Connecticut Light & Power
A Northeast Utilities Company

NEW ENGLAND EAST WEST SOLUTION

DEVELOPMENT AND MANAGEMENT PLAN

FOR CONSTRUCTION OF THE

INTERSTATE RELIABILITY PROJECT

MODIFICATIONS TO THE
CARD STREET SUBSTATION,
LAKE ROAD SWITCHING STATION,
AND KILLINGLY SUBSTATION

VOLUME 2

PROJECT-WIDE APPROVALS, PLANS,
GUIDELINES, AND SPECIFICATIONS

SUBMITTED FOR CONNECTICUT SITING COUNCIL APPROVAL

AUGUST 2013

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DOCKET NO. 424 - The Connecticut Light & Power Company application for a Certificate of Environmental Compatibility and Public Need for the Connecticut portion of the Interstate Reliability Project that traverses the municipalities of Lebanon, Columbia, Coventry, Mansfield, Chaplin, Hampton, Brooklyn, Pomfret, Killingly, Putnam, Thompson, and Windham, which consists of (a) new overhead 345-kV electric transmission lines and associated facilities extending between CL&P's Card Street Substation in the Town of Lebanon, Lake Road Switching Station in the Town of Killingly, and the Connecticut/Rhode Island border in the Town of Thompson; and (b) related additions at CL&P's existing Card Street Substation, Lake Road Switching Station, and Killingly Substation.	}	Connecticut Siting Council December 27, 2012

Decision and Order – Interstate Reliability Project

Pursuant to the foregoing Findings of Fact and Opinion for the Connecticut portion of the Interstate Reliability Project (Interstate), the Connecticut Siting Council (Council) finds that there is a public need for the proposed facility and that the effects associated with the construction of a new overhead 345-kV electric transmission lines and associated facilities extending between CL&P's Card Street Substation in the Town of Lebanon, Lake Road Switching Station in the Town of Killingly, and the Connecticut/Rhode Island border in the Town of Thompson; and related additions at CL&P's existing Card Street Substation, Lake Road Switching Station, and Killingly Substation, including effects on the natural environment; ecological integrity and balance; forests and parks; scenic, historic, and recreational values; air and water purity; fish and wildlife; and public health and safety are not disproportionate either alone or cumulatively with other effects compared to need, are not in conflict with the policies of the State concerning such effects, and are not sufficient reason to deny the application. Therefore, the Council directs that a Certificate of Environmental Compatibility and Public Need, as provided by Connecticut General Statutes §16-50k, be issued to The Connecticut Light and Power Company (CL&P), for the construction, operation and maintenance of such facilities.

Unless otherwise approved by the Council, the facilities shall be constructed, operated, and maintained substantially as specified in the Council's record in this matter, and as subject to the following conditions:

1. The Certificate Holder shall construct the proposed transmission line overhead along the Interstate route with potential route and/or configuration variations noted under Condition numbers 3(p) and 3(q) of this Decision and Order. The new transmission line shall be placed primarily on H-frame structures except in Segment 9 between Lake Road Junction and Lake Road Switching Station in Killingly where the existing and proposed lines would be supported on vertical steel structures; and in the areas of the federally-owned Mansfield Hollow property and Hawthorne Lane Alternative, details of which shall be submitted prior to construction as noted below. Also, structure #39 on the property of Highland Ridge Golf Range shall be constructed as a steel monopole.

2. The Certificate Holder shall construct the additions to Card Street Substation, Lake Road Switching Station, and Killingly Substation, as proposed.

3. The Certificate Holder shall prepare a Development and Management (D&M) Plan, whole or in parts, for this project in compliance with Sections 16-50j-60 through 16-50j-62 of the Regulations of Connecticut State Agencies. The D&M Plan shall be served on the Towns of Lebanon, Columbia, Coventry, Mansfield, Chaplin, Hampton, Brooklyn, Pomfret, Killingly, Putnam and Thompson for comment, and all parties and intervenors as listed in the service list, and submitted to and approved by the Council prior to the commencement of facility construction and shall include:

    a. A detailed site plan showing the placement of the access roads, structure foundations, equipment and material staging area for the overhead route;

b. An erosion and sediment control plan, consistent with the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control as amended;
c. A spill prevention and countermeasures plan;
d. Provisions for crossing inland wetland and watercourses for the route;
e. Details of ground disturbance;
f. Vegetative clearing plan;
g. A wetland restoration plan;
h. Invasive species control plan;
i. Provisions to manage the discovery of undocumented Native American Archaeological resources;
j. A post-construction electric and magnetic field monitoring plan;
k. A schedule of construction hours during nights and/or weekends and mitigation of lighting and noise;
l. A plan to minimize air quality effects during construction;
m. A blasting plan, if necessary;
n. Identification of developed areas for staging and equipment lay down, field office trailers, sanitary facilities and parking before establishing a new area;
o. Plans and strategies to prevent the use of the right-of-way by all-terrain vehicles;
p. Details of the configuration of the line structures within the federally-owned Mansfield Hollow State Park and Wildlife Management Area;
q. Details of the route and line configuration for the segment of the line that crosses Hawthorne Lane in Mansfield; and
r. Details of protection measures for active farmland, including a report of consultations with the owners of agricultural properties to identify active farmland and assess protection of agricultural soils.

4. The Certificate Holder shall comply with the Department of Energy and Environmental Protection recommendations, or coordinate with the Department of Energy and Environmental Protection, for construction of the route in the area of endangered, threatened, or special concern species identified along the Interstate route in Connecticut.

5. The Certificate Holder shall conform to the Council's Best Management Practices for Electric and Magnetic Fields.

6. The Certificate Holder shall comply with all future electric and magnetic field standards promulgated by State or federal regulatory agencies. Upon the establishment of any new standards, the facilities granted in this Decision and Order shall be brought into compliance with such standards.

7. The Certificate Holder shall obtain necessary permits from the United States Army Corps of Engineers and the Connecticut Department of Energy and Environmental Protection prior to the commencement of construction, in areas where said permits are required.

8. The Certificate Holder shall hire an independent environmental inspector, subject to Council approval, to monitor and report on the installation of the overhead transmission system and provide a bi-weekly report to the Council.

9. The Certificate Holder shall provide to the Council an operating report within three months after the conclusion of the first year of operation of all facilities herein, and annually thereafter for a period of three years, with information relevant to the overall condition, safety, reliability, and operation of the transmission systems.

10. This Decision and Order shall be void if all construction authorized herein is not completed within four years of the effective date of the Decision and Order, or within four years after all appeals to this Decision and Order have been resolved.

We hereby direct that a copy of the Findings of Fact, Opinion, and Decision and Order be served on each person listed below, and notice of the Decision published in the Hartford Courant, the Willimantic Chronicle, and the Norwich Bulletin.

By this Decision and Order, the Council disposes of the legal rights, duties, and privileges of each party named or admitted to the proceeding in accordance with Section 16-50j-17 of the Regulations of Connecticut State Agencies.

The Parties and Intervenors in this proceeding are:

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	}	Siting
	}	Council
	}	December 27, 2012

Opinion – Interstate Reliability Project

I. Introduction

On December 23, 2011, The Connecticut Light and Power Company (CL&P) applied to the Connecticut Siting Council (Council) for a Certificate of Environmental Compatibility and Public Need (Certificate) for the construction, operation and maintenance of the Connecticut portion of Interstate Reliability Project (Interstate).

Interstate involves the construction of transmission facilities in northeastern Connecticut, northwestern Rhode Island, and south-central Massachusetts and requires decisions by the Council, the Rhode Island Energy Facility Siting Board, and the Massachusetts Energy Facilities Siting Board for the respective state's portion of the project.

Interstate would extend 75 miles within the three states, predominantly within the existing utility rights-of-way (ROW). It would connect CL&P's Card Street Substation in Lebanon, CT and Lake Road Switching Station in Killingly, CT, National Grid's West Farnum Substation in Smithfield, RI, and National Grid's Millbury Switching Station in Millbury, MA. The project would extend through but electrically bypass CL&P's Killingly Substation in Killingly, CT and Narragansett Electric's Sherman Road Switching Station in Burrillville, RI.

CL&P would own and operate the Connecticut portion of Interstate, although following commencement of commercial operation, CL&P expects to transfer some of the facilities to the United Illuminating Company.

Narragansett Electric Company would own and operate the Rhode Island portion of the facilities. New England Power Company would own and operate the Massachusetts facilities. Both companies are owned by National Grid USA. CL&P is a wholly-owned subsidiary operating company of Northeast Utilities.

The Connecticut portion of Interstate includes new overhead 345-kV electric transmission lines extending approximately 36.8 miles between CL&P's Card Street Substation in Lebanon and the Connecticut/Rhode Island border in Thompson; and associated substation modifications.

The proposed project would pass through federally-owned property within Mansfield Hollow State Park in Mansfield and Chaplin. The existing CL&P ROW on this property is too narrow to accommodate the proposed 345-kV transmission line alongside the existing transmission line. CL&P proposes a ROW expansion.

II. Need

The electric power system in New England became regionalized during the 1960s, when the electric utility companies in New England, including CL&P, developed a plan for a 345-kV transmission grid that would integrate the dispatch of electricity from strategically located generating stations serving loads within and between the New England States and other regions.

In the 1960s and 1970s, when the initial 345-kV loop was completed throughout New England from New York to Maine, the peak load was approximately 14,000 MW. The peak load in 2012 was approximately 29,000 MW and is forecasted in the ISO-NE Capacity, Energy, Loads, and Transmission report to be approximately 34,000 MW in 2022. The Council finds that the peak load when the 345-kV system was first put into place is a fraction of what it currently is, therefore the need for expansion of the 345-kV system is obvious and expected.

ISO-NE is the operator of the New England bulk power grid and, since 2001, is the Regional Transmission Organization, with consolidated authority to operate and plan transmission systems and maintain system reliability. ISO-NE defines reliability in accordance with the definition established by the North American Electric Corporation (NERC), which encompasses two concepts: adequacy and security. Adequacy has to do with supply and demand: it is the "ability of the system to supply the aggregate electric power and energy requirements of the consumers at all times." Security has to do with operating the electrical system within safe thermal and voltage limits: it is "the ability of the system to withstand sudden disturbances." As demand for electricity increases in the region, ISO-NE directs upgrades in the transmission system that are designed and modeled to assure reliability under the type of condition called a "contingency", that is, a condition where a system component fails—for instance, a transmission line or generator goes out of service. Indeed, the transmission system must be designed to withstand multiple contingencies.

In 2004, ISO-NE began a study on reliability deficiencies and interrelated needs throughout the southern New England electric supply system, and in 2006 released a draft report later referred to as the "Southern New England Transmission Reliability Report (SNETR) – Needs Analysis, January 2008." Developed by the planning staffs of ISO-NE, NU and National Grid USA (National Grid), SNETR was the genesis of the New England East-West Solution (NEEWS). In its most general sense, NEEWS is a comprehensive, long-range regional plan for expansion that addresses electric transmission reliability concerns throughout New England.

More specifically, NEEWS consists of four separate but related projects that would alleviate reliability deficiencies in the southern New England transmission system. Each of the projects that compose NEEWS would address at least one identified system deficiency on its own, as well as working together with the remaining NEEWS projects to resolve region-wide issues. These projects are:

a. The Greater Springfield Reliability Project (GSRP) and Manchester to Meekville Junction Project (MMP), which was approved by the Council in Dockets No. 370 and Docket No. 370_MR.
b. The Rhode Island Reliability Project, which is not under this Council's jurisdiction.
c. The Central Connecticut Reliability Project, which may be brought to the Council in the future.
d. Interstate, which is the subject of this proceeding.

In 2008, 2011 and 2012, ISO-NE and the relevant transmission companies re-evaluated the need for Interstate, taking into account changes in system conditions. Each of these analyses found a need for Interstate to resolve reliability deficiencies under contingent conditions for the years studied.

While the Party Civie alleges that there is adequate Connecticut import capability as a result of adding up the capacity of all transmission lines in the interface, it is the Council's opinion that this is not a proper method for transmission planning. Planners must design a transmission system across an interface taking into consideration not only normal conditions, but also the occurrence of a contingency event and the potential for a second contingency event occurring within 30 minutes of the first. The power flowing on the system would then redistribute to the remaining lines in service. The Council finds that the transmission system must be considered as a whole network rather than the sum of its parts.

The Council acknowledges this extended expert review of the need for NEEWS and for Interstate as part of NEEWS. Our own evaluation also builds on our 2010 decision regarding the GSRP, the first NEEWS application presented to us. Regarding Interstate in particular, the Council determines that the project is needed to assure

reliable and economic transmission service throughout Connecticut, along with Massachusetts, Rhode Island, and New England as a whole. We highlight the following support for this determination.

First, Interstate increases the security of the electric system for Connecticut's neighbors and thus for Connecticut. Under contingencies, it eliminates thermal overloads on critical transmission lines in Massachusetts that provide power to Connecticut customers. Also, by providing two new 345-kV lines into the West Farnum Substation in Rhode Island, Interstate eliminates deficiencies otherwise likely, under contingencies, to cause a voltage collapse of Rhode Island's transmission system that could easily propagate into Connecticut.

Second, Interstate raises transfer limits on electricity flowing both east and west across New England at the New England East West Interface (NEEWI); at the same time, Interstate increases the transfer capability into Connecticut. Both aims are accomplished by providing a line into Card Street via the route from West Farnum and Lake Road. Although a net exporter of power during the mid-1980s and early 1990s, Connecticut is currently a net importer and has the least ability of all the New England states to import power as a supplement to its internal supply resources. The likelihood of significant retirement of generators here only exacerbates the need for greater transfer capability to assure system adequacy. Supplemental benefits involve: a) greater access to renewable generation, assisting the state to achieve its Renewable Portfolio Standards and other environmental goals more economically; b) a larger number of 345-kV connections across NEEWI and state boundaries, allowing the electric system in New England as a whole more flexibility as it expands.

Third, Interstate solves an unusual reliability problem involving the Lake Road Generating Station in Killingly, Connecticut. Ever since this plant was built in 2002, it has been considered to be electrically isolated because planning studies showed that a single contingency forces power from the plant to flow out of Connecticut into Rhode Island. Indeed, for that reason, the plant has been treated by ISO-NE as if it were not even part of Connecticut. Operation of Interstate would allow Lake Road Generating Station's power to flow into Connecticut as well as Rhode Island under a single contingency. No longer isolated, the plant's capacity would be counted toward Connecticut's Local Sourcing Requirement, lifting an economic penalty from our state regarding its contribution to regional resource adequacy.

In short, the current expansion of the 345-kV transmission system in Connecticut and southern New England is a logical outgrowth of area load growth, which has roughly doubled in the past 40 years.

Having discussed Interstate's assurance of the electric system's reliability in terms of both security and adequacy, the Council further notes that Interstate is consistent with Connecticut's energy policy under Connecticut General Statute §16a-35k .

Given that Interstate meets reliability needs, has economic and environmental benefits, and improves system integration both within Connecticut and the region as a whole, the Council will approve the Connecticut portion of Interstate generally over the route proposed, with details as specified in subsequent portions of this Opinion.

III. Selected Route

The Council will order Interstate be constructed as proposed along the existing CL&P ROW using an overhead line configuration.

The base-design configuration for most of Interstate is new steel or wood-pole laminated H-frame structures with conductors overhead in a horizontal line configuration. Each structure would be typically 85 feet in height. The Interstate route was divided into 12 different line segments with an additional five subsections labeled "focus areas" (A-E).

The proposed 345-kV transmission lines would be installed adjacent to the existing 345-kV line from Card Street Substation to Lake Road Switching Station, then would follow another existing 345-kV line from Lake Road Switching Station to Killingly Substation. From Killingly Substation to the Connecticut/Rhode Island border, the proposed transmission line would follow a third existing 345-kV line. Additionally, the existing ROW contains the existing 69-kV lines between Card Street Substation and Babcock Junction in Coventry and with an existing 115-kV line between Day Street Junction and Killingly Substation.

The Council will require the construction of a single taller steel monopole structure on Highland Ridge Golf Range property in Mansfield, currently owned by Richard Cheney. This would allow the golf range greater use of its property while still supporting the proposed transmission line, and would not increase project cost.

The Council will order CL&P to submit a Development and Management (D&M) Plan for the Connecticut portion of Interstate prior to commencement of construction and that provides details regarding the construction of the project, including transmission structure locations, clearing and access roads.

While the Council recognizes that electric distribution line siting is not under its jurisdiction, the Council urges CL&P to place electric distribution lines underground at areas where the proposed transmission line would cross. Undergrounding short sections of electric distribution lines would reduce visual impact associated with the crossing at a similar cost.

Substations

Three substations in Connecticut would be modified as part of Interstate. Card Street Substation would be modified by reconfiguring equipment and installation of new equipment to accommodate a new 345-kV transmission line terminal position. CL&P proposes the installation of new equipment to connect Lake Road Generating Station to Interstate. Killingly Substation would be modified to include two new 345-kV transmission line terminal structures

The Council finds that the proposed additions to each of the three substations, which are entirely within the fenced area, would be similar in height and appearance to the equipment already existing on the property, and would have only very limited environmental effect.

Mansfield Hollow Configuration

The proposed transmission line would be aligned along the existing ROW across two segments of federally-owned property in the Mansfield Hollow portion of Mansfield and Chaplin. This includes 0.9 miles through Mansfield Hollow State Park in Mansfield (Segment 1) and 0.5 miles across Mansfield Hollow Wildlife Management Area (WMA) in Chaplin (Segment 2). These properties are owned by the United States Army Corps of Engineers (USACE) and managed by the Connecticut Department of Energy and Environmental Protection (DEEP).

The existing ROW through this federal property is 150 feet wide, which is inadequate for the installation of the proposed transmission line. CL&P is currently negotiating with USACE for expansion of its existing easement and offered USACE three options.

a. The "no ROW expansion" option would be used if the USACE does not grant a conveyance for additional easement rights. This option would include the installation of the existing and proposed transmission lines using vertical conductor configurations and taller monopole structures. The cost is $28.5 million.

b. The "Minimal ROW expansion" option limits the expansion of the additional easement to approximately 4.8 acres by using taller monopole structures to support the proposed transmission line within both Segment 1 and Segment 2. This option would require a 25-foot easement width expansion in Segment 1 and a 35-foot easement width expansion in Segment 2. The cost is $14.3 million.

c. The "11-acre Expansion" option would expand the easement by 55 feet (approximately 5.8 acres) in Segment 1 and 85 feet (approximately 5.2 acres) in Segment 2. In this case, CL&P would construct the new transmission line on structures that generally match the existing structures. The cost is $13.0 million.

The cost and environmental impact (including visual effect) of each of these options varies. For example, while the 11-acre expansion option would result in slightly more ROW clearing than the Minimal ROW expansion, it would also be less expensive and have less visual impact due to the use of matching structures. It would also have some environmental benefits by changing a small amount of mature forest to a scrub-shrub environment, which would benefit wildlife, including birds.

Without deference to Connecticut ratepayers, USACE indicated a preference for the 4.8-acre Minimal ROW expansion option. However, there is currently no official decision of USACE. Therefore, the Council will order that the 345-kV route be approved through the federally-owned property but that the final configuration of the structures and lines is determined in the D&M Plan phase of the docket.

Hawthorne Lane Alternative Option

The Hawthorne Lane cul-de-sac in Mansfield crosses a 0.4-mile section of the ROW between structures 9078 and 9081 of the 330 Line. In 2008, the property owners on Hawthorne Lane in Mansfield initiated negotiations with CL&P to shift a section of the existing ROW to the south and construct existing and proposed lines in a vertical configuration, thereby moving the existing and proposed transmission lines farther from most of the homes in this development, preserving an existing tree screen between the homes and the transmission lines, and eliminating an angle in the existing ROW. The Hawthorne Lane Alternative would require new easements from each landowner to CL&P without purchase and the release of a conservation easement from the Town of Mansfield. The conductors would span the Hawthorne Lane roadway, and a forested wetland system that contains three vernal pools.

The approximately $1.8 million incremental cost of the Hawthorne Lane Alternative would include outages of the existing line and erection and use of temporary structures. Due to the existing line layout, the alternative could be accomplished with minor additional steps during the construction process, rather than a complex process with extended line outages.

At the close of the proceeding record, the Hawthorne Lane property owners were unable to obtain the necessary mortgage subordination commitments to enable the ROW shift to be made. The property owner's attorney reported to CL&P that application packages requesting the outstanding mortgage subordinations had been submitted, and were pending.

The Council finds that the Hawthorne Lane Alternative is a well thought out plan with minimal adverse impact. The Council will leave the final decision on this portion of Interstate to the D&M Plan.

IV. System Alternatives

The route chosen by the Council has emerged from a series of alternative solutions explored and rejected for NEEWS during earlier phases of ISO-NE and utility planning studies, as well as a progressively detailed set of options investigated by CL&P for the Connecticut portions of NEEWS. At various points along the way, not only transmission system alternatives have been considered, but also non-transmission alternatives, or NTAs. For Interstate, the NTA of No Action was eliminated first, on account of pressing problems with reliability in Rhode Island. A CL&P consultant, ICF International, Inc. (ICF) modeled various other NTAs that might plausibly be available within southern New England during the planning period of 5 to 10 years. The scenarios included generation only, demand resources only, and a combination of generation and demand-side resources. Power-flow simulations were used to determine whether a given NTA would match the proposed Interstate's performance in eliminating thermal violations. ICF's final report concluded that none of the NTA scenarios performed as well as Interstate. The Council thus finds that NTAs are not an adequate solution for meeting the regional reliability need, and agrees with CL&P's decision to pursue further only transmission alternatives.

The need for Interstate discussed earlier in this Opinion establishes certain key facilities that any alternative route through Connecticut must connect, namely, the Card Street Substation, Lake Road Switching Station, and National Grid facilities at the Rhode Island border. CL&P eliminated certain all-new alternatives in this area of northeastern Connecticut, such as transmission lines running all overhead or all underground on new ROWs. The linear railroad, pipeline, and highway corridors that might hypothetically allow such use are not evident in this area. Besides, these corridors are typically are too narrow to be developed for transmission lines. Such problems could possibly be surmounted by buying raw land, but, given that existing transmission-line ROWs are available, the Council sees no justification for the expense or environmental impact of developing raw land for all-new alternatives, and concurs with CL&P's decision to exclude them.

After taking first and second cuts at a route by carving off the NTAs and the all-new transmission alternatives, CL&P presented its base design route to the Council. This included one large-scale alternative, the Combination Alternative, which would go underground along a combination of highway and transmission-line ROWs, with a short portion of overhead; or a variation of that alternative called the Route 44 Underground Variation. Further included were about ten other variations designed to solve certain potential or actual constraints and design problems for short segments of the route. The Council evaluated the large-scale Combination Alternative, its variation, and all the other variations in order to determine the final route.

