Landowner's Monitoring and Maintenance Guide for the Bull Creek Restoration Project

Located between Sheridan Road and the Union Pacific Railroad
In the Village of Beach Park, Lake County, Illinois

Prepared by the Lake County Stormwater Management Commission
Revised June 2017

CONTENTS

I. INTRODUCTION AND DEFINITIONS

Background

The reach of Bull Creek located between Sheridan Road and the Union Pacific Railroad tracks in Beach Park Illinois is being restored in phases, beginning with the first phase of work completed in 2002 and subsequent work phases in 2004, 2010 and 2017. The restoration work has addressed debris blockages and severe streambed and streambank erosion of the creek, which is located at the bottom of a ravine system that drains approximately 6 square miles of the Village of Beach Park.

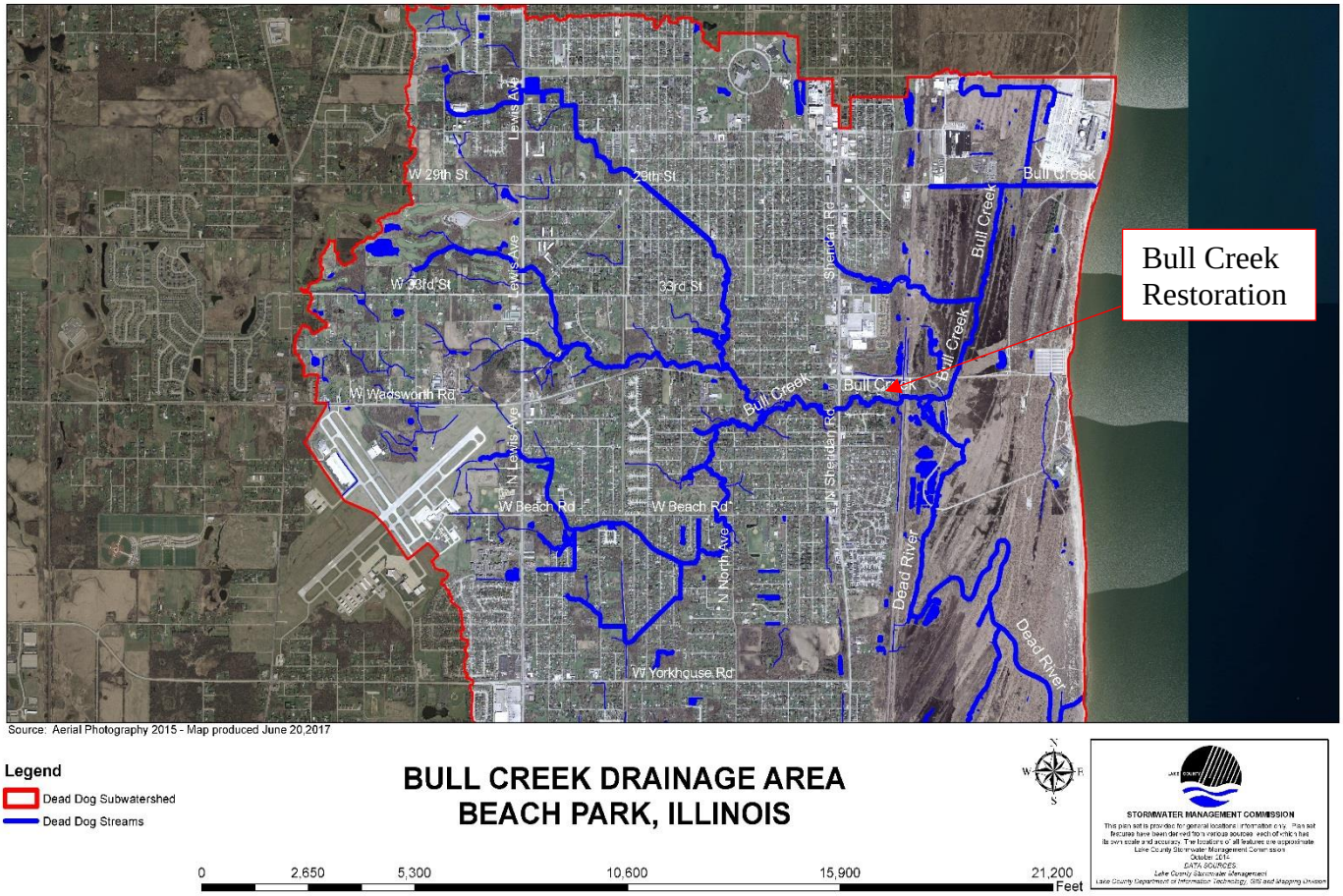

Figure 1: Bull Creek Drainage Area. Bull Creek is part of the Dead River subwatershed of Lake Michigan

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Introduction to Guide

This monitoring and maintenance guide is intended as a reference and guiding document for the Village of Beach Park (Village), Lake County Stormwater Management Commission (SMC), the Bull Creek Stakeholders Association (BCSA) and other landowners that own or manage properties along Bull Creek that have been restored using bioengineering stabilization practices. This document provides information about how the Village and riparian landowners can monitor and maintain the buffer area, streambank, and channel on their property, and discusses the circumstances under which landowners should take action or contact the Village or the SMC about an observed problem. Landowners should contact the Village if they observe significant changes in the condition of the stream channel, or if a problem that is beyond the scope of an individual landowner to resolve has been identified. The Village may elect to contact SMC if the problem concerns a practice that was installed as part of the restoration process. It is recommended that one or more photographs be taken to document the problem with the date and the location from which the photograph was taken be recorded.

The Village of Beach Park may be contacted by phoning (847)746-1770.

SMC may be contacted by phoning (847) 377-7700.

This first section of this guide provides definitions of the various bioengineering practices that were implemented to restore the stream, as well as other restoration and conservation terms used throughout this document. Section II provides information about how landowners can monitor and maintain the vegetation along the streambank and within the riparian zone. Section III discusses what landowners can do to monitor the streambanks and channel and the various structures installed as part of the restoration project. Section IV lists some general household practices that can reduce the amount of pollution entering Bull Creek. Section V lists the threatened species that may occur in the area, how to identify the species, and what to do if one is sighted. Section VI lists references used to prepare this monitoring and maintenance plan.

If you have any questions about the information in this plan, please contact SMC by phoning (847) 377-7700.

