these include vital forbs and grasses/sedges to develop strong root systems:

**Soil Stabilization Mix (for sunny areas) and Forested Wetland Mix (for shady areas):**



[View Native Plant Seed Mixes](#)

All of the shrubs listed are excellent for live staking, which are cuttings from live dormant shrubs planted in early Spring to reduce streambank erosion. More information about live staking is available from the Penn State Extension:



[View Live Staking Information](#)



[View Live Staking Video](#)



## BRUSH MATTRESSES

Brush mattresses are primarily used to armor a streambank and are constructed by interlacing live branches of woody plants which sprout roots from their stems (such as willow, some dogwoods, and alders).

**Live fascines** or rock is usually used at the **toe** and the mattress is held in place with wire or twine tied to live stakes or dead stout stakes.

**COMPLEXITY:** Moderate

**COST:** Low to Moderate (cuttings may be found locally, perhaps at a construction site that is taking out existing woods or clearing out a ditch. Note appropriate live staking species in native plant lists provided.)

**WILDLIFE BENEFIT:** Moderate to High

**CONS:** Stakes need to have adequate year-round access to moisture to survive, stakes may not hold well in sandy or silty soil types while a heavy clay that is highly compacted may not allow adequate root growth. Willow and alder need sunlight and won't do well in a shady location.

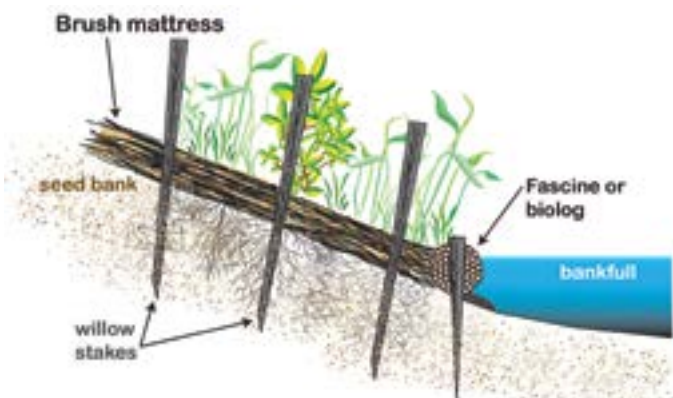


image from MN DNR

## WATTLES, BIOLOGS & FIBER ROLLS

These are sausage-shaped rolls that can be made out of a variety of materials including woody vegetation like live fascines or coconut husks. They are placed in shallow trenches and are used to stabilize banks and slopes. Live stakes are placed on the downhill side of the bundle to hold them in place. They are often used on long steep slopes to break up the slope and slow down the surface drainage. Live plants can be planted into some types of wattles and fiber rolls such as coir wattles.

**COMPLEXITY:** Low

**COST:** Low

**WILDLIFE BENEFIT:** Moderate

**CONS:** Lifespan is usually 2-5 years but can fail if exposed to high stream velocity

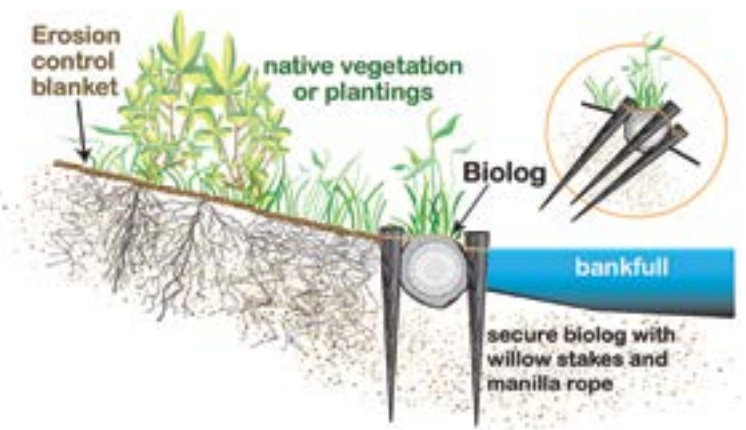


image from MN DNR

## DEFINITIONS

### LIVE FASCINES

Bundles of live woody vegetation buried shallow placed parallel to the flow of the stream. The plant bundles will sprout and form a root mass to help protect the streambank.

