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Via Electronic Mail and Hand Delivery

March 6, 2014

Melanie Bachman
Acting Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **Petition No. 1042: Somers Solar Center, LLC Petition for a Declaratory Ruling that No Certificate of Environmental Compatibility and Public Need is Required for the Construction and Operation of a 5.0 MWac Solar Photovoltaic Project located at 458 & 488 South Road, Somers, Connecticut – D&M Plan Change**

Dear Ms. Bachman:

On March 25, 2013, the Connecticut Siting Council ("Council") issued a Decision and Order finding that the Somers Solar Center, LLC ("SSC") 5 MWac solar photovoltaic project ("Project") would not have a substantial adverse environmental effect and would not require a Certificate of Compatibility and Public Need. Subsequently, on May 17, 2013, the Council issued a decision approving the Development and Management Plan ("D&M Plan") for the Project, which provided that "[a]ny changes to the D&M Plan require advance Council notification and approval."

In order to optimize the efficiency and performance of the Project, pursuant to the requirements of the D&M Plan decision, SSC hereby requests that the Council approve a change to the Project D&M Plan that will permit SSC to engage in the selective cutting and removal of 25 trees at the Project site as described in the attached Technical Memorandum. In order to mitigate any adverse effects associated with this work, SSC will undertake the proposed tree removal in the manner recommended in the attached Technical Memorandum. Furthermore, to protect against the spread of invasive species, SSC will implement the Invasive and Noxious Species Management Plan recommended in the Technical Memorandum.

Since removal of the trees will improve Project performance without creating a substantial adverse environmental effect, SSC respectfully requests that the Council approve this requested change at its next regularly scheduled meeting. As required by the Decision and Order, a copy of this request is also being served upon the Town of Somers.

Please feel free to contact me if you have any questions or require additional information. Thank you.

Sincerely,

Joey Lee Miranda

Enclosures

Copy to: Gregg Crenshaw, Somers Solar Center, LLC
Lisa Pellegrini, Town of Somers First Selectman
Jeffrey Lipton, The Pleasant View Farms Realty Company

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TECHNICAL MEMORANDUM

Proposed Selective Tree Managment
Somers Solar Center, LLC.
Somers, Connecticut

February 25, 2014

Somers Solar Center, LLC is proposing selective cutting and removal of trees ("proposed tree work") at the Somers Solar Center located at: 488 South Street Somers, Connecticut. The purpose of the proposed tree work is to optimize the efficiency and performance of the photovoltaic arrays. In preparation of the solar center going online, Somers Solar Center has been observing and testing the arrays to ensure the panels are capturing the maximum amount of sunlight per day. It has been observed by Somer Solar Center some photovoltaic panels in arrays A and B(*Figure 1*) are shaded for part of the day, degrading the total energy output of the arrays. The proposed tree work does not involve clear cutting, stump removal, or grubbing. In general, subject trees, which have been identified in the field, will be cut at grade and felled in place. The specific proposed tree work is described in detail below.

Somers Solar Center, LLC asked Fuss & O'Neill to observe and analyze the subject trees that are slated for removal. The type of trees, the existing environs, and surrounding view sheds were studied and conclusions were made as to the best methods and approaches for the area.

Site Observations and Recommendations

Fuss & O'Neill's Professional Wetland Scientist, Josh Wilson and Landscape Architect, Stephanie White visited the site on January 13, 2014. The subject trees were located and confined to one area on site which is depicted on Figure 1 as "Proposed Tree Removal Areas":

Area #1: Wetland Area east and west of Array A and B.

Below is description of our observations and recommendations for the treatment in this area.

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Area #1

Area 1 is regulated wetland area and watercourse, which was delineated previously by Fuss & O'Neill as part of the design phase of the project. The principal watercourse is an unnamed perennial tributary of Abbey Brook. It flows in a southerly direction though the middle of the site, between Arrays A and B and to the east of array area D. The unnamed stream is located in a distinct drainage-way and is fed by groundwater discharge as well as runoff and drainage from the surrounding agricultural fields.

Within Area #1, there are approximately 25 emergent white pines (*Pinus strobus*) subject for removal, ranging in height from 50'-80'(*Figures 2, 3 and 4*). Emergent trees are those that have grown taller than the surrounding canopy in order to capture more sunlight. The emergent pines not only shade the surrounding forest, but also cast a year-round shadow on the nearby solar arrays.

The proposed tree removal of the 25 pines will involve felling the trees within the wetland area. It is our recommendation the felled trees, including trunks, limbs and leaves, not be removed from the wetland. After being felled, only the tops of the trees that extend beyond the limits of the wetlands are to be removed from the site. Care will taken to ensure the felled trees will not hit or damage the solar panels. The dead wood will remain to provide habitat and cover for wildlife. We also recommend that of the 25 pines to be removed, up to five be "topped" – that is, the upper portion of foliated tree be removed leaving a defoliated trunk and branches. This standing dead wood will proved sources of food as well as nesting and perching opportunities for wildlife. The five trees to be "topped" are located on the uphill southeastern edge of the wetlands where they can be easily accessed outside of the delineated wetland.