The Council began by categorizing the alternate and variations in terms of whether they were designed to go overhead or underground. Overhead lines and structures generally do less environmental damage than cables underground. Cables, being "invisible" to the public, appear to pose no environmental issues at all, an appearance that is misleading. Overhead systems leave relatively small footprints overall, can span environmentally sensitive areas, call for less clear-cutting, decrease the need for access roads, involve lower line-losses and fewer other inherent electrical problems. Cables can only be developed on a continuous corridor with an access road along its full length; they cannot easily accommodate significant grade changes in terrain; they demand numerous splice vaults that are bulkier than the cable ducts, as well as transition stations at either end where the cables connect to the overhead system; and cables' operating characteristics are considerably more complicated than those for overhead lines. These drawbacks for underground systems, and other problems, have costs. While estimates do differ, typical costs per mile for underground systems are at least five times the costs per mile for overhead. In this regard, the Council noted, based on past experience with ISO-NE cost allocations rules and procedures, that 100% of the incremental cost for underground systems would likely be charged to Connecticut ratepayers.

Taking into account these significant environmental and economic costs, the Council decided against any undergrounding. The decision eliminated the Combination Alternative; its variation, called the "Route 44 Variation"; the Mansfield Underground Variation; the Mount Hope Underground Variation; the Brooklyn Underground Variation; and the Willimantic South Underground Variation.

The Combination Alternative was designed to avoid the route across Mansfield Hollow Lake, Mansfield Hollow State Park and WMA, and decrease the length of Interstate compared to an all under-highway installation. It is a whole-route alternative, going mostly underground along a combination of highway ROWs (36 miles) and transmission-line ROWs (two miles). A final mile would extend overhead between a new transition station to be built in Thompson and the Connecticut/Rhode Island border. Land for the necessary transition facilities could be found on available CL&P property and at Card Street Substation and Lake Road Switching Station; however, the fence lines at those substations would have to be expanded, involving adverse environmental impacts. In addition, CL&P's easements in Putnam and Thompson do not include underground line rights: the Council understands those would have to be negotiated, increasing costs. Finally, the two-mile area where the Combination Alternative route would run along the transmission-line ROWs is environmentally highly sensitive.

The Route 44 Variation was designed to replace the overhead end of the Combination Alternative with an underground piece in order to accommodate the possibility that the Rhode Island portion of Interstate would be built underground. It would eliminate the overhead line in Thompson and the need for a transition station there. However, this variation would not generally relieve the adverse environmental effects of the Combination Alternative, of which it is only a small part; nor would the variation make any difference in the cost. Either the Combination Alternative or the Route 44 Variation would cost $1.1 billion, against the $193 million estimated cost of Interstate as proposed. The high cost alone was prohibitive, in the Council's view, but the adverse environmental impacts were also major drawbacks.

The Mansfield Underground Variation would have extended underground 0.7 miles along CL&P's transmission ROW. The variation would have resulted in environmental impacts and would have cost approximately $53.5 million more than the overhead transmission line that would be replaced. Due to environmental and economic effects of this variation, the Council did not approve this variation.

The Mount Hope Underground Variation would have extended underground 1.1 miles along CL&P's transmission ROW. The underground cables would have impacted several wetlands that would be spanned by the overhead lines, which would avoid impact. This variation would have cost $59.6 million more than the overhead configuration. Due to environmental and economic effects of this variation, the Council did not approve this variation.

A 0.3-mile extension of the Mount Hope Underground Variation was proposed by the Party Civie. This variation would have cost more than the Mount Hope Underground Variation and increased the adverse environmental effects. Since the environmental and economic effects of this modified variation are even greater than the original variation that was already rejected by the Council, the Council did not approve this variation.

The Brooklyn Underground Variation would have extended 1.4 miles along the proposed overhead transmission route. This variation would cross three perennial streams, and several wetland areas including two vernal pools and an amphibian breeding habitat area. The variation would cost approximately $73.8 million more than the overhead line configuration it would replace. On account of the adverse environmental effects of this variation, as well as the costs, the Council did not approve this variation.

The Willimantic South Underground Variation would have consisted of 10.7 miles underground cables mostly beneath or along roadways. The variation would cross several wetlands and watercourses (including seven vernal pools and one amphibian breeding habitat). The variation would have cost $266.1 million more than H-frame structures and a vertical line configuration on the federal property in the Mansfield Hollow area. On account of the adverse environmental effects of this variation, as well as the costs, the Council did not approve this variation.

The cost associated with installation of any underground alternative would impose an unreasonable economic burden on Connecticut ratepayers. In addition, none of the underground variations would result in a significant overall reduction of Electric and Magnetic Fields.

Once the Council ruled out undergrounding, the alternatives remaining for consideration were the Brooklyn and Willimantic South overhead variations, the three Mansfield Hollow Configurations, and the Hawthorne Lane alternative. The Council selected the Hawthorne Lane alternative provisionally and left the Mansfield Hollow Configurations to be decided later: all of these are discussed in the section of the Opinion that presents the final route.

As to the Brooklyn Overhead Variation, it was designed for a new "greenfield" corridor that would have extended 3.3 miles through forested land, lawn areas associated with residences, and agricultural fields. It also would have disturbed 4.4 acres of wetlands. On account of the environmental effects associated with greenfield development and its high cost, the Council did not approve this variation.

As to the Willimantic South Overhead Variation, it would have involved an 8.6-mile new corridor and a short length of 15-foot ROW expansion in width, both designs requiring easements from private landowners. It would have crossed 15 watercourses and 22 wetlands, two Connecticut State Parks, and property owned by the Fin, Fur and Feather Club, Inc. Its cost would have been approximately $9-$10 million more than the Mansfield Hollow configuration it would have replaced. On account of the adverse environmental effects of this variation, as well as the costs, the Council did not approve this variation.

Having carefully reviewed this wide range of alternatives and variations, the Council determined that the overhead facility as proposed is the most cost-effective and appropriate, in terms of both its capital and life-cycle costs, is consistent with the purposes of the Public Utilities Environmental Standards Act (PUESA), and is consistent with the regulations and standards adopted pursuant to Connecticut General Statutes § 16-50t.

V. Environment

The northeast corner of Connecticut is mainly rural in character, with scattered, small neighborhoods, agricultural fields, woods, and abundant water resources, including associated wetlands. The existing overhead transmission lines have been a familiar part of this landscape for decades, and in several areas farmers are cultivating fields beneath them on the ROWs. The Council judges that the least environmental disturbance would come from developing Interstate generally alongside the existing lines, as proposed, instead of either diverging from the well-established route into new territory, or adding a new underground cable system—whether whole or in pieces—that would impact sensitive environmental resources the overhead facility currently spans. Nevertheless, the Council acknowledges that any new construction will have numerous temporary and some permanent environmental impacts, and will assure that these are minimized.

Terrain and Soils

The Council will require the inclusion of grading and filling details in the D&M Plan for Interstate, with the aim of restoring as many areas as possible to pre-construction conditions following the installation of transmission structures and lines.

The Council will order CL&P to address in its D&M Plan the protection of valuable agricultural soils, whether by consulting with landowners who actively farm the ROW, or, elsewhere along the ROW, by working with state or regional agencies to identify valuable soils and manage their disposition appropriately during construction.

Wetlands and Watercourses

The Interstate route and temporary and permanent access roads would cross several watercourses, which would require temporary and permanent culverts. The route would cross a portion of the Thompson Aquifer Protection Area. No new structures would be located within the Aquifer Protection Area, but three structures would be located adjacent to the eastern edge of the area. Many wetlands, including vernal pools and amphibian breeding habitat, are located along or adjacent to the Interstate route. A number of these resources could be either permanently impacted by the presence of the transmission facility or temporarily impacted by construction. CL&P has designed the transmission line to place new structures outside of wetlands where possible. However, 19 structures would be located in wetland areas, requiring permanent fill. Additionally, temporary or permanent access roads, crane pads and vegetative clearing may impact wetlands.

The Council will require that the D&M Plan for Interstate provide detailed plans showing all wetland impacts. On the basis of this detail, the Council may require further wetlands mitigation, which may include compensatory options, under the jurisdiction of DEEP.

The primary temporary impacts would be potential erosion and sedimentation into wetlands and watercourses during construction of transmission structures and access roads. Other temporary impacts include possible fuel spills into wetlands and watercourses from the operation of construction equipment, and possible adverse effects on wetlands and watercourses from temporary vegetative clearing related to construction. The Council will require that the D&M Plan include specific programs to minimize all such temporary impacts and to restore areas affected by such temporary impacts as much as possible to their pre-construction condition. Further with that aim, the Council will order that an environmental inspector be hired to monitor compliance with the D&M Plan during construction and to monitor restoration for a period afterward.

Vegetation

Transmission-line construction and maintenance requirements are established by international, federal, and regional power authorities so as to assure reliability. In general, such requirements dictate the removal of all tall-growing tree species from the ROW, while low-growing tree species and taller shrub species may remain in the areas outside of the conductor zones, which is the area directly below the lines to 15 feet from the most outward conductors.

On the existing ROW along the proposed route, CL&P currently manages the vegetation on an average of 150 feet of the typical 300-foot ROW in areas with one existing line, and more than 150 feet where the ROW is wider and supports more than one line. Interstate would require the vegetative management of an additional 70 to 90 feet of the ROW. The vegetation clearing would amount to approximately 218 acres of upland forest and 50 acres of forested wetlands to scrub/shrub lands. Following construction, invasive plant species in wetland areas would be monitored and controlled on a four-year cycle and invasive plant species in upland areas would be controlled during routine vegetation management (also on a four-year cycle).

The Council recognizes that the proposed project would have a long-term effect on vegetation and associated wildlife habitats, but considers these effects would be incremental and localized. Conversion of the land on the ROW to old field and shrubland habitat would benefit wildlife species that are currently declining in the state and region. Much of the old field and shrubland habitat is gone because former agricultural land is being developed or allowed to revert to woodland. The Council will order an Invasive Species Control Plan for the project, developed in consultation with the USACE, DEEP and other agencies. This plan shall identify measures for controlling invasive plants listed on the Connecticut Invasive Plant List – October 2011. Also, through conditions to be applied in the D&M Plan, the Council will encourage the continuance of vegetative maintenance practices, including those related to herbicide application and to invasive species that protect native plants and wildlife.

Wildlife

Construction of the proposed project may temporarily displace wildlife from the area due to disturbance from vegetation clearing and the operation of construction equipment. For instance, vegetation clearing and management will affect bird species. The nesting season for a majority of birds extends from May 1st through July 31st: construction during this period could potentially result in the loss of a breeding season for birds with established nests within the proposed work area.

DEEP recommended field surveys to identify the presence or absence of state-listed bird, butterfly, and moth species. CL&P performed field the recommended field surveys in 2008. Species discovered during the surveys as well as previously identified species in the area result in 29 state-listed endangered, threatened or special concern species within the vicinity of Interstate, including five butterfly species, 12 moth species, seven bird species, one turtle species, two snake species, one aquatic snail and one aquatic dragonfly.

Mitigation to minimize impact to Lepidoptera involves maintaining its habitat. Lepidoptera host plant communities were found along the ROW. CL&P would install exclusion fencing to protect plant communities. If exclusion fencing is not feasible, mitigation would include avoiding permanent impact to important vegetative areas to the extent practicable; limiting construction to existing dirt access roads; creating a Vegetation Management Plan to reduce potential colonization by invasive species and promote the growth of native host plant species; and performing additional rare species surveys along certain areas of the ROWs.

The wood turtle is a state-listed species identified as potentially occurring near the proposed route. The Council will order that CL&P comply with DEEP recommendations, to the extent feasible, for wood turtles, including: minimizing the removal of low-growth vegetation in areas adjacent to rivers/streams documented to support wood turtles; using erosion and sedimentation controls to minimize the deposition of sediment into wetland areas and to preclude wood turtles from accessing active construction areas; and ensuring construction contractors are able to identify wood turtles and know proper handling and care procedures if one is encountered. Also, a DEEP-approved turtle monitor would be present during construction in wood turtle habitats. If found, wood turtles would be removed from the active area and placed in the direction they were moving.

The eastern hognose snake and eastern ribbon snake are state-listed species identified as potentially occurring near portions of the proposed route. Both snake species are typically dormant from November 1 through April 1. The Council will order that CL&P comply with DEEP recommendations, to the extent feasible, for the eastern hognose snake and eastern ribbon snake, including: training construction contractors to identify the snakes properly handle and care for the snakes if encountered; and maintaining the presence of a DEEP-approved snake monitor during construction. Any snakes that are encountered would be removed from the active workspace.

An aquatic snail and the moustached clubtail dragonfly, also aquatic, were identified as potentially occurring near the proposed route. For the aquatic snail, negative effects would be minimized by maintaining as much vegetation as possible along the ROWs in riparian zones and installing the appropriate erosion and sedimentation controls. For the moustached clubtail dragonfly, mitigation may include avoiding or minimizing construction within the species' habitat, maintaining vegetation as feasible within riparian zones, and use of soil erosion and sedimentation controls.

Noise and Air Quality

Operation of the Interstate lines will not be a significant source of audible noise. Any noise from heavy machinery during construction of Interstate would be short-term. The Council will condition the D&M Plan, however, to schedule construction periods during reasonable day-time hours.

Operation of the transmission lines would not impact air quality. Air quality effects from constructing Interstate would be temporary. The Council will condition the D&M Plan so that such effects would be mitigated by properly maintaining vehicles and equipment to limit emissions, watering access roads to suppress fugitive dust, and using crushed stone aprons at access road entrances from public roads to minimize tracking of soil onto pavement.

Visibility on Reserved/Protected Land, Recreational Property

Clearing previously unmaintained portions of the ROW and adding a new line of H-frame structures for Interstate would have some visual impact for people who live in the vicinity of the route or travel along affected roads. However, visual impacts along the most of the route would be minimized by making the new structures match the existing ones as closely as possible in placement and in structure type.

There are a number of trails, open space and scenic vistas in the area surrounding the CL&P ROW associated with the Interstate route including, but not limited to Airline State Park Trail, Hop River State Park Trail, Nipmuck Trail, trails associated with Mansfield Hollow State Park and WMA, Joshua's Tract Conservation and Historic Trust, Inc. property, and Quaddick State Park. Since the proposed transmission lines would be installed adjacent to existing transmission lines, the Council considers that views of the proposed lines will not be significantly different from existing views.

Historic and Cultural Resources

The proposed route would not be adjacent to any resources listed on or eligible for the National Register of Historic Places (NRHP) or the State Register of Historic Places (SRHP).

Five known Native American archaeological sites are within one mile of the proposed route. One site, located in Pomfret, was determined as not eligible for the NRHP. The remaining four archaeological sites are in Mansfield and each have insufficient reported data to make a determination of eligibility for the NRHP. There are 21 significant above-ground historic architectural resources within approximately 0.25 miles of the proposed route, some of which are within historic districts. Given the distance of all these archaeological sites from the proposed route the Council expects that the project will have no adverse impact on them.

The proposed project is not expected to have an adverse visual impact on the 21 historic architectural resources near the project routes.

The Council notes that CL&P would conduct additional archaeological reconnaissance investigations during the project planning stage and coordinate with the Connecticut SHPO, Native American tribes, the USACE and the Quinebaug-Shetucket Rivers Valley National Heritage Corridor, Inc.

Substations/Switching Station

Since the proposed modifications to the substations do not go outside the existing fence lines, the Council expects no adverse environmental impacts.

Three wetlands exist on the Card Street Substation property, 100 feet outside the existing fence line; however, effects to those wetlands would be minimized by the installation of erosion and sedimentation controls.

Two state-listed moth species were known to occur near Lake Road Switching Station; however, at a distance that prevents any adverse impacts.

Killingly Substation is located in an area that may contain state-listed invertebrate species of moths and butterflies, and CL&P consultants observed these species during field surveys of the ROWs; however, the substation itself would not be suitable habitat for these species. Killingly Substation is also in the vicinity of the Tracy Road Trail, which is a one-mile paved walking/biking trail; however, intervening vegetation and topography screen the substation from the trail.

Considering that no new substations are being constructed and that construction activities at all the substations will go on inside the fence line, the Council judges that the substations will have minimal environmental effect.

VI. Electric and Magnetic Fields

The Council's *"Electric and Magnetic Field Best Management Practices for the Construction of Electric Transmission Lines in Connecticut"* (EMF BMPs) were revised in December 2007 to address concerns regarding potential health risks from exposure to EMF from transmission lines. The Council's EMF BMPs support the use of effective no-cost and low-cost technologies and management techniques to reduce magnetic fields (MF) exposure to the public while allowing for the development of electric transmission line projects.

International health and safety agencies, including the World Health Organization (WHO), the International Agency for Research on Cancer (IARC), and the International Commission on Non-Ionizing Radiation Protection (ICNIRP), have studied the scientific evidence regarding possible health effects from MF produced by non-ionizing, low-frequency (60-Hertz (Hz)) alternating currents in transmission lines. Two of these agencies have attempted to advise on quantitative guidelines for mG limits protective of health, but have been able to do so only by extrapolation from research not directly related to health: by this method, the maximum exposure advised by the International Committee on Electromagnetic Safety (part of IARC) is 9,040 mG, and the maximum exposure advised by the ICNIRP is 2,000 mG. Otherwise, no quantitative exposure standards based on demonstrated health effects have been set world-wide for 60-Hz MF, nor are there any such state or federal standards in the U.S.

Consistent with the Council's EMF BMPs, CL&P began with a "base" design of the proposed project that includes "no-cost" magnetic field management features. CL&P then added in potential designs that are "low-cost" magnetic field management features at five locations along the project route. The five locations with potential low-cost magnetic field management designs are sections of the route that are near public or private schools, licensed child day care facilities, licensed youth camps, public playgrounds or near statutory facilities or near an area that the Council may determine to be a residential area.

Locating a new transmission line on an existing ROW, adjacent to an existing transmission line, allows for phasing the conductors of the new line resulting in partial cancellation of magnetic fields from each of the two lines. CL&P designed the proposed project for best phasing of line currents in the same direction to reduce magnetic fields at no cost. For the section of the line between Card Street Substation and Lake Road Switching Station the proposed lines are very similar to the existing lines, which allows for the best reduction in MF. There are several sections of Interstate where the base design H-frame line configuration would result in lower MF levels at one or both ROW edges than the existing pre-Interstate lines.

CL&P modeled the proposed transmission line using an H-frame base design configuration, except along four segments of the route. The four segments include one segment within Mansfield Hollow, where the existing transmission line consists of a delta configuration and the proposed configuration is vertical; and three of the five focus areas (Focus Areas A, D and E) where CL&P proposes other 345-kV line configuration to comply with the Council's EMF BMPs. In two of the identified focus areas (Focus Areas B and C) CL&P proposes the base design H-frame configuration of the proposed conductors.

Focus Area A

Focus Area A is a 2.3 mile section of the ROW in Coventry and Mansfield where there are homes near each side of the ROW. There are three homes immediately adjacent to the north ROW edge and three homes immediately adjacent to the south ROW edge. In this Focus Area, CL&P identified a delta line configuration as an EMF BMP alternative.

While a delta configuration of the proposed lines would reduce MF levels on the northern ROW edge when compared to the H-frame base design, the cost is also approximately $3 million greater. Additionally, the construction of the proposed lines in the base design horizontal configuration would result in MF levels that are lower along the southern ROW edge when compared with the delta configuration or the pre-Interstate levels.

Therefore, the Council finds that the delta line configuration in Focus Area A would add cost to the project and particularly to Connecticut ratepayers without a significant reduction in MF. The Council will order the transmission lines to be constructed on H-frame structures in Focus Area A.

Focus Area B

Focus Area B is a 0.9 mile section of the ROW in Mansfield between structures 9070 and 9078 of the existing 330 Line. In this section, the ROW is near the Green Dragon Day Care and the Mount Hope Montessori School--both statutory facilities. In Focus Area B, CL&P recommended the horizontal line configuration on H-frame structures.

While other line configurations would reduce MF levels compared to the H-frame configuration, each option would increase the project cost. Additionally, the MF levels associated with the transmission lines decreases rapidly with distance from the ROW edge. At the nearest corners of Mount Hope Montessori School and Green Dragon Day Care, the H-frame line would actually yield a lower MF than the existing pre-Interstate transmission lines on the ROW or the Interstate lines in a delta configuration. The Council will order the base design H-frame line configuration in Focus Area B.

Discussion during the proceedings for this docket brought up an option of CL&P providing vegetative screening on the Mount Hope Montessori School property. The Council encourages planting of this screening and will order that vegetative screening at the school be discussed in the D&M Plan for this docket.

Focus Area C

Focus Area C is the Hawthorne Lane Alternative, as described above.

Focus Area D

Focus Area D is a one-mile section of the ROW in Brooklyn between structures 9210 and 9219 of the existing 330 Line. In this focus area, there is one home-based child day care facility and a number of homes along Darby Road and Meadowbrook Drive. In this focus area, CL&P has recommended an EMF BMP delta line configuration that would reduce MF levels on the northern ROW edge (where more homes are located) by more than 15 percent compared to the base design H-frame line configuration and cost less than the vertical or split-phase configurations.

The Council finds that while the delta line configuration would reduce MF levels compared to a horizontal configuration along the northern ROW edge, it is a small reduction that decreases with distance from the ROW edge. Also, the MF levels at the nearby home day care facility property would be lower if the lines were configured on H-frame structures rather than delta structures. Therefore, the Council finds that spending an additional $1.4 million on a delta line configuration would be unjustified and orders the line be constructed on H-frame structures in Focus Area D.

Focus Area E

Focus Area E is a 0.6 mile section of the ROW in Putnam between structures 9305 and 9310 of the existing 347 Line. This section of the ROW crosses the rear portion of residential properties on Elvira Heights. There are 15 homes within 400 feet of the ROW, the nearest of which is about 115 feet from the southeast ROW edge. In this line section CL&P brought forward an EMF BMP configuration constructing the existing and proposed lines on delta structures.

CL&P brought forward this configuration option to comply with the Council's EMF BMP Guidelines in an area with nearby homes; however CL&P does not recommend this option. In analyzing configuration options for MF level reduction along the ROW edges compared to the base design configuration, the only options that resulted in this reduction required changing the existing structures as well as the proposed structures. However, MF level reduction at the ROW edges for the two delta line configuration compared to the base design configuration is minimal. The base-design would yield MF levels of 20.4 mG at the southern ROW edge (where homes are located) compared to 13.3 mG if the existing and proposed lines were installed in a delta line configuration.

