**Preventing the spread of invasive plant species:**

**Best Management Practices for movement of topsoil and gravel fill, mulch and equipment** **in Connecticut.**

**Adverse impact and costs associated with Invasive Plants:**

Invasive plant species are a serious threat to native habitats and ecosystems by adversely affecting species diversity and land values. Invasive plant species crowd out native plants, altering these ecosystems and the wildlife they support. Some invasive species such as Giant Hogweed present health risks to people while others such as Japanese Barberry create habitats that favor rodents associated with elevated levels of Lyme disease-transmitting Deer ticks.

The most effective management strategy is to prevent invasive plant species from spreading into new habitat. Preventing the initial spread of invasive plant species is easier and less expensive than remediating a landscape after the invasive plants become established.

Once an invasive species spreads to new habitat, early detection and rapid response is the best course of action for preventing establishment. By detecting an invasion early and reacting quickly the cost of remediation can be greatly reduced.

**Concern associated with movement of fill, mulch and equipment**:

Roadsides provide a desirable habitat for invasive plants due to ample sunshine, disturbed and bare soils, and moist drainage channels. If bare areas are present or if vegetation is eliminated due to herbicide treatments, it is important to reestablish desirable vegetation, such as turf grasses or native plants, before non-native plants invade the area.

Many invasive plant species spread through seed dispersal by wind or wildlife. However, others are inadvertently disseminated through human activities such as the movement of excavated soil, sand, gravel, and mulches; or through the movement of mowing, maintenance and excavation equipment from invaded sites to uninvaded sites.

This movement of materials and equipment not only spreads seeds but also stem and root fragments that can readily sprout to invade new habitat. These **Best Management Practices (BMPs)** were developed to assist landowners, work crews and supervisors in preventing the introduction and spread of invasive plant species on disturbed and managed land, especially when materials (e.g. soil fill, gravel, mulch) and equipment are moved and natural plant cover is disturbed or removed; circumstances which are commonly associated with residential or commercial construction projects and highway road work.

**Best Management Practices (BMPs):**

**Pre- and Post-Season Planning**

1. Develop a plan to identify and map roadsides and construction sites with new and existing areas of invasive plants. Keep the entire crew engaged in the identification of new areas. It is much easier to eradicate a small, new area of invasive plants than an established, large one. Establish a schedule and prioritize your approach depending on the best time to control.
2. Develop species-specific control plans that include when to use herbicides or when to mow and/ or control in the vegetative phase. Repeat control for aggressive species, especially perennials.
3. Monitor work areas after treatment for at least two years. Return to re-treat, as needed.

**Soil and Excavated Material from site of origin**

1. Minimize soil disturbance and monitor excavation sites for emerging invasive species for at least two years.
2. Avoid transporting soil, fill, stone, hay, or other materials from an area known to have invasive plants. If you cannot verify that these materials are free of invasive plant fragments or seeds, monitor the site with this deposited material for emergence of invasive plants for at least two years.
3. Stabilize disturbed soils as soon as practical with acceptable seeding and mulch.
4. Do not use excavated material elsewhere unless it is free of invasive plant fragments or seeds.
5. Wherever possible, avoid excavation in areas containing Japanese knotweed, giant knotweed, purple loosestrife, mugwort, and phragmites. Plants will emerge from their root fragments.
6. Stockpile any excavated material containing invasive species on an impervious surface until the plant material is destroyed.
7. Whenever transporting soil or fill materials containing invasive species, cover the load during transport.

INSPECTION & MONITORING:

1. Inspect sites where soil and other fill or mulch is to be introduced. Record presence of invasive species already present. Treating invaded areas before introducing new material is recommended.
2. Inspect soil and gravel fill prior to movement. Before moving soils or gravel, inspect the area of origin (including but not limited to, surrounding ditches, top soil piles, gravel/sand piles, fence rows, roads, easement, rights-of-way, working area, storage areas, and buffer zone surrounding the entire area)
3. Inspect soils and gravel fill prior to spreading on new site.
4. Monitor sites where new fill or mulch is introduced. Treat newly emerging invasive species immediately. Monitor the site for up to 2 years.