Practically speaking, removal of the trees will improve the performance of the photovoltaic array. Similarly, it will open the canopy and allow for younger, deciduous species to flourish. It is also important to note that removing the white pines and opening up the canopy may also make the wetland area more susceptible to invasive species. Therefore, we recommend that an invasive species management plan be implemented over a five year period to control the establishment or spread of invasive species within the wetland. (See appendix for invasive species management plan.)

Subject trees will be accessed by foot. No heavy logging machinery (e.g., forwarders, skidders, etc.) will be used within the wetland area to cut or remove the trees. Only the portions of the trees that fall outside of the wetland limits will be removed. The proposed selective cutting of trees will not result in adverse impacts to the wetlands or watercourse within Area 1. Also, views from the South

Road will not be impacted from the tree removal. A vegetative buffer is located along the western edge of south road, which impeeds the view into the site (*Figure 5*)

Conclusion

The proposed tree work is intended to optimize the performance and output of the photovoltaic panels at the Somers Solar Center. The proposed tree work will have no adverse effect on regulated resources (i.e., wetlands and watercourses) or on aesthetic qualities of the site (e.g., buffering).

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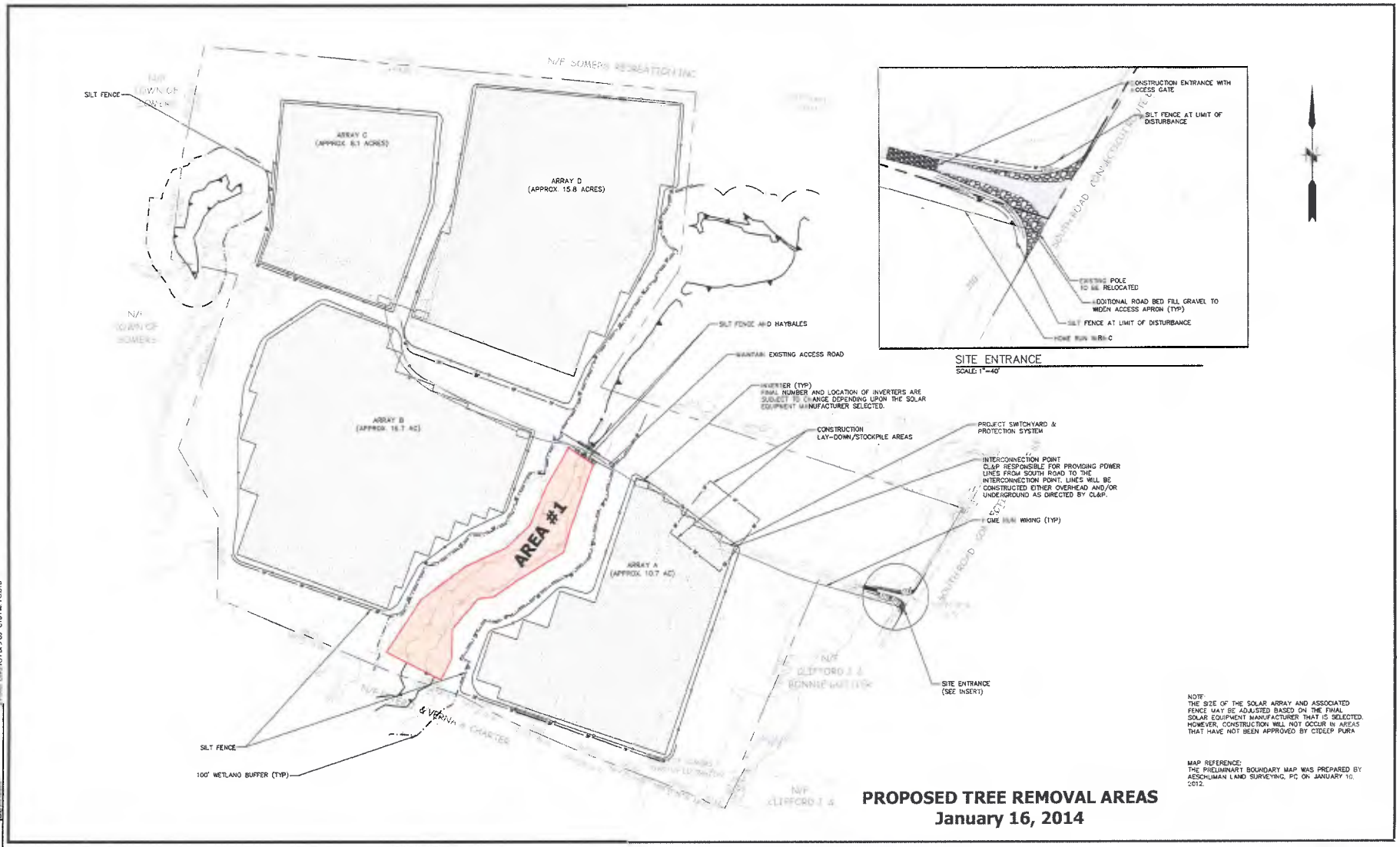
Figure Images

Figure 1-Proposed Tree Removal Areas



No.	DATE	DESCRIPTION	DRAWN BY	REVIEWER

SEAL

SEAL

SCALE:
HORZ: 1" = 150'
VERT:
DATUM:
HORZ: NAD 83
VERT: NAVD 88
150 75 0 150
GRAPHIC SCALE

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SOMERS SOLAR CENTER, LLC

EROSION & SEDIMENT CONTROL PLAN

488 SOUTH ROAD

SOMERS CONNECTICUT

PROJ. No. 20120085.A20
DATE: 02/ 5/2013

CE-101

Figure 2-Western horizon and distant emergent pines to be removed

Figure 3 -Emergent Pines to be removed in Area #1.