### TOE

A toe lies along the base of the slope and supports the weight of the bank and riprap. It often needs to be dug down to stable material.

## BANKFULL BENCH

A bankfull bench is a flat or shallowly sloped area above bankfull that slows high velocity flows during flows above bankfull. While often a naturally occurring feature of a healthy stream, they can be constructed to reduce shear stress on the stream banks and provide a stable bankfull channel section.

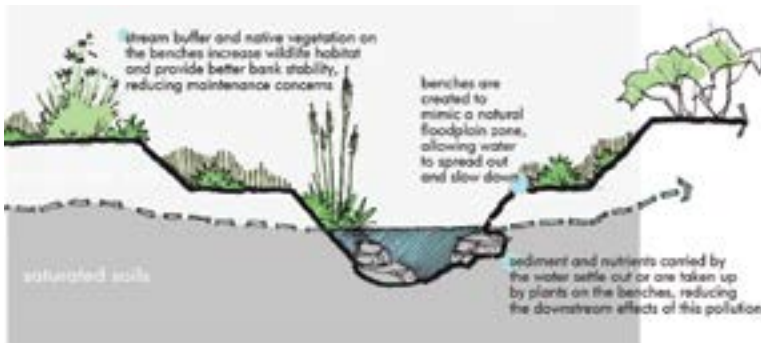
The bankfull bench elevation is critical to providing stability to the stream. A bankfull bench can be created by installing a toe wood-sod mat made of logs, branches, brush, roots, and soil as fill. Root wads can be added for additional roughness and habitat. The fill is covered with a layer of live cuttings and a top layer of sod mats and transplants set at the bankfull stage. The streambed may deepen over time after construction.

**COMPLEXITY:** Moderate

**COST:** Moderate

**WILDLIFE BENEFIT:** Moderate to High

**CONS:** Heavy equipment needed, must be properly designed & sized



## STONE TOE PROTECTION

The Stone Toe Protection method is the placement of stone parallel to the stream at the toe of the eroding bank in sufficient amounts and height above normal water level to protect areas where flowing water is eroding or undercutting the lower bank. The stone provides protection for the toe, stabilizes the lower portion of the bank, and over time allows a stable slope to be created as deposition of sediment behind the row of stones encourages future growth of additional vegetation. Stone is also buried in the bank at regular intervals along the bank (called keys or tiebacks) to prevent erosion from occurring behind the stone toe protection. Stone size is determined by stream velocity. Use a well-graded mixture of angular stone sizes.

This method integrates well with other practices such as willow posts and weirs.

**COMPLEXITY:** Low to Moderate

**COST:** Low to Moderate (stone size & project dimensions must be determined by stream & watershed analysis)

**WILDLIFE BENEFIT:** Low to Moderate

**CONS:** Does not directly protect the mid and upper bank; needs to be used in combination with other erosion control techniques in many situations. If improperly designed can cause erosion on neighboring properties



## ROOT WAD REVETMENTS

Root wad revetments consist of the lower section of tree trunks with the root fan still attached which are driven into the streambank so that the trunks angle upstream and the root wads are positioned below the bankfull level directed into the flow. Trunks are anchored with large boulders and a matrix of logs. Root wad revetments are often used to stabilize a cutbank combined with other practices such as the construction of a bankfull bench, live cuttings, natural vegetation plantings, and erosion control fabric.

**COMPLEXITY:** Low to Moderate  
(using nearby materials)

**COST:** Moderate

**WILDLIFE BENEFIT:** Moderate  
(creates habitat)

**CONS:** Limited lifespan, materials need to be replaced periodically based on species. They are not appropriate near bridges or other structures where dislodged materials would cause damage in a large storm event.