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Definitions

Biodiversity – Biodiversity refers to the diversity of plants and animals (the number and variety of organisms) found within a specified geographic region. It is also the variability among living organisms on the earth, including the variability within and between species and within and between ecosystems.

Buffer zone – The buffer zone area along Bull Creek refers to an area along the stream where deep-rooted native vegetation has been planted to stabilize the streambank and protect the adjacent riparian area from erosion. The roots and leaves of the vegetation in the buffer serve to catch and filter stormwater, removing some of the nutrients and chemicals in the water before it reaches the stream. The buffer zone along this reach of Bull Creek is protected in a conservation easement.

Coir fiber rolls, mattresses, and blankets – Coir fiber rolls, mattresses, and blankets are made from the woody fibers of coconut husks. These products are secured in place with stakes and are designed to prevent erosion while plants get established. Coir fiber rolls were placed at the toe (or base of the streambank) of the floodplain terraces on the inside bends in the Bull Creek project area. Coir mattress was used along the base of the streambank on the outside bends of the project area. The coir fiber blankets are similar in design to the mattresses, only thinner, are placed on the upper streambank above the coir mattress. Deep-rooted plants will stabilize the streambank as the coir product slowly degrades.

Conservation Easement - a conservation easement is a power invested in a private land conservation organization or government to constrain the exercise of rights otherwise held by a landowner in order to achieve certain conservation purposes for a specific land area. It is an interest in real property established by agreement between the landowner and a conservation organization or unit of government. The conservation easement "runs with the land," meaning it is applicable to both present and future owners of the land. As with other real property interests, the grant of conservation easement is recorded in the local land records and the grant becomes a part of the chain of title for the property. A conservation easement was established along Bull Creek to include the creek and vegetated buffer. The easement is held by the Bull Creek Stakeholders Association.

Debris – In this document, debris refers to any natural material (e.g., brush, grass clippings, and tree limbs) in the riparian area, along a streambank, or within the channel.

Deposition – Deposition in the context of streams refers to the process by which flowing water deposits or drops some of its sediment load as it moves downstream. Deposition often occurs in areas of more slowly moving water (on the inside bends of a stream channel).

Drainage Easement – a drainage easement is a power invested in a private land organization or government to constrain the exercise of rights otherwise held by a landowner so as to install, lay, construct, renew, operate and maintain and reconstruct as the Grantee deems necessary drainage and/or streambank stabilization in, on, over and within the permanent drainage easement for a specific land area. It is an interest in real property established by agreement between the landowner and a Grantee organization or unit of government. The drainage easement "runs with the land," meaning it is applicable to both present and future owners of the land. As with other real property interests, the grant of drainage easement is recorded in the local land records and the grant becomes a part of the chain of title for the property. A drainage easement was established along Bull Creek to include the creek and vegetated buffer. The drainage easement is held by the Village of Beach Park.

Erosion – Erosion of the soil or substrate can occur when water in a stream scours the sides or bottom of the channel or streambed, removing sediment from these areas as it moves downstream. Erosion often occurs on streambanks on the outside bends of a stream channel. The process of erosion can contribute excess sediment to a stream, alter the channel form, degrade water quality and negatively impact aquatic life.

Floodplain terrace – Floodplain terraces were constructed on the inside bends of Bull Creek by excavating the soil from steep streambanks and decreasing the slope of the bank to allow the water to spill over to the floodplain, which provides flood storage during rain events. The floodplain terraces also help to reduce the velocity of the water flow and subsequently, its erosive force.

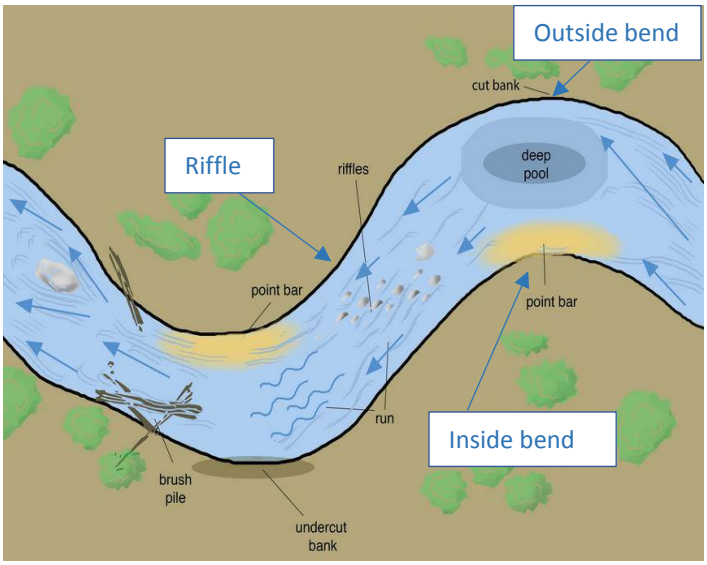
Inside bend – The inside bend of a stream is the streambank along the inside curve in a stream channel. In natural stream form, the inside bend is considerably lower than the streambank on the outside bend. Water flow in the inside bend is often moving at a lower velocity than on the outside bend. As a result, sediment is often deposited in these areas, creating depositional zones.

Invasive vegetation – Invasive vegetation can be a non-native or a native plant species native to a different region of the U.S.A. Invasive vegetation competes with native vegetation for sunlight, moisture, nutrients and space. If the invasive vegetation is unmanaged, it can dominate the natural area and crowd out desirable deep-rooted native plants.

Native vegetation – Native vegetation refers to plants that naturally occur in the region. A list of native plants that were planted as part of the Bull Creek restoration project is attached to this document.

Outside bend – The outside bend of a stream refers to the outside curve of the stream channel. Water flowing in this area is often moving at a higher velocity, therefore, the streambank on the outside bend is often subject to scour and erosion.

Riffle – A riffle refers to an area in the streambed where the water flows over accumulated stone. The streambed is higher (and the water level is shallower) compared to the bed immediately upstream or downstream. Riffles naturally occur in the straight runs between the meander bends of a stream channel. Artificial riffles have been installed in Bull Creek by embedding and adding stone to the streambed. These riffles are designed to stabilize the grade (or bottom) of the channel bed by preventing the channel from eroding and incising deeper into the landscape.