Figure 4-View of Emergent Pines from access drive

Figure 5-Exising vegetative buffer along South Road to remain.

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Appendix A

Invasive and Noxious Species Management Plan

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INVASIVE AND NOXIOUS SPECIES MANAGEMENT PLAN

1.1 Risks

The areas receiving tree work at the Somers Solar site are under moderate risk for the establishment of invasive or noxious plant species. Invasive species impact native vegetative communities by out-competing for habitat through the physical crowding out of native species, can be responsible for interfering with natural succession, and can cause a reduction in the overall biodiversity of an area or community. Invasive species are aggressive in their reproduction, spread, and persistence within a community, all at levels with which native species cannot compete. The table below has been compiled based on field investigations which have identified the invasive species as being present in the project area. Additional species of concern are listed in the 'potential' column.

Common Name	**Scientific Name**	Known on-site	**Potential***	**Wetland Indicator Status⁺**
Asiatic Bittersweet	*Celastrus orbiculatus*	✓		UPL
Autumn Olive*	*Elaeagnus umbellata*	✓		N/A
Common Reed	*Phragmites australis*		✓	FACW
Garlic mustard	*Alliaria petiolata*	✓		FACU
Japanese Barberry	*Berberis thunbergii*	✓		FACU
Japanese Honeysuckle	*Lonicera japonica*	✓		FAC
Japanese Knotweed	*Polygonum cuspidatum*	✓		FACU
Multiflora Rose	*Rosa multiflora*	✓		FACU
Purple Loosestrife	*Lythrum salicaria*		✓	FACW
Winged Euonymus	*Euonymus alatus*	✓		FACU

* Considered potential problem species, anticipated following site disturbance

⁺OBL: Occur almost always, under natural conditions, in a wetland (probability: >99%)

FACW: Usually occur in wetlands (probability: 67-99%), but occasionally found in non-wetlands

FAC: Equally likely to be found in wetlands or non-wetlands

FACU: Usually occur in non-wetlands (probability: 67-99%), but occasionally found in wetlands (probability: 1-33%)

UPL: Occur in wetlands in another region, but almost always occur (probability: >99%) under natural conditions, in non-wetlands in this region. If a species does not occur in wetlands in any region, it is not listed.

1.2 Constraints

There are no constraints associated with the monitoring or control of invasive or noxious species on-site.

1.3 Monitoring and Management of Invasive Species

Monitoring for the presence or spread of invasive species should be included as part of routine maintenance of the property by a qualified botanist or arborist. Any area in which selective tree work has been performed should be re-examined several times over the course of five growing seasons to ensure the control of the invasive species has been obtained. An emphasis should be placed on spring observations to catch new incursions, and to check the status of those areas treated in the previous season. Qualified individuals conducting the monitoring should look for all known and potential species noted in this plan during all seasons. If additional species are identified, supplemental control strategy information can be found from the sources listed in this report. See discussions for individual species above for specifics about the appropriate timing for treatments. "Tips" for recognizing certain species addressed in this plan are listed in the table below. (*tips are not provided for all species*)

Season	"Tips for Observation"	Notes
Spring	Barberry, Multiflora Rose and Garlic Mustard are some of the first plants in the landscape to 'green-up', and very easy to recognize.	Thoroughly check areas treated the previous summer and fall for newly emerging seedlings
Summer	Garlic mustard will be one of the tallest of the herbaceous species in the surrounding area, and its long thin seed pods are easily visible in the summer.	Field mark or make notes of areas treated to be re-evaluated the following spring. Try to catch and treat species before they reach the seed-bearing stage to halt further establishment
Fall	Fruits of Japanese Barberry, Porcelain-berry, Bittersweet are easy to spot in the fall.	Use care in removing species which have gone to seed, so as to prevent spread of seeds to soil. Field mark, or make notes of areas treated to be re-evaluated the following spring

1.3.1 Preventive Measures

During routine maintenance activities, practices can be adhered to that will decrease the chances of inadvertently spreading invasive species across the site. Practices include:

- Control mechanisms shall be employed until eradication or control is reached. In some cases, such as the repeated mowing approach, control or eradication may not be reached for several years.
- Following removal of invasive species, any plant material shall, to the extent practical, be disposed of off-site to avoid depositing any potential seeds on the property. **Do not chip or mulch woody stems from invasive species.**

- Invasive plant material which has been removed shall not be placed in any compost piles/bins on or off site (particularly municipal compost sites) because of the potential for spreading seed sources.

1.3.2 Control

Unless otherwise noted above, the paragraphs below describe preferred treatment strategies for all of the invasive species currently known to exist on the property, or with the potential to colonize the site. Whenever practical, strategies which cause the least disturbance are preferred.