Constructing both the existing and proposed lines on delta structures would have increased environmental effects, including an increase in vegetation disturbance and an increase in temporary and permanent effects to wetlands and watercourses. Also, the Focus Area E option would cost approximately $4.3 million, which would be expected to be charged 100 percent to Connecticut ratepayers. Therefore, the Council will order construction of the base design construction of the proposed line on H-frame structures in Focus Area E, with no change to existing structures.

VII. Conclusions

The facility approved by this Council in the Opinion, Decision and Order is necessary for the reliability of the electric power supply of the state and therefore, a public need exists for this facility.

The Council's ultimate decision reflects the balance required by Connecticut law to protect the environment, protect the public health and safety of our citizens, and to secure Connecticut's energy future for generations to come.

The nature of the probable environmental impact alone and cumulatively with other existing facilities, including EMF of the facility, has been reviewed by this Council in approving this facility. The Council has examined the policies of the state concerning the natural environment, ecological balance, public health and safety, air and water purity, and fish, aquaculture and wildlife, together with all other environmental concerns, and balanced the interests in accordance with Conn. Gen. Stat. § 16-50p(a)(3)(B) and Conn. Gen. Stat. § 16-50p(a)(3)(C).

The environmental effects that are the subject of Conn. Gen. Stat. § 16-50p (a)(3)(B) can be sufficiently mitigated and do not overcome the public need for the facility approved by the Council in the Opinion, Decision and Order.

Conn. Gen. Stat. § 16-50p(a)(3)(D)(i) requires that the Council specify what part, if any, of the facility approved shall be located overhead. That is designated in this Opinion, Decision and Order.

The facility approved by this Council in the Opinion, Decision and Order conforms to a long-range plan for expansion of the electric power grid of the electric systems serving the State of Connecticut and interconnected utility systems and will serve the interests of electric system economy and reliability.

The overhead route of the facility approved by this Council in its Opinion, Decision and Order are cost effective and the most appropriate alternative based on a life-cycle cost analysis of the facility and underground alternatives to the facility and complies with the provisions of Conn. Gen. Stat. § 16-50p. The overhead route of the facility approved by this Council in its Opinion, Decision and Order, are consistent with the purposes of Chapter 277a of the General Statutes of Connecticut, and with Council regulations and standards adopted pursuant to Conn. Gen. Stat. § 16-50t, including the Council's best management practices for electric and magnetic fields for electric lines and with the Federal Energy Regulatory Commission's "Guidelines for the Protection of Natural Historic Scenic and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities" and other applicable federal guidelines.

The overhead route of the facility approved by this Council in its Opinion, Decision and Order are contained within a buffer zone, no less in area than the existing right-of-way that protects the public health and safety. In considering this buffer zone, the Council took into consideration, among other things, residential areas, private and public schools, licensed child daycare facilities, licensed youth camps and public playgrounds adjacent to the proposed overhead route of the overhead portions and the level of voltage of the overhead portions and any existing overhead transmission lines on the approved route. The location of the line will not pose an undue hazard to persons or property along the area traversed by the line.

In order to verify compliance with the Council's Decision and Order, the Council will require the Certificate Holder to hire an independent inspector(s), subject to Council approval, to document compliance with environmental requirements, prepare status reports, and act as a liaison between the Council, and the Certificate holder's environmental inspector and contractors. This independent inspector will provide bi-weekly progress reports in writing to the Council and to the chief elected official, or their representative, of each municipality traversed by the proposed project describing all significant construction activities and all associated environmental effects. This independent inspector shall have formal training and experience in civil and environmental engineering and have sufficient oversight and authority to stop construction practices that are inconsistent with the Council's Decision and Order; the approved D&M Plan; or that may cause significant damage or disruption to the environment.

To ensure that the proposed project is properly developed, the Council will require the Certificate Holder to submit a D&M Plan which will include, among others, detailed site plans identifying structure locations; an erosion and sediment control plan consistent with the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control; a Spill Prevention, Control, and Countermeasures Plan; provisions for revegetation and maintenance of the proposed ROW; provisions for inspection and monitoring of the proposed ROW; pre-construction and post-construction measurements of electric and magnetic fields.

There is a public need for the facility, which will be approved by this Council in the Opinion, Decision and Order.

With the conditions listed above, and having found a public need for the proposed facility, the Council will issue a Certificate of Environmental Compatibility and Public Need for the construction of an overhead 345-kV electric transmission line along the Interstate Route between CL&P's Card Street Substation in Lebanon, Lake Road Switching station in Killingly and the Connecticut/Rhode Island border with associated additions to CL&P's Card Street Substation, Lake Road Switching Station, and Killingly Substation.

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January 9, 2013

TO: Parties & Intervenors

FROM: Linda Roberts, Executive Director LRoberts

RE: **DOCKET NO. 424** - The Connecticut Light & Power Company application for a Certificate of Environmental Compatibility and Public Need for the Connecticut portion of the Interstate Reliability Project that traverses the municipalities of Lebanon, Columbia, Coventry, Mansfield, Chaplin, Hampton, Brooklyn, Pomfret, Killingly, Putnam, Thompson, and Windham, which consists of (a) new overhead 345-kV electric transmission lines and associated facilities extending between CL&P's Card Street Substation in the Town of Lebanon, Lake Road Switching Station in the Town of Killingly, and the Connecticut/Rhode Island border in the Town of Thompson; and (b) related additions at CL&P's existing Card Street Substation, Lake Road Switching Station, and Killingly Substation.

In accordance with Conn. Gen. Stat. § 4-181a (c), which provides that an agency "may, without further proceedings, modify a final decision to correct any clerical error…," the Connecticut Siting Council hereby corrects clerical errors in the final Interstate Reliability Project Findings of Fact #177 and page 12 of the Opinion. Please see the enclosed errata sheets in connection with the above-referenced proceeding.

Please remove the old pages and insert the corrected ones.

LR/CMW

This errata sheet corrects Finding of Fact #177 on Page 28. Page 28 previously read:

General Project Construction Activities

168. Construction of the proposed project would require temporary storage areas, staging areas, and crane pads. CL&P prefers to locate storage and staging areas in the vicinity of the ROW; however, they may not be immediately adjacent to ROWs. CL&P would attempt to locate storage and staging areas on CL&P-owned property where possible. If CL&P-property is not available or suitable for storage or staging areas, CL&P would investigate the use of areas that have been previously developed or vacant land. Staging and storage sites would be identified during the D&M Plan for the proposed project or CL&P would submit them separately to the Council for approval prior to use. (CL&P 1, Vol. 1, pp. 4-5 through 4-7)

169. Temporary storage areas require approximately two to five acres and are used to temporarily store construction materials, equipment, supplies, mobile construction offices, parking of personal vehicles of construction crew members, parking construction vehicles and equipment, and performing minor maintenance on construction equipment. (CL&P 1, Vol. 1, pp. 4-6, 4-7)

170. Storage areas are typically moved as construction progresses along the ROW. Following use as a storage area, the land would be restored to pre-construction conditions, pursuant to the use agreement with the property owner. (CL&P 1, Vol. 1, pp. 4-6, 4-8)

171. Staging areas typically require less than two acres and are used for temporarily stockpiling materials for transmission line construction, such as erosion and sedimentation control materials, and for temporarily stockpiling materials removed from the ROW during construction. Staging areas could be within or off the ROW. As construction progresses, staging areas would be relocated to be near construction work. (CL&P 1, Vol. 1, pp. 4-6, 4-7)

172. Crane pads are located at each transmission structure location and are the necessary work areas to stage structure components for final on-site assembly. The crane pad is typically a 100-foot by 100-foot area that provides a safe, level work base for the construction equipment used to erect the transmission structure. (CL&P 1, Vol. 1, p. 4-7)

173. The construction of a crane pad includes the removal of vegetation, grading to create a level area, removal of the topsoil and layering of a filter fabric and rock base. A roller is typically used to flatten and compact the pad. In wetland areas, removable timber mats may be used to allow water to flow beneath the pad. As an alternative to timber mats, a large rock base may be used to allow water flow with smaller rock layered on top and a layer of gravel intermixed with soil on top of that. (CL&P 1, Vol. 1, p. 4-8)

174. Crane pads are typically removed following construction and the area would be restored to pre-construction grade to the extent practical and consistent with CL&P's ROW maintenance program. (CL&P 1, Vol. 1, p. 4-8)

175. Construction field offices would be located in existing commercial facilities where feasible. If there is no commercial facility available, trailers, portable sanitary facilities and associated parking would be located, optimally on CL&P-owned property. Following construction, trailers and equipment would be removed and the area would be restored. (CL&P 1, Vol. 1, p. 4-9)

176. The average distance between 345-kV transmission line structures is approximately 575 feet; however, the distance may range from less than 200 feet to over 1,000 feet depending on the presence of geographic and environmental features. (CL&P 9, R. 20)

177. Where a 345-kV line must cross an existing distribution line, the 345-kV structures might have to be taller to maintain a 48-foot clearance between the lowest conductor and the distribution line. To avoid increasing the 345-kV structure height, the distribution line in conflict could be installed underground. This would allow the 345-kV structure height to be reduced by approximately 20 feet and save about the same cost per structure. (Tr. 4, pp. 45-51)

178. Wherever blasting is needed for construction, a certified blasting contractor would develop a controlled drilling and blasting plan in compliance with state and local regulations. (CL&P 1, Vol. 1, p. 4-21)

Page 28 of the Findings of Fact (with corrected language underlined):

General Project Construction Activities

168. Construction of the proposed project would require temporary storage areas, staging areas, and crane pads. CL&P prefers to locate storage and staging areas in the vicinity of the ROW; however, they may not be immediately adjacent to ROWs. CL&P would attempt to locate storage and staging areas on CL&P-owned property where possible. If CL&P-property is not available or suitable for storage or staging areas, CL&P would investigate the use of areas that have been previously developed or vacant land. Staging and storage sites would be identified during the D&M Plan for the proposed project or CL&P would submit them separately to the Council for approval prior to use. (CL&P 1, Vol. 1, pp. 4-5 through 4-7)

169. Temporary storage areas require approximately two to five acres and are used to temporarily store construction materials, equipment, supplies, mobile construction offices, parking of personal vehicles of construction crew members, parking construction vehicles and equipment, and performing minor maintenance on construction equipment. (CL&P 1, Vol. 1, pp. 4-6, 4-7)

170. Storage areas are typically moved as construction progresses along the ROW. Following use as a storage area, the land would be restored to pre-construction conditions, pursuant to the use agreement with the property owner. (CL&P 1, Vol. 1, pp. 4-6, 4-8)

171. Staging areas typically require less than two acres and are used for temporarily stockpiling materials for transmission line construction, such as erosion and sedimentation control materials, and for temporarily stockpiling materials removed from the ROW during construction. Staging areas could be within or off the ROW. As construction progresses, staging areas would be relocated to be near construction work. (CL&P 1, Vol. 1, pp. 4-6, 4-7)

172. Crane pads are located at each transmission structure location and are the necessary work areas to stage structure components for final on-site assembly. The crane pad is typically a 100-foot by 100-foot area that provides a safe, level work base for the construction equipment used to erect the transmission structure. (CL&P 1, Vol. 1, p. 4-7)

173. The construction of a crane pad includes the removal of vegetation, grading to create a level area, removal of the topsoil and layering of a filter fabric and rock base. A roller is typically used to flatten and compact the pad. In wetland areas, removable timber mats may be used to allow water to flow beneath the pad. As an alternative to timber mats, a large rock base may be used to allow water flow with smaller rock layered on top and a layer of gravel intermixed with soil on top of that. (CL&P 1, Vol. 1, p. 4-8)

174. Crane pads are typically removed following construction and the area would be restored to pre-construction grade to the extent practical and consistent with CL&P's ROW maintenance program. (CL&P 1, Vol. 1, p. 4-8)

175. Construction field offices would be located in existing commercial facilities where feasible. If there is no commercial facility available, trailers, portable sanitary facilities and associated parking would be located, optimally on CL&P-owned property. Following construction, trailers and equipment would be removed and the area would be restored. (CL&P 1, Vol. 1, p. 4-9)

176. The average distance between 345-kV transmission line structures is approximately 575 feet; however, the distance may range from less than 200 feet to over 1,000 feet depending on the presence of geographic and environmental features. (CL&P 9, R. 20)

177. Where a 345-kV line must cross an existing distribution line, the 345-kV structures might have to be taller to maintain a 48-foot clearance between the lowest conductor and the ground. To avoid increasing the 345-kV structure height, the distribution line in conflict could be installed underground. This would allow the 345-kV structure height to be reduced by approximately 20 feet and save about the same cost per structure. (Tr. 4, pp. 45-51)

178. Wherever blasting is needed for construction, a certified blasting contractor would develop a controlled drilling and blasting plan in compliance with state and local regulations. (CL&P 1, Vol. 1, p. 4-21)

This errata sheet corrects page 12 of the Opinion. Page 12 previously read:

Substations/Switching Station

Since the proposed modifications to the substations do not go outside the existing fence lines, the Council expects no adverse environmental impacts.

Three wetlands exist on the Card Street Substation property, 100 feet outside the existing fence line; however, effects to those wetlands would be minimized by the installation of erosion and sedimentation controls.

Two state-listed moth species were known to occur near Lake Road Switching Station; however, at a distance that prevents any adverse impacts.

Killingly Substation is located in an area that may contain state-listed invertebrate species of moths and butterflies, and CL&P consultants observed these species during field surveys of the ROWs; however, the substation itself would not be suitable habitat for these species. Killingly Substation is also in the vicinity of the Tracy Road Trail, which is a one-mile paved walking/biking trail; however, intervening vegetation and topography screen the substation from the trail.

Considering that no new substations are being constructed and that construction activities at all the substations will go on inside the fence line, the Council judges that the substations will have minimal environmental effect.

I. Electric and Magnetic Fields

The Council's *"Electric and Magnetic Field Best Management Practices for the Construction of Electric Transmission Lines in Connecticut"* (EMF BMPs) were revised in December 2007 to address concerns regarding potential health risks from exposure to EMF from transmission lines. The Council's EMF BMPs support the use of effective no-cost and low-cost technologies and management techniques to reduce magnetic fields (MF) exposure to the public while allowing for the development of electric transmission line projects.

International health and safety agencies, including the World Health Organization (WHO), the International Agency for Research on Cancer (IARC), and the International Commission on Non-Ionizing Radiation Protection (ICNIRP), have studied the scientific evidence regarding possible health effects from MF produced by non-ionizing, low-frequency (60-Hertz (Hz)) alternating currents in transmission lines. Two of these agencies have attempted to advise on quantitative guidelines for mG limits protective of health, but have been able to do so only by extrapolation from research not directly related to health: by this method, the maximum exposure advised by the International Committee on Electromagnetic Safety (part of IARC) is 9,040 mG, and the maximum exposure advised by the ICNIRP is 2,000 mG. Otherwise, no quantitative exposure standards based on demonstrated health effects have been set world-wide for 60-Hz MF, nor are there any such state or federal standards in the U.S.

Consistent with the Council's EMF BMPs, CL&P began with a "base" design of the proposed project that includes "no-cost" magnetic field management features. CL&P then added in potential designs that are "low-cost" magnetic field management features at five locations along the project route. The five locations with potential low-cost magnetic field management designs are sections of the route that are near public or private schools, licensed child day care facilities, licensed youth camps, public playgrounds or near statutory facilities or near an area that the Council may determine to be a residential area.

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ATTACHMENT B

PROJECT SPILL PREVENTION AND COUNTERMEASURES PLAN

INTERSTATE RELIABILITY PROJECT

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ATTACHMENTS

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1. INTRODUCTION

This Spill Prevention and Countermeasures Plan (SPCP or Plan) describes measures to minimize the potential for a spill of petroleum products or a hazardous or toxic substance and, in the event that a spill does occur, to contain and control the release to minimize the effects. The Connecticut Light and Power Company (CL&P) will require all construction contractors to adhere to the procedures presented in this Plan during the construction of the Interstate Reliability Project (Project). Accordingly, this Plan describes:

- The identification of petroleum products and materials classified as hazardous or toxic that are likely to be used during Project construction;
- Training, equipment inspection and maintenance, and other procedures designed to minimize the potential for a spill;
- The transport, storage, and disposal procedures for these substances; and
- The procedures to be followed in the event of a release of a petroleum or hazardous / toxic substance to the environment, including a spill reporting protocol. Attachment B.1 includes a copy of the Spill Report Form that construction contractors must complete.

This SPCP conforms to the requirements of the Project's regulatory approval from the Connecticut Siting Council (Council), as well as commitments made in Project permit applications to the U.S. Army Corps of Engineers (USACE) and the Connecticut Department of Energy and Environmental Protection (CT DEEP)[1]. The Plan applies to all elements of the construction of the Project, including not only Project sites (e.g., the transmission line rights-of-way [ROWs], off-site access roads and substations / switching stations), but also contractor yards and staging areas managed for Project support purposes.

Note: CL&P does not anticipate on-site bulk storage of petroleum or other regulated substances during Project construction. However, if a construction contractor elects to maintain large quantities of petroleum products at a Project staging area, then requirements in addition to this SPCP will apply. Specifically, pursuant to Title 40, Section 112 of the Code of Federal Regulations (CFR), a Spill Prevention, Control, and Countermeasure (SPCC) Plan must be prepared if the construction site will have 1,320 gallons of aggregate above-ground storage capacity or more in 55-gallon (or larger) containers, or 42,000 gallons in underground storage not regulated by underground storage tank (UST) rules. Any temporary tanks or fueling trucks parked on site and used to "store" petroleum are subject to the SPCC Plan requirements. If, at any time, a Project construction contractor's cumulative storage capacity exceeds 1,320 gallons on-site, the contractor must prepare a SPCC Plan, signed by a registered professional engineer, in accordance with 40 CFR 112. Copies of the SPCC Plan do not need to be filed with any regulatory agencies, but must be maintained at the contractor's Project office and also be provided to CL&P's Construction Manager, Burns and McDonnell (BMcD).

[1] Condition No. 3(c) of the Council's approval of the Project (Decision and Order, Docket No. 424) requires that a SPCP be prepared as part of the D & M Plan for the Project. In its applications to the USACE and CT DEEP, CL&P committed to conform to NU's 2011 *BMP Manual: Construction and Maintenance Environmental Requirements for Connecticut.*

2. IDENTIFICATION OF PETROLEUM PRODUCTS AND OTHER HAZARDOUS / TOXIC SUBSTANCES USED DURING CONSTRUCTION, AND DESIGNATION OF CLEANUP CONTRACTOR

2.1 Materials Subject to this SPCP

The principal materials used during Project construction that are addressed in this SPCP are petroleum products, such as fuels, lubricants, fluids, and related materials used for the operation of construction vehicles and equipment. Also included are other substances classified as hazardous or toxic that may be used during construction.

Prior to the start of construction, each construction contractor will provide to CL&P a list of the petroleum products and hazardous / toxic substances to be used in the performance of Project work, along with a Material Safety Data Sheet (MSDS) for each such material. The MSDSs will be kept on-site (e.g., at the construction contractors' offices in Project construction yards or staging areas) for the duration of construction. If, during the course of construction, a contractor proposes to use a substance not on the original list, the list must be modified and the appropriate MSDS provided to CL&P prior to the use of the material on the Project.

Due to the different types of petroleum products and other regulated materials typically used during construction, different handling and storage procedures may be required. CL&P will require its construction contractors to adhere to all directions and warnings for products used on the Project.

2.2 Designation of Connecticut-Licensed Spill Response and Cleanup Contractor

As required pursuant to CGS Section 22a-454, spill cleanup, contaminated material handling, and contaminated material transport must be performed by a licensed contractor. Accordingly, prior to the start of construction, each construction contractor must identify a licensed spill response contractor who will be on-call 24/7 during construction. Each construction contractor's designated spill response contractor will be subject to CL&P's review and approval.

3. TRAINING AND MANAGEMENT PRACTICES

Key measures to avoid spills during construction include proper training of construction personnel in spill prevention and control techniques, properly maintaining construction equipment, and proper management regarding the storage and use of petroleum and hazardous/toxic substances used during construction. In the event that a spill does occur, construction personnel will be trained in the techniques to promptly and properly contain, clean up, and report the spill.

3.1 Training

As part of the Project's environmental awareness training, all construction personnel, including contractors and CL&P field management and inspection staff, will be briefed on the requirements of this SPCP. They also will be made aware of sensitive resources along and in the vicinity of Project work sites (e.g., ROWs, off-ROW access roads and staging areas, substations, and switching stations), and will be informed of the pollution control laws, rules, and regulations applicable to their work.

CL&P will require all construction contractors to:

- Instruct their personnel regarding the routine inspection, operation, and maintenance of equipment as needed to minimize the potential for the accidental discharge or release of fuel, oil, or lubricants to the environment;
- Verify that all employees handling fuels and, as applicable, hazardous or toxic materials, are property trained;
- Implement refueling procedures to minimize the potential for a release to the environment;
- Maintain adequate supplies of standard equipment, materials, and supplies in accessible locations for cleanup of a release; and
- Adhere to all regulatory requirements and Project specifications regarding equipment operation, refueling, or the general use of petroleum products near water resources, including containment.
- Follow required reporting procedures in the event of a spill.

If deemed necessary during construction, CL&P may schedule and conduct supplemental spill prevention briefings with construction crews to re-emphasize the importance of spill prevention and to review the procedures to be followed in the event of a spill. These briefings may highlight topics such as:

- Importance of having adequate equipment, materials, and supplies available for response to and cleanup of a release;

- Typical sources of releases, such as equipment failure or malfunction;
- Precautionary measures to prevent releases; and
- Standard procedures to be followed if a release occurs.

The supplemental training will be documented by CL&P field management or inspection staff.

3.2 Equipment Inspection and Maintenance

To minimize the potential for a spill due to equipment failure, the construction contractors will be responsible for:

- Routinely inspecting and maintaining construction equipment, including hydraulic lines, valves, and other hoses;
- Promptly repairing any equipment leaks or faulty equipment components;
- Routinely inspecting and maintaining in good condition all containers, valves, pipes, hoses, and other components of storage areas for fuels and lubricants;
- Providing appropriately-sized and provisioned spill containment kits to construction crews and replenishing such supplies as needed; and
- Maintaining stockpiles of spill cleanup materials at easily accessible locations, including at substation and switching station sites and staging areas.

Construction contractors will inspect and maintain equipment that must be fueled and/or lubricated according to an established schedule.

In addition, the construction contractor will be responsible for providing portable toilets at construction sites. The construction contractor will be responsible for properly locating portable toilets in upland areas, away from any water resources, sensitive environmental resources, or other restricted areas, and for arranging for routine cleaning and maintenance of these facilities.