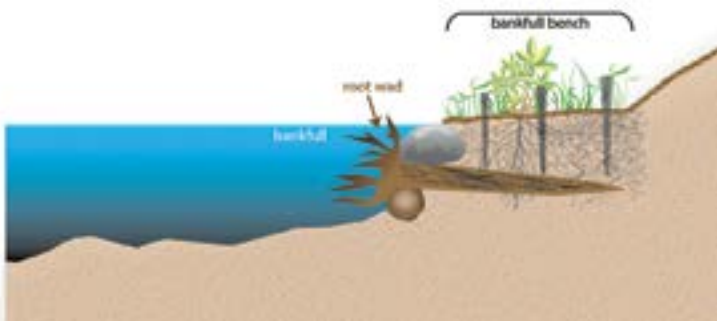


Image from MN DNR

## ROCK WEIRS

Rock weirs, also called j hooks or bendway weirs, are very low channel spanning rock structures that are installed to protect streambanks by redirecting streamflow. They also establish and maintain lower depth to width ratio, increase sedimentation along stream banks, and control flow direction. They thereby are able to minimize meandering, stabilize stream gradient, provide energy dissipation and create pool habitat. Rock weirs redirect stream flow to the center of the stream channel and away from the streambank and are installed pointing towards the upstream end to accomplish this function. Because each stream channel and project site is unique, rock weir design and placement should, at a minimum, take into account the bankfull discharge, sediment regime, drainage area, and stream hydrograph characteristics of the watershed.

**COMPLEXITY:** Low to Moderate

**COST:** Moderate

**WILDLIFE BENEFIT:** Moderate to High

**CONS:** Not suited to all situations, can accumulate trash & debris necessitating regular maintenance, can cause downstream scour



## GABION BASKETS

Gabion Baskets are wire “baskets” filled with rock built onsite to protect streambanks especially in areas where streambanks are steep and there is no room to pull the banks back to a stable slope.

Baskets can be staggered and stacked to various heights. Where hillside seeps are present a drainage tile is installed behind the wall of baskets to divert subsurface water around the wall. When properly installed, with high-quality wire, and in ideal situations, gabions baskets have a lifespan of 50-100 years.

**COMPLEXITY:** Moderate

**COST:** Moderate to High

**WILDLIFE BENEFIT:** Low

**CONS:** Wire baskets suffer wear & tear in streams with high velocities, lifespan is decreased in areas of road salt exposure & acidic soils, difficult to install, additional drainage and geotextiles are often needed



## STREAM HABITAT ENHANCEMENT

Many of the erosion control practices for streambanks have a bonus benefit for wildlife. Native vegetation provides food and shelter for all types of wildlife, including beneficial insects, an important food source. It also provides areas of shade which is essential for aquatic species. Weirs create pools and spawning habitats, while brush bundles and rootwads provide cover for juvenile and adult fish, a refuge from high flows, and substrate for macroinvertebrates. Providing an adequate area for streams to meander increases habitat complexity and pool-riffle ratio.

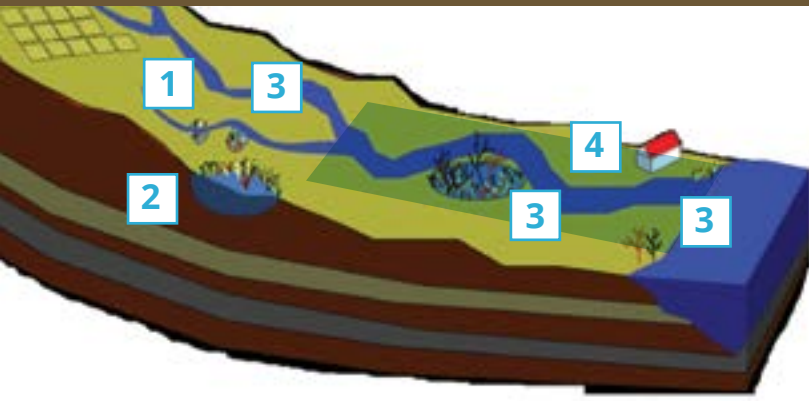
### ADDITIONAL RESOURCES



[Fluvial Erosion Hazard Mitigation Manual](#)