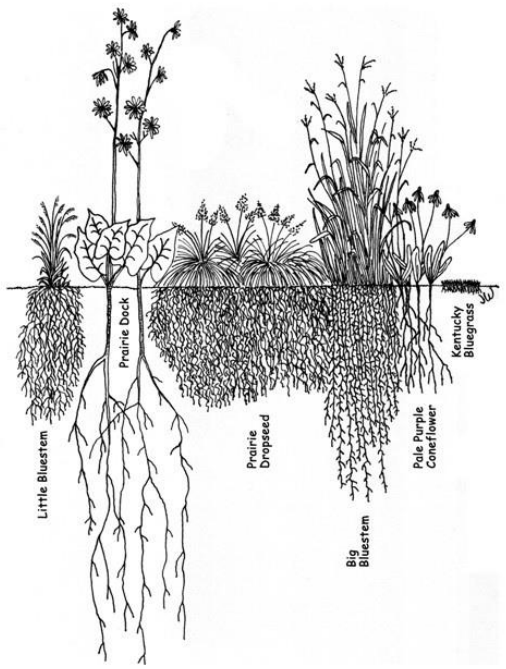
Stone toe protection – Stone toe protection refers to the rocks that have been placed at the toe of the streambank to stabilize the bank. Stone toe protection is embedded into the channel and is installed along the severely eroded areas of the outside bends in the project area. Ideally, plants will germinate among the stone and serve to further stabilize the streambank.

Riparian zone or area – The riparian zone refers to the area adjacent to a stream or river and includes the vegetation in the buffer zone.

Vegetated geogrids – Vegetated geogrid lifts were installed in one bluff location along Bull Creek. The lifts are constructed of layers of wrapped stone or soil and planted with appropriate deep-rooted native shrubs, grasses and flowers. The lifts are supported by "A-jacks," which are concrete, jack-shaped structures that are installed as a base in the streambed for the geogrid lifts. A-jacks are also used to protect the toe of the bluff.

II. VEGETATION – MAINTAINING THE NATIVE STREAM BUFFER

This section provides a discussion of how the vegetation along the streambank and within the stream buffer zone should be monitored and maintained. Vegetation in the buffer zone is crucial in terms of protecting the health of the stream. Plants act as anchors, holding the soil in place and preventing erosion. They also allow water to more easily soak through the soil. The plants and soil act as a natural filtering system, cleaning the water before it reaches the stream. Taller vegetation creates shade, which will lower the water temperature, providing a more desirable habitat for fish. Plants also provide food and habitat for other aquatic and terrestrial insects and animals.



Comparison of deep-rooted native plants and Kentucky Bluegrass (far right). The roots of native plants stabilize the soil and infiltrate stormwater runoff.

Landowners along Bull Creek dedicated a conservation easement along Bull Creek and have agreed to establish a "no-mow" native plant buffer zone along the stream within the areas of the conservation easement on their properties. The easement varies from 30 feet to 50 feet in width from the center of the creek. A "no-mow" approach does not eliminate the need for occasional prescribed mowing to maintain the native plants, but it does not follow typical grass mowing procedures for lawns that include frequent and short cuttings. Ideal buffer widths are determined by considering the soil structure, slope, and adjacent land use. According to the Watershed Development Ordinance in Lake County, for areas of new development, when the channel has a watershed greater than one square mile, the minimum buffer width shall be 30 feet on each side of the channel. **Attachment 1** of this document provides a description and map of the native buffer zone widths along Bull Creek in the conservation easement.

Native Species

Native vegetation refers to those plants that are naturally found in the intended area of planning. Native plants are adapted to soils and hydrologic conditions found in stable stream corridors and are typically deep rooted. They are also part of a natural, ecological balance. A list of the native plant species that were seeded as part of the Bull Creek restoration project is included as **Attachment 3**.

Managing Native Species

It is important to manage newly planted areas for weeds during the first three years after planting. The contractor will be responsible for monitoring and maintain the native plant areas through the first and second growing season. After this period, it will be the homeowner's responsibility to maintain the vegetation on their properties. If there is a noticeable unexplained change in the health of the native plants, contact the or Stormwater Management Commission or Village.
The native buffer zone will require more intense management during the first three years while the native plants get established. Management during establishment will include watering, weed control and monitoring and reporting plant loss to the Stormwater Management Commission (SMC) following high flow events. Weed control is the area of management that requires the greatest commitment from landowners. Periodic hi-mowing (greater than 10" above ground surface) may be needed to control weed growth. Hand-weeding beginning in year two may be appropriate in some areas. It is also recommended that landowners with property along streambanks or other shorelines avoid or minimize the use of chemicals (e.g., herbicides and insecticides) in the buffer zone and on their adjacent lawns outside of the buffer zone except as described in the following native plant maintenance section.

If possible, remove debris that may be keeping sunlight from penetrating to the ground layer. Blowing and/or dumping of grass clippings, leaves, branches, animal waste or vegetative or man-made debris in the riparian buffer zone or on the streambank should be strictly avoided. As described previously, deep-rooted native plants in the stream buffer and on the banks, stabilize the soil preventing land loss to erosion and pollution. Piling yard waste in the buffer zone, ravine slopes and on the streambanks, will kill the desirable stabilizing buffer vegetation or increase nutrients not intended for the ravine system.

Recommended Maintenance Program in the Buffer Zone

Native wildflowers and grasses grow slowly when compared to non-desirable weedy species, which tend to germinate and grow more quickly in the first two years. This initial slow growth of native plants makes maintenance of the buffer during the first few years necessary. Cutting back weeds in the first year prevents production of more weed seeds that could cause problems in the second year.

The long-term goal for the native plant areas is to maintain a majority of native grasses intermixed with native flowers. Periodic high mowing is the best short-term control for weedy species to promote successful establishment of the native plants. As a rule, it is best to not pull weeds during the first year of native area growth as native plant seedlings will be disturbed and uprooted with the weed removal.

The following invasive plant species have been observed in the Bull Creek Conservation Easement and will need to be controlled. In following under the header **Managing Invasive Species** are images representing the most aggressive invasive or aggressive species that will require either herbicide spot applications or digging up the entire root system:

1. Perennials: Ragweed species, Canada Thistle, Curly Dock, Sweet Clover, Garlic Mustard, Phragmites, Reed Canary Grass, Teasel, Wintercreeper, Common Daylily, Purple Loosestrife,

2. Trees: Non-native Elm, Cottonwood, Tree of Heaven, Black Locust, Box Elder, Amur Honeysuckle, Common Buckthorn, Glossy Buckthorn, Multi-flora Rose, European Cranberry Viburnum, Norway Maple, Japanese Barberry, Burning Bush, and Common Mulberry.