3.3 Fuel and Material Storage

CL&P will require its construction contractors to implement the following procedures when storing fuels and hazardous / toxic substances. These procedures are intended to limit the potential for spills and to minimize the impact of releases that may accidentally occur:

- No bulk quantities of hazardous substances, toxic materials, and petroleum products will be stored, unless approved by CL&P, within 25 feet of any waterbody, wetland, water supply well, spring, or other water resource. Such materials typically will be stored in upland areas;

- At Project staging and support sites, contractors will make efforts to store only enough products required to complete the job;

- Materials will be stored in a neat, orderly manner, in appropriate containers, and, if possible, under a roof or enclosure;

- Chemical and/or petroleum products will be kept in original containers with the original manufacturer's label. Fuels that need to be kept in portable containers will be stored in tightly sealed containers designed to hold such fuels and will be clearly labeled. Preferably, the containers will be stored in a covered truck or trailer that provides secondary containment for the products;

- Substances will not be mixed unless approved by the manufacturer;

- Whenever possible, all of a product will be used before disposing of the container,

- Manufacturer's recommendations for proper use and disposal of a product will be followed; and

- If surplus product must be disposed of, the manufacturer's or state-recommended methods for proper disposal will be followed.

Any containment area for the storage of petroleum products will have a minimum capacity of 110% (1.1 times) the combined maximum volume of all containers within the containment area. (The containment must have sufficient freeboard to accommodate the maximum precipitation from a 25-year 24-hour storm event.) Storage areas will not have drains unless such drains lead to a containment area or vessel of sufficient size to contain and recover a full release of all stored products. A berm, or other suitable containment device, will be installed around any storage shed housing materials that are potentially hazardous to the environment. Similarly, bulk storage tanks having a capacity of more than 55 gallons will be provided with secondary containment consisting of a temporary earthen berm or other means.

After each rainfall, the contractor will inspect all containment areas for excess water. If no sheen is visible, they can pump the collected water to the ground in a manner that does not cause scouring. If present, any sheen must be cleaned up prior to discharging the water. Otherwise, the contaminated water must be transported and disposed of off-site in accordance with local, state, and federal requirements.

3.4 Equipment Refueling and Parking

Contractors will implement the following measures when refueling equipment and when parking equipment on Project sites:

- Generally, fuel will be stored at contractor yards and construction equipment will typically be refueled there;

- Refueling equipment will be manned throughout the refueling operation. Bulk fuel or lubricating oil dispensers will be equipped with a dispensing nozzle that cannot be locked open to allow unattended use;

- Spill kits will be on hand during all refueling operations;

- Equipment refueling will not be performed within 25 feet of any waterbody or wetland, with the following potential exceptions, which will be reviewed by Project field compliance personnel on a case-by-case basis:

    - Areas with rugged terrain or steep slopes where movement of equipment outside of such 25-foot buffers would cause excessive disturbance to the work area;

    - Areas where removing equipment from a wetland or from near a wetland and/or watercourse for servicing or refueling would increase adverse impacts to the water resource;

    - Locations where the water body or wetland is located adjacent to a road crossing (from which the equipment can be fueled): and

    - Refueling of equipment that is not readily mobile or must remain on-site for prolonged periods to safely complete a construction task (e.g., drilling rigs, cranes for structure installation).

- During refueling, all necessary precautions will be taken to avoid or minimize the potential for an accidental spill. Appropriate spill kits / absorbent materials will be available at all refueling sites. If refueling must occur within a wetland or within 25 feet of a water resource, temporary containment will be provided as appropriate; and

- Except for equipment that cannot be practically moved (e.g., cranes, drill rigs), construction equipment and vehicles will not be serviced or parked overnight on access roads or work pads within wetlands.

Prior to the start of construction activities, construction contractors will designate locations at Project yards, staging areas, and other support sites where refueling will be performed, and for the parking of fuel trucks, mobile tanks, and lubricating vehicles. Such designated refueling and parking locations must be approved by CL&P or BMcD.

4. SPILL EQUIPMENT, RESPONSE, CONTROL, AND CLEANUP

4.1 Spill Containment and Cleanup Equipment

Prior to the start of construction, contractors will prepare, for approval by CL&P, a list of the type, quantity, and storage location of spill containment and cleanup equipment that will be available for use during construction. Table 4-1 provides a general list of the basic types of spill containment and cleanup materials to be kept on-hand during construction activities in uplands, near water resources, and at refueling and product storage sites. In response to a spill, the contractor will use equipment and control/cleanup measures appropriate to contain and clean up the spilled material, taking into consideration the environmental characteristics of the area affected by the release.

4.2 Spill Response and Control

If a spill occurs, containment and control of the release are the immediate priorities. CL&P's construction contractor(s) will take immediate action to minimize the impact of the spill (containment) and to implement appropriate cleanup action. Cleanup procedures will begin immediately after a release is contained. In the event of a spill, the contractor will typically take the following actions:

- The spill will be immediately stopped at the source;
- If the spill impacts a water resource, the spill will be contained through the use of appropriately deployed containment materials (e.g., sorbent booms, absorbent pads, constructing dikes) and then will be collected with sorbent materials, skimmed off water surfaces with booms, and/or the contaminated soil will be excavated;
- If the spill occurs in uplands, the contaminated soil will be excavated;
- The waste materials will be properly disposed at a CL&P-approved disposal site; and
- The affected areas will be restored as closely as possible to previous condition.

4.3 Spill Notifications

4.3.1 Notifications to Federal, State, and Local Agencies

In Connecticut, a spill, as defined in Connecticut General Statutes (CGS) Section 22a-450, means the discharge, spillage, uncontrolled loss, seepage, or filtrations of oil or petroleum or chemical liquids or solid, liquid or gaseous products or hazardous waste that poses a potential threat to human health or the environment. All such spills are reportable. CL&P requires that **ANY release of these materials, in any amount, must be reported to the CT DEEP.** Project construction contractor(s) are responsible for providing immediate notification of spills to the CT DEEP and other entities, as required.

Table 4-1

Typical Spill Containment and Cleanup Equipment and Supplies

For General Construction in Upland Areas (Overhead Transmission Line, Substations, Switching Station):

- Sorbents (e.g., pillows, socks, and wipe sheets) for containment and pick-up of spilled liquids;
- Pre-packaged, self-contained spill kits containing a variety of sorbents for small to large releases; (e.g. kits that can be stored on equipment with the capacity of absorbing up to 5 gallons);
- Structures such as gutters, culverts, and dikes for immediate spill containment;
- Shovels, backhoes, etc., for excavating contaminated materials;
- Sumps and collection system; and
- Drums, barrels, and temporary storage bags to clean up and transport contaminated materials.

For General Construction in or Near Water Resource Areas (Overhead Transmission Line):

- All of the above (for upland sites) and the following:
- Oil containment booms and the related equipment needed for rapid deployment; and
- Equipment to remove petroleum-based products from water.

(This equipment will be located near wetlands and water bodies to reduce response time in the event of a release.)

For Storage of Products and Equipment Refueling:

- Sorbent pads and/or mats, containment equipment, or equivalent protective measures (e.g., kiddie pools or basins to be placed on the ground beneath equipment before refueling or maintenance activities). (The quantity and capabilities of the mats will be sufficient to capture the largest foreseeable spill given workspace characteristics, crankcase size, and other fuel vessel capacities.)

- Dedicated sorbent / spill response kits or functional equivalent to be kept on major pieces of construction equipment (e.g., pumps, cranes, drill rigs, hydraulic lifts) that must be routinely refueled or maintained on Project sites (because movement of such equipment to designated refueling or maintenance yards is impractical or inefficient).

It is the Project construction contractors' responsibility to report spills of any amount to CT DEEP. Spills must be reported immediately (24/7) to:

CT DEEP Emergency Response and Spill Prevention Division
860-424-3338 or toll free at 866-337-7745 (866-DEPSPIL)

If the above numbers are unavailable for any reason, call 860-424-3333

In the event of any spill, the Project construction contractor shall immediately report the following facts to CT DEEP, pursuant to Section 22a-450[2]:

- Location of spill;
- Quantity and type of substance, material, or waste released;
- Date and cause of the incident;
- Name and address of the owner;
- Name and address of the person making the report, and their relationship to the owner.

In addition to the notification to CT DEEP, some spills may be reportable to the Federal government. An oil spill must be reported to the Federal government if the spill is to navigable waters or the adjoining shoreline; water quality standards could be violated; the spill causes a sheen or discoloration; or the spill causes a sludge or emulsion. Spills of hazardous chemicals must also be reported to the Federal government, depending on the quantity of the material spilled and if the release could threaten human health. The Federal reportable spill quantities for hazardous materials are listed in 40 CFR, Part 302.4 (refer to the table entitled "List of Hazardous Substances and Reportable Quantities")[3]. Incidents that are required to be reported under the Federal Emergency Planning and Community Right-to-Know Act or other prevailing/applicable Federal law are reportable to:

- The State Emergency Response Commission (CT DEEP at 860-424-3338);
- The National Response Center at 800-424-8802;
- The local community emergency coordinator.

A report by the Project construction contractor to the local fire department is also recommended (911 throughout Connecticut).

[2] Note: Unless specifically requested for a particular incident, CT DEEP does not require a written submission when reporting a spill.
[3] Available online at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title40-vol27/pdf/CFR-2010-title40-vol27-sec302-4.pdf

4.3.2 Notification and Reporting to CL&P

In addition to notifying the CT DEEP, the construction contractor or other Project personnel who first observes a spill will provide immediate verbal notification to the designated BMcD Project representative[4]. Within 24 hours of a spill, the construction contractor will prepare and submit to the designated BMcD representative a Spill Report Form (refer to Attachment 1). This form must include the following information regarding the spill, along with any relevant supporting information and representative photographs:

- Date, time, and location of the spill, including name and address of the owner of the property where the spill occurred;
- The quantity and type of the substance, material, or waste spilled;
- Circumstances that caused the spill;
- List of water resources affected or potentially affected by the release (if applicable);
- Statement verifying whether a sheen is present;
- Size of the affected area;
- Estimate of the depth that the material has reached in water or in soil;
- Determination of whether the release has or will migrate off Project work areas (e.g., CL&P property, ROWs, staging areas, off-ROW access roads);
- Determination of whether the release is under control;
- Status of the cleanup effort and a description of the methods used (or to be used) to clean up the release;
- Name(s), company affiliation(s), and address(es) of the personnel who identified the release;
- List of any soil and water samples taken;
- Names of contacts made to federal, state, and local agencies, as applicable, and time of report; and
- Name, address, and company affiliation of the person who completed the Spill Report Form.

The designated BMcD Project representative will verify that the construction contractor's Spill Report Form is complete and will submit it to CL&P.

[4] Contact information for the Project environmental compliance team personnel (CL&P and BMcD), including the designated BMcD representative, will be provided to all construction contractors as part of the required Project environmental training.

4.4 Spill Cleanup

CL&P's construction contractors will clean up all spills promptly using appropriate containment and cleanup measures. Spill containment equipment will not be used for storing wastes resulting from cleanup efforts or other contaminated material.

Small spills may be contained and cleaned up by Project construction crews using the on-site spill containment and cleanup materials. In such cases, all contaminated materials will be properly handled, contained, and transported in secure containment to a staging area for pick-up and ultimate disposal by the construction contractor's designated and pre-approved spill response firm**. In no case will spills or contaminated materials (including waste oils) be buried or otherwise disposed of on Project sites.**

If the Project construction contractor determines that a release cannot be adequately excavated and disposed of by its construction crews alone, the construction contractor will contact the designated spill response firm. Any cleanup must be performed by a licensed spill response contractor, as required by CGS Section 22a-454. The Project construction contractor will work with the spill response contractor(s) and will verify that all excavated wastes are transported to a licensed disposal facility approved by CL&P.

4.5 Penalties for Non-Reporting

Any person who fails to report incidents as required by Section 22a-450 may be fined by CT DEEP not more than $5,000 and the employer of such person not more than $10,000.

Failure to report incidents, as required by the Project, can result in removal from the Project or termination.

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ATTACHMENT B.1

SPILL REPORT FORM

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SPILL REPORT FORM

Date: _____ **Time of Spill Occurrence: _____**
Name/Title of the first observer: _____

Regulatory Agencies Notified / Time & Date of Notification (use reverse side if needed): _____
_____

Location of Spill: **Parcel No. _____** **Town _____** **County _____**
Nearest Public Road: _____ Nearest Structure No. (if on-ROW): _____

Nearest Street Address or landmark (if off-ROW): _____

Attachments (circle all that apply): map photographs other_____

Type of material spilled: _____

Quantity spilled (circle one): 10 gals. or less 10 - 1,000 gals. Over 1,000 gals.

Specify approximate amount spilled: _____

Circumstances causing spill: _____
_____
Size of area affected by spill: _____ Estimate depth of spilled material on water or soil: _____

If spill is into water, is a sheen present? (circle one): YES NO

Has spill left Company property or ROW? (circle one): YES NO

Is spill under control? (circle one): YES NO*

*If not, is there a potential for the spill to leave the

ROW or staging area? (circle one): YES NO

Has spill cleanup begun? (circle one): YES** NO

**If so, what methods are being or will be used?: _____

Have soil and/or water samples been taken? (circle one) YES*** NO

***If yes, list sample types: _____

Signature of Contractor Representative/Date:
_____

Print Name/Title: _____

Signature of Designated Project Representative/Date:
_____

Print Name/Title: _____

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ATTACHMENT C

GUIDANCE FOR SOILS AND GROUNDWATER MANAGEMENT

INTERSTATE RELIABILITY PROJECT

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1. INTRODUCTION

During the construction of the Interstate Reliability Project (Project), the effective management of soils and groundwater is a key consideration. As part of Project design, The Connecticut Light and Power Company (CL&P):

Conducted due diligence environmental screening of the Project area (including the Project transmission line rights-of-way [ROWs] and the Card Street Substation, Lake Road Switching Station, and Killingly Substation [collectively, "the stations"]) to identify locations of soil and groundwater potentially contaminated by historical land uses or other activities;

Performed focused field studies to characterize soils and groundwater (for the presence/absence of contaminants) along portions of the Project transmission line ROWs, as deemed appropriate based on the results of the environmental screening; and

Developed a plan for handling and managing excavated soil and groundwater during construction.

This document summarizes the analyses that CL&P conducted to assess soil and groundwater conditions in Project areas (i.e., along the Project transmission line ROWs and at the stations) and reviews the procedures that Project construction contractors will be required to follow when excavating, storing, handling, and transporting soils, and for handling groundwater if it is encountered in excavations.[1]

In addition to this guidance protocol, CL&P will prepare a comprehensive *Material Handling Guide* (MHG) for Project construction contractors. The MHG will include detailed specifications for the management not only of soil and groundwater, but also of other materials generated during the construction of the Project, such as metals, concrete, etc. The MHG will be part of the contractual specifications for the Project.

2. PRE-CONSTRUCTION STUDIES

CL&P commissioned a due diligence review (environmental screening) of existing records of current and historical uses of properties along the Project ROWs and at the stations, and regarding nearby (off-site) sources of potential soil or groundwater contamination. This environmental screening was performed in general accordance with applicable requirements of the American Society for Testing

[1] This document does <u>not</u> address typical procedures for soils protection (e.g., topsoil segregation) and groundwater management during Project construction in active farmlands. Such procedures are addressed in the transmission line D&M Plan, Volume 1, Appendix D, which summarizes the results of CL&P's consultations with farmland property owners and lessees and the measures to be implemented during construction to protect soils in active farmlands. However, the procedures in this guidance document will apply to any Project excavations in areas of active farmland where soils and/or groundwater are characterized as requiring special handling, treatment, storage, or disposal.

and Materials (ASTM) *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (E1527-05)*. The majority of the Project ROWs and all three station sites were found to encompass areas characterized primarily by soils and groundwater that are not known to contain contaminants. However, the environmental databases showed that there were industrial/commercial facilities, landfills, and historic spills located along, but not on or immediately adjacent to, portions of the Project ROWs and station properties.

The review of the environmental databases revealed no recorded spills or past industrial / commercial land uses associated with the three stations. However, based on the environmental screening, CL&P elected to conduct field investigations to obtain more specific data regarding groundwater and soil characteristics along certain portions of the transmission line ROWs. Most of the information in the environmental databases lacks specific details, such as the types and concentrations of contaminants present or, in the case of a past spill, whether all material released was cleaned up. This type of information can often only be obtained through in-situ characterization sampling.

A sampling and analysis program conducted along portions of the Project ROWs was designed to provide such site-specific information for areas identified in the environmental databases. In addition, other areas along the ROWs also were sampled to obtain baseline information required by soil recycling or disposal facilities, which may be used (as needed) for off-site excess soil disposal from the Project.

2.1 Transmission Line ROWs

In the fall of 2012, soil and groundwater samples were collected at planned new transmission line structure locations in the vicinity of the properties identified by the screening process as having potential environmental concern, as well as at other proposed structure locations along the Project ROWs, to obtain sufficient characterization data. Soil and groundwater samples were taken at such structure locations, because the construction activities required to install the structure foundations will require soil excavation and the possible off-site disposal of excess soil. During foundation excavations, groundwater also may be encountered.

Generally, soil samples were obtained both near the ground surface, to assess the potential for surficial contamination, and at depth (generally between 10 and 20 feet below grade), to assess potential contamination at the groundwater interface. Groundwater samples were also collected at structure locations where groundwater was encountered during the soil sampling process. The samples were analyzed for a variety of contaminants, including but not limited to volatile organic compounds, semi-volatile organic compounds, polychlorinated biphenyls, pesticides, herbicides, heavy metals, and petroleum hydrocarbons.

Soils at the sites tested along the majority of the Project ROWs were found to meet state standards. Locations where the concentrations of contaminants in soil exceeded the applicable state standards, i.e., the residential direct exposure criteria (RDEC) or the pollutant mobility criteria for a GA aquifer (GAPMC) will be identified and characterized in the MHG. The RDEC and GAPMC are the strictest

of the Connecticut Remediation Standards for a residential property or an aquifer presumed to be used for drinking water without treatment.

The results of the groundwater sampling and analyses showed that groundwater in the Project area is of good quality and meets the Connecticut Groundwater Protection Criteria for a GA aquifer area (presumed to be used for drinking without treatment).

2.2 Substations and Switching Station

The due diligence environmental screening effort did not identify any spills at the station sites or indicate the presence of any historic contamination that would have implications for construction. As a result, no soil or groundwater sampling was performed at Card Street Substation, Lake Road Switching Station, or Killingly Substation.

3. SOIL AND GROUNDWATER HANDLING DURING CONSTRUCTION

The pre-construction study results were used to identify areas along the Project ROWs where special soils or groundwater management techniques will be required and to develop specific soil and groundwater management strategies for contractor implementation during construction. Proper management of soils and groundwater will minimize the potential for environmental impacts during construction or for the public or workers to be exposed to any contaminants.

3.1 Transmission Line ROWs

Soils. Along most areas of the transmission line route, the pre-construction studies determined that excess soils resulting from construction excavations are suitable for placement in uplands along the Project ROWs. Accordingly, such soils generated during construction will be spread within upland areas on the Project ROWs.

The characterization sampling program identified isolated locations, which will be identified in the MHG, where soil contained contaminants above the applicable state threshold for spreading the excavated soil onto the ground surface in the vicinity of an excavation. In these locations, the planned handling method will be to transport the soils to an off-site location for proper reuse or disposal, such as at an approved landfill or treatment facility. The soils generated during excavation in these locations will be temporarily stockpiled on site, and covered with plastic until transport to the designated receiving/disposal facility can be coordinated.

Groundwater. Based on the sampling and analysis program, groundwater within the Project ROWs does not contain any contaminants above the applicable state thresholds. As a result, when encountered during construction, groundwater can be pumped from the excavation and placed in a settling (fractionization, or "frac") tank or basin, filtered, and discharged back to the ground. Contractors will conduct such activities pursuant to the Connecticut Department of Energy and Environmental Protection (CT DEEP) *General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities* (permit DEP-PED-GP-015); refer to the

transmission line D&M Plan, Volume 2, Attachment F. If discharge back to the ground is not desirable, the dewatering waters can be discharged directly into municipal stormwater catch basins if the discharge meets the permit conditions and if municipal stormwater sewers are located in the vicinity.

Residual silt/sediment collected at the bottom of any frac tanks will be disposed off-site at an appropriately designated disposal facility or spread back on the ground surface in the vicinity from which it was generated.

3.2 Substations and Switching Station

Soils. Except for an underground ground wire to be installed at a shallow depth just outside of the fence surrounding the Lake Road Switching Station, all Project equipment and facility additions at the switching station, Card Street Substation, and Killingly Substation will be within the developed (fenced) portions of the existing stations. Because the Project modifications at each station are relatively minor, only limited soil excavation is expected to be required. However, CL&P anticipates that most excavated soils will not be used for backfill. Any excess material will require characterization and ultimate disposal at an approved facility, as described below.

Excess soil generated as a result of Project modifications at the stations will be temporarily stockpiled on-site in a designated location and then hauled off-site to an approved temporary storage site. (The excavated soils alternatively may be transported directly off the station to an approved temporary storage site.) The excavated soils will be stockpiled on plastic and properly contained to prevent mixing with other soils or materials (e.g., gravel) and protected to prevent erosion.

The stockpiled soils will be sampled and tested for the same chemical constituents as described in Section 2.1. Based on the test results, the construction contractor will select an appropriate pre-approved final reuse or disposal facility for the excavated soils. The construction contractor will be responsible for arranging off-site transport of the soils to the approved reuse or disposal facility, in accordance with applicable regulatory requirements.

Groundwater. It is possible that groundwater may be encountered in some of the excavations for the station equipment modifications. Any groundwater encountered will be managed on-site via basins or frac tanks, filtered or settled, and discharged back to the ground at the site under the CT DEEP *General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities* (permit DEP-PED-GP-015; refer to the station D&M Plan, Volume 2, Attachment F).

3.3 Unanticipated Areas of Contamination

While considered unlikely, it is possible that areas of contamination will be encountered during construction that were not foreseen or were not identified as a result of the due diligence screening and sampling / analysis process. If suspected contamination is encountered during construction (as indicated by field observation or odor), Project work will cease at the subject location until the potential contamination is sampled and characterized and a management strategy is developed.

If contamination is discovered in excess soils after-the-fact, such as by virtue of rejection from an off-site disposal facility that conducts its own confirmation testing before acceptance of the material, the rejected soils will be redirected to an appropriate disposal facility based on the type of contamination discovered.

Furthermore, the soils in the Project area where the unanticipated contaminated soil originated will be sampled, characterized, and the boundaries of any contamination will be delineated prior to commencing any off-site transport and disposal activities along the affected portion of the ROW.

