

Roadside Invasive Plant Management Plan

Southeastern Wisconsin Invasive Species Consortium, Inc.

Working to reduce the impact of invasive species in
Sheboygan, Washington, Ozaukee, Waukesha,
Milwaukee, Walworth, Racine and Kenosha Counties



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A. Introduction	1
B. Strategy and general plan for control along roadways	1
C. Four species, two plant types, two general control methods	2
D. Control Strategy / Plan details	3
1. Conduct continued annual monitoring of roadways	3
2. Identify newly-occurring individual plants and very small new patches	3
3. Eliminate/eradicate those newly-occurring individual plants	3
4. Identify exiting, well-established, larger infestations	3
5. Adjust and customize ROW mowing to prevent spreading seed	3
6. Sustain this program on a continuing basis	3
E. Species Information and Control Methods	4
1. Common and cut-leaved teasel	4
2. Wild parsnip	6
3. Phragmites	7
4. Japanese knotweed	9
F. General Management Recommendations	12
1. Properly-timed Mowing	12
2. Monitoring Disturbed Areas	12
3. Seeding with Invasive-Free Mixes	12
4. Routine Control of Current Populations	13
G. Summary of Best Management Practices (BMPs)	13
H. Summary of Chapter NR 40	15
I. Appendices	17
1. List of further resources	17
2. Seed mix guide	18
3. Sample inventory / monitoring / treatment form	19

A. Introduction

According to Wisconsin state statutes, invasive plants are any species of plant that is not native to our area and causes, or is likely to cause, harm to the economy, the environment, and/or human health. In an area where forestry, agriculture, tourism, and recreation are important to the economy, it is important to keep invasive plants from affecting those industries. In 2009, the state passed a rule – Chapter NR 40 – which regulates the transfer, transport, introduction, and possession of invasive species. This rule affects the management of rights-of-way in Wisconsin.

The time to begin managing invasive species in the rights-of-way is *before* they arrive in your area. Once they get a foothold, the best chance at controlling them is to start management as soon as possible, saving considerable time and money in the future. This plan will set priorities for the control or eradication of invasive plants that have already become established in the area, and outline practices to prevent the introduction of new invasive plants.

Populations of some high-priority invasive plants along your highways have been mapped by your residents. Please keep in mind that not all roadways were surveyed for this management plan, and there may be other invasive species on your roadsides that need to be managed. Detailed descriptions and control tips for species that were identified during our surveys can be found in section F. In addition, the map included in your paper and digital packets illustrates the areas that were surveyed and found to have invasive plants during the summers of 2011 and 2012.

We have identified targeted priorities that will minimize the long-term workload associated with invasive plant control. The first priority (after prevention) is to manage new infestations, beginning with those that are the fastest growing, cause the most damage, and occur near uninfested natural areas. It is also important to consider the difficulty of control, giving higher priority to infestations where control is most likely to succeed with available resources. Section G details the best management practices (BMPs) for rights-of-way in order to streamline this process. Section B and the attached appendices in section I offer additional recommendations and resources for the best results in controlling invasive plants.

B. Strategy and general plan for control along roadways

The four (five actually) species that SEWISC chose for its roadside survey, Common and Cut-leaved Teasels, Wild Parsnip, Phragmites, and Japanese Knotweed (JKW), were specifically chosen because:

- They are still controllable in most parts of southeastern Wisconsin;
- They are being spread though our area primarily along roadways;
- They are species that are easily spotted and identified while traveling in a vehicle; and
- If left to spread, uncontrolled, each of these species has a high likelihood of causing serious economic harm, degrading our highway ROWs, and in the case of Phragmites, and Japanese Knotweed, spreading to our wetlands and waterways where each could be devastating.

While none of these species are brand new to our area, so there is little prospect of eliminating or eradicating them from the region, there is still time for control to prevent them from becoming dominant and causing extensive harm. The strategy and plan presented here is based entirely on 1) the current status of these species as early invaders in most of our region, 2) the potential for keeping them from becoming even more widespread, and 3) the characteristics of the species. In other words, this is a containment and control plan.

The basic elements of a program to contain and control invasive plants on right-of-ways are simple to prioritize and outline:

- Adjust and customize ROW mowing to prevent spreading seed, and when possible, to prevent seed set in established patches. In other words, don't spread the species by mowing. In general this means a full-mowing of the ROW in the month of July.
- Keep a close eye on all your roadways and identify newly-occurring individual plants and very small new patches of these invasives.
- Eliminate/eradicate those newly-occurring individual plants and very small new patches using methods appropriate for the species.
- and, Sustain this program on a continuing basis.

Unless resources are available to accomplish all of these priority control tasks, aggressive and more costly control of well-established populations should only be conducted if it can be justified for specific localities (e.g. a roadside population poses a definite threat to an adjacent high-quality natural area). **DO NOT spread established populations!**

C. Four species, two plant types, two general control methods

Before we expand upon the details of the overall containment and control plan it is useful to describe the general control methods for our species.

Monocarps – Plants that produce seed once and then die:

The Teasels and Wild Parsnip are called biennials. Individual plants don't all flower and make seed in their second year of growth so they can actually be short-lived perennials; but both species are strictly monocarpic, which means that they always die completely after they make their seed. Both plants grow as rosettes (a circular cluster of leaves that radiate from a center close to the ground like a dandelion) for their first year of growth, or until they bolt (send up a tall stalk from the center which will produce their flowers and seed). Once they bolt, they have used up their central growing point and will not be alive the following year. What lives on the following year is the seed that they have made; seeds of both species can remain viable in the soil for three or four years after they are produced.