# STREAM WORK PERMITS



## WHO HAS JURISDICTION?

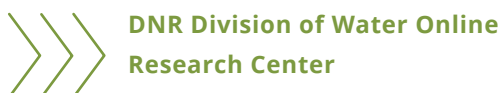
- 1. Wetlands adjacent to streams**  
Streams with less than one square mile drainage  
USACE & IDEM
- 2. Isolated wetland**  
IDEM
- 3. Navigable water, Open Water, Floodways, and Streams**  
IDNR, USACE, & IDEM
- 4. Floodways**  
IDNR

## WHAT YOU CAN DO WITHOUT A PERMIT:

- Seeding, mulching, and planting of trees and shrubs using hand tools along streambanks and riparian areas
- Installing riparian buffers
- Invasive species eradication without land-disturbing grubbing
- Cutting hazard trees off at the stump
- Removal of woody debris and manmade materials from the stream and banks – hand-held tools and chainsaws can be used in the stream, while heavy machinery can only be used from the bank. See IDNR log jam permitting guide found here (also applies to beaver dam removal):



- Extending downspouts down steep banks with tile on top of the ground
- Cleaning out culverts
- Work along a stream with a contributing drainage area of less than 1 square mile (no DNR jurisdiction) and note USACE & IDEM have jurisdiction over these-use USGS Stream Stats website to determine drainage area:



## ACTIVITIES LIKELY TO NEED AT LEAST LOCAL AND/OR STATE PERMITS:

- Construction of a road or bridge across a stream
- Streambank stabilization projects\* (See section on stabilization practices for examples)-bank stabilization activities usually also require a Regional General Permit (RGP) and IDEM 401 Water Quality Certification
- Removing sand/gravel bars from the streambed with heavy equipment
- Placing rock riprap or other hard armoring along the stream or in the streambed
- Repairing or removing a bridge or culvert
- Removing soil in order to cut back the steepness of streambank slopes
- Cutting a swale or building a levee to redirect drainage
- Wetland impacts require an RGP, max impact is an acre or less
- Construction in a floodway-the following is a list of typical floodway projects subject to IDNR review/ approval:
  - Fill, excavation and/or land grading
  - Bank stabilization
  - Construction of bridges and private access crossings
  - Construction or reconstruction of buildings
  - Fencing

## ACTIVITIES LIKELY TO NEED A FEDERAL ARMY CORPS OF ENGINEERS PERMIT:

- Straightening or rerouting a stream-note stream relocation, stream crossings and encapulation/tiling require a Regional General Permit (RGP) in Indiana: if under 300 LF (Linear Feet) requires RGP notification to IDEM only; if over 300 LF requires notification to USACE/IDEM and may require mitigation. Max limit is 1,500 LF impacted.
- Placing rock riprap, concrete, or other hard armoring along the stream or in the streambed
- Redirecting flow of a stream by moving or reshaping gravel bars
- Using concrete or other construction or impervious debris to armor streambanks

## WATER QUALITY

Curious about water quality where you live in Marion County? There are a number of local and state water quality monitoring networks where you can review historic and recent water quality data. Check out these sites for more information:

 [Marion County Public Health Department Watershed Sampling Program](#)

 [IDEM Surface Water Monitoring](#)

 [White River Alliance RAFT Program](#)

- Dredging streams
- Creating dikes or dams
- Construction of a road or bridge across a stream
- Wetland impacts over an acre require an individual permit and require mitigation

Permits or approval of all work must be acquired before construction begins. These permits may include, but are not limited to, Nationwide or Individual permits under Section 404 of the Clean Water Act from the U.S. Army Corps of Engineers (USACE), Section 401 Water Quality Certification from the Indiana Department of Environmental Management (IDEM), the Indiana Department of Natural Resources (IDNR) Division of Water, and the City of Indianapolis Department of Business and Neighborhood Services.