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ATTACHMENT D

SNOW REMOVAL AND DE-ICING PROCEDURES

INTERSTATE RELIABILITY PROJECT

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TABLE OF CONTENTS

ATTACHMENTS

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1. INTRODUCTION

1.1 Applicability

The Connecticut Light and Power Company's (CL&P's) Interstate Reliability Project (Project) includes the installation of approximately 36.8 miles of new 345-kilovolt (kV) transmission lines and modifications to three existing CL&P stations (Card Street Substation, Lake Road Switching Station, and Killingly Substation; collectively referred to as "the stations"). The Project construction is scheduled to occur over a two-year period and thus will involve work during the winter, when periods of ice and snow can be expected.

The removal of ice and snow from work sites, including both on- and off- right-of-way (ROW) access roads, work pads, and stations, will be critical to allow construction to proceed safely. However, snow removal and de-icing must be performed to protect the environment, in accordance with the Project's regulatory requirements.

This document presents the procedures that will apply during construction when accumulated snow or ice must be removed from Project work sites. The procedures are designed to:

- Define responsibility for snow removal and disposal;
- Identify acceptable snow disposal (i.e., stockpile) sites for CL&P approval in advance of the winter construction season;
- Describe the requirements for preparing and maintaining appropriate snow disposal sites; and
- Establish methods for removing snow and ice from work sites safely and in conformance with Project environmental requirements, as contained in Development and Management (D&M) Plans and other state and federal permits.

In addition to these Project-specific procedures, snow removal and disposal activities must be in accordance with Northeast Utilities Best Management Practices Manual: Connecticut (December 2011) and the applicable provisions of the Connecticut Department of Energy and Environmental Protection's (CT DEEP's) best management practices (BMPs) for such activities. These BMPs are reproduced in Attachment D.1 of this document, and can also be found on the CT DEEP website at: http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325692&depNav_GID=1654.

1.2 Responsibility

The Project contractor(s) will be responsible for implementing these procedures. A designated Project representative from CL&P or CL&P's Project construction manager (Burns and McDonnell [BMcD]) must approve, prior to use, all snow disposal sites identified by each contractor. Similarly, any proposed deviations from these procedures must be justified and approved in advance by a designated Project representative.

2. SNOW DISPOSAL SITES

2.1 General

Snow disposal sites may be located within Project ROWs, at stations, or within approved Project staging and support sites. However, snow disposal sites will only be located in upland areas, as identified on the D&M Plan maps or maps that accompany other permit approvals from the CT DEEP and the U.S. Army Corps of Engineers.

No snow disposal sites will be located in the following areas:

- Any water resources (e.g., wetlands, vernal pools, ponds, lakes, watercourses, or swales).
- Within public wellhead protection areas associated with a public water supply well or within 100 feet of a private well.
- In sanitary landfills and gravel pits.
- On top of stormwater catch basins or in stormwater drainage swales or ditches.
- Within a restricted access area, as defined on the D&M Plans (including, but not limited to, threatened and endangered species habitat, archaeological sites, areas of interest to Native American tribes).
- On private property (including privately-owned portions of the ROW) without the prior, written approval from the landowner.

Snow disposal sites on Project ROWs on pervious surfaces must be located to allow snow meltwater to infiltrate into the soil, leaving behind any access road / work pad materials (e.g., gravel) or other debris that may be mixed in with the snow. Such materials must be collected and removed from the Project areas when possible in the springtime.

Snow stored on asphalt or concrete must not be piled on top of manholes or catch basins.

2.2 Disposal Site Ownership

Where possible, snow disposal sites will be located on CL&P-owned properties; at least 25 feet from water resources, in non-environmentally sensitive areas, and/or in Project-approved designated staging areas. If snow disposal sites are on privately-owned portions of the ROW, the contractor must coordinate with CL&P and BMcD (the designated Project representative) to obtain landowner approval prior to use.

If snow is to be disposed of in off-ROW locations (e.g., municipally-approved stockpile sites), the contractor must obtain and provide documentation to the designated Project representative of all applicable approvals and any conditions relating to the use of the disposal site.

3. SNOW AND ICE REMOVAL FROM WORK SITES

3.1 General

The following procedures will apply for the removal of snow and ice from Project work sites:

- No de-icing agents will be used within any water resources (e.g., wetlands, watercourses) or within 25 feet of such areas.

- Snow may be removed by plowing (blading) or snow blowing, depending on the amount and type of snow, the area that must be cleared, and the site location.

- Snow may be bladed level (rather than removed) along access roads to improve driving conditions.

- When ice covers construction sites located in upland areas, Calcium Magnesium Acetate (CMA) may be used to de-ice access roads, crane pads, and other work areas as necessary to provide a safe construction surface. CMA must be applied according to product specifications. The Material Safety Data Sheet for CMA must be kept by each contractor using this de-icing method.

- All bags or containers of CMA will be promptly removed from work sites, when empty or when activity at the work site has ceased, and disposed of properly.

- De-icing methods other than the use of CMA require the prior approval of the designated Project representative and may entail additional regulatory approvals.

- Clean sand may be used as a "traction agent' on access roads and construction pads.

3.2 Right-of-Way

In addition to the procedures identified in Section 3.1, the contractor will implement the following procedures when removing snow from work sites on the Project transmission line ROWs or from off-ROW access roads:

- **Upland Areas**: Remove snow from access roads and crane pads, taking care to avoid plowing up gravel or other materials that comprise the base for the road or crane pad. Stockpile / dispose of snow in approved upland portions of the ROW or place in dump trucks for disposal at other approved sites.

- **Wetlands and Waterbodies**: Do not, under any circumstances, plow snow into any wetland, vernal pool, or waterbody (including ponds, lakes, swales, or watercourses). To clear snow from access roads and crane pads located in wetlands, as well as from bridges across watercourses, carefully remove snow either to designated stockpile sites in approved upland portions of the ROW or load into dump trucks for disposal at other approved sites.

- **Restricted Access or Other Environmentally-Sensitive Sites**: Do not plow snow into any restricted access areas or into any other environmentally-sensitive areas as designated on the

D&M Plan maps. Never plow, blow or otherwise deposit snow beyond approved work limits.

When removing or blading snow from access roads or work pads, contractors will avoid plowing up topsoil, subsoil, or gravel. Any erosion and sedimentation controls damaged during the snow removal and/or stockpiling processes will be repaired promptly.

3.3 Substation and Switching Station Sites

In addition to the procedures identified in Section 3.1, the contractor will implement the following procedures when removing snow from work sites at the Project substations and switching station:

- Remove snow from work sites as needed using plows or snow blowers.
- Stockpile snow in the pre-approved disposal area(s) on the station site. Approved snow disposal locations will be situated, to the extent practicable, at least 25 feet from any water resources or catch basin and within a stabilized portion of the station site, and must be protected with appropriate erosion and sedimentation controls as necessary.
- Promptly repair any soil and erosion controls damaged during the snow removal and/or stockpiling process.

4. SNOW DISPOSAL SITE PREPARATION AND MAINTENANCE

The construction contractor(s) will be responsible for preparing and maintaining snow disposal sites as follows:

- Deploy silt fence or equivalent barrier on the down-gradient side of the snow disposal site.
- During the growing season, maintain a 25-foot vegetative buffer strip between the disposal site and adjacent waterbodies (to filter meltwater).
- Clear any debris from the site prior to use for snow disposal.
- Clear and properly dispose of debris from the site at the end of the snow season (as determined by season-specific weather) and in any event no later than May 15.

5. SNOW DISPOSAL WHEN APPROVED SITES ARE FULLY UTILIZED

Depending on snowfall accumulations, it is possible that all of the pre-approved snow disposal sites could be fully utilized and that additional disposal sites or other snow disposal options will need to be considered. Under such circumstances, contractors must coordinate with the designated Project representative to identify snow disposal options.

New snow disposal sites must be pre-approved by the Project representative and may require notice to or approval by local, state, and/or federal regulatory agencies.

ATTACHMENT D.1

CT DEEP
BEST MANAGEMENT PRACTICES
FOR DISPOSAL OF SNOW ACCUMULATIONS
FROM ROADWAYS AND PARKING LOTS

Connecticut Department of Energy & Environmental Protection

Best Management Practices for Disposal of Snow Accumulations from Roadways and Parking Lots

Purpose: These guidelines have been developed to clarify DEEP recommendations to state and municipal officials, and others regarding the removal and disposal of snow accumulations from roadways and parking lots. For purposes of this guidance snow accumulations refers to snow banks and snowpiles that are removed by front-end loader or by loading on trucks for disposal. This guidance does not apply to normal snow plowing operations that must, inevitably, discharge some snow into wetlands and watercourses.

Implementation: While following these guidelines does not constitute a permit or authorization, the Department recognizes there is a considerable need for flexibility in implementation of this policy, particularly in emergency situations. There is no intent to interfere with snow plowing operations. Where trucking and snow dumping operations are undertaken the Department recommends these guidelines be followed.

Problem: Current road maintenance activities include removal of snow accumulations from bridges, roads and parking areas for the purpose of providing more space for subsequent snow storms and for ease of travel and parking. Sometimes this snow is moved by truck or with a front-end loader and deposited directly into surface waters of the state including streams, wetlands and Long Island Sound. This practice is not recommended due to the presence of dirt, salt, litter and other debris, which are routinely mixed in the accumulated snow.

Under normal conditions of snowmelt, the majority of these contaminants remains on or next to the paved surface or may be captured in stormwater catch basins. These contaminants can then be swept from streets and bridges or vacuumed from catch basin sumps. However, when accumulated snow is collected and dumped into surface waters, this mixture of snow, sand and debris may smother aquatic life in the bottom of streams and rivers and degrade the aesthetics of the surface water with silt plumes and litter. Large quantities of snow (and the sand and debris) may also cause blockage of storm drainage systems, resulting in increased chance for localized flooding.

Recommended Management Practice: Snow accumulations removed from roadways, bridges, and parking lots should be placed in upland areas only, where sand and other debris will remain after snowmelt for later removal. Care must be exercised not to deposit snow in the following areas:

- freshwater or tidal wetlands or in areas immediately adjacent to such areas where sand and debris may be flushed during rainstorms;
- on top of storm drain catch basins;
- in storm drainage swales;
- on stream or river banks which slope toward the water, where sand and debris can get into the watercourse; and
- in areas immediately adjacent (within at least 100 feet) of private or public drinking water well supplies (due to the possible presence of road salt).

For Governmental Entities: In normal winter conditions, governmental entities should follow the recommended management practices outlined above. In extraordinary winter conditions, the commissioner may, upon public notification, offer governmental entities the flexibility of limited in-water disposal. When such flexibility is offered,

governmental entities who have determined that extraordinary circumstances exist where all upland, land-based disposal options have been fully exhausted (i.e., disposal capacity is not available) and snow needs to be removed to meet public safety demands (i.e., clear access ways for police, emergency medical and fire responders), may use certain waterways for snow disposal in accordance with the following conditions:

- Upland storage and disposal of snow (i.e., athletic fields, parks and other flat, open-field sites) and other snow management methods (i.e., snow melting equipment) must be the first alternatives explored and exhausted. Environmentally sensitive areas must be avoided;
- This guidance applies only to snow and ice which is not visibly contaminated with material other than salt and sand from road clearing activities;
- For coastal communities, preference should be given to snow disposal in salt water where available;
- Disposal in rivers or streams must be limited to those water bodies that have adequate flow and mixing and are not prone to ice jams;
- The disposal must occur only in open water in areas that will not interfere with navigation;
- Disposal must be conducted in a manner so as to prevent ice dam formation or damage to bridges, docks or other structures;
- Disposal in ponds and lakes is discouraged;
- There shall be no disposal in coastal or freshwater wetlands, eelgrass beds, vegetated shallows, vernal pools, shellfish beds mudflats, public water supply reservoirs and their tributaries, or others areas designated as being environmentally sensitive;
- The activity must comply with local laws and requirements;
- Precautions must be taken to avoid shoreline or stream bank damage or erosion from truck/equipment activity; and
- Governmental entities must notify the Department by email (address email to kevin.sowa@ct.gov) prior to disposing of snow and ice in waterways or, if advance notification is not possible, then the Department must be contacted as soon as possible after snow disposal has begun.

Notification: Notification can be made by addressing an email to Kevin Sowa at: kevin.sowa@ct.gov. The notification must include the following: (1) the name of the governmental entity making the notification; (2) contact information for the governmental entity including name, email address and phone number; (3) the street address where the snow disposal activity will occur; (4) the name of the waterbody where the snow will be disposed; (5) the estimated quantity of snow to be disposed; (6) the dates during which the disposal activity will occur; and (7) a statement that the governmental entity has exhausted all disposal alternatives and snow management methods and will make best efforts to adhere to these snow disposal guidelines.
Information: For further information please call the Water Permitting and Enforcement Division Engineer of the Day at 860-424-3018.

DEP-PED-GUID-002 Revised 02/04/11

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ATTACHMENT E

BEST MANAGEMENT PRACTICES MANUAL: CONSTRUCTION AND MAINTENANCE ENVIRONMENTAL REQUIREMENTS FOR CONNECTICUT

INTERSTATE RELIABILITY PROJECT

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Tighe&Bond

Construction & Maintenance
Environmental Requirements

Best Management Practices Manual: Connecticut

Prepared For:

Northeast Utilities Transmission Group
107 Selden Street
Berlin, CT

December 2011

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Tighe&Bond

CONTENTS

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Table TOC-1

Best Management Practices Summary Table

	Area / Activity	Applicable BMPs	Tab	Tab Section
ACCESS ROADS	Upland	Construction Entrance Track Pad	1	A
		Stormwater Management BMPs (includes temporary waterbars, drainage swales, and sedimentation basins)		B
	Wetland	Swamp mats	2	A
	Watercourse Crossings	Without bridged crossings	3	A
		Bridged crossings		B
		Culverts		C
		Poled fords		D
WORK PADS	De-Energized	Swamp mat workpads, including timber mats and lightweight mats	4	A
	Energized	Swamp mat workpads		B
SOIL STOCKPILE MANAGEMENT	All	Soil Stockpile Management	5	A

Table TOC-2

Appendix A: Erosion/ Sedimentation and Water Control Summary Table

Type	Applicable Control	Location
EROSION/ SEDIMENTATION CONTROLS	Hay (or Straw) Bales	Section I
	Silt Fence	
	Erosion Control Blankets	
	Straw Wattles	
	Wood Chip Bags	
	Inlet/ Catch Basin Sediment Filter	
	Loaming and Seeding	
	Mulching with Hay/Straw/Woodchips	
	Coir Log Use for Bank Stabilization	
	Check Dam	
WATER CONTROL	Discharge Hose Filter Socks	Section II
	Coffer Dam and Stream Bypass Pumping	
	Coffer Dam and Stream Bypass via Gravity	
	Overland Flow	
	Frac Tank	

Section 1
Introduction

1.1 Purpose

As a matter of Northeast Utilities (NU) policy regarding environmental stewardship and in accordance with local, state, and federal regulations, all transmission construction and maintenance projects shall use environmentally sound best management practices (BMPs) to minimize or eliminate environmental disturbances that may result from construction activities. Regardless of whether a specific permit is needed for the work, construction and maintenance projects must follow clear and enforceable environmental performance standards, which is why these BMPs have been compiled. In most cases, maintenance activities are exempt from regulatory authorization as described in further detail in Appendix B of this BMP manual. Permits are typically required for new work. Contractors will be provided with copies of any project specific permits, and will be required to adhere to any and all provisions of the permit(s). Permit conditions that are more detailed than the BMPs outlined in this manual should always be given deference. However, where certain construction elements are not addressed by permit conditions, or where permitting is not required, or for emergency situations where obtaining a permit before the work occurs may not be an option, these BMPs shall be considered as NU's standards. In some cases, and at the discretion of the NU Management, the BMPs presented herein may be modified to be more appropriate for site-specific conditions.

1.2 Scope and Applicability

These BMPs primarily address the disturbance of soil, water, and vegetation incidental to construction within on- and off-road utility corridors, substations, including the establishment of access roads and work areas, in and near wetlands, watercourses, or other sensitive natural areas, including storm drain systems (e.g. catchbasins). Types of construction include, but are not limited to installation or maintenance of underground and overhead utilities, substations and other facilities. Other common construction issues such as noise, air pollution, oil spill procedures, handling of contaminated soils, and work safety rules are addressed in the Northeast Utilities Contractor Work Rules and related appendices.

1.3 Definitions

The following definitions are provided to clarify use of common terms throughout this document.

Casing: A galvanized steel corrugated pipe that serves as a "foundation" for utility pole installation.

Emergency Projects: Limited to actions needed to maintain the operational integrity of the system or activities necessary to maintain or restore public health and safety in response to a sudden and unexpected event. Determinations of emergency status will be made by the NU Transmission Line and Maintenance Manager in consultation with Transmission Siting and Permitting staff. Some emergency response actions may require after-the-fact permitting/notification with regulatory agencies.

Embedded Culvert: A culvert that is installed in such a way that the bottom of the structure is below the stream bed and there is substrate in the culvert.

Erosion control: A measure to prevent soil from becoming dislodged.

Existing Access Roads: Previously permitted or grandfathered access roads that are used to access structures that are clearly visible or can be found by mowing or by the presence of road materials in soil cores.

General Permit Category 1: Projects with minimal disturbance to wetlands and waters of the U.S. that do not require a formal permit application to be submitted to the U.S. Army Corps of Engineers (Corps). Projects completed under Category 1 must meet the General Conditions of the General Permit. Refer to General Permit appendices for Category 1 thresholds. Under the General Permit, a Category 1 Form must be submitted to the Corps and CTDEEP certifying that the work will be conducted in accordance with the General Conditions of the General Permit prior to the commencement of work.

General Permit Category 2: Projects which require a formal permit application to be submitted to the Corps and CTDEEP. The Corps coordinates the review of Category 2 activities with state and federal agencies to ensure that a proposed activity results in no more than a minimal impact to the aquatic environment. Category 2 activities must meet the General Conditions of the General Permit. Refer to General Permit appendices for Category 2 thresholds. There is no established timeframe for a Category 2 permit review, but a general review timeframe is approximately 60 days. Projects that cannot be completed under Category 2 must file for an Individual Permit with the Corps.

Individual Permit: Projects which are not eligible under Category 1 or 2 or which do not meet the General Conditions of the General Permit will require the submission of an application for an Individual Permit to the Corps. An Individual Permit is generally required for projects which propose more than a minimal impact to the aquatic environment. There is no established timeframe for an Individual Permit review, but a general review timeframe is approximately 60 days following the publishing of a Public Notice. When a project also requires an individual water quality certification or coastal zone management consistency concurrence, it is required that those permits be obtained from the State of Connecticut before the Corps issues its Individual Permit.

Intermittent Watercourse: Per the Connecticut Inland Wetland and Watercourses Act, intermittent watercourses are delineated by a defined permanent channel and bank and the occurrence of two or more of the following characteristics: (A) Evidence of scour or deposits of recent alluvium or detritus, (B) the presence of standing or flowing water for a duration longer than a particular storm incident, and (C) the presence of hydrophytic vegetation.

Low-Impact Vehicles: Vehicles that have a lesser impact on an environmentally sensitive area due to the vehicle being smaller, lighter, or different in another way than a vehicle which would have a greater impact. Low impact vehicles could include ATVs, tracked vehicles with low ground pressure, or vehicles with oversized balloon-type tires.

Maintenance Projects: Typically consist of activities limited to the repair and/or replacement of existing and lawfully located electrical utility structures and/or facilities where no change in the original structure or footprint is proposed. Maintenance activities also include vegetation management.

Minimization: Causing as little disturbance to an area as possible during construction.

New construction: Also referred to as capital projects, they are required to go through a full permit review by the NU Siting and Permitting Department.

Restoration/Rehabilitation: To return a disturbed area to its former, original or unimpaired condition. A site is considered fully restored when it has returned (as closely as possible) to its original state. Restore disturbed areas as soon as possible.

Re-vegetation: Establishment of plant material for temporary or permanent soil stabilization.

Stabilization: A system of permanent or temporary measures used alone or in combination to minimize erosion from disturbed areas.

Sediment Control: Control of sediment after it has been dislodged.

Vehicles with Low Ground Pressure: Vehicles which have tires or tracks that apply less than three pounds per square inch (psi) on the ground surface.

Work: For the purposes of this BMP Manual, the disturbance of soil, water, and vegetation incidental to construction within on- and off-road utility corridors, substations, including but not limited to the establishment of access roads and work areas, in and near wetlands, watercourses, or other sensitive natural areas, including storm drain systems (e.g. catchbasins). Types of construction include, but are not limited to installation or maintenance of underground and overhead utilities, substations and other facilities.

1.4 Contacts (Transmission Siting and Permitting)

TABLE 1-1
NU Contacts (Berlin, CT)

Group/Location	Phone
Transmission Siting & Permitting Manager	(860) 665-2036

Section 2
Project Planning

All projects are required to go through a permit review by the Transmission Siting and Permitting Group. A summary of potentially applicable laws and regulations is provided in Appendix B of this document.

2.1 Types of Wetlands

Federal and state regulatory definitions of wetlands are provided in Appendix B. Wetland areas common to New England and common to Connecticut include, but are not limited to, the following:

Forested Wetlands

Forested wetlands, which are dominated by trees 20 feet or taller, are typically drier wetlands with standing water during periods of seasonal high groundwater, high precipitation, and/or snowmelt and runoff (early spring through mid summer). Tree species typical of this type of wetland include red maple (*Acer rubrum*) and eastern hemlock (*Tsuga canadensis*). "Pit and mound" topography is common in forested wetlands, where mature trees grow on the higher and drier mounds and obligate wetland species are found in the lower pits.

Scrub-Shrub Wetlands

Scrub-shrub wetlands are dominated by woody vegetation less than 20 feet tall, and may include peat bogs. Typical bog species include leatherleaf (*Chamaedaphne calyculata*), cotton grasses (*Eriophorum* sp), cranberry (*Vaccinium macrocarpon, V. oxycoccus*), and black spruce (*Picea marina*). Other non-bog scrub-shrub wetlands are characterized by buttonbush (*Cephalanthus occidentalis*), alders (*Alnus* sp), dogwoods (*Cornus* sp), and arrowwoods (*Viburnum* sp).

Marshes

Marshes are dominated by erect, herbaceous vegetation and appear as grasslands or stands of reedy growth. These wetlands are commonly referred to by a host of terms, including marsh, wet meadow, fen. These areas are flooded all or most of the year and, in New England, tend to be dominated by cattails (*Typha* sp).

Wet Meadows

Typical wet meadow species include grasses such as bluejoint (*Calamagrostis canadensis*) and reed canary grass (*Phalaris arundinacea*), sedges (*Carex* sp) and rushes (*Juncus* sp), and various other forbs such as Joe-Pye-weeds (*Eupatorium* sp) and asters (*Aster* sp).