There is one basic strategy to control these biennials: keep them from making seed. Details and timing of control methods for each species are described below. For these biennials, there are many options depending on the season, including chemical control at any stage before mature seeds are formed, hand cutting, and mowing.

Long-lived, spreading, perennials:

Phragmites and JKW, although completely unrelated, share a number of characteristics that make them particularly successful, and troubling, invasives. They are both long-lived, perennial species that spread aggressively and rapidly by underground stems, or rhizomes, forming large clones. They establish by seed, but not prolifically, however cut fragments of the stems of both of these species can root and start new clones. The clones are essentially immortal and will continue to spread until they reach some absolute barrier. Phragmites is a threat to all of our valuable wetlands; and JKW will be devastating to the banks of our streams and rivers if allowed to establish.

Control of either of these species requires the use of herbicide. Well-established clones of both species almost always require multiple treatments; brand new clones can often be killed with a single properly-timed and executed herbicide application. The control of new small plants of these species is orders of magnitude simpler and cheaper than control of established clones, which is a multi-year project.

D. Control Strategy / Plan details

The biology and ecology of the plants largely dictates what must be done to prevent their spread. For example, we might know that if a plant is going to be mowed as a method to prevent it from making seed it must be mowed at a certain stage of flower and seed development. However SEWISC is not experienced at practical management of highways and must rely on the expertise in your local Highway Department to devise the methods you can best implement to accomplish the goal. Even if SEWISC had personnel with extensive experience in highway management, the precise control plan would need to be tailored to the resources and work plan of your local Highway Department. **SEWISC needs your highway department as a partner in this work.**

- 1) Identify existing, well-established, larger infestations (already mapped by SEWISC).
 - a. Established infestations of Phragmites and JKW must be marked or mapped so that they are known to your roadside mower. Since stem fragments of these species can readily spread the plant down the roadway, equipment must be cleaned after mowing these patches before the mower is moved from the patch; or the patches must be mowed by hand, or left un-mowed.
 - b. Established infestations of Teasel and Parsnip must be marked or mapped so that they are known to your roadside mower unless mowing is timed (generally July) so that the standing plants do not contain any viable seed. If the patches contain seed, they must be avoided by the mower or the equipment must be cleaned.
- 2) Adjust and customize ROW mowing to prevent spreading seed (or plant parts in the case of Phragmites and JKW), and, when possible, to prevent seed set in established patches.
 - a. Avoid mowing Phragmites and JKW, or mow as a special effort and clean equipment.
 - b. Mowing Teasel and Parsnip when they are in full bloom, but before seed begins to ripen (mid-July) can prevent seed production and kill the plants. Mowing when plants have ripe seed must be avoided or equipment must be cleaned.
- 3) Conduct continued annual monitoring of roadways.
 - a. Individual plants identified during the growing season could be found and killed before they ever have a chance to establish and set seed, however
 - b. At least three of these species (Teasels, Phragmites, and JKW) are most easily and effectively spotted in the winter, when they are more apparent and obvious. The monitoring would be best scheduled as late-fall through early-spring work.
- 4) Identify newly-occurring individual plants and very small new patches.
 - a. Your Highway Department must identify some combination of mapping, marking, and/or immediate treatment of new plants that works for you. SEWISC is not experienced at practical management of highways and must rely on the expertise in your local Highway Department.
- 5) Eliminate/eradicate those newly-occurring individual plants and very small new patches using methods appropriate for that species.
 - a. For Teasel and Parsnip there are several seasonal timing options from spring through mid- to late-July (see details below). The early season options most likely involve spot or selective herbicide application, mid-summer options can involve cutting or mowing. All control options for these species must be performed before they make viable seed in mid- to late-July.
 - b. Herbicide control of Phragmites and JKW involves selective or spot application and can be timed variously during the growing season depending on the application method and herbicide (see details).
- 6) Sustain this program on a continuing basis.
 - a. All of these measures need to be ongoing and continual to be effective; the species are not going to go away.

E. Species Information and Control Methods

COMMON AND CUT-LEAVED TEASEL CONTROL METHODS

Common and Cut-leaved Teasel and very similar ecologically and the control methods appropriate for these two species are identical. Teasel is a monocarpic perennial; it spends two to several years in the rosette stage, and then bolts, blooms, and dies. Preventing seed production will eventually eliminate a population, but if the patch has been established long, the viable seeds in the soil may continue to establish new plants for up to six years. Because they are both biennials (monocarpic perennials), control methods for Teasel and Wild Parsnip are very similar. If treated in the early stages of infestation it is possible to cheaply and quickly control teasel.

Determine the maturity status of the plant:



After plants are bolted and have begun to flower they should be closely examined to determine if they contain seed that will mature and be viable if the plants are cut and left in place. If the plants already have seeds that will mature and you are eliminating a small patch or individual plant, then the heads should be cut and disposed of off-site.

It is not easy to examine the individual seeds of Teasel the way it is with Parsnip, so it is necessary to be more conservative about when a plant has matured to the stage when its seeds will ripen. You can tell whether a teasel head has not yet begun to flower vs. when it has finished flowering and it is ripening seed. When the head is formed but has not yet flowered, you can see the purple (Common Teasel) or white (Cut-leaved Teasel) blossoms down inside the floral bracts (see picture). After the teasel head has completed flowering you will just see the black tops of the developing seeds inside the floral bracts (see picture). At this stage there is mature seed and the heads should be removed from the site. When teasel has first begun to flower it can be cut and left in place and the seeds will not mature. Once the teasel has been blooming for over a week, if your goal is eradication, remove the seed heads that have matured beyond this stage.