Note: *The use or application of any chemical treatments for the control of invasive species should be undertaken with caution and extreme care. Foliar application of herbicides can result in the eradication of desirable species through drift of the herbicides during spraying. Measures to avoid unintended application should be implemented such as spraying on non-windy days, and using wind screens where necessary. Rodeo™ or other wetland-approved herbicides shall be used in areas near streams or watercourses. Always read and follow product specifications and precautions. Lastly, the application of chemical treatments should always be conduct by a in a manner consistent with State and Federal laws and regulation. The State of Connecticut requires that pesticides are applied by a certified commercial operator under the direction of a certified commercial supervisor.*

1.3.2.1 Asiatic Bittersweet

Asiatic bittersweet *(Celastrus orbiculatus)* is a rapidly spreading deciduous vine that threatens all vegetation in open and forested areas. It overtops other species and forms dense stands that shade out native vegetation. Trees and shrubs can be strangled by twining stems that twist around and eventually constrict the flow of plant fluids. Trees can be girdled and weighed down by vines in the canopies, making them more susceptible to damage by wind, snow, and ice storms.

Control Methods: The most effective control method for Asiatic Bittersweet is to prevent establishment by annually monitoring for and removing small plants. Eradication of established plants is difficult due to the persistent seed bank in the soil. Larger plants are best controlled by cutting combined with herbicide treatment.

Mechanical Control: Light infestations of a few small plants can be controlled by mowing or cutting vines and hand pulling roots. Weekly mowing can eradicate plants, but less frequent mowing (2-3 times per year) will only stimulate root suckering. Cutting and uprooting plants is best done before fruiting. Vines with fruits should be bagged and disposed of in the trash to prevent seed dispersal. Heavy infestations can be controlled by cutting vines and immediately treating cut stems with herbicide. Cutting vines without removing or killing the roots will stimulate vigorous re-growth resulting in larger patches.

Chemical Control[1]: Herbicides can be applied broad scale as a foliar spray, or to select individuals as cut stump treatments.

1) Foliar Spray: This method is most effective for low, dense patches. Early in the growing season, cut all vegetation to ground level and allow to re-grow. One month , spray the area with a 1-2% solution of water-soluble triclopyr (Garlon 3A™) using a backpack sprayer. Triclopyr is suggested over glyphosate since it does not kill monocots (e.g., grasses, sedges, lilies), which remain and keep the soil from being exposed. Triclopyr is the active ingredient, in relatively dilute form, in Ortho's Brush-B-Gone, which is not a restricted chemical and can be used as an alternative to Garlon 3A™.

2) Cut Stump Treatment: This method is most effective for tall patches. Care should be taken to cut and treat only bittersweet vines and not native plants, since these will be needed to re-vegetate the area. In late summer, cut vines and apply a systemic herbicide like triclopyr (Garlon 3A™) or glyphosate (Roundup™) to the cut. To ensure uptake of the herbicide before the plant seals off the cut, apply immediately after cutting, within 5-15 minutes. Apply with a sponge or paint brush. Any vines left hanging in the trees will decompose and fall within two to three years.

Biological Control: Currently, there are no known biological control methods.

1.3.2.2 Autumn Olive

Ecological impact: Autumn Olive (*Elaeagnus umbellata*) grows rapidly and is a prolific seed producer. It establishes in disturbed sites adjacent to ornamental plantings where it shades out other plants that require direct sunlight. It is widely disseminated by birds and can easily adapt to many sites including areas with infertile soil. Its ability to fix nitrogen can adversely affect the nitrogen cycle of native plant communities that depend on low soil fertility.

Control methods: The most effective control method for autumn olive is to prevent establishment by annually monitoring for and hand pulling small plants. Cutting and burning stimulate sprouting. Repeated cuttings over several consecutive years will reduce plant vigor and may prevent spread. However, herbicide use in combination with cutting may be more effective.

Mechanical Control: Seedlings and small plants should be hand pulled when the soil is moist. Be sure to remove the entire plant including all roots, since new plants can sprout from root fragments. Root sprouts resemble seedlings, but are attached to a lateral root and are nearly impossible to pull up. Larger plants can be cut off at the main stem and treated with herbicide.

[1] Chemical Control methods, as specified for all species, may be modified to incorporate suitable equivalent chemical treatments.

Chemical Control: Herbicides can be applied broad scale as a foliar spray, or to select individuals as injection or cut stump treatments. Foliar sprays are highly effective, but should be used only where contact with nearby native vegetation can be prevented. Injection treatment can inhibit or prevent sprouting if done at the right time of year.

1) Foliar pray: this method is most effective on small stands. Spraying should be done in late August or September when plants are actively translocating nutrients to the roots. Use a 1-2% solution of glyphosate (e.g., Roundup ™ or Rodeo™ and water). If plants are in or near wetlands, only Rodeo™ should be used. Glyphosate is a non-selective herbicide that will kill all vegetation. Managers should be cautious not to spray so heavily that herbicide drips off the leaves. Other herbicides that have proven effective, but remain in the soil for longer, are specific for broadleaf and woody species. These include Dicamba (Banvel™, Picloram Tordon™, Silvex, and 2,4,5-T applied in late June in a 90% water/10% bark penetrating carrier. Dicamba applied in late June at 4 lbs./gal. (2 qts./100 gal./acre) with a surfactant is also effective