Floodplains

In Connecticut, areas that contain alluvial or floodplain soils are regulated as wetlands. These areas may flood so infrequently or be so freely drained that hydrophytic vegetation and hydric soils are not present. Soils in these areas must be examined carefully to determine whether well drained alluvial or floodplain soils are present.

Streams

A stream is any natural flowing body of water that empties to any ocean, lake, pond or other river. Perennial streams, or rivers, have flows throughout the year. Intermittent streams do not have surface flows throughout the year, though surface water may remain in isolated pockets.

Vernal Pools

Vernal pools are typically contained basin depressions lacking permanent aboveground outlets. These areas fill with water with the rising water table of fall and winter and/or with the meltwater and runoff of winter and spring snow and rain. The pools contain water for a few months in the spring and early summer. Due to periodic drying cycles, vernal pools do not support breeding fish populations and can thus serve as breeding grounds for a variety of amphibians, including some rare and protected species of frogs and salamanders.

Other Considerations

Other regulated factors taken into consideration during the project planning process include the presence of protected (i.e. threatened, rare or endangered) species, non-native invasive plant species and/or historical and archaeological. Special requirements may need to be evaluated as part of new construction and/or some maintenance activities.

2.2 Meetings

Pre-construction meetings are typically held prior to the commencement of all work to appoint responsible parties, discuss timing of work, and further consider options to avoid and/or minimize disturbance to sensitive areas. These meetings can occur on or off-site and should include all the applicable stakeholders (i.e., NU, contractors, consultants, inspectors and/or monitors, and regulatory agency personnel). A brief **Pre-job briefing** would suffice for smaller maintenance projects.

Pre-job briefings are daily or otherwise routine meetings that are conducted on-site with the work crew throughout the duration of work. These meetings are a way of keeping everyone up to date, confirming there is consensus on work methods and responsibilities, and ensuring that tasks are being fulfilled with as little disturbance to the environment as possible.

2.3 Construction Monitoring

Some construction projects may require an environmental monitor. This is a way to keep a chronological record of pre-construction site conditions, progress, and changes that are made, as well as to document problems and authorized solutions.

If work will occur in a wetland resource area or an area mapped or otherwise designated as rare or endangered species habitat, permit conditions may dictate that construction be monitored by a qualified and pre-approved wetland or wildlife specialist.

All construction inspections performed by NU personnel will be entered into the siting and permitting database. Other wise construction inspections will be stored in NU's Records Information Management system.

2.4 Signage

Where appropriate (e.g. during construction projects), signage shall be installed that makes clear where critical boundaries (i.e. the limits of jurisdictional wetland resource areas and/or rare species habitat) and setbacks occur, regulatory authorization by agencies, and issues prohibitions of certain uses on ROWs, such as off-road vehicle (ORV) traffic.

Signage shall be installed along sediment and erosion control barriers at appropriate intervals to ensure that the presence and location of said barriers is clear to construction personnel during deep snow or other low visibility conditions. Inspection and maintenance of this signage shall be conducted on a regular basis to ensure effectiveness.

Examples of signage at wetlands.

Section 3
Construction Considerations

During all project activities (e.g. maintenance, new construction), federal, state, and local regulatory authorities require steps be taken to avoid, minimize, and/or mitigate disturbance to the environment. Wetlands and other sensitive areas should be avoided whenever possible. However, some work may require entrance into these areas in order to access a work site. This section discusses measures that should be taken to minimize disturbance to sensitive areas during work area access if disturbance is unavoidable.

BMPs have been developed to aid in this process and should be carefully selected and implemented based on the proposed activities and the nature of sensitive area(s) encountered at each site. Proper selection of BMPs should take into consideration the project goals, permit requirements, and site specific information. Once an assessment of the area has been made and requirements of the project have been established, all BMPs should be considered and implemented as appropriate.

Tables TOC-1 and TOC-2 summarize BMP types. This Section addresses BMPs specific to construction of new access roads, repair of existing access roads, installation of work pads, structure-related work, and soil stockpile management. Information regarding recommended erosion and sedimentation controls or stormwater controls is also discussed. Please refer to Appendix A for typicals and representative photographs of BMPS used for erosion and sedimentation control and water diversion during construction.

3.1 Access Roads

Construction access roads are generally previously permitted or grandfathered unpaved roadways which work crews use to access a site. If new access road construction is planned as part of a major project, please refer to the existing Development and Management Plans approved by the Connecticut Siting Council (CSC) specifically for the project.

3.1.1 New Access Roads

New access roads are generally associated with new or large-scale projects that have separate permitting requirements. Installation of access roads will be based on the approved CSC Development and Management Plan and as regulated by any federal and state permits. If a new access road is needed and not associated with a large project, the Transmission Siting and Permitting Group should be notified to make a decision on best access routes. Permit requirements must be followed.

3.1.2 Existing Access Roads

Access roads in upland areas should not exceed 16 feet in width, including side slopes. Maintaining existing access roads includes mowing of vegetation, grading, placement/replacement of stone, and the installation/maintenance of erosion control features (ie. water bars, swales, sedimentation basins).

When access roads are in wetlands, measures should always be taken to avoid disturbance to wetlands, waterways, and sensitive areas. If avoidance is not possible, then measures should be taken to minimize the extent of disturbance. Alternate access

routes or staging areas should always be considered. Below is a list of methods that should be considered where disturbance is unavoidable:

- Minimize the width of typical access roads through wetlands. If an existing access road is evident in the wetland, you must maintain the width of the original access road. If unable to ascertain the original width of the access then make every effort to keep road less than or equal to 16 feet wide;
- Use low-impact vehicles and/or vehicles with low ground pressure when driving through wetlands;
- Coordinate timing of work to the extent feasible to cause the least amount of disturbance (e.g. during the regulatory low-flow period (July 1 – September 30), when water/ground is frozen, after the spring songbird nesting season);
- Use swamp, timber, or similar mats in wetlands to minimize soil disturbance and rutting when work needs to occur during non-frozen ground conditions; and
- Conduct work manually if warranted (decision to be made by scientist)

Existing access roads that have become part of the wetland are considered previous fill that were either permitted or grandfathered and where it is evident that an access road exists, it is acceptable to place stone over the previously placed fill. Where the existing access road is not evident, Transmission Siting and Permitting must be called to make a determination whether stone can be placed in the wetland. If stone is not evident, through soil cores, hand digging or other method, swamp mats will be used. If permanent access is warranted through the wetland, the new access road will need to have a permitting review and will most likely require permits.

The access road in the wetland will not exceed 12 feet in width (unless there is evidence that the road was originally wider than 12 feet).

Over time, existing access roads require maintenance and repair. Travel by construction equipment and general traffic to reach a particular portion of right-of-way must be via the designated access road and route. Changes in the location of the access road or the use of alternate roads must be approved by the NU Representative prior to their construction or use. Access road routes have been selected to prevent degradation of the utility corridor, and must be constructed, used, and maintained in accordance with this manual, as well as federal, state, and local regulations, and other project plans.

Though in some situations they may be necessary, constructing duplicate access roads should be avoided to the greatest extent possible. Some appropriate reasons for suggesting alternate routes are:

- Poor site conditions along preferred route because of weather or season;
- Property rights constraints, or property owner's preference;
- Equipment requirements;
- Unanticipated off-site access limitations along existing roads; and/or
- Unanticipated access opportunities (e.g., ice, snow, other developments) which may avoid environmental disturbance and/or reduce cost.

General Design: New and Existing Access Roads

Construction access roads that require new grading and/or filling, or are to be heavily used require the creation of a stable, tractable, load-bearing surface resistant to erosion. If the existing soil and subsoil are not well drained, it may be necessary to import an aggregate road base (i.e., gravel borrow) such as that meeting the requirements of aggregate found in the Connecticut *Standard Specifications for Roads, Bridges and Incidental Construction*, Section M1.02. When the construction access road follows the same route as the permanent design road, constructing the grades and subgrade for the permanent roadway early in the construction sequence is recommended.

Construction access roads shall typically not exceed 16 feet in width except for passing points, where necessary. Subgrading shall not extend beyond the space required for the finished road and normal side slopes.

Where possible, construction access roads should conform to the contours of the land, avoiding grades steeper than 10 percent and creating side slopes no steeper than a ratio of 2:1. If the side slopes are steeper than 2:1, then use of engineered slope stabilization methods is imperative (see Stabilization Structures Functional Group, 2002 Connecticut Guidelines for Soil Erosion and Sediment Control). Consider the volume and type of construction traffic as well as the extent that natural ground must be altered to accommodate the traffic. If no grading is required and the construction traffic is very intermittent (e.g., access roads used to maintain utility lines) the measures used may be limited to water bars, or some top dressing with gravel or stone in areas where the vegetation over soft soil is destroyed by traffic.

During wet weather these roadways can generate significant quantities of sediment if not constructed with adequate stormwater management and erosion control measures. Inspection of the construction access road and the associated erosion and sedimentation measures should occur by the person(s) designated at the pre-construction meeting, at the end of each day the road is used, and repairs to controls made immediately. If the road is not used for more than a week, then inspection of the erosion and sedimentation controls should occur at an appropriate frequency as dictated by the specific measures used and extent of heavy rain events. Repairs may include regrading and/or top dressing the traveled surface with additional aggregate to eliminate ruts, as well as those repairs required by each erosion and sedimentation measure used. After the use roadway is no longer needed, the disturbed area shall be seeded and mulched as required to match preconstruction conditions.

Erosion and Sedimentation Controls

Construction personnel are reminded to control erosion and flow conditions during access road construction by utilizing the following erosion and sedimentation measures which are described and illustrated further in Appendix A:

- **Outlet protection**, a **level spreader**, or a **stone check dam** may be used to de-energize concentrated flows from diversions and in temporary channels.
- **Geotextile silt fencing** and **hay-/straw bale barriers** may be utilized to provide protection at the toe of fill slopes and discharges from water bars.
- Side slopes can be protected by installing **erosion control blankets** and **seeding** the area with a fast-growing native or annual grass mix.

- **Dust contro**l should be employed when construction access road conditions create airborne dust.

- **Geotextile fabric** shall be used beneath all new fill and construction entrances.

Best Management Practices

The following are BMPs that are applicable to new access roads in uplands and are described at the following tabs:

Construction Entrance Track Pad – Tab 1A

Stormwater Management BMPs (includes Water Bars, Drainage Swales, and Sedimentation Basins) – Tab 1B

TAB 1A

Construction Entrance Track Pad

Applications: Erosion and sedimentation control; Roadway protection

- Where the construction access road meets a paved access point to prevent construction machinery from tracking soil onto paved roadways.

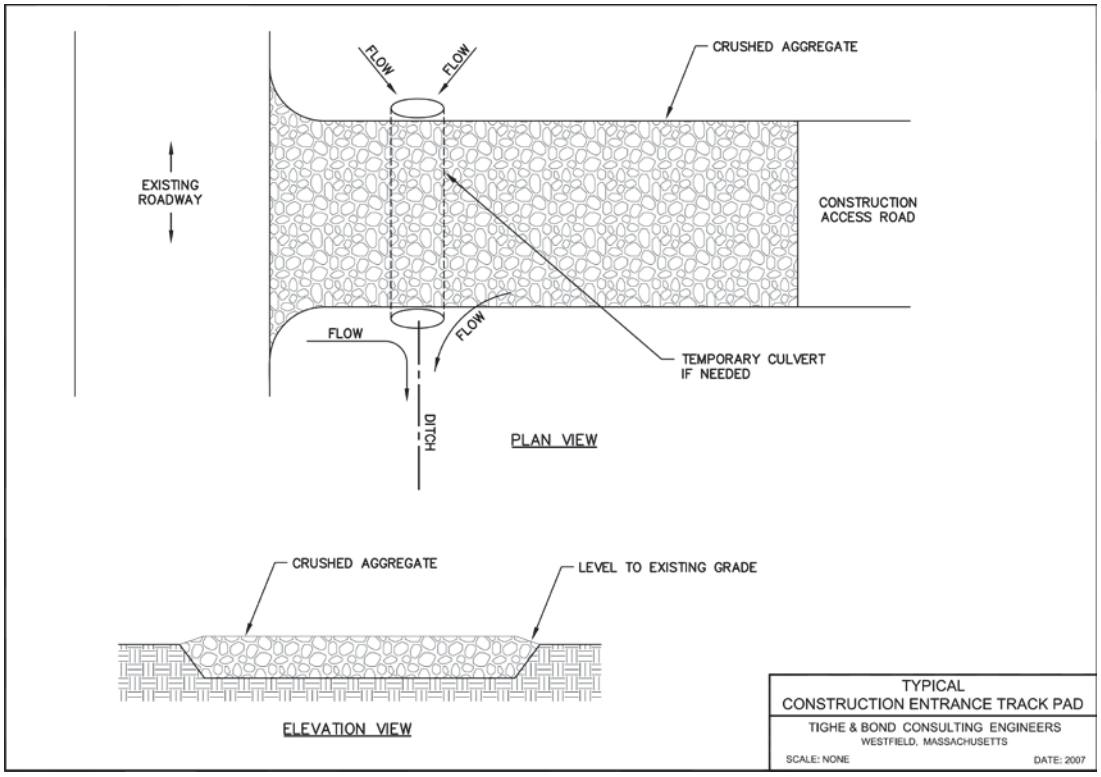
Limitations:

- Stone may need to be removed and refreshed and/or cleaned as needed if the pad becomes clogged with soil;
- Muddy conditions may warrant the use of a tire wash station and procedures should be established to ensure soils are not tracked off site.

How to Use:

- Materials appropriate to construction site soil conditions should be employed and/or replenished, as necessary.
- Where appropriate when safety and environmental conditions are considered, vehicle tires or tracks may be spun quickly ("burn out") on the track pad to further facilitate the removal of soil.
- Stone tracking pads should be at least 50 feet long, and constructed of 3-6 inch washed stone with a depth of at least 12 inches. On sites with clayey soils stone tracking pads should be underlain with a geotextile liner to prevent the stone from sinking into the soil.

Construction entrance track pad.



TAB 1B

Water Bar

Applications: Erosion and sedimentation control

- Linear features constructed across an access way to redirect water flow off of the road surface to prevent erosion.

Limitations:

- Usually must be reinstalled/reworked at the beginning and end of each construction season, due to damage from vehicle traffic and stormwater flows;
- Cannot divert unfiltered runoff to a wetland;
- Can impede vehicular movement;
- Should never be used to direct a watercourse into another waterbody.

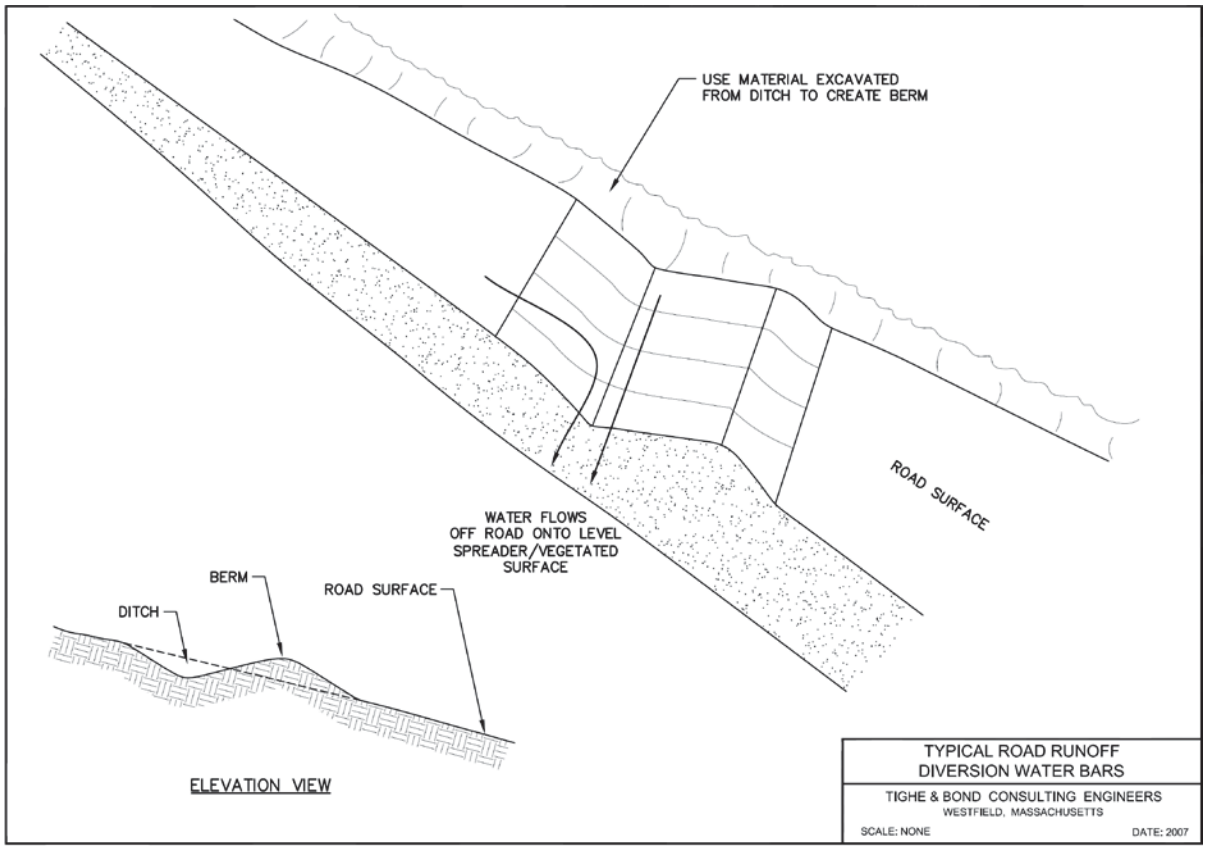
How to Use:

- Consists of a trench dug at least 6 inches below grade followed by an earthen mound at least 6 inches above grade.
- Installed at a downgradient sloping angle across the road, utilizing stable outlets and upland areas adjacent to the road. Design to avoid water bar runoff from upslope waterbars converging with further downgradient water bars.
- Compact the trench and mound with wheeled equipment or other method. Can further stabilize the trench with riprap or stone where applicable.
- Constructed at appropriate intervals along the access way, based on slope, soil type, and surrounding land use. Highly erodible soils or areas with steeper slopes will dictate closer spacing of water bars. Maximum recommended spacing is presented in the table below.

Slope of Road (%)	Maximum Distance Between Waterbars (feet)
1 or less	300
2	200
3-5	150
Greater than 5	100

- Water bars may include the use of hardwood logs to provide structural stability.
- Since they can be damaged by traffic, water bars should be routinely checked and maintained, including removal of accumulated sediment and debris from the trench. Routine inspection will also determine if the original spacing is adequate or if additional water bars need to be constructed.

Diversion waterbar.



Drainage Swales

Applications: Convey stormwater away from work area and/or improve water quality and reduce peak runoff.

- Used to intercept, redirect, and convey surface flows in order to prevent erosion in unprotected areas or flooding in work areas.
- Act as drainage channels and are used during construction or at a disturbed site or road to divert the flows from an unstable area to one that is not as vulnerable to erosion. Can be used to reduce erosion in uplands, and/or prior to discharge of stormwater flows to natural receiving waters – such as wetlands or streams.

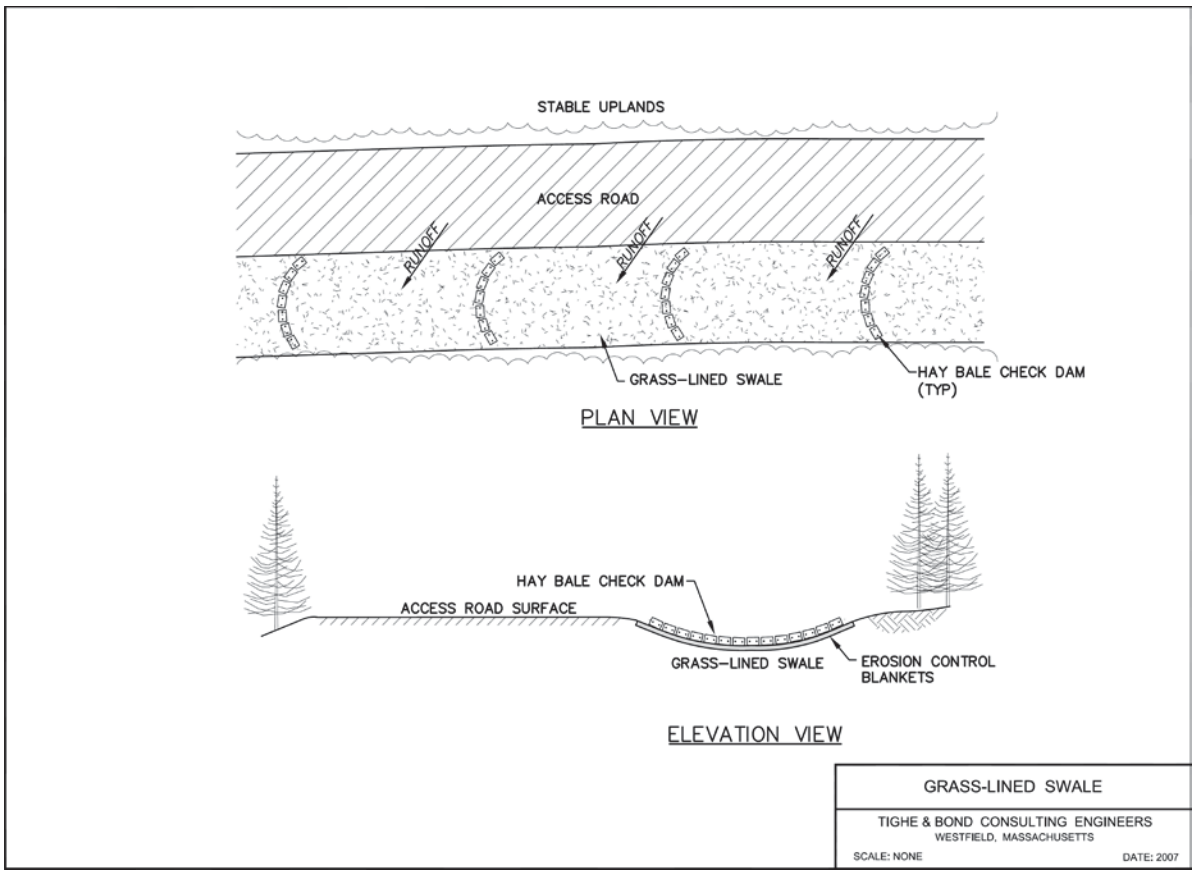
Limitations:

- Vegetated swales need to have adequately established vegetation before flow is diverted to them;
- Need to have adequate bottom stabilization to prevent scouring.