Cutting & Digging

Teasel is not tap-rooted like Parsnip; its roots branch and the plants cannot be easily pulled. It is however relatively simple to kill the plant by cutting the root off 1" to 2" below ground with a sharp

spade. The best time to cut the plants is as soon as blooms show, but before any seeds have begun to mature (usually early- to late-July, but go by the plant not the calendar). If there is too much risk that seeds will mature (see above) remove the heads and dispose of them.

Mowing

Plants should be mowed as low and close to the ground as is practical. Some proportion of plants mowed too high will flower and set seed that year. Plants bent over but not cut off by the mower will also make good seed. Proper timing is crucial for mowing to be successful. If plants are mowed when the blooms are just beginning to show, but before any seed have matured (see above), few plants will have the energy to send up a new stalk and try to flower again that season, and of those that do, few will make any good seed. This crucial window for mowing teasel can be as long as three weeks, typically in early- to late-July. Mowing with a flail mower is a little more forgiving in terms of the plants maturing seed after being cut than cutting whole plants described above, because the flail mower chops the plant to smaller pieces.

If plants are mowed too early a large percentage may be able to flower again that season and make good seed. If plants are mowed too late when the seed is mature, the mower must be cleaned to avoid spreading the plant.

Never mow Teasel with fully mature seed and continue mowing to un-infested areas without cleaning the mower! Doing that will literally plant this aggressive invasive plant down the roadway and increase the problem, it would also violate NR-40, the Invasive Species Rule, because that would clearly not be following Best Management Practices for teasel, which are required by the law.

Control with Herbicides

Since we are focused on killing isolated plants and small patches, methods for selective spot treatment of Teasels as opposed to broadcast spraying are described here. However, the broad-leaved selective herbicides, 2,4-D and metsulfuron, are effective at killing Teasel, so broadcast spray in a grass-dominated ROW is an option.

Spot treat (i.e. selectively spray individual plants) Teasel at any growth stage except late-flowering when mature seeds have begun to form (Fall rosette stage, Spring rosette stage, early summer bolting to early flowering stage). There are several effective herbicides for treatment of Teasel including:

- **Triclopyr** (e.g. Garlon, Element, etc.) – broad-leaved selective: Mixed at 2.5 oz concentrate / gallon of water.
- **2,4-D** – broad-leaved selective: Mixed at 1.5 oz concentrate / gallon of water.
- **Metsulfuron** (e.g. Escort) – broad-leaved selective – Any rosette or early-summer bolting stage – Follow label mixing instructions.
- **Aminopyralid** (e.g. Milestone) – broad-leaved selective – Any rosette or early-summer bolting stage – Follow label mixing instructions.
- **Imazapic** (e.g. Plateau) – broad-leaved selective – Any rosette or early-summer bolting stage – Follow label mixing instructions
- **Glyphosate** (e.g. Roundup) – non-selective: Mixed at 2 oz. concentrate / gallon of water. Glyphosate is most effective when used on the rosettes in the fall. Control with glyphosate during the spring rosette and early bolting growing season can sometimes be relatively poor.

Follow herbicide label instructions for all herbicide use. **Always read, understand, and follow the label directions. The herbicide label is the LAW!**

WILD PARSNIP CONTROL METHODS

Wild parsnip is a monocarpic perennial; it spends two to several years in the rosette stage, and then bolts, blooms, and dies. Preventing seed production will eventually eliminate a population, but if the



patch has been established long, the viable seeds in the soil may continue to establish new plants for up to six years.

Warning/Caution: The sap of this species is extremely dangerous. Contact of the plant (especially its juices) on skin followed by exposure of that skin to sunlight causes severe second degree burns. All growth stages of the plant are toxic. No one is immune to this reaction. Proper clothing can prevent skin contact with the toxic sap of the plant tissues; gloves, long sleeves, and long pants must be worn.

Determine the maturity status of the plant:

After plants are bolted and have begun to flower they should be closely examined to determine if they contain seed that will mature and be viable if the plants are cut and left in place. If the plants already have seeds that will mature and you are eliminating a small patch or individual plant, then the heads should be cut and disposed of off-site.

Parsnip flowers are in a compound umbel. That means that the structure is an umbrella with little umbrellas at the ends of the main umbrella spokes. The first seeds to mature in this inflorescence are at the very center of the main umbel. When seeds in this central main umbel measure more than 1/8" across, they can probably mature even if the plant is pulled or cut and left to lie on the ground. If your goal is eradication, remove the seed heads when they have matured beyond this stage.

Also, when any seed in the central umbel measures close to 1/4" across the plants should not be mowed unless the mower is cleaned before progressing out of the parsnip and down the roadway.

Pulling & cutting

Individual plants that have bolted are tap-rooted and can often be pulled relatively easily. Wild parsnip is easiest to pull right after a rain when the ground is moist or during a drought when the root shrinks. If the plants cannot be pulled without breaking off at the ground, cutting the tap root off 1" to 2" below ground with a sharp spade is simple and will kill the plant. The best time to pull or cut is as soon as blooms show, but before any seeds have begun to mature (usually late-June to mid-July, but go by the plant not the calendar). If seeds are too mature (see above) remove the heads and dispose of them.

Mowing

Plants should be mowed as low and close to the ground as is practical. Proper timing is crucial for mowing to be successful. If plants are mowed when the blooms are showing yellow, but before any seed have matured (see above), few plants will have the energy to send up a new stalk and try to flower again that season, and of those that do, few will make any good seed. This crucial window for mowing parsnip can be as long as three weeks, typically in late-June to mid-July.