Safe herbicide use requires proper equipment, use and understanding of the risks associated with the chemicals to be used. Each pesticide has a Material Safety Data Sheet (MSDS) label. Observe MSDS labels on herbicides for appropriate application rates and appropriate use in proximity to water sources and sensitivity or adverse effects to water quality or wildlife. For contracted services, licensed pesticide applicators can be located or verified through the Illinois Department of Agriculture (https://www.agr.state.il.us/Environment/Pesticide/aplicatorsearch.php).

First Year Maintenance Program:

1. To control invasive plant species, do a "hi-mow" using a flail-type mower or string trimmer on a regular basis during the first year of native plant establishment. High mowing is critical to the success of the native plants.
    a. Mow 3-6 times during the first year (frequency will be dependent on plant growth).
    b. Maintain plant heights between 6-12 inches above the ground.
    c. Remove clippings to prevent smothering the young prairie seedlings as they grow.
    d. The last mow should be early-September. Do not mow after this date. The remaining growth will serve as winter protection for seedlings.
2. In addition to mowing, a spot herbicide application to control invasive woody species and other undesirable plant species may be needed. See above list for some problematic plants.

Second Year Maintenance Program:

1. For native plant success to continue, mow at a height of 6 inches in late-spring (typically April-Early May) and remove mowed vegetation to prevent smothering.
2. Mowing frequency during the growing season (2-4 times) will be dependent on invasive plant species activity and available moisture:
    a. Mow in early summer (typically Early-June) at a height of 10-12 inches to remove flower heads from invasive plant material that may be growing.
    b. Do not ever mow lower than 10 inches during the growing season in the second year and do not mow after early-September.
3. In addition to mowing, a spot herbicide application to control invasive woody species and other undesirable plant species may be needed, see the above list for some problematic plants.

Third Year and Long-Term Care Maintenance Program:

1. For effective control of invasive plant species,
    a. Mow at a height of 6 inches in late-spring (typically April- Early May) and remove mowed vegetation to prevent smothering.
    b. Mowing may be needed but will be dependent on invasive plant species activity and available moisture.
    c. In addition to mowing, spot herbicide application control of invasive woody species and other undesirable plant species may be needed throughout the growing season, see the list above for some problematic plants.
    d. Controlled mowing of your native plant area every other year will help ensure the long-term success of your ravine habitat and continued success. Removing the plant litter from the previous year's growth, exposes the soil surface to the sun.
2. A controlled burn could be completed in mid-spring if conducted by a Certified Illinois Prescribed Burn Manager could be conducted every other year, but this is client dependent and

fuel dependent. The success establishment of native grasses will ensure that there is sufficient fuel for the prescribed burn. **NO BURNING on the bluff face as it will damage the permanent fabric used to stabilize the slopes.**

a. A prescribed burn is dependent on fuel availability.
    i. The contractor for the prescribed burn shall have experienced, trained and certified professionals including certified burn boss and associated certifications.
    ii. All state and local permits shall be applied for in October of the year prior to burning. Permits typically take 90 days from receipt of application by the IEPA to award. In addition to permit, notification to municipal fire and safety departments and adjacent property owners should be performed.
    iii. All submittals required for safety and permit award shall be prepared and provided by the hired professional as required by state and local authorities.
    iv. The contractor should prepare fire breaks and have all necessary equipment for work and safety.

Monitoring and Managing Invasive Vegetation

Invasive Species

Non-native invasive plant species are typically transplanted by humans, mammals, and birds to a location, area, or region where they did not previously naturally occur. These plants can establish a breeding population in the new location and without further intervention by humans may become a pest crowding out the native plant community. Several native plant species can become weedy and dominate an area particularly due to changes in hydrology or after disturbance of the soil, therefore native species such as box elder trees and cottonwood and black locust saplings will also need to be controlled as invasive. Invasive vegetation tends to establish quickly, but typically has weaker root structures, thereby not providing the same erosion protection as deep-rooted native plants. Managing invasive plants is the single most important maintenance practice for the stream buffer zone.

Managing Invasive Species

Managing invasive species is essential for preserving the integrity and health of the stream. Invasive species tend to occupy recently restored streambanks because restoration practices often disturb the soil and provide more light and space for invasive vegetation to get established. The first step to controlling these plants is to be able to properly identify them. Once the species have been identified, manual removal is the safest way to eliminate the undesired vegetation. Some of the invasive woody species in the buffer zone have been cut and treated with herbicide. If the previously cut stumps start to sprout suckers (re-growth), the stumps may need to be recut and treated. The pictures below depict the invasive species that are likely present near Bull Creek (figures 2 through 13).

See **Attachment 4** for sources if information on "how to" best manage each invasive species.

Figure 2. Garlic mustard, *Alliaria petiolata*

Figure 3. Amur honeysuckle, *Lonicera maackii.*

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Figure 4. Reed canary grass, *Phalaris arundinacea*

Figure 5. Common buckthorn, *Rhamnus cathartica*

Figure 6. Glossy buckthorn, *Rhamnus frangula*

Figure 7. Multiflora rose, *Rosa multiflora*

Document Date: 8/14/2017

Figure 8. Purple loosestrife, *Lythrum salicaria*

Figure 9. Common reed, *Phragmites australis*

Figure 10. Black locust, *Robinia pseudoacacia*
Native to Illinois but can be weedy and invasive.

Figure 11. Cottonwood, *Populus deltoides*
Native to Illinois but can be weedy and invasive.

Figure 12. Box elder, *Acer negundo.*
Native to Illinois but can be weedy and invasive.

Figure 13. Giant ragweed,
Native to Illinois but can be weedy and invasive.

III. MANAGING THE STREAM CHANNEL

Channel and Stabilization Structure Conditions

This section discusses what to look for in terms of changes to the bioengineered or stabilization structures implemented as part of the restoration of Bull Creek. More information on stream channel form and function is included in **Attachment 5**. It is important to note that the structures put in place to restore the stream channel and bank will likely shift slightly over time as the stream adjusts to the changes made to it. In addition, sediment will accumulate on the sediment bars along the inside bends of the stream channel over time. After the first several years, most of the practices implemented will likely need only minimal maintenance. However, it is critical to monitor the structures during the first two years, because during this period the stream channel will be adjusting to the changes. In general, landowners should monitor the transitional areas for erosion. Transitional areas refer to the locations where the bioengineering and stabilization structures interface with the natural streambank and channel. In addition, landowners should check for other changes in the structures and practices implemented, which are described below.