2) Cut stump treatment: This method is most effective if done in late August or September. To ensure uptake of the herbicide before the plant seals off the cut, apply immediately after cutting, within 5-15 minutes. Use a 10-20% solution of glyphosate (e.g., Roundup™ or Rodeo™) and water. Apply with a sponge or paint brush or spray with a spray bottle or backpack sprayer. Follow-up with a foliar spray or cut stump treatment the next year if sprouts appear

3) Injection Treatment: This treatment is most effective if done during the dormant season, in March. Using a hand axe, make downward-angled cuts into the sapwood around the tree trunk. Make one cut for each inch of diameter, plus one extra (e.g., for a 10 inch diameter tree, make 11 cuts). Space the cuts so that 1-2 inches of uncut living tissue remains between them. Apply a low concentration of oil-soluble triclopyr (Garlon 4™) into each cut so that the bottom of the cut is covered, but not running over. A trigger spray bottle works well as an applicator. This method is relatively easy for one person to do, but working with a partner is recommended in case of accident. Follow-up with a foliar spray or cut stump treatment the next year to control any sprouts.

Biological Control: currently, there are no known biological control methods.

1.3.2.3 Common Reed

Phragmites is a tall, perennial grass that can grow to over 15 feet in height. In North America, both native phragmites and introduced subspecies are found. Introduced Phragmites forms dense stands which include both live stems and standing dead stems from previous year's growth. Leaves are elongate and typically 1-1.5 inches wide at their widest

point. Flowers form bushy panicles in late July and August and are usually purple or golden in color. As seeds mature, the panicles begin to look "fluffy" due to the hairs on the seeds and they take on a grey sheen. Below ground, Phragmites forms a dense network of roots and rhizomes which can go down several feet in depth. The plant spreads horizontally by sending out rhizome runners which can grow 10 or more feet in a single growing season if conditions are optimal. Once introduced Phragmites invades a site it quickly can take over a marsh community, crowding out native plants, changing marsh hydrology, altering wildlife habitat, and increasing fire potential. Its high biomass blocks light to other plants and occupies all the growing space belowground so plant communities can turn into a Phragmites monoculture very quickly. Phragmites can spread both by seed dispersal and by vegetative spread via fragments of rhizomes that break off and are transported elsewhere.

Management options: Areas with large, established, populations of Phragmites are best restored using herbicides. Other options include mowing and prescribed burning.

Mechanical Control: This type of control (e.g., repeated mowing) may be effective at slowing the spread of established stands but is unlikely to kill the plant. Excavation of sediments may also be effective at control but if small fragments of root are left in the soil, they may lead to reestablishment.

Chemical Control: Glyphosate-based herbicides (e.g., Rodeo) are the most effective control method for established populations. If a population can be controlled soon after it has established chances of success are much higher because the below-ground rhizome network will not be as extensive. Herbicides are best applied in late summer/early fall after the plant has flowered either as a cut stump treatment or as a foliar spray. It is often necessary to do repeated treatments for several years to prevent any surviving rhizomes from re-sprouting. When applying herbicides in or around water or wetlands, be sure to use products labeled for that purpose to avoid harm to aquatic organisms.

Biological: At this time no means of biological control are available in the United States for treating Phragmites infestations.

1.3.2.4 Garlic Mustard

Garlic mustard (*Alliaria petiolata*) is a naturalized European biennial herb that typically invades partially shaded forested and roadside areas. It is capable of dominating the ground layer and excluding other herbaceous species. Its seeds germinate in early spring and it develops into a basal rosette during the first year. Garlic mustard produces white flowers between late April and June of the following spring. Plants die after producing seeds, which typically mature and disperse in August. Normally its seeds are dormant for 20 months and germinate the second spring after being formed. Seeds remain viable for up to 5 years. Garlic mustard is a biennial that spreads only by seed. Therefore, elimination of the plant before it can go to seed is the best method of minimizing proliferation.

Management Options: Several effective methods of control are available for Garlic mustard, including chemical and non-chemical, depending on the extent of the infestation and available time and labor.

Mechanical Control: Removal strategy of Garlic mustard includes repeat cutting or pulling to removal all vegetation and prevent the deposit of additional seed. The two methods of mechanical concrol include hand pulling and cutting.

1) Hand pulling is an effective method for removing small populations of garlic mustard, since plants pull up easily in most forested habitats. Plants can be pulled during most of the year. However, if plants have capsules present, they should be bagged and disposed of to prevent seed dispersal. Care should be taken to minimize soil disturbance but to remove all root tissues. Soil disturbance can bring garlic mustard seeds to the surface, thus creating a favorable environment for their germination. To avoid this, soil should be tamped down firmly after removing the plant. Re-sprouting is uncommon but may occur from mature plants not entirely removed.

2) Cutting is effective for medium- to large-sized populations depending on available time and labor resources. Cut stems when in flower (late spring/early summer) at ground level either manually (with clippers or a scythe) or with a motorized string trimmer. This technique will result in almost total mortality of existing plants and will minimize re-sprouting. Dormant seeds in the soil are unaffected by this technique due to minimal disturbance of the soil. However, as viable seeds may be produced from cut stems, they should be removed from the site when possible. Cuttings should be conducted annually until the seedbank is depleted.