If plants are mowed too early, a large percentage may be able to flower again that season and make good seed. If plants are mowed too late when the seed is mature, the mower must be cleaned to avoid spreading the plant.

Never mow Wild Parsnip with fully mature seed and continue mowing to un-infested areas without cleaning the mower! Doing that will literally plant this dangerous invasive plant down the roadway and endanger the public; it would also violate NR-40, the Invasive Species Rule, because that would clearly not be following Best Management Practices, which are required by the law.

Control with Herbicides

Since we are focused on killing isolated plants and small patches, methods for selective spot treatment of plants as opposed to broadcast spraying are described here. However, the broad-leaved selective herbicides, 2,4-D and metsulfuron, are effective at killing Wild Parsnip, so broadcast spray in a grass-dominated ROW is an option.

Spot treat (i.e. selectively spray individual plants) Wild Parsnip at any growth stage except late-flowering when mature seeds have begun to form (Fall rosette stage, Spring rosette stage, early summer bolting to early flowering stage). Effective herbicides include:

- **Glyphosate** (e.g. Roundup) – non-selective: Mixed at 2 oz. concentrate / gallon of water.
- **2,4-D** – broad-leaved selective: Mixed at 1.5 oz concentrate / gallon of water.
- **Metsulfuron** (e.g. Escort) – broad-leaved selective – Follow label mixing instructions.

Follow herbicide label instructions for all herbicide use.

PHRAGMITES CONTROL METHODS

Phragmites is a long-lived (essentially immortal) very large perennial grass that spreads aggressively by rhizomes, or underground stems which can expand the clone as much as 50' in a single year. Use of herbicides is the only practical method for control of Phragmites. No single, one-time, herbicide application provides 100% control (kill) of established Phragmites, so a combination of management practices is required. It is relatively simple and inexpensive to eradicate small patches of Phragmites soon



after they have established compared to trying to control well-established stands. Clones of Phragmites become very dense and there is seldom much of any other plant growing within established Phragmites clones. As with Japanese Knotweed mowing or cutting does not control Phragmites and just runs the substantial risk of spreading the plant because shoot fragments can root and make new plants.

Herbicide Control of Phragmites

Cut-stem application

If you are eliminating just a few isolated stems of Phragmites, you have caught it very early – Congratulations! – and it may be worth using the very selective cut-stem application method:

- Cut the stems below the lowest leaf, leaving a 4” or shorter stump late in the growing season, after the plant is in full flower.
- Using a small squeeze or spray bottle thoroughly wet the cut stem with glyphosate (e.g. Roundup) herbicide
- For this method the glyphosate should be mixed as a 25% concentration of the concentrate, that is 1 part glyphosate concentrate to three parts water.

Foliar spray application

The most effective available methods for control of Phragmites with foliar-spray application of herbicide, regardless of which herbicide is used, require mechanical cutting the plants to the ground following the herbicide application. However, selective re-treatment of resprouts is usually necessary since 100% kill is seldom achieved with a single treatment. At present, there is no long-term species-specific control measure.

Glyphosate (Rodeo™) and imazapyr (Habitat™) are the herbicides used most frequently to control Phragmites. Spraying is most effective during the summer, after the seed head has formed, up to the first frost. Spray should be applied to wet the leaves and flower plumes (when present), but not to the point of dripping. Special care should be taken to avoid impact to desirable species as imazapyr and glyphosate are non-selective and will enter through contact with the stems and leaves of any species. A 1.5% solution of the concentrate (2 oz. / gallon of water) should be used with either glyphosate or imazapyr.

While the cost of imazapyr can be significantly higher than glyphosate, recent studies suggest that when imazapyr is used alone or in combination with glyphosate, it can control Phragmites for a longer period of time. Imazapyr is also effective on Phragmites over a longer season than glyphosate, so it can be used effectively as early as June.

JAPANESE KNOTWEED CONTROL METHODS

Japanese Knotweed (JKW) is a long-lived (essentially immortal) perennial plant that spreads aggressively by rhizomes, or underground stems which can expand the clone as much as 20' in a single year. Use of herbicides is the only practical method of control for JKW, and JKW is somewhat resistant to herbicides. No single, one-time, herbicide application has been identified that will reliably provide 100% control (kill) of established JKW. Perhaps more than any of our other target species there is a tremendous advantage to identifying and eradicating JKW soon after it has established compared to trying to deal with well-established stands.



Herbicide Control of Japanese Knotweed

Cut-stem application

If you are eliminating just a few isolated stems of JKW, you have caught it very early – Congratulations! – and it may be worth using the very selective cut-stem application method:

Cut each stem at or below the second joint from the ground. If the stem is cut at a joint, apply the herbicide to the surface of the stem that remains rooted. If the stem is cut between joints, apply 5mL of herbicide into the hollow stem. This method can be very selective and highly effective; however, it is considerably more labor-intensive than foliar spray application.

The cut stump herbicide application method can be used any time during the growing season, although it may be least effective in the spring and require a repeat application. Wait until any resprouts have grown to at least 3 feet tall before re-applying the cut stump treatment.



Glyphosate (e.g. Roundup®, Ranger®, Kleenup®, etc.)

- Concentrate is normally sold as 40 to 50% active ingredient (a.i.).
- For cut stump treatment of JKW with glyphosate you want to use about a 25% solution of this concentrate, which will result in a mix that is 10% – 12.5% a.i.
- To achieve this concentration, mix 1 part concentrate (40-50% a.i.) to 3 parts water (e.g. 1 quart concentrate to 3 quarts water to make 1 gallon).
- *Effectiveness* (reduction of stem density): In year one = 90-100%; following year = 50-70%
- Repeat application in the following year is likely to be necessary.