How to Use:

- Usually consist of a ditch that is either vegetated or lined with rip rap, trap rock, erosion control blankets, or other materials.
- Depth and spacing of swales should be dependent on runoff conditions of the specific site.
- Need to be routinely maintained to prevent brush/sediment buildup. Inspect swale regularly and after every rain event (0.25 inches or greater). Repair and/or re-seed rill or gully erosion. Remove accumulated sediments and brush before it reaches a depth of six inches.
- Check dams constructed of hay bales, rip rap, or other materials can be used to slow flows along certain reaches of a swale.
- Temporary swales should be removed once construction is complete or once areas are stabilized. If leaving swales in place will allow for long-term benefits and be compatible with the ultimate use of the site, then they may remain in place.

Grass-lined swale underlain with erosion control blanket and containing hay-bale check dams; used to quickly stabilize soils along a construction access road subjected to significant stormwater runoff. Blue arrow indicates direction of flow.



Sedimentation Basins

Applications: Erosion and sedimentation control

- Used to filter and settle out sediment in stormwater runoff before water is released into a wetland or other unprotected and/or sensitive area and may be used for drainage areas of various sizes.

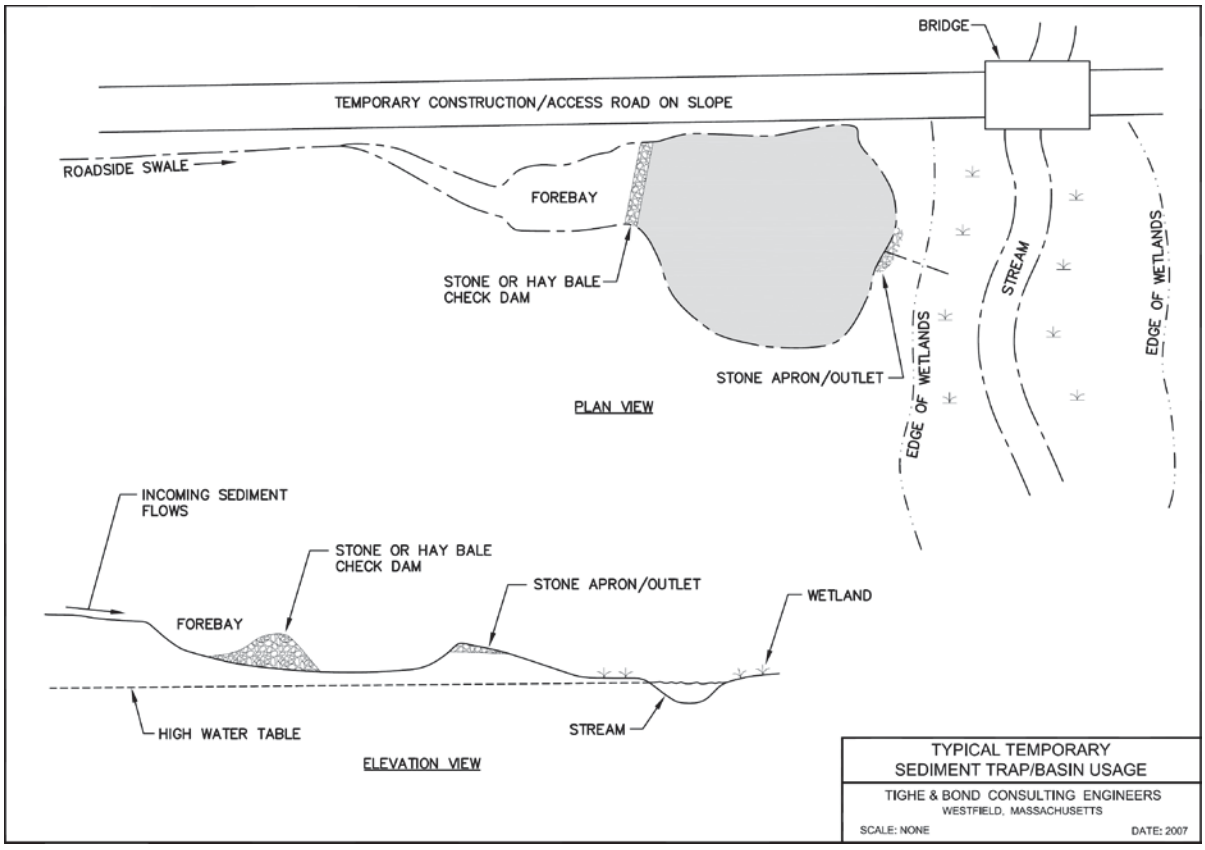
Limitations:

- Needs to be adequately sized based on expected rain events and the contributing drainage area. Based on the size of the project area, a qualified engineer may be required to calculate the appropriate size of the basin. Guidance for basin sizing is provided in the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control (Chapter 5-11). The Guidelines are available at the following website: http://www.ct.gov/dep/cwp/view.asp?A=2720&Q=325660.

How to Use:

- Direct stormwater runoff to sedimentation basins. Basin formed by excavating a depression similar to a small pond, or placing an earthen embankment across an existing drainage swale or naturally low area.
- Clear, grub and strip all vegetation and root material from area of embankment and place embankment fill in lifts, 9 inches per lift at maximum. Compact fill and construct side slopes 2:1 or flatter. Excavate rectangular outlet section from compacted embankment.
- Filter fabric can be installed on bottom and sides of basin, and covered by riprap.
- Extend outlet apron/spillway below toe of dam on level grade until stable conditions are reached (5 feet minimum). Cover inside face of stone outlet section with a 1-foot layer of ½ to ¼ inch aggregate. Vegetate embankments, spillways and disturbed areas down gradient of the basin, either with permanent or temporary seeding.
- Monitor the amount of sedimentation in the basin. Inspect after every rain event and maintain as needed, including removing accumulated sediment, repairing erosion and piping holes, cleaning or replacing the spillway gravel, and re-seeding or planting vegetation.
- Should ideally consist of a forebay where debris and some sediment begins to settle out of the water; a check dam constructed of stone or hay bales which water must flow through, filtering out more sediments; and the actual sediment basin, which is a pool with a slow enough velocity that sediments have time to settle out of the water column before the water flows over the dam at the outlet and is released.
- Sediment basins should be sized to provide a minimum of 12 to 24 hours of detention to maximum expected runoff amounts for the duration of the basin's use.
- Often a critical stormwater management component for larger construction sites, and/or those with poorly drained upland soils.
- Construction of temporary sediment basins should occur before primary construction on a project begins.
- If compatible with the eventual (post-construction) site use, it may be appropriate to leave sediment basins in place indefinitely.

Sedimentation basin with haybale filters.



3.1.3 Wetland

Construction access roads that are constructed in or across wetlands require the following considerations in addition to the considerations for access roads in uplands:

- Construction of new access roads in wetlands, whether temporary or permanent, that do not utilize swamp mats (i.e. earthen and/or rock fill roads, corduroy roads, etc.) require considerable project specific permitting and design. These kinds of projects should comply with project specific permits and plans, while only using this BMP manual as a general reference source. Permits often also require wetlands replication when permanent new access roads are constructed in wetlands.
- Avoid putting the construction access road in a wetland whenever possible. Explore all feasible and prudent alternatives before determining that a wetland crossing is absolutely necessary. When avoidance is not possible, consider crossings that will result in the least amount of disturbance. This may involve locating the construction access road so that it crosses the wetland at its narrowest width or uses areas previously disturbed for access or other purposes.
- Minimize the width of the temporary construction access road through the wetlands (generally no wider than 16 feet when using swamp mats). It is preferable to have a passing point created before and after the wetland crossing, but internal passing points may be needed if the crossing is very long or critical sight line restrictions exist.
- Consider the soil conditions. Expect deep organic wetland soils to require geotextiles, timber/swamp mats, or other materials during use to keep imported road materials separated from wetland soils. In shallow organic, or saturated soils thick plywood sheets or AlturnaMATS® may be sufficient to support a stable travel surface for small, lightweight vehicles. In addition, in areas which are inundated or have deep organic wetland soils, it may be necessary to use more than one layer of swamp mats.
- Prevent obstructions to surface and subsurface flow across and through the construction access road. Provide adequate drainage. This may require the use of crushed stone, a layer of log corduroy, timber mat bridges, or multiple cross culverts, particularly if the wetland does not contain a well-defined watercourse channel and/or the wetland crossing is long. If the wetland soils are susceptible to seasonal high groundwater tables or flooding, then give additional consideration for maintaining flows across and/or over the construction access road without causing erosion or siltation during such times.
- Plan in advance how the construction access road will be removed and the wetland restored. A road stabilization geotextile can facilitate the segregation of imported soils, crushed stone, and/or log corduroy from the native wetland soils and make wetland restoration easier. However, after the end of an extensive project and a highly traveled crossing, stone and other material removal from the wetland surface will still usually have to occur, even when placed in conjunction with geotextile.

In some cases access roads may not need to be constructed in a wetland to get access into or through a wetland if the work can be designed such that disturbance to the wetland are avoided or negligible. Options to be considered are presented below.

Equipment Selection and Usage

- **Low ground pressure equipment**. Using equipment that reduces the pressure it exerts on the ground can minimize disturbance to sensitive areas. Employing the use of equipment with wide tires, rubberized tracks, and low ground pressure (<3 psi) can help minimize soil compaction.
- **Wide tires**. Increasing the width of tires will increase traveling surface area and therefore reduce the amount of ground compaction that the equipment will cause. Ultimately, this will reduce rutting, and allow for easier maneuvering of the vehicle. However, wide tires may be costly and will require a wider travel area.
- **Tracks**. Equipment with tracks spreads the weight of the vehicle over a much larger surface, reducing ground pressure and enabling the vehicle to move more freely through wet substrates. Each track can be between 1.5 and 3 feet wide, length depending on the width of the vehicle. This can greatly reduce rutting and allow the vehicle to move with less difficulty through wet substrates.
- **Lightweight equipment**. Disturbance in a wetland area can be lessened by reducing the size of equipment (i.e., All-Terrain-Vehicles (ATVs), Gator™, etc.) used in sensitive areas. This reduces the amount of pressure to the travel surface as well as the necessary width of access ways.

Equipment with tracks.

Timing of Work

- **Work during frozen conditions**. Activities conducted once wetland areas are frozen can minimize rutting and other disturbance to the surrounding environment. Work during this time also generally reduces disturbance of aquatic and terrestrial wildlife movement by avoiding sensitive breeding and nesting seasons.
- **Work during the "low flow" period**. The U.S. Army Corps of Engineers regulatory low flow period is designated as July 1 through September 30. Conducting work during the low flow period can reduce disturbance to surface water and generally avoids spawning and breeding seasons of aquatic organisms.

Alternate Access

- **Manual access**. In some cases such as for smaller projects, work areas can be accessed manually – on foot through terrestrial areas, and by boat through open water or ponded areas. Small projects, such as repairs of individual structures, or parts of structures, that do not categorically require the use of heavy machinery, should be accessed manually to the greatest extent practicable.

Use of overhead / aerial access (i.e. helicopters)

- Using overhead or aerial equipment can be expensive and is not always feasible, but it may be appropriate in some situations in order to get vehicles and other equipment to a site that may be otherwise very difficult to access. The use of overhead and/or aerial equipment may be beneficial for work in areas where large water bodies, deep crevices, or mountainous areas hinder ground access.

Erosion and Sedimentation Controls

Construction personnel are reminded to control erosion and flow conditions during new access road construction by utilizing the following erosion and sedimentation measures which are described and illustrated further in Appendix A:

- **Geotextile silt fencing** and **hay / straw bale barriers** may be installed at the edges of earthen roads or swamp mat roads to prevent erosion of soil into wetlands from the road fill or tracked soil on swamp mats.
- Side slopes of earthen roads can be protected by installing **erosion control blankets** and **seeding** the area with a fast-growing native or annual grass mix.
- **Dust control** should be employed as necessary when construction access road conditions create airborne dust when necessary.

Best Management Practices

The following are BMPs that are applicable to new access roads in wetlands and are described at the following tab:

Swamp Mats (includes Timber Mats and Alternative Mats) – Tab 2A

Permeable Road – Tab 2B

Dewatering – Appendix A Section II

TAB 2A

Swamp Mats (also known as construction mats)

Applications: Wetland crossings; rut minimization.

- Used for access where the ground surface is unstable due to shallow, standing water, saturated soils, or other substrates not suitable for heavy vehicles.

Limitations:

- Only for temporary use. Generally mats should be removed within 60 days;
- May float away in high water conditions;
- Need to be installed with heavy machinery;
- AlturnaMATs® limited to smaller vehicles and equipment;
- Equipment operators should remain cautious so as not to drive or slip off the side of the mats;

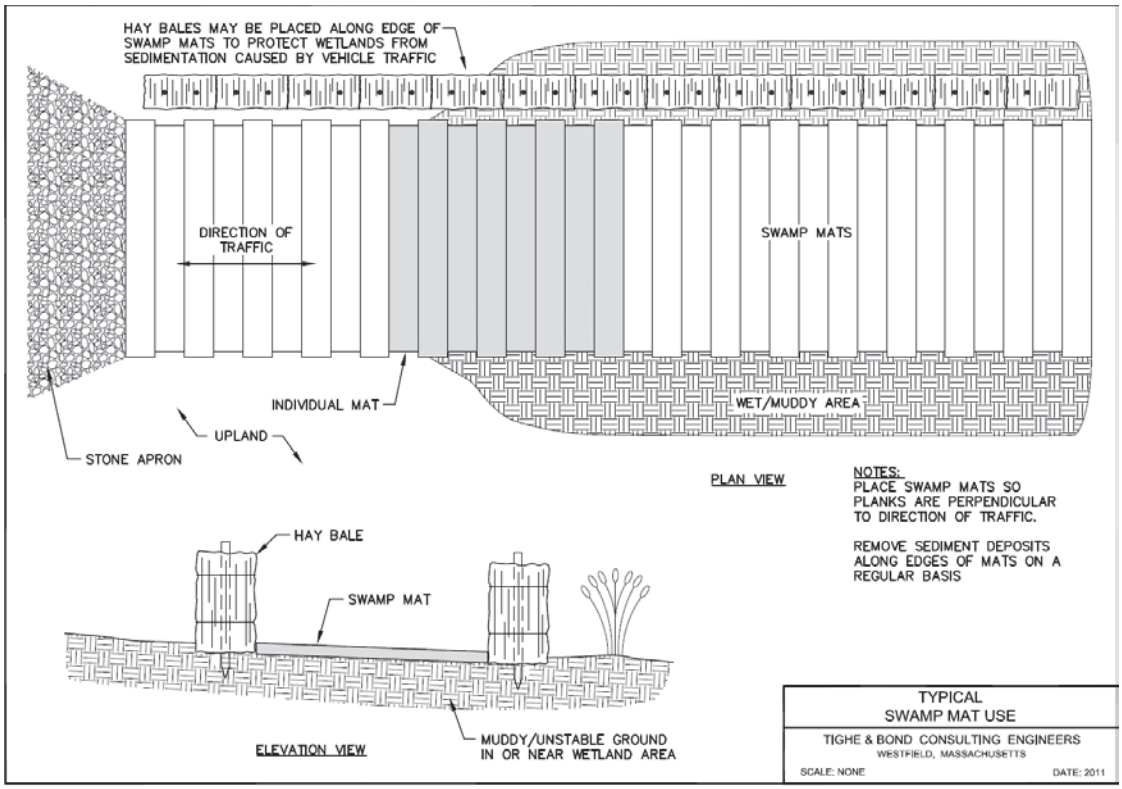
How to Use:

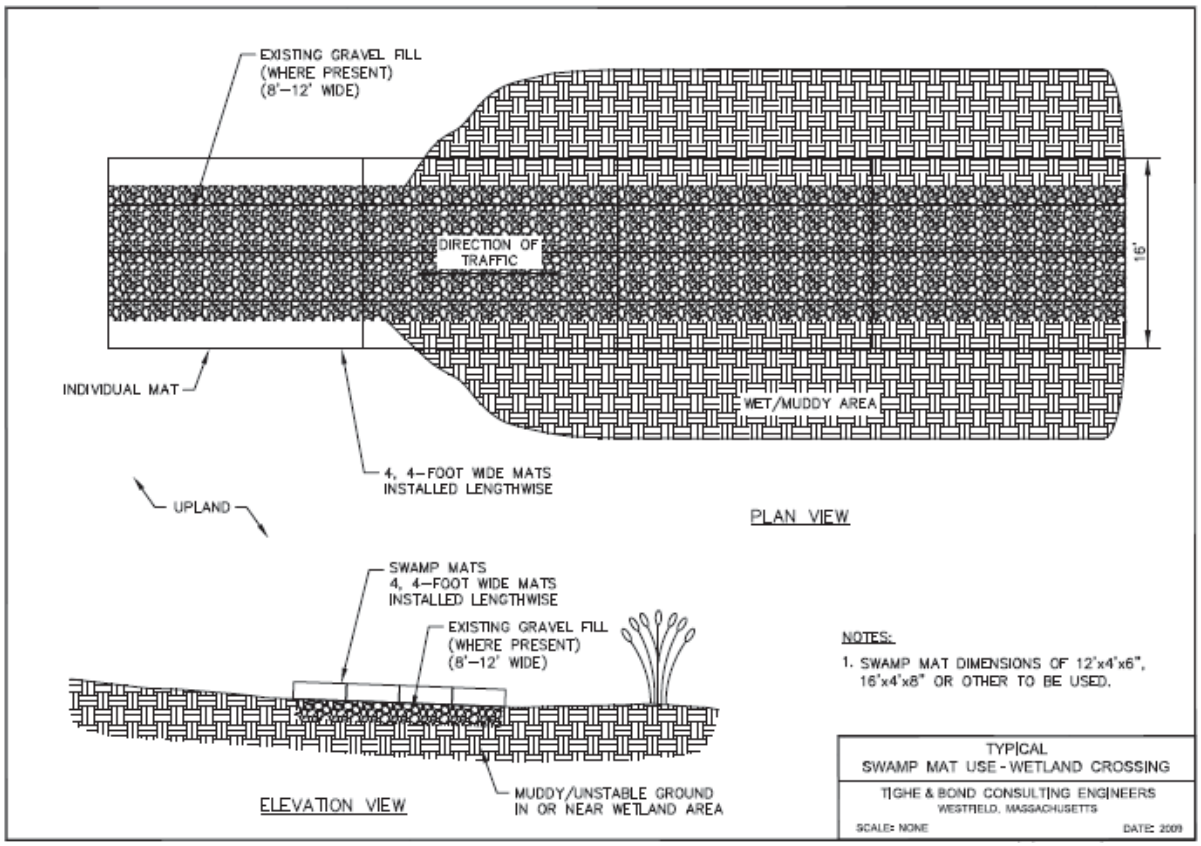
- Should be removed by "backing" out of the site, removing mats one at a time and regrading soils to pre-existing contours while taking care not to compact soils;
- Should be cleaned after use to remove any invasive plant species seed stock. Cleaning methods may include but are not limited to shaking or dropping mats in a controlled manner with a piece of machinery to knock off attached soil and debris, spraying with water or air, and sweeping.

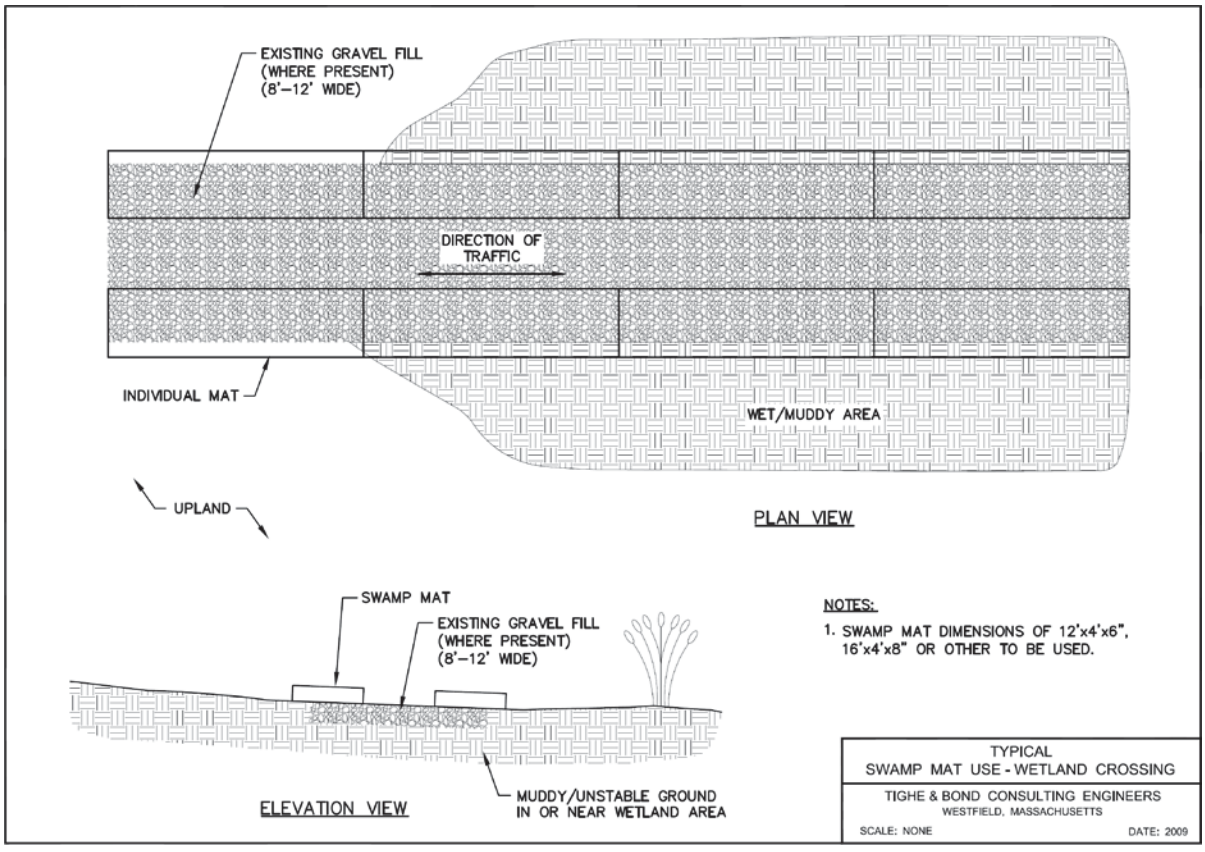
Lightweight, easy to maneuver alternatives to traditional mats, such as AlturnaMATS®, are also available. AlturnaMATS® are half-inch thick polyethylene slip-resistant ground protection mats. They are available in dimensions up to 4 feet by 8 feet and range in weight from 21.5 to 86 pounds. See photograph and typical on following pages.