Chemical Control: The post-emergence herbicides listed below should be applied after seedlings have emerged, but prior to flowering of second-year plants. None of these herbicides will affect subsequent seedling emergence of garlic mustard or other plants. It is very important to limit damage to non-target vegetation. If other plants are killed, garlic mustard will likely replace them. Indiscriminate herbicide applications can thus increase garlic mustard populations! As with cutting, the goal is to selectively remove garlic mustard leaving the desired plant community.As a cool season herb, garlic mustard continues to grow on snow-free days when temperatures exceed freezing. This provides an opportunity for selective treatment of garlic mustard if applications are made when other plants have not yet appeared (spring) or have died for the year (late fall).

Application of 1-2% glyphosate (Roundup) provides effective control of garlic mustard seedlings and rosettes. Note: glyphosate is a non-selective herbicide meaning that it will kill or damage most plants it comes into contact with (including woody plants). However, to be effective, this herbicide must be absorbed by growing leaf tissue or bark, i.e. the plant must be actively growing. Applications in very early spring (March-April) can often be timed for periods when few if any other plants beside garlic mustard are actively growing. Similarly in

late fall, applications can be made with reduced risk to many non-target species. However, glyphosate will damage sedges and other species that are actively growing at this time and therefore susceptible to herbicide uptake. Always take precautions to avoid contacting desirable plants with the herbicide. This may include the hard to see stems of small woody shrubs and trees. Bentazon (Basagran) applied at 8 ounces (by weight) per acre may be an acceptable substitute, less effective on garlic mustard but with reduced risk to some non-targets particularly annual and perennial grasses.

Biological: At this time no means of biological control are available in the United States for treating Garlic mustard infestations.

1.3.2.5 Japanese Barberry

Japanese Barberry *(Berberis thunbergii)* is multi-branched dense shrub that can grow to 2.5 m (8 ft) in height. Shiny green to burgundy leaves are alternate along its thorny stems. Solitary yellow flowers bloom from March to April, and the fruit is a round or elliptical red berry. Japanese barberry is a popular landscape shrub that has escaped into many natural areas, and can grow in dense thickets in the understory of woods and forests. It is a prolific seed producer, and numerous birds eat and subsequently disperse the seeds.

Mechanical Control: Removal strategy for Japanese Barberry includes repeated cutting to stop the spread of the shrub. However, cutting alone will not eradicate the shrubs. For eradication it is recommended that herbicide be used.

Chemical Control: Japanese barberry breaks bud earlier in the spring than most woody species. Thus, it is possible to selectively spray its young leaves before other woody species have produced leaves. For such early season treatments, triclopyr is usually more effective than glyphosate. Wait until significant leaf expansion to ensure sufficient absorption of triclopyr. From mid-summer to fall, both glyphosate and triclopyr are effective when applied as foliar sprays or as cut stump treatments. The half-life of triclopyr in water is less than 24 hours so it may be safe to use near open water. As always, the owner should consult state regulations and a licensed applicator prior to use of herbicide. Treatment is expected to require two to three years of management to achieve control of the plant.

Biological: At this time no means of biological control are available in the United States for treating Japanese barberry infestations.

1.3.2.6 Japanese Honeysuckle

Japanese honeysuckle *(Lonicera japonica)* is a perennial vine that climbs by twisting its stems around vertical structures, including limbs and trunks of shrubs and small trees. Leaves are oblong to oval, sometimes lobed, have short stalks, and occur in pairs along the stem. In southern and mid-Atlantic states, Japanese honeysuckle often remains evergreen. In colder northern climates, the leaves may fall off after exposure to prolonged winter temperatures.

Flowers are tubular, with five fused petals, white to pink, turning yellow with age, very fragrant, and occur in pairs along the stem at leaf junctures. Stems and leaves are sometimes covered with fine, soft hairs. Japanese honeysuckle blooms from late April through July and sometimes into October. Small black fruits are produced in autumn, each containing 2-3 oval to oblong, dark brown seeds about 1/4 inch across. In North America, Japanese honeysuckle has few natural enemies which allows it to spread widely and out-compete native plant species. Its evergreen to semi-evergreen nature gives it an added advantage over native species in many areas. Shrubs and young trees can be killed by girdling when vines twist tightly around stems and trunks, cutting off the flow of water through the plant. Dense growths of honeysuckle covering vegetation can gradually kill plants by blocking sunlight from reaching their leaves. Vigorous root competition also helps Japanese honeysuckle spread and displace neighboring native vegetation. A ubiquitous invader, Japanese honeysuckle thrives in a wide variety of habitats including fields, forests, wetlands, barrens, and all types of disturbed lands.

Growth and spread of Japanese honeysuckle is through vegetative (plant growth) and sexual (seed) means. It produces long vegetative runners that develop roots where stem and leaf junctions (nodes) come in contact with moist soil. Underground stems (rhizomes) help to establish and spread the plant locally. Long distance dispersal is by birds and other wildlife that readily consume the fruits and defecate the seeds at various distances from the parent plant.

Management Options: Several effective methods of control are available for Japanese honeysuckle, including chemical and non-chemical, depending on the extent of the infestation and available time and labor.