Triclopyr (e.g. Garlon 4®, Element 4®, etc.)

- Concentrate is normally sold as about 62% active ingredient (a.i.).
- For cut stump treatment, the triclopyr concentrate is mixed with an agricultural oil (such as Bark Oil Blue®), not with water.
- For cut stump treatment of JKW with triclopyr you want to use about a 25% solution of this concentrate in the oil, which will result in a mix that is ~15% a.i.
- To achieve this concentration, mix 1 part concentrate (~62% a.i.) to 3 parts oil (e.g. 1 quart concentrate to 3 quarts Bark Oil Blue® to make 1 gallon).
- *Effectiveness* (reduction of stem density): In year one = 90-100%; following year = 50-70%
- Repeat application in the following year is likely to be necessary.

Foliar spray application

The most effective available methods for foliar-spray application of herbicide, regardless of which herbicide is used, require cutting the plants to the ground twice during the season before the herbicide is applied late in the growing season.

Preparation and timing of foliar herbicide application:

For best results cut twice and spray the re-growth after the second cutting:

- 1) Cut in spring when JKW reaches 3' tall;
- 2) Then cut again when the JKW re-growth has again reached over 3' tall and the plant is in flower;
- 3) Finally, spray the late-summer to fall re-growth of JKW when it reaches 3' tall.

With all foliar application of herbicide, spray to completely wet the leaf surfaces, but not to the point of runoff of the herbicide.

Very small fragments of cut JKW can root and grow. Be very careful of how you dispose of cut material if you remove the material from the site. Do not scatter the pieces or compost the material because of the risk of spread. In a dense stand of JKW (its normal growth habit), it may be safest to leave the cut material in place on the ground within the JKW stand. The JKW will have no problem coming up through the dry cut stems.

Herbicides for foliar application:

With any foliar application of herbicide, adding an approved marker dye to the herbicide mix (usually at about one oz/gal.) can greatly improve your efficiency at achieving complete, but not excessive, coverage. The following four herbicides have proven to be effective at controlling JKW, although all will likely require more than a single treatment. Glyphosate and triclopyr are more widely available than imazapyr and aminopyralid, which are specialty herbicides only available from a licensed dealer.

Glyphosate (e.g. Roundup®, Ranger®, Kleenup®, etc.)

- Avoid using mixtures of glyphosate and other herbicides as it can reduce effectiveness.
- Concentrate is normally sold as 40 to 50% active ingredient (a.i.). *(If the concentrate you use is outside of this range (e.g. 25% a.i.), you will need to adjust the mixing directions given below.)*

- For foliar spray of JKW with glyphosate you want to use about a 6% solution of this concentrate, which will result in a mix that is 2.5% – 3% a.i. (*This is the percent of active ingredient you want to use; if your concentrate is not in the 40-50% range, calculate the dilution to achieve this concentration.*)
- To achieve this concentration, mix 8 oz. concentrate (40-50% a.i.) per 1 gallon of water.
- **Caution:** Use product labeled for aquatic use if potential exists for solution to contact surface waters. Applications can result in bare ground as glyphosate is not selective. Overspray or drift to desirable plants should be avoided, as even minute quantities of the spray may cause severe injury to plants.
- *Effectiveness* (reduction of stem density): In year one = 70-90%; following year = 50-70%
- Repeat application in the following year will be necessary to achieve complete control.

Triclopyr (e.g. Garlon 4®, Element 4®, Garlon 3A®, or Element 3A®, etc.)

- Concentrate is normally sold as about 62% active ingredient (a.i.).
- For foliar spray of JKW with triclopyr you want to use about a 2% solution of this concentrate, which will result in a mix that is ~1.25% a.i. (*This is the percent of active ingredient you want to use; if your concentrate is not ~62% a.i., calculate the dilution to achieve this concentration.*)
- To achieve this concentration, mix 2.5 oz. concentrate (~62% a.i.) per 1 gallon of water.
- Spring or summer applications of this herbicide are not effective in controlling JKW, so applications should only be made in the fall.
- **Caution:** The “4” formulation of Garlon, Element, etc. is not approved for use over water; it is toxic to fish. If there is a potential for the solution to contact surface waters, the “3A” formulation, of the product must be used. Applications will kill or damage all broadleaved plants, but are safe to established grasses. Overspray or drift to desirable plants should be avoided, as even minute quantities of the spray may cause severe injury to plants.
- *Effectiveness* (reduction of stem density): In year one = 70-90%; following year = 50-70%
- Repeat application in the following year will be necessary.
- The active ingredient triclopyr is often sold to homeowners as a “brush herbicide”.

Imazapyr (e.g. Arsenal®, Chopper®, Habitat® and Stalker®)

- Imazapyr must be purchased from a licensed company that sells pesticides and may require an applicator’s license, but it is quite effective.
- Concentrate is normally sold as about 27% active ingredient (a.i.).
- For foliar spray of JKW with imazapyr you want to use about a 1% solution of this concentrate, which will result in a mix that is ~0.27% a.i.
- To achieve this concentration, mix 1.25 oz. concentrate (~27% a.i.) per 1 gallon of water.
- Spring or summer applications of this herbicide are not effective in controlling JKW, so applications should only be made in the fall.
- **Caution:** Use product labeled for aquatic use (Habitat®) if potential exists for solution to contact surface waters. **Applications can result in bare ground as imazapyr is not selective** and, unlike the other two herbicides, can remain active in the soil for several months to over a year depending on application rate. Overspray or drift to desirable plants should be avoided, as even minute quantities of the spray may cause severe injury to plants.
- *Effectiveness* (reduction of stem density): In year one = 70-90%; following year = 70-90%
- Repeat application in the following year may be necessary.