Manage existing topsoil and dead plant material to reduce contamination by invasive plants.

1. Save local existing topsoil for reuse. Plan topsoil management prior to soil disturbance.
2. Develop topsoil management plans on all projects that include grading or earthwork unless the topsoil and duff material are determined to be contaminated with invasive plants.
3. Identify on the worksite plans, where local topsoil and dead plant material should be:
	1. Removed or excavated
	2. Stockpiled
	3. Reapplied
4. When excavating local topsoil and removing duff material, minimize handling of the material to reduce detrimental impacts to soil microorganisms.
5. Stockpile local topsoil and duff material in windrows no taller than ten feet for local topsoil and five feet for duff. Implement temporary erosion control measures to reduce the likelihood of invasive plant establishment and loss of material.
6. Seed local topsoil stockpiles that will remain in place for over six months with a fast-growing non-invasive native plant species to maintain soil microorganisms. Covering topsoil stockpiles with impermeable barriers such as plastic sheeting may destroy living soil microorganisms.
7. Monitor stockpiles of topsoil and duff material regularly as they are highly susceptible to invasion by invasive plants. Determine management needs based on presence of invasive plants.

When using mulch:

1. Use weed-free mulch.
2. Apply mulch at the recommended thickness to suppress the establishment and growth of invasive plants. Ensure mulch remains on-site. Lighter mulches will blow away in areas prone to heavy wind; mulches can move if watering results in surface flow. Consider the use of tackifiers or biodegradable netting to stabilize mulch on erosion prone areas.
3. Supplement with additional mulch to retain thickness and effectiveness after it begins to decompose.

SOIL DISTURBANCE & STABILIZATION

1. Minimize soil disturbance whenever possible, as invasive plants readily colonize areas of disturbed soil. Monitor recent work sites for the emergence of invasive plants for a minimum of 2 years after project completion.
2. Stabilize disturbed soil as soon as possible by seeding with native species, or by using clean mulch, hay, rip-rap, or gravel. Species on the prohibited invasive plant list should never be planted.
3. Avoid using fill from invaded sites. Materials such as fill, loam, mulch, hay, rip-rap, and gravel should not be brought into project areas from sites where invasive plants are known to occur. When uncertain about the quality of fill, monitor work sites for the emergence of invasive plants for a minimum of 2 years.

MOVEMENT & MAINTENANCE OF EQUIPMENT

1. When equipment needs to be moved, plan work flow so that equipment is moved from non-invaded sites to invaded sites. This is especially important during ditch cleaning and shoulder scraping.
2. Use staging areas that are free of invasive plants to avoid spreading seeds, clippings or plant fragments.
* If working in areas with invasive plants, clean all equipment, clothing, and hand tools of all visible soil and plant material before leaving the project site. Acceptable methods of cleaning include, but are not limited to:
	+ Portable wash station that contains runoff from washing equipment (containment must be in compliance with wastewater discharge regulations);
	+ High pressure air;
	+ Brush, broom, or other hand tools (used without water).
1. If equipment will be used in invaded areas, remove above-ground invasive plant materials such as purple loosestrife, phragmites, and Japanese knotweed prior to the start of work.
2. Excavated material taken from sites that contain invasive plants cannot be used away from the invaded site until all viable plant material is destroyed. Excavated material from areas containing invasive plants may only be reused within the *exact* limits of the invaded site.
3. Any excavated material that contains viable plant material and is not reused within the limits of the invaded site must be stockpiled on an impervious surface until viable plant material is destroyed OR the material must be disposed of by burying a minimum of 3-5’ feet below grade (Note: the proper depth varies with species. Burial may not be an option species such as Japanese knotweed that have robust underground storage organs).
4. Whenever possible, excavation should be avoided in areas containing Japanese knotweed, purple loosestrife, mugwort, and phragmites. If excavation does occur in these areas, the BMPs described for HANDLING EXCAVATED MATERIAL & INVASIVE PLANT MATERIAL must be followed.
5. Ditched areas should be stabilized daily as part of the regular work operations. The disturbed soils and new ditch profile are to be protected as soon as possible by stone, erosion control materials or seeding and mulch from a source free of invasive plant material. Seeds of native species should be used whenever possible. Mulch may be straw or a manufactured product.