Monitoring Channel and Stabilization Structures for Signs of Displacement or Excessive Erosion

Coir Fiber Rolls

Coir fiber rolls were placed at the toe of the streambank along the inside bends where the floodplain terraces were constructed during the earlier project phase to prevent the streambank from undercutting and eroding in those areas. Coir Rolls are a low-impact control technique to reduce the erosive power of water to the toe of a streambank. Eventually, these products will deteriorate, and the plants put in behind them and the native seeding should anchor the bank and protect the soil from undercutting. The coir fiber rolls should be inspected after they decompose to make sure that the existing vegetation can support the bank.

Coir Fiber Mattresses and Blankets

Coir fiber mattresses and blankets were also installed in Bull Creek as part of the previous construction phase and were plugged and seeded. The coir products were used to stabilize the outside bends of the channel until the plants establish. Coir fiber blankets are a stabilization technology that aid in establishing native plants from seed or plugs all the while minimizing soil erosion as the native species establish and stabilize along the streambank.

Figure 14. This photograph shows the coir fiber mattress and blanket on the far bank of Bull Creek. The mattress is on the bottom and in contact with the water and the blanket is above it.

Floodplain terraces

Floodplain terraces were constructed along the inside bends of the stream channel. These areas allow high water events storage capacity and help in reducing erosive streambanks in stream channels within meandering stream channel bends. Landowners should contact the Village or SMC if these areas erode extensively.

Riffles

The "crest" or highest point of the riffles constructed in Bull Creek should remain at the height at which they were installed. Riffles are a bioengineering technique designed to mimic natural stream channel occurrences. Riffles aid in removing sediment from moving water, reducing water speed, and oxygenating water. SMC will be using survey equipment to monitor the height of these riffles periodically, but landowners can also watch the riffles for significant changes, particularly after storm events, and notify the Village or SMC if the riffles are damaged extensively. Landowners should also monitor the banks near the riffles for erosion. If the riffles are altered and start to redirect the water to the banks, the riffles will need to be repaired to avoid erosion in these areas. A photograph of a riffle immediately following installation is shown below in figure 15.

Figure 15. Photograph of bioengineering practices immediately following construction include a riffle (center), coir fiber roll (left side of the stream and in contact with the water), coir fiber mattress (right side of the stream and in contact with the water), and coir fiber blanket (both banks).

Sandbars

Sandbars have accumulated in various locations throughout the stream and are part of a natural and healthy stream. Sandbars are the result of converging streams where sediment drops out of the water column. In Bull Creek where high water events typically flow over land in the floodplain and converge with the normal stream channel the sand drops out forming a sand bar. However, if a landowner notices that new sandbars are forming in locations where they had not been before, they should take note of this and let the Village or SMC know if the new sandbar develops rapidly or extensively. An example of such a sandbar is shown below (figure 16).

Figure 16. Photograph of a new sandbar developing (center) in a location following restoration.

Stone Toe Protection

Stone has been imbedded into the toe of the streambank and bed along the outside bend of the stream in sections of the restored Bull Creek. Stone toes aid in reducing the erosive power of water to stream banks. This practice should require little to no maintenance, but contact the Village or SMC if problems are observed above the stone toe.

Tile Drains

Gravel was placed below the areas where sump pump drainage tiles divert water to Bull Creek. (See photograph below, figure 17) Rock was also used to protect eroding gullies and pipe outlets to the creek. Landowners with these structures on their property should take note if the rock from these outlets has been significantly relocated or removed and repair any erosion that occurs as a result.

Any existing or new tile drains should be extended to outlet directly to the normal water line of Bull Creek, this practice reduces erosion in the floodplain or on the top of the streambank.

Figure 17. Photograph of tile drains that divert sump pump water to Bull Creek. Note the gravel that has been placed below the drains to prevent erosion as the water flows to the channel.

Vegetated Geogrids

Vegetated geogrid lifts were installed in two bluff areas in one location along Bull Creek. A-Jack structures and stone were trenched in at the toe of the bluff to support the lifts. The lifts should be monitored to ensure that they remain intact, are stable, and are not altered significantly. Native vegetation has been planted within the geogrid lifts, and landowners should monitor this vegetation to make sure that it continues to grow. After the first couple growing seasons, properly constructed vegetated geogrid lifts should not require much maintenance. A photograph of the vegetated geogrid under construction is below in figure 18. In areas where vegetated geogrids are installed (North streambank of 9841 Paxton Rd. and North streambank of 9797 Paxton Rd.), no burning of any kind can occur as the fabric will burn and this will impact long-term stabilization integrity. Low mowing close to the ground should also be avoided in the geogrid areas, minimizing damage to the geogrid insures long-term stabilization integrity.

Figure 18. Photograph of two of the vegetated geogrid lifts and the A-jacks structures directly below them. The image shows the structure during construction; a number of additional lifts were added on top.

Removing Woody Debris and Trash

Fallen trees and large limbs can limit the sunlight that streambank vegetation receives and can also redirect the flow of the water when they fall in or across the channel close to the water surface. Fallen trees may cause in-stream debris accumulations (debris jams) and erosion, therefore, it is necessary to assess whether a fallen tree may cause a problem and remove such the tree and debris out of the channel and floodway before significant amounts of it have accumulated. Managing fallen trees when necessary will protect the restored stream channel and buffer. Further, any trash found in the buffer area, stream banks, or stream channel (e.g., old tires, car parts, and appliances) should be removed as soon as possible. Landowners should inspect the streambank and channel for debris periodically and after significant storm events. The floodway means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. The area highlighted in yellow in Figure 19, indicates the floodway.

Because in-stream woody debris provides aquatic habitat, the American Fisheries Society (AFS) recommends removing only those debris accumulations that are obstructing flows to a degree that results in unacceptable flow problems, or that are likely to cause problems. Small amounts of woody debris generally do not cause a problem and should be left undisturbed. AFS management recommendations for several scenarios are listed below.