Aminopyralid (Milestone®)

- Aminopyralid must be purchased from a licensed company that sells pesticides and may require an applicator's license, but it is quite effective.
- Concentrate is normally sold as about 41% active ingredient (a.i.).
- For foliar spray of JKW with aminopyralid, mix 8 to 16 ml (0.25 to 0.5 oz) Milestone® per 1 gallon of water.
- **Caution:** Do not apply directly to water or to areas where surface water is present. Aminopyralid remains active in the soil for up to one year depending on application rate. Overspray or drift to desirable plants should be avoided, as even minute quantities of the herbicide may cause severe injury to plants. Do not apply excessive amounts of herbicide, i.e. amounts that run off of leaves. Do not compost treated plants; the herbicide can persist through the composting process. Unlike imazapyr, aminopyralid should be safe for established grasses.
- *Effectiveness* (reduction of stem density): In year one = 90-100%; following year = 70-90%
- Repeat application in the following year may be necessary.

Pesticides are registered for specific uses in specific areas/habitats. No herbicide is without risks. Read the directions (label) carefully. As the applicator, you are legally responsible for using pesticides in accordance with the label directions. **References to pesticide products in this document are for your convenience and not an endorsement of one product over a similar product.**

F. General Management Recommendations

1. Properly-timed Mowing

Properly-timed mowing will *not* eradicate invasive plants, but it can be a good strategy for containing their spread. With our biennial (monocarpic) invasive plants, consistently mowing at the right time will eliminate seed set and eventually exhaust the populations. In order to prevent seed spread, it is important to mow before or during flowering, but *not* after. Mowing too early (before flowering) is not ideal because the biennials will resprout and can flower repeatedly during the season. Mowing after plants have gone to seed is likely to spread the seeds with the mowing equipment, on which they will hitch a ride to other areas. For our target biennial invasives, July mowing is normally ideal.

2. Monitoring Disturbed Areas

Any time that road construction, maintenance, or a similar disturbance takes place, it sets the stage for new invasive plants to colonize. This is why culverts and bridges are often densely populated with invasive species. Gravel pits are also a hotbed for invasive plants, which can germinate in roadsides where the gravel is spread.

Inspect disturbed areas 2-3 times a year for at least three growing seasons following the disturbance (i.e. construction, etc.). Inspections can be carried out during mowing or other routine operations. Treat and remove any invasive plants that crop up before they have a chance to spread and become a much larger problem. Monitoring and managing invasives for at least three years will give desirable plants a chance to get established. Once the site is densely covered with plants that are *not* invasive, it is much harder for invasive plants to move into the site.

3. Seeding with Invasive-Free Mixes

Historically, many invasive species (such as kudzu) were intentionally introduced for the purpose of erosion control, only to discover too late that they are nearly impossible to contain once introduced. To prevent this, use seed mixes that do not include invasive plants. Go with trusted species that are not invasive, and avoid new "miracle" species or seed mixes. Also, include annuals in your seed mix which

will quickly germinate and cover exposed soil, making it harder for invasive plants to get a foothold. Species to avoid in seed mixes include bird's foot trefoil and crown vetch. A sample seed mix is included in Appendix 2.

4. Routine Control of Current Populations

Once an area with invasive plants has been identified, it is important to monitor and treat it regularly. This could mean mowing three times per season in a certain area for roadside patches, or treating specific areas with an herbicide once per season.

While it would be ideal to strive for a weed-free gravel pit, it may be impractical. At a minimum, consider treating the section of the gravel pit from which you are actively hauling gravel. This will not eliminate invasive plant seeds, but it will reduce them substantially, making it much easier to manage invasives at sites where the gravel used.

G. Summary of Best Management Practices (BMPs)

These BMPs are taken from the *Invasive Species Best Management Practices for Transportation and Utility Rights-of-Way Manual* published by the Wisconsin Council on Forestry and the Wisconsin Department of Natural Resources in 2009. The full 63-page text is available on the internet at <http://council.wisconsinforestry.org/invasives/transportation/> and contains further descriptions, considerations, and suggestions for each BMP.

1. Soil Disturbance BMPs

Planning:

BMP SD 1: Prior to implementing right-of-way activities, scout for, locate and document invasive species infestations.

BMP SD 2: Consider the need for action based on: 1) the degree of invasiveness; 2) severity of the current infestation; 3) amount of additional habitat at risk for invasion; 4) potential impacts; and, 5) feasibility of control with available methods and resources.

BMP SD 3: Plan activities to limit the potential for introduction and spread of invasive species, prior to construction.

BMP SD 4: Provide appropriate resources for identification of local invasive species for workers.

Activities:

BMP SD 5: Minimize soil disturbance, which may include using existing roads, access points, staging areas and alternative construction.

BMP SD 6: Avoid invasive species populations when feasible and minimize the spread of invasive species during activities that require soil disturbance.

BMP SD 7: Prior to moving equipment into an uninfested area or out of an infested area, clean soils, seeds, plant parts, or insects from exterior surfaces to the extent practical.

BMP SD 8: Stabilize disturbed soils as soon as possible.

BMP SD 9: Use non-invasive cover crops or native seed for revegetation.

2. Vegetation Management and Inspection/Monitoring BMPs

Planning:

BMP VM 1: Prior to implementing right-of-way activities, scout for, locate and document invasive species infestations.

BMP VM 2: Plan activities to limit the potential introduction and spread of invasive species, prior to construction.