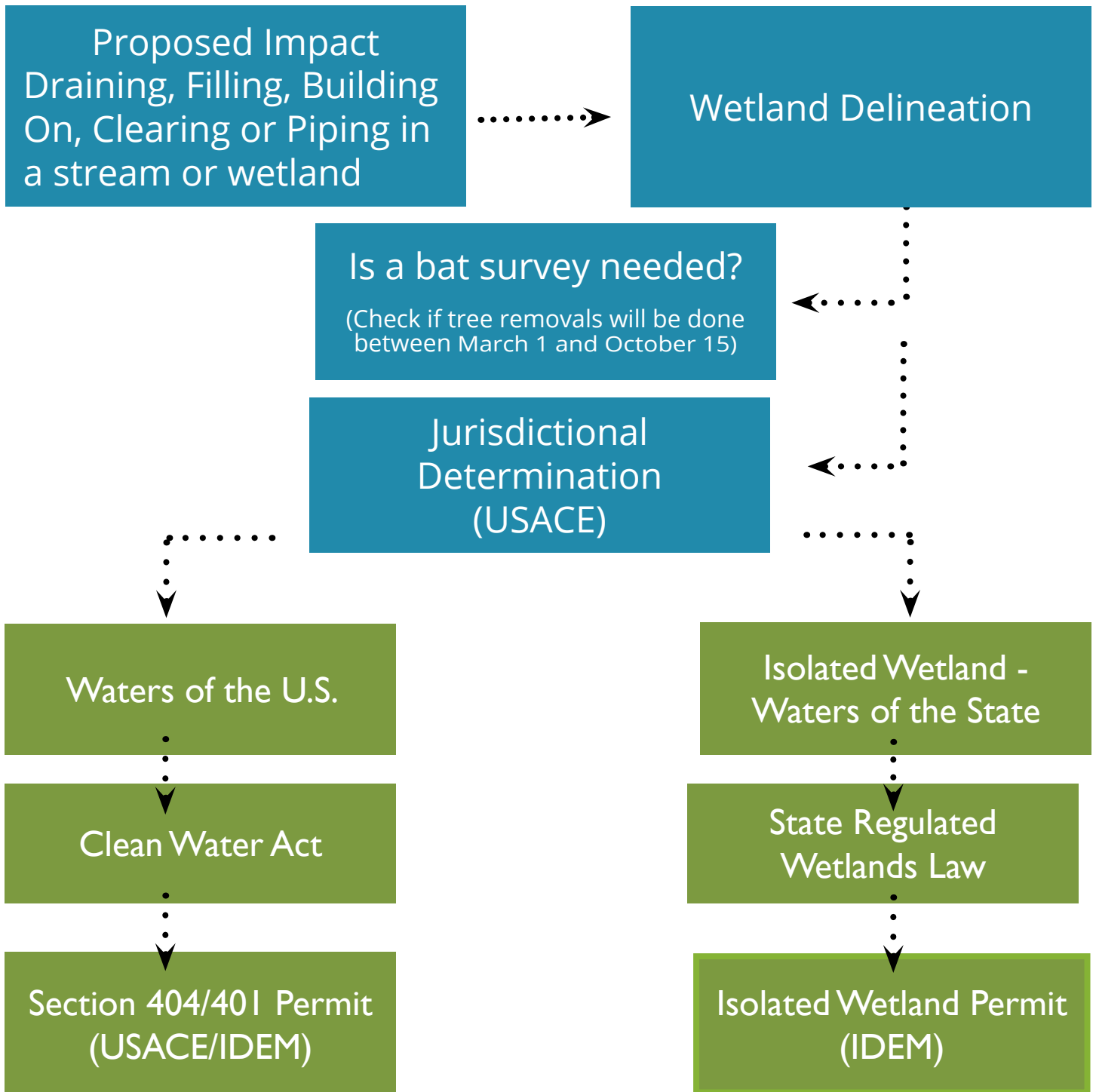


For a more comprehensive historical perspective on local water quality and the current White River Report Card, check out the following resources:

 [IDEM Water Quality Trends in Indiana Streams](#)

 [White River Report Card](#)

# STREAM WORK PERMITS - WHO HAS JURISDICTION?



# CONTACT INFORMATION

If you wish to divert surface water, add drainage tile, or otherwise make changes to drainage in Marion County contact:

## CITY OF INDIANAPOLIS

Department of Business and Neighborhood Services  
Phone: (317) 327-8700  
Fax: (317) 327-5174