- *Affixed logs that are cross-ways in the channel and that are causing problems or are likely to cause problems should be moved to a more parallel orientation or may be removed entirely. Isolated or single logs should not be disturbed if they are embedded, lodged or rooted in the channel and are not causing flow problems.*
- *Free logs that are not rooted, embedded, or lodged should be left, repositioned, affixed or may be removed.*
- *Rooted trees (alive or dead) may be cut and repositioned or removed if they are likely to cause problems in the near future. Tree stumps with roots should be left in place to prevent bank erosion and provide valuable fish habitat.*

- *Small accumulations of debris (sticks and leaves) in the stream channel should be left in place as long as the debris is not obstructing stream flow. Such material is beneficial to fish and other aquatic life.*

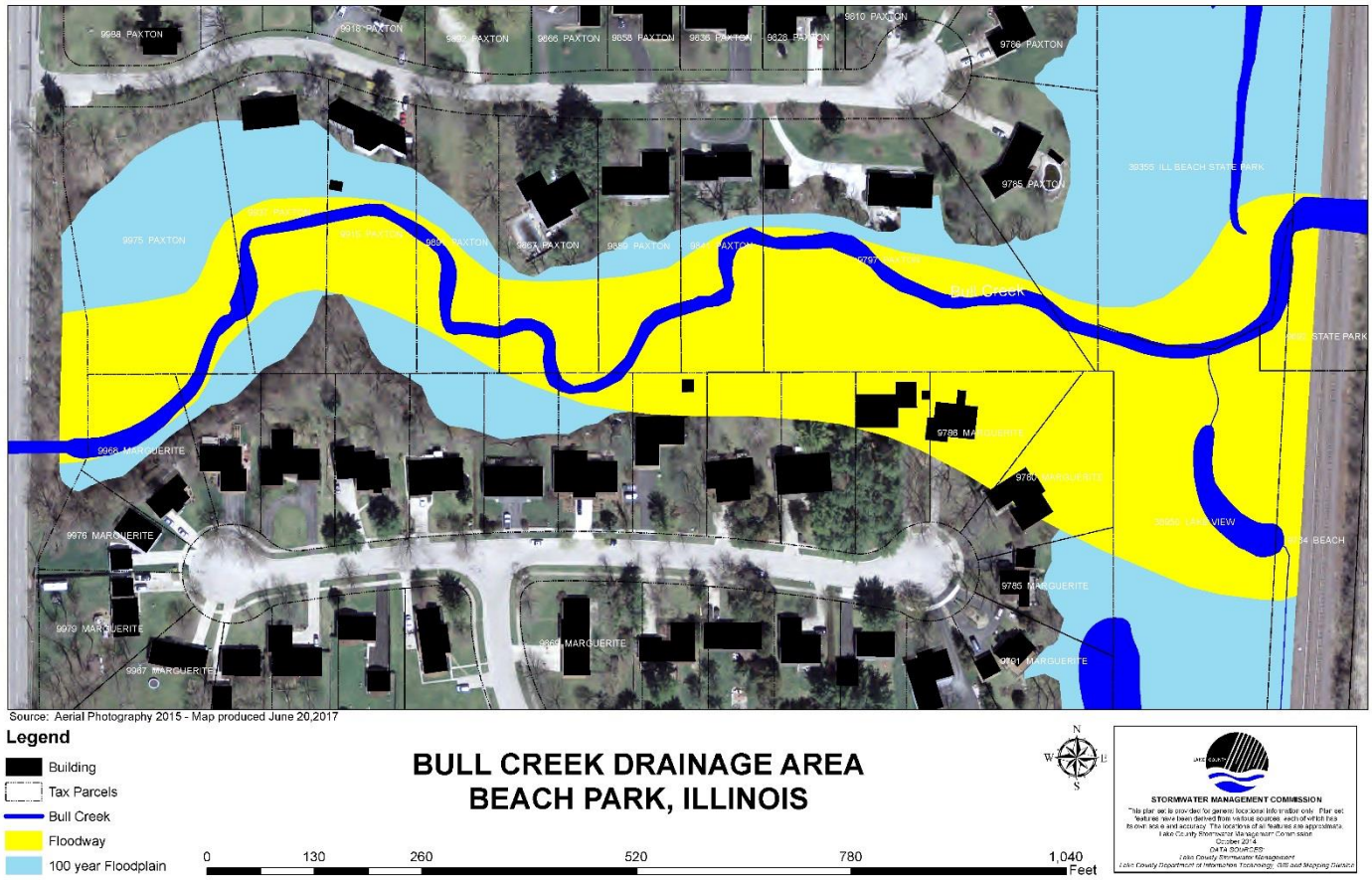

Figure 19: Bull Creek Regulatory and Floodplain

It is the landowner's responsibility to manage downed trees on his/her property. Larger logs and trees need to be cut into smaller pieces before being removed to avoid damaging the bank and channel and any areas disturbed during removal may need to be reseeded. Please contact the Village or SMC if you are uncertain about how to handle a fallen tree or debris accumulation in the stream channel on your property.

IV. BEST YARD MANAGEMENT PRACTICES FOR A HEALTHY STREAM

Lawn Management

Lawn management in areas outside the easements should use practices that promote healthier stands of grass and protect the stabilization measures within the easement. Turf mowing recommendations are to mow no less than 3" above the ground surface, setting a higher grass mowing height can reduce the presence of weeds that can grow in the lawn by as much as 50 percent, by allowing the grass to out-compete the weeds.

Document Date: 8/14/2017

Rain Gardens and Rain Barrels

Rain gardens are landscaped areas planted with wildflowers and other native vegetation that soak up rainwater, mainly from the roof of a house or building. The rain garden fills with a few inches of water after a storm and the water slowly filters into the ground rather than running off to a stream or into a storm drain that leads to a stream. Rain gardens help protect streams and lakes from pollutants carried by stormwater (e.g., lawn fertilizers, pesticides, and harmful substances that wash off roofs and paved areas) and protect communities from flooding and drainage problems. For more information on rain gardens, see the University of Wisconsin-Extension's brochure, "Rain Gardens: A Household Way to Improve Water Quality in Your Community," available via the Web at http://clean-water.uwex.edu/pubs/raingarden.

Rain barrels are large barrels that collect rainwater from the down spouts on roofs. The water is stored in the barrel and can be used for watering landscaping. Rain barrels are simply a method of collecting water to reduce stormwater runoff and for reducing the use of potable water for landscaping. For more information on attaching a rain barrel to your gutter system: http://www.rainbarrelguide.com/how-to-install-rain-barrels/ There are also several short "how to" videos available on the Web at youtube.com.