Mechanical Control: For small patches, repeated pulling of entire vines and root systems may be effective. Hand pull seedlings and young plants when the soil is moist, holding low on the stem to remove the whole plant along with its roots. Monitor frequently and remove any new plants. Cut and remove twining vines to prevent them from girdling and killing shrubs and other plants. An effective method for removal of patches of honeysuckle covering the ground is to lift up and hold a portion of the vine mass with a rake and have a chain saw operator cut the stems low to the ground. Mowing large patches of honeysuckle may be useful if repeated regularly but is most effective when combined with herbicide application (see below). Mow at twice a year, first in mid-July and again in mid-September. Plants can also be grubbed out using a Pulaski or similar digging tool, taking care to remove all roots and runners. Burning removes above ground vegetation but does not kill the underground rhizomes, which will continue to sprout. In certain situations, tethered goats have been used to remove honeysuckle growth, but must be monitored to prevent their escape to the wild where they would become an added ecological threat.

Chemical Control: In moderate cold climates, Japanese honeysuckle leaves continue to photosynthesize long after most other plants have lost their leaves. This allows for application of herbicides when many native species are dormant. However, for effective

control with herbicides, healthy green leaves must be present at application time and temperatures must be sufficient for plant activity. Several systemic herbicides (e.g., glyphosate and triclopyr) move through the plant to the roots when applied to the leaves or stems and have been used effectively on Japanese honeysuckle. Following label guidelines, apply a 2.5% rate of glyphosate (e.g., Rodeo for wetlands; Roundup for uplands) mixed with water and an appropriate surfactant, to foliage from spring through fall. Alternatively, apply a 2% concentration of triclopyr (e.g., Garlon 3A) plus water to foliage, thoroughly wetting the leaves but not to the point of drip-off. A coarse, low-pressure spray should be used. Repeat applications may be needed. Treatment in the fall, when many non-target plants are going dormant, is best. Also, a 25% glyphosate or triclopyr solution mixed with water can be applied to cut stem surfaces any time of year as long as the ground is not frozen.

Biological control: No biological control agents are currently available for Japanese honeysuckle.

1.3.2.7 Japanese Knotweed

Japanese knotweed *(Polygonum cuspidatum)* is a fast-growing herbaceous perennial that grows in large clumps three to six feet in height. It has hollow stems similar to bamboo, with swollen joints along the stem. Leaves are broadly egg-shaped, with pointed tips and squarish bases. The flowers are greenish white and profuse, growing in slender fingerlike clusters where the leaves meet the branches. This plant occurs in a wide variety of habitats, in many soil types, and a range of moisture conditions. It appears to be found primarily in disturbed open areas with plenty of sun; shade depresses its growth. Edges of roadways and stream banks are common locations at which to find Japanese knotweed. In Connecticut, leaves appear on Japanese knotweed in April. Flowers develop in August and September. Once established, the species reproduces primarily through its extensive rhizomes, which may reach 45-60 feet in length. The early emergence of Japanese knotweed leaves in the spring and its stand-forming habit produce a dense canopy beneath which few other plant species can survive. In addition, the persistent accumulation of stem litter within established stands also reduces species diversity and damages wildlife habitat.

Control Methods: It is extremely difficult, if not impossible, to eradicate large established stands of Japanese knotweed. However, establishment can be prevented fairly easily by removing plants before they become firmly entrenched. Current control methods include both mechanical and Japanese Knotweed herbicidal treatments.

Mechanical control: Cutting with persistence, at least three cuts in one growing season can be effective.

Chemical Control: Herbicides such as glyphosate (active ingredient in Roundup®) may be more effective when applied to the re-growth of cut stems. Glyphosate is a non-selective herbicide and great care should be taken in its usage.

Biological: At this time no means of biological control are available in the United States for treating Japanese knotweed infestations.

1.3.2.8 Multiflora Rose

Multiflora rose *(Rosa multiflora)* is a large, dense shrub that has escaped from ornamental and conservation plantings to become a serious invasive plant problem across the eastern half of the U.S. It invades natural areas, pastures, and light gaps in forests. Multiflora rose produces abundant small white flowers in the spring. Birds and mammals consume the red fruits, called hips, and may disperse them long distances. The majority of plants develop from seeds in the soil, which may remain viable for 10 to 20 years. It may also spread vegetatively when tips of arching branches touch the ground and develop roots (called layering), and from plants that emerge from shallow roots. Plants grow slowly for the first one or two years followed by rapid expansion through layering and root sprouts. Multiflora rose spreads quickly and may grow 1 to 2 feet per week to form impenetrable thickets of thorny stems.

Mechanical Control: Hand pulling can be an effective strategy for young small stems of multiflora rose, and repeated harvesting can control the spread and top growth of established shrubs, but total eradication comes from the use of herbicides.

Chemical Control: Multiflora rose is susceptible to both glyphosate and triclopyr. Triclopyr can be applied starting in spring before or during flowering. Glyphosate is most effective when applied after flowering (early summer) until early fall. Cut-stump treatments with both herbicides also provide control, but cutting stumps in established thickets is very difficult because of the numerous thorny branches.