City of Indianapolis BNS

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If you wish to fill, dredge, or excavate a wetland or water body in central or southern Indiana, contact:

## U.S. ARMY CORPS OF ENGINEERS

Louisville District Office - Regulatory Program  
P.O. Box 59  
Louisville, KY 40201  
Phone: (502) 315-6733



US Army Corps of Engineers

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If you wish to fill or work within a floodway of a stream or river, or propose to alter the shoreline or lakebed of a public freshwater lake, contact:

## INDIANA DEPARTMENT OF NATURAL RESOURCES

Division of Water  
402 West Washington St., Room W264  
Indianapolis, IN 46204-2251  
Phone: (877) 928-3755 or (317) 232-4160  
Email: water\_inquiry@dnr.in.gov



IDNR Division of Water

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If you wish to fill, dredge, or excavate a wetland or water body anywhere in Indiana, contact:

## INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Section 401 WQC/Isolated Wetlands Program  
100 N. Senate Ave. IGCN 1255  
Indianapolis, IN 46204-2251  
Phone: (800) 451-6027 or (317) 233-8488



IDEM Wetlands Program

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### Contact IDEM:

## INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Office of Water Quality, Wetlands and Storm Water Section  
100 North Senate Avenue  
Indianapolis, IN 46204-2251  
Phone: (317) 233-8488  
Toll Free: (800) 451-6027  
Fax: (317) 234-4145



IDEM Office of Water Quality

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For information and maps for flood risk assessment and insurance contact FEMA:



FEMA Flood Maps

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### Financial Resources

## INDIANA DEPARTMENT OF NATURAL RESOURCES

Lake & River Enhancement Program



IDNR - LARE Program

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For onsite consultations in Marion County

## MARION COUNTY SOIL & WATER CONSERVATION DISTRICT



[MCSWCD - Contact Us](#)

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# LAND USE PLANNING FOR DEVELOPERS

Land Developers have great responsibilities and challenges but they also have great opportunities to leave long lasting positive fingerprints on our community. Well designed and built commercial and residential developments can greatly benefit those who work and live there – physically, financially, aesthetically and even mentally. In addition, developments can even provide benefits to our natural environment.

## **BEST MANAGEMENT STARTS FROM THE BOTTOM LEVEL – THE SOIL.**

Soils information is now easily accessed on the [Web Soil Survey](#). Making wise land use decisions by knowing and understanding the soil types on a piece of land can help alleviate soil related problems such as erosion, failing septic systems, drainage problems, pavement maintenance issues, plant health and corrosion of pipes.

## **GREEN SPACES – WELL WORTH THE COST.**

Green spaces are areas of vegetated, undeveloped land which can be used for providing shade, beauty, exercise/recreation, nature trails, wildlife habitat, biodiversity and storm water management. Native plants and trees are highly recommended for these areas as they are well adapted to our climate, need less long term maintenance and provide better wildlife habitat.

As this guide has shown, wide buffers along streams are very advantageous for the environment but also give a hedge of protection for future homeowners. Allowing ample room for streams to meander, stabilize and flood, protects structures and provides safety for the residents of the community. Some general guidance and regulations are already provided by local, state and federal agencies but often these are minimum standards and may not adequately protect the stream corridor in every situation.

Natural wetlands provide a number of benefits including flood storage, groundwater recharge, improvements to water quality, food and habitat for fish & wildlife, and opportunities for recreation and education.



## **SLOW DOWN / CLEAN UP**

Slowing down the rate of runoff into our streams can assist with flooding, erosion and pollution problems. Capturing some of the runoff from our rooftops and driveways and allowing this water time to seep into the soil onsite can be accomplished through a number of means including rain gardens, bioswales, pervious pavement, green roofs and other green infrastructure practices. As sediment is the #1 source of water pollution by volume, construction sites should be continuously monitored with erosion control practices checked after each storm event for potential failures.

## **PLAN FOR THE FUTURE!**

Make wise decisions by remembering that nature evolves and changes. The stream running through the property needs room to move and expand. Trees should be planted making room for their mature height and breadth. Wide buffers along waterways and retention ponds will protect them from erosion and pollution for years to come.