Use of Fertilizers

One of the biggest problems for Lake County streams and lakes is the over-application of fertilizers, increasing the amount of nutrients entering water bodies, which causes excessive growth of algae blooms and other aquatic plants. Nutrients can come from many sources, and one of the largest sources is from the overuse and misapplication of lawn fertilizers. The following list includes several actions and precautions that can prevent this problem from occurring.

- If fertilizing is necessary, apply a phosphorous-free product.
- Fertilizers with nitrogen should not be applied more than once annually and should be timed with active growth.
- Do not fertilize plants near streambanks and avoid applying fertilizers before it rains as it is likely to wash off as pollution and not be effective.
- Avoid spilling and applying fertilizer on impervious areas like sidewalks and driveways, because the nutrients can too easily wash away into a stream or storm drain.
- Do not dump excess fertilizer (or any other substance) into a storm sewer. Utilize the services of SWALCO (http://www.swalco.org/).
- Follow directions on the product label and determine fertilizer type and application rates based on the results from testing a soil sample.

Attachment 2 of this document lists soil testing facilities throughout and surrounding Illinois. The cost of testing one soil sample ranges from between $10 and $15, and it is recommended that two samples be submitted for analysis—one sample from a part of the yard where the plants are growing well and a second sample from a part where the plants are not as healthy. In this region, fertilizer should be applied in September if a soil test determines that it is needed.

Use of Pesticides

Pesticides such as plant control herbicides should be applied by trained and certified applicators. Herbicides a type of pesticide can in different formulations, functions and application requirements. The following list includes several actions and precautions that can prevent this problem from occurring.

- Pesticides should be used sparingly or as needed when active growth is occurring.
- All MSDS and product labels should be read and understood. Avoid applications before it rains as it is likely to wash off as pollution and not be effective.
- Avoid spilling because the chemicals tend to move easily with water and can easily wash away into a stream or storm drain.
- Do not dump excess pesticides into a storm sewer. Utilize the services of SWALCO (http://www.swalco.org/).

Disposing of Yard Waste

Dumping grass clippings, leaves, branches, animal waste or other debris in the riparian buffer zone or on the streambank should be strictly avoided as it can interfere with the natural flow of the stream and disrupt vegetation growth on the bank and in the buffer. As described previously, deep-rooted native plants in the stream buffer and on the banks, stabilize the soil preventing land loss to erosion and pollution. Piling yard waste in the buffer zone, ravine slopes and on the streambanks, will kill the desirable stabilizing buffer vegetation. Although composed of natural materials, piling or dumping grass, leaves and branches along the stream is not a natural process. These yard waste materials contain nutrients that can disrupt the stream's chemical composition and encourage excess growth of algae or aquatic vegetation when contributed in volume to the stream system.

Landowners should consider using a mulching lawn mower that leaves the grass clippings on the lawn, or composting the clippings and other yard waste in an area that is located away from the stream. Clippings can provide moisture and nutrients to the lawn, reducing the need for fertilizer and irrigation.

General household practices

This section discusses practices that landowners can implement to reduce the pollution created in their yards and subsequently, the amount that reaches nearby waterways. This information is particularly pertinent for landowners living along Bull Creek, but it is relevant for everyone since all land areas drain into a waterbody.

- Do not pour chemicals on the ground, in a stream, or down a storm drain. Chemicals contaminate water and sediments.

- Direct roof downspouts and sump drains to grassed areas or rain gardens where it can soak into the ground.

- Avoid directing sump, roof or driveway runoff to the surface of the slope leading down to Bull Creek as it will likely result in erosion.

V. THREATENED PLANT AND ANIMAL SPECIES

Identifying Threatened Species

The Illinois Department of Natural Resources (IDNR) has determined that there are three state listed threatened species that could potentially inhabit Bull Creek in the vicinity of the restoration project. If you spot one of these species, please contact:

Brad Semel
District Heritage Biologist
Illinois Department of Natural Resources
8916 Wilmot Road
Spring Grove, IL 60081
PHONE: (815) 675-2385
E-MAIL: brad.semel@illinois.gov

Document Date: 8/14/2017

VI. REFERENCES

Bannerman, Roger and Ellen Considine. *Rain Gardens: A How-to Manual for Homeowners*. Wisconsin Department of Natural Resources and U.S. Geological Survey. 2003. This document is available at <http://clean-water.uwex.edu/pubs/raingarden.>

Biedenharn, David S., Charles M. Elliott, and Chester C. Watson. *The WES Stream Investigation and Streambank Stabilization Handbook.* Presented by the U.S. Army Corps of Engineers, Waterways Experiment Station (WES), Vicksburg, Mississippi. October 1997.

Center for Plant Conservation Web site. Information about the forked aster is available at <http://www.centerforplantconservation.org/NC_Choice.html>; click on Quick List and then on *Aster furcatus*.

Schueler, Tom and Ken Brown. *Urban Stream Repair Practices, Version 1.0.* Urban Subwatershed Restoration Manual No. 4. Center for Watershed Protection. Ellicott City, MD. November 2004.

Document Date: 8/14/2017

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Illinois Natural History Survey, Center for Biodiversity Web site. Information about the Blanding's turtle is available at <http://www.inhs.uiuc.edu/cbd/herpdist/species/em_blandin.html> and Kirtland's snake information is available at <http://www.inhs.uiuc.edu/cbd/herpdist/species/cl_kirtlan.html>.

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University of Wisconsin at Stevens Point, Robert W. Freckmann Herbarium <http://wisplants.uwsp.edu>.

U.S. Environmental Protection Agency Web site. *Factsheet: How Can I Make a Rain Barrel?* This document is available at http://www.epa.gov/Region3/p2/make-rainbarrel.pdf .

U.S. Environmental Protection Agency Web site. *Factsheet: What is a Rain Barrel?* This document is available at <http://www.epa.gov/Region3/p2/what-is-rainbarrel.pdf>.

Wisconsin Department of Natural Resources http://dnr.wi.gov/org/caer/ce/invasives

Attachment 2 – List of Regional Soil Testing Labs

The University of Illinois Extension maintains a list of labs capable of providing a soil analysis. The url: https://extension.illinois.edu/soiltest/ is a good reference point that also indicates the various soil testing parameters available.