BMP VM 3: Assess current available resources and seek new resources to prevent invasive species spread.

BMP VM 4: Provide training in identification, control and prevention of known invasive species to employees and contractors performing vegetation management.

Activities:

BMP VM 5: Prior to moving equipment into an uninfested area or out of an infested area, clean soils, seeds, plant parts, or insects from exterior surfaces to the extent practical.

BMP VM 6: Inspect and clean clothing, footwear and gear for soils, seeds, plant parts, and insects before and after activities.

BMP VM 7: Carefully dispose of soils, seeds, plant parts or insects found during inspection and cleaning.

BMP VM 8: Locate and use staging areas that are free of invasive plants to avoid spreading seeds and other viable plant parts (e.g. root fragments).

BMP VM 9: Consider the likely response of invasive species when conducting activities that result in disturbed soil, increased sunlight, fire, etc.

BMP VM 10: Ensure that control methods are done within the appropriate time window.

BMP VM 11: Monitor ROWs during day-to-day activities and post-management activities; determine necessary treatments based on presence of invasive species.

3. Transport of Materials BMPs

Planning:

BMP TM 1: Take steps to avoid moving invasives to non-infested areas.

BMP TM 2: Prior to transporting materials, manage the load to limit the spread of invasive species.

Activities:

BMP TM 3: Prior to moving equipment into an uninfested area or out of an infested area, clean soils, seeds, plant parts, or insects from exterior surfaces to the extent practical.

BMP TM 4: Dispose of soils, seeds, plant parts or insects found during inspection and cleaning.

BMP TM 5: Establish staging areas and temporary facilities in locations that are free of invasives.

BMP TM 6: Use soil and aggregate material from sources that are free of invasive species.

BMP TM 7: Manage stock piles to limit the spread of invasive species.

BMP TM 8: Do not transport woody material that may contain invasive species (ex. Emerald Ash Borer).

BMP TM 9: If you must transport woody material that may contain invasive species, bring them to a designated area for appropriate disposal.

BMP TM 10: Keep and reuse onsite materials rather than importing new materials.

4. Revegetation and Landscaping BMPs

Planning:

BMP RV 1: Plan activities to limit the potential introduction and spread of invasive species, prior to revegetation.

BMP RV 2: Select non-invasive or native species for revegetation and landscaping activities.

Activities:

BMP RV 3: Inspect and clean clothing, footwear and gear for soils, seeds, plant parts, or insects before and after activities.

BMP RV 4: Prior to moving equipment into an uninfested area or out of an infested area, clean soils, seeds, plant parts, or insects from exterior surfaces to the extent practical.

BMP RV 5: Revegetate disturbed soils as soon as possible to minimize invasive species establishment.

BMP RV 6: Where site conditions permit, allow natural revegetation to occur.

BMP RV 7: Ensure the species specified in the plan are the ones being used.

BMP RV 8: Monitor the revegetation site.

H. Summary of Chapter NR 40

NR 40 is a Wisconsin rule administered by the Department of Natural Resources that, among other things, classifies invasive species as Prohibited or Restricted and regulates the transportation, possession, transfer, and introduction of those species. The major purpose of the rule is to educate people in Wisconsin about invasive species, and the actions they can take to minimize their spread and the damage caused by invasives. The full text of the bill can be seen on the internet at <http://dnr.wi.gov/topic/invasives/classification.html>

1. Definitions of key terms:

Invasive species – species or “varieties” that are not native to Wisconsin and that cause, or are likely to cause, economic or environmental harm or harm to human health.

Prohibited invasive species – not currently found in Wisconsin, or are only found as small infestations, but which, if introduced into the state, are likely to cause significant harm.

Restricted invasive species – already well-established in the state; known to cause, or have the potential to cause, significant harm.

Introduce – release an invasive species into the environment.

Possess – own, maintain control over, restrain, hold, grow, raise or keep. Landowners “posses” plants growing on their property.

Transfer – buy, sell, trade, barter, exchange, give or receive, or to offer to do any of these.

Transport – cause, or attempt to cause, an invasive species to be moved within the state. This includes importation.

Reasonable precautions – actions that prevent or minimize the transport and introduction of invasive species. Reasonable precautions include BMPs approved by the WDNR.

2. Major points of the rule:

- Unless there is a specific exemption or a permit has been issued under the rule, no one may transport, transfer or introduce a Prohibited or Restricted invasive species. No one may possess any Prohibited species or any Restricted fish.
- It is not a violation if the department reasonably determines that the conduct was incidental or unknowing, and was not due to the person’s failure to take *reasonable precautions* (defined above, includes BMPs from Section G of this plan).
- The rules allow the transport of Prohibited and Restricted invasive species for the purpose of identification, control or disposal. The location of Prohibited species must be reported to the WDNR.
- The rules also require preventive measures or limit certain common activities that may function as pathways for the inadvertent introduction or spread of invasive species. Examples include several measures that are intended to prevent the introduction of invasive aquatic species, and prohibiting the transportation of an identified carrier of an invasive species from a quarantine area or infestation control zone, such as moving firewood or ash trees from an area known to have Emerald Ash Borer.
- The rules include authority to enter lands for the purpose of inspection, sampling and control of Prohibited invasive species; allow the department to order landowners to implement control measures, and allow for state control at the landowner’s expense if the landowner is unable or unwilling to comply and is determined to be at fault for the introduction.
- Not all invasive species have been assessed and classified at this time. Many are pending assessment. Other species (primarily plants) that are known to be invasive are administratively listed as “non-restricted” and are not regulated under the rules because of their economic value.