[Marion SWCD Stormwater and Sediment Reviews](#)

[Construction Stormwater General Permits \(CSGP\)](#)

[CSGP Implementation of Buffers](#)

[IDNR Division of Water Permits information](#)

# MY STREAM STABILIZATION PLAN



BEFORE PHOTO

## EXISTING INVASIVES - ID & ERADICATION PLAN (SEE PAGE 15)

PLANT	DATE TREATED	METHOD
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## PERMITS OBTAINED (SEE PAGES 23-26)

## MATERIALS NEEDED

## NATIVE PLANT LIST (SEE PAGE 17)



AFTER PHOTO

## SOIL TEST RESULTS



# EXAMPLES & WHAT TO EXPECT...

The function and lifespan of your stream stabilization project is dependent upon ongoing maintenance and repair. The site should be regularly monitored, especially after large storm events. As many of the suggested practices include native plantings, a number of seasonal maintenance actions will be needed. Check the site for pest infestations, wildlife damage, scour, erosion, sediment accumulations, and damaging vehicular or pedestrian traffic. Replace any dead trees or shrubs and control undesirable vegetative competition. It may be necessary to use physical plant protection such as tree tubes, fertilizer, pesticides and other chemicals to assure buffer function. Chemicals should be used on a “spot” basis in order to protect forbs and legumes that benefit native pollinators and other wildlife.

Once well established, periodic harvests or thinning may be beneficial for keeping riparian zones in a healthy, vigorously growing condition. Refer back to this publication and contact the SWCD if you have any questions.

## INDIANAPOLIS ART CENTER

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This project stabilized approximately 300 feet of the south streambank of the White River at the Indianapolis Art Center and utilized previously installed gabion baskets. Stone slabs were installed as caps into the existing gabions and additional rip rap was added to establish the toe of slope.



(Image from V3 Companies)

## BROADRIPPLE PARK

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This project stabilized approximately 200 feet of White River streambank with erosion control mat and rip rap to protect the bank from further erosion.



Broadripple Before



Broadripple After

# MAINTENANCE OF STREAM REPAIR PROJECTS

## YEAR 1

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- **TAKE BEFORE AND AFTER PHOTOS** to help you see how your site has developed and where plants are located.
- **MARK LIVE STAKES WITH TALL COLORED POSTS** to make maintenance easier.
- **WATER ALL NEW PLANTS** as needed.
- **IDENTIFY VOLUNTEER PLANTS AND INVASIVE WEEDS**, swiftly eradicate invasives.
- **INSTALL TREE SHELTERS** or tubes to protect young trees from wildlife damage.
- **INSPECT AFTER LARGE RAINS AND FLOODING** and repair any eroded areas before they get worse.
- **REMOVE TRASH AND ANYTHING IMPEDING PLANT GROWTH.** Tree snags and fallen woody debris provide wildlife habitat so they can be left unless they are obstructing drainage or causing erosion.
- **TEST THE SOIL.** Fertilize the 2nd and 3rd year if needed.

## YEAR 2 & BEYOND

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- **VISIT THE SITE AT LEAST SEASONALLY** and after any major storm event.
- **MONITOR THE CONDITION OF MATURE TREES** – dead or dying trees or those with a substantial amount of roots exposed by erosion should be cut down leaving the stump and roots for wildlife and erosion control.
- **PRUNE PLANTS ONLY AS NEEDED** – focus on building a strong root system.
- If the slope of area permits, **MOW BUFFERS 6" HIGH IN LATE FALL OR EARLY SPRING** until established for weed control but be sure not to damage trees and shrubs.
- **CHECK SURVIVAL RATES AND REPLANT** as needed.
- **USE HERBICIDES CAREFULLY** and according to label instructions. Use herbicides labeled for aquatic use in those areas close to the water. The use of some chemicals require an applicator's license.

For information on the applicator's certification visit the Purdue website:



**Commercial Applicators Certification**



—MARION COUNTY—  
**SOIL AND WATER**  
—CONSERVATION DISTRICT—

*Image from Central Indiana Land Trust*