Attachment 3 - Native Plant Species installed as Seed or Plugs for Bull Creek Restoration

Floodplain Native Plants						
Botanical Name	**Common Name**	**Type**		**Botanical Name**	**Common Name**	**Type**
Aquilegia canadensis	Wild Red Columbine	Flower		*Carex arundinacea*	Sweet Wood Reed	Grass
Aster lateriflorus	Calico Aster	Flower		*Carex granularis*	Meadow Sedge	Grass
Aster novae-angliae	New England Aster	Flower		*Carex sparganoides*	Burred Sedge	Grass
Aster sagittifolius	Arrow-Leaved Aster	Flower		*Elymus canadensis*	Prairie Wild Rye	Grass
Echinacea purpurea	Purple Coneflower	Flower		*Elymus virginicus*	Virginia Wild Rye	Grass
Eupatorium purpureum	Sweet Joe Pye Weed	Flower		*Hystrix patula*	Bottlebrush Grass	Grass
Helianthus divaricatus	Woodland Sunflower	Flower		*Panicum virgatum*	Switch Grass	Grass
Monarda fistulosa	Wild Bergamot	Flower				
Physostegia virginiana	Obedient Plant	Flower		*Cornus sericea*	Red Osier Dogwood	Shrub
Polygonum punctatum	Dotted Smartweed	Flower		*Cephalanthus occidentalis*	Button Bush	Shrub
Polygonum virginianum	Virginia Knotweed	Flower		*Hamamelis virginiana*	Witch Hazel	Shrub
Rudbeckia hirta	Black-Eyed Susan	Flower		*Sambucus canadensis*	Elderberry	Shrub
Rudbeckia submentosa	Sweet Black-Eyed Susan	Flower				
Solidago flexicaulis	Zigzag Goldenrod	Flower				
Solidago ulmifolia	Elm-Leaved Goldenrod	Flower				

Stream Bank Native Plants						
Botanical Name	**Common Name**	**Type**		**Botanical Name**	**Common Name**	**Type**
Asclepias incarnata	Swamp milkweed	Flower		*Carex cristatella*	Crested sedge	Grass
Helenium autumnale	Common sneezeweed	Flower		*Carex emoryi*	Riverbank Sedge	Grass
Helianthus grosseserratus	Sawtooth Sunflower	Flower		*Carex frankii*	Bristly Cattail Sedge	Grass
Iris virginica	Blue Flag Iris	Flower		*Carex grayi*	Common Bur Sedge	Grass
Lobelia cardinalis	Cardinal flower	Flower		*Carex grisea*	Wood Gray Sedge	Grass
Mimulus rigens	Monkey flower	Flower		*Carex lacustris*	Common lake sedge	Grass

Document Date: 8/14/2017

Rudbeckia laciniata	Cutleaf Coneflower	Flower		*Carex pellita*	Broad-Leaved Woolly Sedge	Grass
Silphium perfoliatum	Cup plant	Flower		*Carex stipata*	Common fox sedge	Grass
Symphyotrichum lanceolatum	Panicled Aster	Flower		*Carex vulpinoidea*	Fox sedge	Grass
Symphyotrichum lateriflorum	Side-Flowering Aster	Flower		*Cinna arundinacea*	Wood Reed	Grass
Verbena hastata	Blue Vervain	Flower		*Elymus riparius*	Riverbank wild rye	Grass
Verbesina alternifolia	Wingstem	Flower		*Elymus virginicus*	Virginia Wild Rye	Grass
Zizea aurea	Golden alexanders	Flower		*Glyceria striata*	Fowl Manna Grass	Grass
				Leersia oryzoides	Rice Cut Grass	Grass
Alder rugosa	Speckled Alder	Shrub		*Scirpus atrovirens*	Dark green bulrush	Grass
Cornus sericea	Red Osier Dogwood	Shrub		*Spartina pectinata*	Prairie Cord Grass	Grass
Cephalanthus occidentalis	Button Bush	Shrub				
Sambucus canadensis	Elderberry	Shrub				

Geogrid Slope Native Plants						
Botanical Name	**Common Name**	**Type**		**Botanical Name**	**Common Name**	**Type**
Aquilegia canadensis	Wild Red Columbine	Flower		*Andropogon gerardii*	Big Bluestem Grass	Grass
Aster lateriflorus	Calico Aster	Flower		*Bouteloua curtipendula*	Side-Oats Grama	Grass
Aster novae-angliae	New England Aster	Flower		*Carex arundinacea*	Sweet Wood Reed	Grass
Aster sagittifolius	Arrow-Leaved Aster	Flower		*Carex granularis*	Meadow Sedge	Grass
Echinacea purpurea	Purple Coneflower	Flower		*Carex sparganoides*	Burred Sedge	Grass
Eupatorium purpureum	Sweet Joe Pye Weed	Flower		*Elymus canadensis*	Prairie Wild Rye	Grass
Helianthus divaricatus	Woodland Sunflower	Flower		*Elymus virginicus*	Virginia Wild Rye	Grass
Monarda fistulosa	Wild Bergamot	Flower		*Hystrix patula*	Bottlebrush Grass	Grass
Physostegia virginiana	Obedient Plant	Flower		*Panicum virgatum*	Switch Grass	Grass
Polygonum punctatum	Dotted Smartweed	Flower		*Panicum virgatum*	Switch Grass	Grass
Polygonum virginianum	Virginia Knotweed	Flower		*Schizachyrium scoparium*	Little Bluestem Grass	Grass
Rudbeckia hirta	Black-Eyed Susan	Flower		*Spartina pectinata*	Prairie Cord Grass	Grass
Rudbeckia submentosa	Sweet Black-Eyed Susan	Flower		*Sporobolus heterolepis*	Prairie Dropseed	Grass
Solidago flexicaulis	Zigzag Goldenrod	Flower				
Solidago ulmifolia	Elm-Leaved Goldenrod	Flower				

Attachment 4 – Sources of Information on Invasive Plant Management and Alternative Plants for Landscaping

Midwest Invasive Plant Network Invasive Plant Control Database
http://www.mipn.org/control.html

Document Date: 8/14/2017

Weed Control Methods Handbook: Tools & Techniques for Use in Natural Areas
Mandy Tu, Callie Hurd & John M. Randall, The Nature Conservancy Wildland Invasive Species Team
version April 2001
http://www.invasive.org/gist/products/handbook/methods-handbook.pdf

Attachment 5 – Stormwater Best Practices

Lake County Stormwater Management Commission offers technical support and document references on our website. We offer Landowners information on best practices and available resources for improving water quality, decreasing runoff and improving natural habitats.

https://lakecountyil.gov/2261/Stormwater-Best-Practices