MOWING

1. Avoid mowing areas infested with purple loosestrife, phragmites, mugwort, and Japanese knotweed, as these can sprout from stem and root fragments. Stake roadside populations with “Do Not Mow”.
2. If mowing is necessary, mow these areas BEFORE seed maturation (approximately July 15th in CT but it is best to inspect the site to determine the stage of maturation).
3. Clean mowing equipment daily, and prior to transport. This is particularly important if mowing is after seed maturation**.**

HANDLING EXCAVATED MATERIAL & INVASIVE PLANT MATERIAL

1. Destroy removed plant material. Methods include:
* Drying/Liquefying: place on impervious surface and cover
* Brush piles: not for plants with fruit or seed
* Burying: minimum of 3 feet below grade
* Burning: have a designated burn pile for invasive plants and the proper burn permit
* Herbicide: requires a licensed applicator (CT DEEP)
1. Cover invasive plant material when transporting.
2. Excavated materials taken from infested areas should only be used onsite, unless all plant material has been destroyed. Only use within exact limits of infestation.
3. Stockpile unused excavated materials on impervious surface, or bury at a depth that will prevent emergence.
4. Excavation should be avoided in areas containing purple loosestrife, phragmites, mugwort, and Japanese knotweed.
5. Cover soil from infested areas when transporting.

**References and resources:**

Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers (3rd Edition). California Invasive Plant Council. <https://www.cal-ipc.org/resources/library/publications/landmanagers/>

BEST MANAGEMENT PRACTICES FOR ROADSIDE INVASIVE PLANTS IN THE ADIRONDACK PARK. New York State Department of Transportation. <http://adkinvasives.com/wp-content/uploads/2016/01/BMPs-for-Roadside-Invasive-Plants-in-the-ADKs.pdf>

Non-native Invasive Species Best Management Practices Guidance for the U.S. Forest Service Eastern Region. United States Department of Agriculture Forest Service. August 2012 <https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5412628.pdf>

A Land Manager’s Guide to Best Management Practices (BMPs) to Prevent the Introduction and Spread of Invasive Species. The University of Georgia Center for Invasive Species and Ecosystem Heath. <https://bugwoodcloud.org/mura/gist/assets/File/LMBMP.pdf>

NAISMA WEED FREE GRAVEL MINIMUM CERTIFICATION STANDARDS. NORTH AMERICAN INVASIVE SPECIES MANAGEMENT ASSOCIATION (NAISMA). 2017. <https://www.naisma.org/>

Best Practices for Controlling Invasive Plant Species. PennDOT technical information sheet #184. 2017. <http://www.dot7.state.pa.us/BPR_PDF_FILES/Documents/LTAP/TechSheets/TS_184.pdf>

BEST PRACTICES For Managing Invasive Species on Utility Operations: A Pocket Guide for British Columbia’s Utility Workers. 2014 EDITION. <https://bcinvasives.ca/documents/Utilities_BMP_FINAL_WEB_05_16_2014.pdf>

BEST MANAGEMENT PRACTICES FOR ROADSIDE INVASIVE PLANTS. New Hampshire Department of Transportation (2008). <https://www.nh.gov/dot/org/projectdevelopment/environment/units/program-management/documents/BMPsforRoadsideInvasivePlants.pdf>