3. Classification Criteria and Requirements

Invasive species are classified into the following four categories: (a) Prohibited, (b) Restricted, (c) Caution, and (d) Non-restricted. Only species in the Prohibited and Restricted categories are listed in NR 40. Species are classified based on the following criteria:

- The potential to directly or indirectly cause economic or environmental harm or harm to human health.
- The extent to which it is already established in the state, or in portions of the state.
- The likelihood that, upon introduction, it will become established and spread in the state.
- The potential for eradicating or controlling its spread, including the technical and economic feasibility of eradication or control.
- The socio-economic value afforded by the species, including any beneficial uses or value it may provide for recreation, commerce, agriculture or industry.

Prohibited Category

- **Actions Prohibited:** No person may import, transport, possess, transfer or introduce a Prohibited invasive species. Landowners technically “posses” plants growing on their property.
- **Control Requirements:** (a) Unless the lands are public, if the WDNR has reason to believe a prohibited species is on a property, they may enter for inspection or control only with permission or an inspection warrant. (b) If the prohibited species population is deemed reasonable and feasible to control, the WDNR may ask any person who owns, controls or manages land to control the Prohibited species in accordance with a plan approved by the department. The WDNR will seek funds to assist in the control. However, the landowner/manager is ultimately responsible for the control. (c) If voluntary cooperation is not achievable or likely, the WDNR or its designee may control or order the control of the species. If the department determines that the landowner/manager is at fault for the presence of the prohibited species, the department may recover expenses incurred for control.
- **Exemptions:** (a) Persons are allowed to transport a Prohibited invasive species for the purpose of identification, control or disposal without a permit, provided that the person reports the location of the Prohibited invasive species to the WDNR. (b) It is not a violation if the department reasonably determines that the conduct was incidental or unknowing, and was not due to the person’s failure to take reasonable precautions.

Restricted Category

- **Actions Prohibited:** No person may import, transport, transfer or introduce a Restricted invasive.
- **Control Requirements:** Any person who grows a Restricted plant at a nursery shall make a good faith effort to destroy it upon closure of the nursery.
- **Exemptions:** (a) Persons are allowed to transport a Restricted invasive species for the purpose of identification, control or disposal without a permit. (b) No permit is required for persons to transport, transfer or introduce parts of a Restricted plant species that are incapable of reproducing or propagating. (c) It is not a violation if the department reasonably determines that the conduct was incidental or unknowing, and was not due to the person’s failure to take reasonable precautions.

I. Appendices

Appendix 1. List of Further Resources:

a) **Southeastern Wisconsin Invasive Species Consortium, Inc.** – is a local network of professionals and citizens working to protect southeastern Wisconsin from invasive species, and educate people about their impacts. SEWISC can provide:

- technical assistance regarding plant identification, site-specific and species-specific control recommendations, and much more through an extensive network of professionals around the region
- brochures and fact sheets regarding invasive plants in our area
- contact information for local professionals working with invasive plants
- a website with information specific to rights-of-way managers, as well as information for homeowners in southeastern Wisconsin

Visit their website at www.sewisc.org for more information.

b) **Online Weed ID Tool** – find out which species you have using this online plant key designed for the amateur. Go to <http://weedid.wisc.edu/weedid.php>.

c) **Invasive Plant Atlas** – online resource with numerous photos and other information about invasive plants. Go to <http://invasiveplantatlas.org/>.

d) **Material safety data sheets (MSDS) and product labels** – free up-to-date versions are available for most herbicides online at <http://www.cdms.net/> under Services.

Appendix 2. Seed mix guide

** Note that common names and scientific names are provided. *Please check scientific names when you purchase seeds.* Common names vary among different distributors and locations. Some invasive species are sold under different common names, but the scientific name should always be the same.

Recommended Species:

- Oats (*Avena sativa*)
- Canada Wildrye (*Elymus canadensis*)
- Annual Rye (*Lolium multiflorum*)
- Big Bluestem (*Andropogon gerardii*)
- Little Bluestem (*Schizachyrium scoparium*)
- Red Fescue (*Festuca rubra*)
- White Clover (*Trifolium repens*)
- Red Clover (*Trifolium pratense*)

Species to AVOID when seeding:

- Bird's Foot Trefoil (*Lotus corniculatus*)
- Crown Vetch (*Coronilla varia*)
- Hairy Vetch (*Vicia villosa*)
- Cow vetch (*Vicia cracca*)
- Reed Canarygrass (*Phalaris arundinacea*)
- White Sweet Clover (*Melilotus officinalis*)
- Yellow Sweet Clovers (*Melilotus alba*)

WI DOT seed mixes preferred:

- 10
- 20
- 40
- 60
- 70
- 70A
- 75 (erosion)
- 80 (salt tolerant)

Appendix 3. Sample inventory / monitoring / treatment form

COLLECTION INFORMATION

State _____ County _____ Date observed _____
Collector name _____
Street address _____ City _____ Zip _____
Phone _____ Email _____

CHARACTERISTICS & LOCATION

Plant name (Common and/or Latin name)

Size & density of infestation. Describe spread and estimate numbers

Habitat description. Describe general habitat type such as forest interior, forest edge, old field, prairie, wetland, lakeshore, crop field, pasture, disturbed ground, urban setting type. Is it public or private land?

Location landmarks. Provide enough details so site can be found again. Note nearby landmarks such as city name, roads, intersections, driveways, lake edges and other natural and cultural features.

Geographic coordinates (Complete one.)

1. Latitude _____ N Longitude _____ W

2. UTM _____ E _____ N

3. Township, Range, Section, Part Section