1.3.2.9 Purple Loosestrife

Purple loosestrife (*Lythrum salicaria*) is a wetland perennial native to Eurasia that forms large, monotypic stands throughout the temperate regions of the U.S. and Canada. It has a vigorous rootstock that serves as a storage organ, providing resources for growth in spring and regrowth if the plant has been damaged from cuttings. New stems emerge from the perennial roots enabling the plant to establish dense stands within a few years. Seedling densities can approach 10,000-20,000 plants/m2 with growth rates exceeding 1 cm/day. A single, mature plant can produce more than 2.5 million seeds annually which can remain viable after 20 months of submergence in water. In addition, plant fragments produced by animals and mechanical clipping can contribute to the spread of purple loosestrife through rivers and lakes.

Mechanical Control: In small populations, younger plants (1-2 years old) can be pulled by hand. Plants more than 2 years old should be dug out with special care to include the entire rootstock. Use of tools, such as a Weed Wrench, on plants once they have developed a woody cane can be an effective way to remove this rootstock. Plants should be removed

before flowering to ensure that seeds are not dispersed during the disturbance. All plant parts should be carefully bagged, removed from the site, and placed in approved landfills or preferably burned to prevent escape to other non-infested sites. In addition, clothing, boots, and equipment should be properly cleaned to ensure that no seeds are transported. Follow-up treatments of sites are recommended for 3 years to eliminate re-sprouts from fragments left behind.

Hand tools may be used to cut plants, particularly younger plants (1-2 years old) which have not yet developed woody stems. Since these tools mow the plants and leave the root structures intact, repeated cuttings may be necessary over the course of a growing season. All plant parts should be removed immediately from the site and properly disposed of. Once severed, stems are buoyant and may disperse to other areas and re-sprout.

Purple loosestrife produces a huge volume of seeds that contribute to the seedbank in the soil. In areas where this plant is expanding and removal is not feasible, cutting the flowers off with common garden clippers or shears can dramatically slow the spread of seeds. Again, all plant parts that are cut should be bagged and removed from the site to prevent re-sprouting.

Mowing is not recommended for purple loosestrife because it can further spread the species by distributing plant stems that will sprout vegetatively. If feasible, native plants should be restored to the control area by seeding or planting. This re-establishment of vegetation will deter new loosestrife seedling development.

Biological Control: Several insects that feed specifically on purple loosestrife in Europe have undergone intensive laboratory and field tests in the U.S. To date four insects have been approved for release in Connecticut.

Two leaf-eating beetles, *Galerucella calmariensis* and *G. pusilla* defoliate purple loosestrife, leaving behind dried out skeleton of the leaves. By defoliating large portions of the plant, these beetles impact the plant's ability to photosynthesize. This type of stress reduces the plant's ability to store reserves for overwintering and limits its capacity to form flowers. Beginning in 1996, Donna Ellis at the University of Connecticut has released *Galerucella* beetles at several study sites in Connecticut as part of a long-term research project. The beetles are causing extensive feeding damage to purple loosestrife at the release sites, and they have been overwintering and reproducing successfully.

Hylobius transversovittatus is a weevil that attacks the entire plant. Adults feed on aboveground portions of purple loosestrife, while the larvae attack the roots and crown of the plant. By attacking the rootstock, Hylobius weevil larvae affect nutritional uptake and the plant's ability to overwinter and survive during stressful conditions.

Another weevil, *Nanophyes marmoratus*, attacks the flowers of purple loosestrife. Upon emerging, overwintering adults move to young plants and feed on the newly developing

leaves. After flowering is initiated the adults move to the flower spike and feed on the opened flowers located on the bottom of the spike. Adults feed exclusively on the flowers. Long-term effects should be significant since feeding action and oviposition prevent normal flower development thereby limiting seed production.

For more information about biological control of purple loosestrife, contact: Donna Ellis, Dept. of Plant Science, Box U4067, University of Connecticut, Storrs, CT 06269, Tel: (860) 486-6448, Email: donna.ellis@uconn.edu

Chemical Control: In dense, monotypic stands of purple loosestrife, spray loosestrife seedlings before they reach 12" tall with glyphosate. For established loosestrife growing from perennial rootstocks, spray glyphosate when loosestrife is actively growing from full flowering to just after flowering (late summer to early fall, before frost). Use Rodeo formulation if loosestrife is growing in standing water or if spray will contact water. The following concentrations of Roundup© and Rodeo© are recommended: Roundup [glyphosate (41%)]: 2.5 fl. oz./gal, Rodeo [glyphosate (53.8%)]: 2 fl. oz./gal.

1.3.2.10 Winged Euonymus

Winged Euonymus, or burning-bush, *(Euonymus alatus)* is a deciduous shrub that averages 6 to 9 feet in height but is capable of reaching 15 feet. It has opposite, simple, elliptical toothed leaves which turn bright scarlet in autumn. Among its distinctive features are the prominently corky-winged green and brown twigs. Winged Euonymus grows in a variety of soil conditions and spreads readily from cultivation into old fields, open woods, and mature second growth forests. In open woodlands, winged Euonymus replaces native shrubs. In areas where it forms dense monotypic stands, it reduces habitat diversity. The root system forms a dense mat just below the soil surface. The combination of the dense shade provided and the tight root system makes survival of other plants beneath Euonymus impossible.

Mechanical Control: Hand pulling sprouts and saplings can be effective. Larger shrubs may require heavy equipment for eradication of the plant.

Chemical Control: Use of herbicides on cut stumps and young plants may be effective.