Swamp mats (or timber mats) are used in areas where the ground surface is unstable due to shallow standing water, saturated soils, or other substrates not suitable for heavy vehicles. For proper swamp mat installation and usage, refer to the below photographs and typicals. In most cases swamp mats should be placed along the travel area so that the individual boards are resting perpendicular to the direction of traffic. No gaps should exist between mats and they should be used far enough on either side of the resource area so as not to result in ruts when equipment enters and exits a sensitive area. Swamp mats should be removed by "backing" out of the site, removing mats one at a time and regarding soils as required to pre-existing contours while taking care not to compact soils.

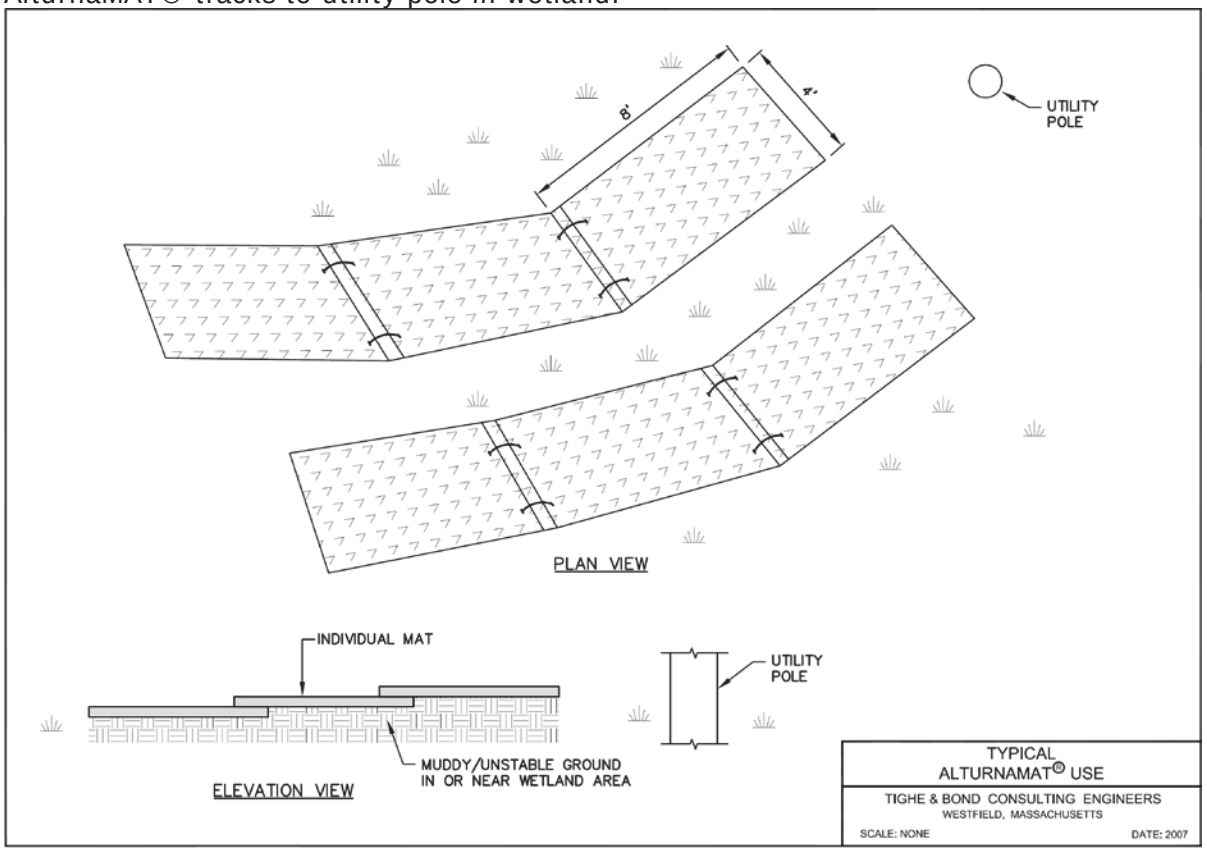
Timber mat access road.




EXISTING GRAVEL FILL
(WHERE PRESENT)
(8'–12' WIDE)
DIRECTION OF
TRAFFIC
16'
INDIVIDUAL MAT
WET/MUDDY AREA
4, 4–FOOT WIDE MATS
INSTALLED LENGTHWISE
UPLAND
PLAN VIEW
SWAMP MATS
4, 4–FOOT WIDE MATS
INSTALLED LENGTHWISE
EXISTING GRAVEL FILL
(WHERE PRESENT)
(8'–12' WIDE)
MUDDY/UNSTABLE GROUND
IN OR NEAR WETLAND AREA
ELEVATION VIEW
NOTES:
1. SWAMP MAT DIMENSIONS OF 12'x4'x6",
16'x4'x8" OR OTHER TO BE USED.
TYPICAL
SWAMP MAT USE - WETLAND CROSSING
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2009


EXISTING GRAVEL FILL
(WHERE PRESENT)
(8'–12' WIDE)
DIRECTION OF
TRAFFIC
INDIVIDUAL MAT
WET/MUDDY AREA
UPLAND
PLAN VIEW
SWAMP MAT
EXISTING GRAVEL FILL
(WHERE PRESENT)
(8'–12' WIDE)
MUDDY/UNSTABLE GROUND
IN OR NEAR WETLAND AREA
ELEVATION VIEW
NOTES:
1. SWAMP MAT DIMENSIONS OF 12'x4'x6",
16'x4'x8" OR OTHER TO BE USED.
TYPICAL
SWAMP MAT USE - WETLAND CROSSING
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2009

AlturnaMAT® tracks to utility pole in wetland.



TAB 2B

Permeable Road (also known as rock sandwich, French Mattress, or road with continuous cross-drainage,)

Applications: Wetland crossings; rut minimization;

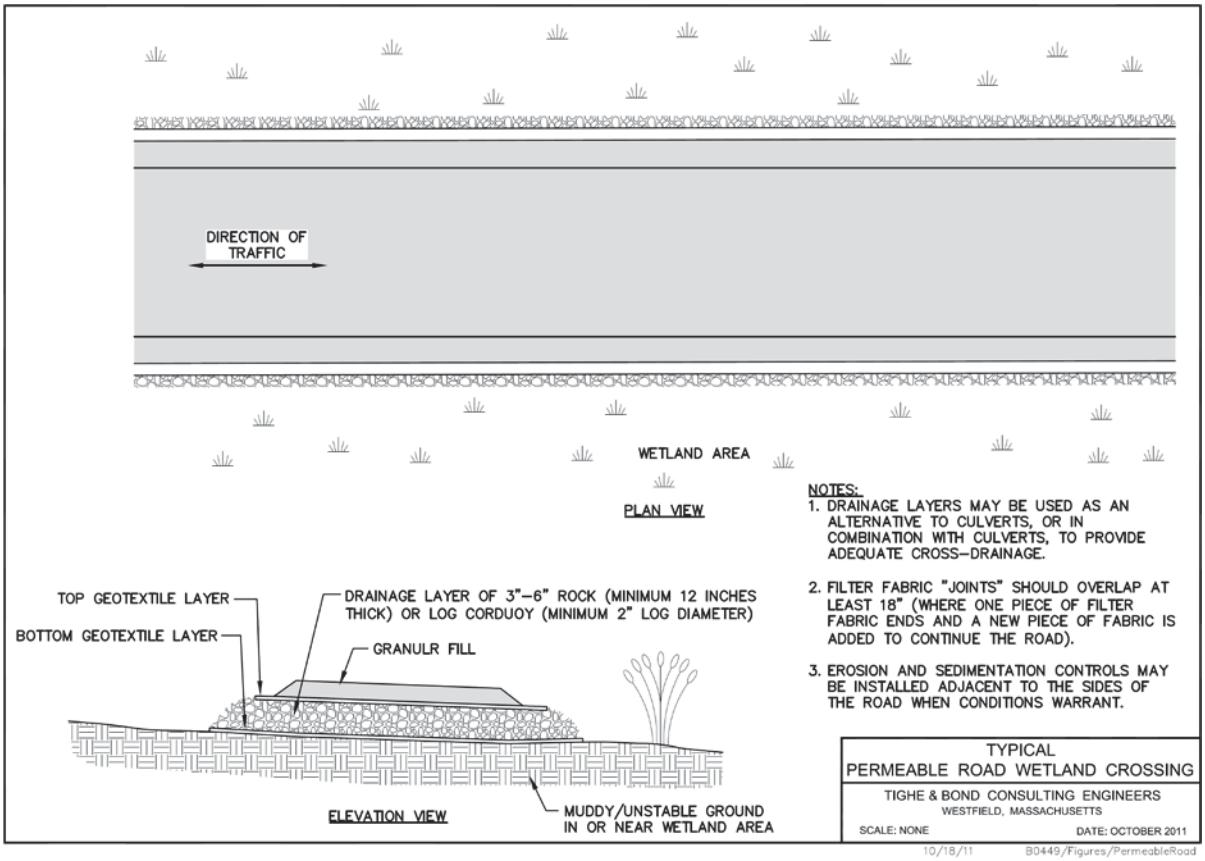
- Used for access where the ground surface is unstable due to shallow, standing water, saturated soils, or other substrates not suitable for heavy vehicles. Can also help prevent groundwater from wicking up into the road fill material and help to minimize the potential for frost action and the creation of potholes.

Limitations:

- Not appropriate for areas where concentrated, high volume and/or velocity water flow will intersect the road (i.e. stream crossings).
- Need to be installed with heavy machinery;
- Equipment operators should remain cautious so as not to drive or slip off the side of the road;

How to Use:

- Road constructed, as shown on the typical on the next page, on top of the soil surface. To minimize impacts to the resource area, excavation of the existing soil is generally not recommended. Existing soil is covered with a geotextile fabric prior to road construction.
- Road should be installed far enough on either side of the resource area so as not to result in ruts when equipment enters and exits a sensitive area.
- Should be removed by “backing” out of the site, removing road one section at a time and regrading soils to pre-existing contours while taking care not to compact soils;
- Edges of cross-drainage layer along the sides of the road should be inspected and cleaned regularly to prevent clogging by debris, leaf litter, sediment, etc.
- Drainage layers may be used in combination with culverts to provide adequate cross drainage.


DIRECTION OF TRAFFIC
WETLAND AREA
PLAN VIEW
TOP GEOTEXTILE LAYER
BOTTOM GEOTEXTILE LAYER
DRAINAGE LAYER OF 3"–6" ROCK (MINIMUM 12 INCHES THICK) OR LOG CORDUOY (MINIMUM 2" LOG DIAMETER)
GRANULR FILL
ELEVATION VIEW
MUDDY/UNSTABLE GROUND IN OR NEAR WETLAND AREA
NOTES:
1. DRAINAGE LAYERS MAY BE USED AS AN ALTERNATIVE TO CULVERTS, OR IN COMBINATION WITH CULVERTS, TO PROVIDE ADEQUATE CROSS–DRAINAGE.
2. FILTER FABRIC "JOINTS" SHOULD OVERLAP AT LEAST 18" (WHERE ONE PIECE OF FILTER FABRIC ENDS AND A NEW PIECE OF FABRIC IS ADDED TO CONTINUE THE ROAD).
3. EROSION AND SEDIMENTATION CONTROLS MAY BE INSTALLED ADJACENT TO THE SIDES OF THE ROAD WHEN CONDITIONS WARRANT.
TYPICAL
PERMEABLE ROAD WETLAND CROSSING
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: OCTOBER 2011
10/18/11
B0449/Figures/PermeableRoad

3.1.4 Watercourse Crossings

There are a number of BMPs that can be selected to minimize disturbance to streams. Each situation should take the current site and project needs into consideration to select the best method which will be most cost-effective and incur the fewest secondary disturbances. Additional erosion and sedimentation controls (e.g. hay or straw bales) may be required in conjunction with the following stream crossing BMPs to protect sensitive areas. The stream crossing methodology chosen will depend largely on the equipment required for a particular task, the existing environmental conditions, and the duration of the crossing.

Erosion and Sedimentation Controls

Construction personnel are reminded to control erosion and flow conditions during new watercourse crossings by utilizing the following erosion and sedimentation measures which are described and illustrated further in Appendix A:

- **Geotextile silt fencing** and **hay/straw bale barriers** may be installed at the edges of earthen roads or swamp mat roads to prevent erosion of soil into watercourses from the road fill or tracked soil on swamp mats. These controls however should generally not be placed within a watercourse.
- Side slopes of earthen roads can be protected by installing **erosion control blankets** and **seeding** the area with a fast-growing native or annual grass mix.

Best Management Practices

The following are BMPs that are applicable to new access roads watercourse crossings and are described at the following tabs:

Stream Crossings Without Bridges (includes limiting turbidity and stone crossing) – Tab 3A

Bridged Crossings (includes swamp mat bridges and railroad car bridges) – Tab 3B

Culverts – Tab 3C

Poled Fords – Tab 3D

Dewatering – Appendix A Section II

TAB 3A

Stream Crossings Without Bridges: Limiting Turbidity

Applications: Turbidity control

- In some situations such as routine or emergency maintenance with small ATVs, pickup trucks or tracked equipment, it may be acceptable for equipment to simply travel (perpendicularly) through a stream. Such crossings are generally considered acceptable where there is a stable stream bottom (rock or sand/gravel), where an existing or historic access road is present, and/or where the crossing is at a relatively narrow reach of the stream and any adjacent wetlands.

Limitations:

- Limited to areas where stream banks and bottoms will not be significantly damaged by the crossing;
- Wet crossings not preferred by regulatory agencies;

How to Use:

- Streams should be crossed slowly to minimize in-stream turbidity.

Stream Crossings Without Bridges: Stone Crossings

Applications: Stream crossing; turbidity control

- Use to cross small streams with stable stream bottoms.

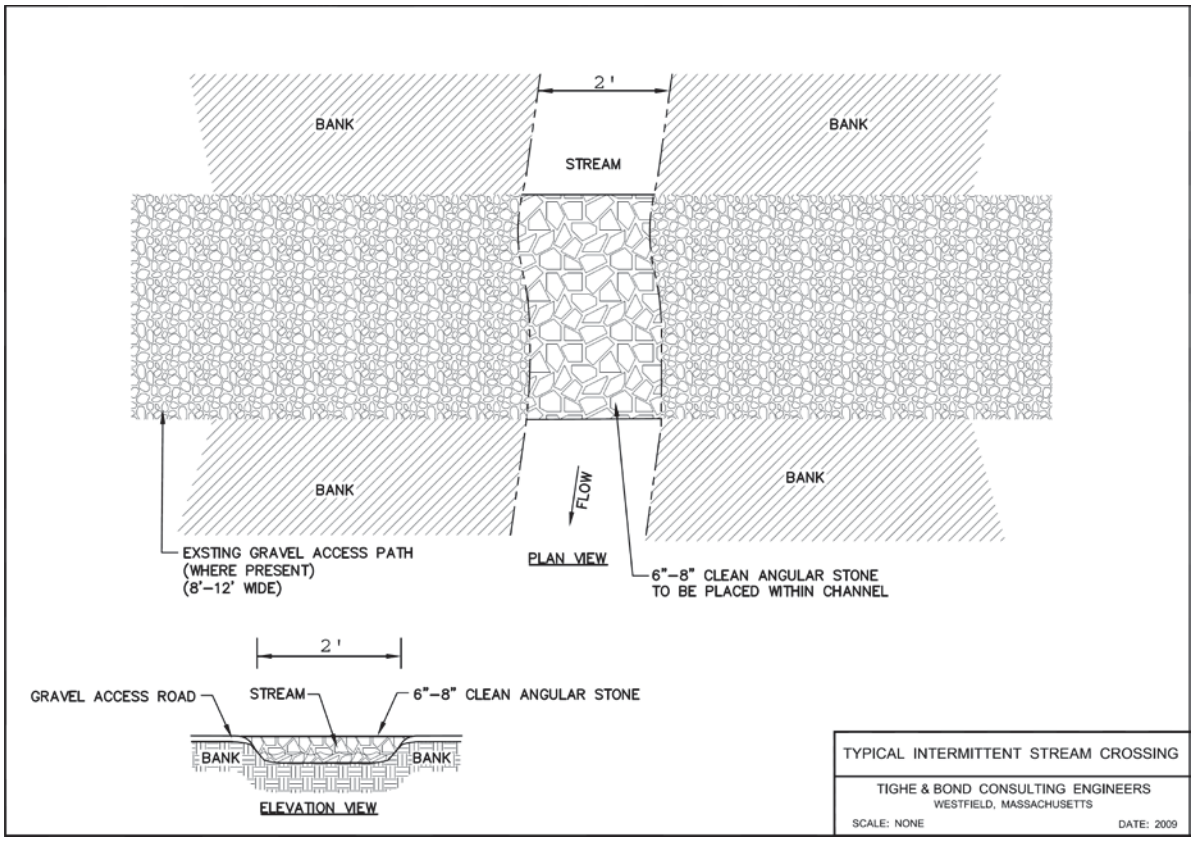
Limitations:

- Only use in small (less than 2-feet wide or braided) intermittent streams which do not appear on USGS topographic maps, and have a downstream section with a gradient greater than 20%;
- Not suitable in areas where there could be a potential for fish passage.
- Stone size should be sufficient to allow for macroinvertebrate passage.
- Not preferred for new access road crossings. Generally is a BMP more suitable for existing access road crossings.

How to Use:

- Carefully place 6-inch to 8-inch clean angular stone within stream at crossing. Limit width of stone to that needed for widest vehicle/equipment to crossing the stream.
- Drive over stone slowly.
- Leave riprap in intermittent streams for future use. More damage will occur by removing stone.

Intermittent stream crossing with angular stone.



TAB 3B

Bridged Crossings: Swamp Mats as Temporary Bridge

Applications: Watercourse crossings

Limitations:

- Require the use of machinery for installation;
- May become unstable under high flows.

How to Use:

- Untreated wooden timber mats may be used as a temporary bridge over a stream to allow construction vehicles access to the work site.
- Small sections of matting are placed on either side of the stream parallel to the flow of water at top of banks. These act as supports. Mats may then be placed perpendicular to the stream, resting on top of the initial swamp map supports.
- It may be necessary to place a large steel plate along the top of the swamp mats for extra stability and to minimize the amount of sediment that could fall between the spaces of each timber.
- Timber mat bridging is suitable for crossing intermittent and perennial streams.
- Before constructing a stream crossing, it should be confirmed that the timber mats are capable of supporting the equipment to be used.

Timber mat bridge.

Bridged Crossings: Rail Car as Temporary Bridge

Applications: Watercourse crossings

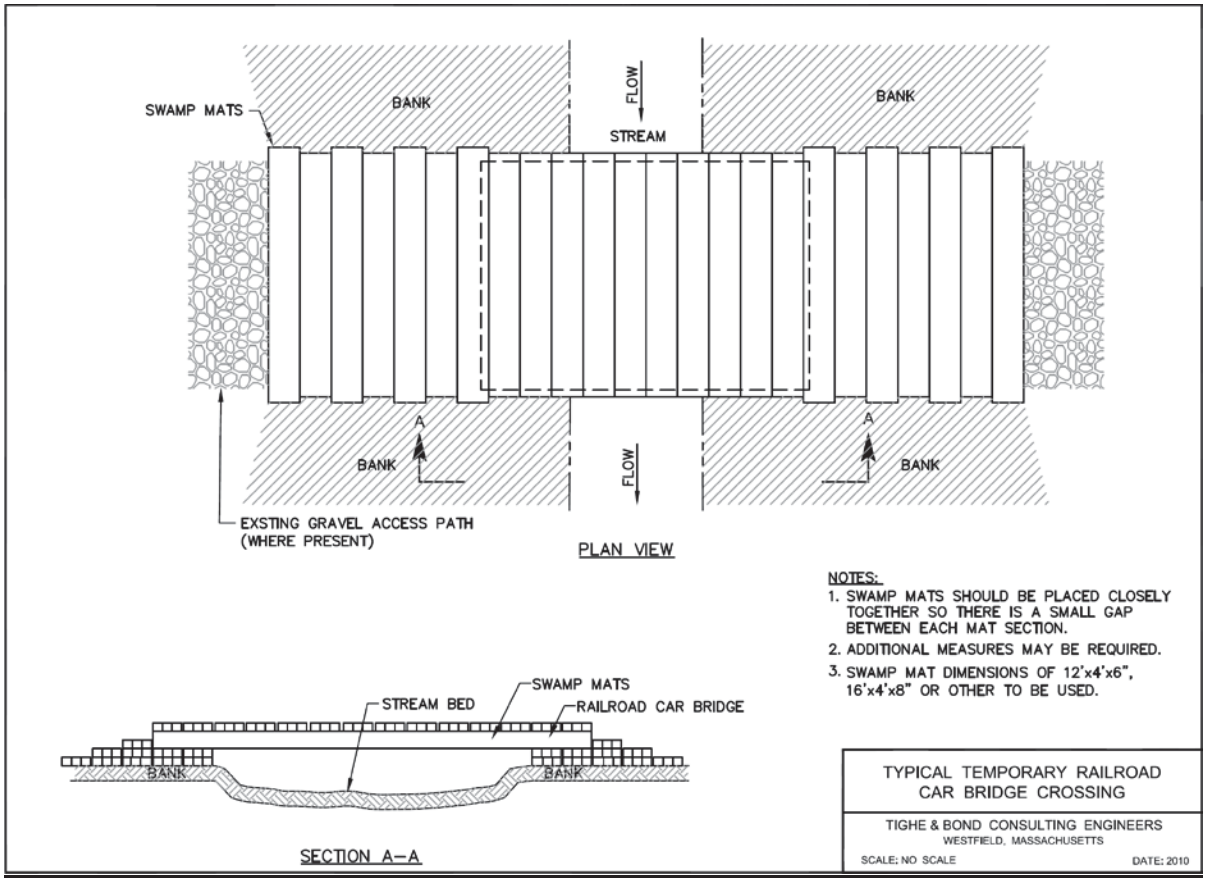
Limitations:

- Requires heavy equipment for transport and installation;
- Expensive;
- Banks must be stable to support heavy loads.

How to Use:

- Used rail car frames can be used for crossing larger and deeply incised streams where timber mats are unsuitable.
- For these types of crossings, the rail car frame is placed across the stream from bank to bank perpendicular to the direction of flow (on a timber frame footing if necessary). Timber matting is then placed upon the rail car frame to provide vehicle access

Rail car bridge crossing.


SWAMP MATS
BANK
FLOW
STREAM
BANK
A
BANK
FLOW
A
BANK
EXSTING GRAVEL ACCESS PATH
(WHERE PRESENT)
PLAN VIEW
NOTES:
1. SWAMP MATS SHOULD BE PLACED CLOSELY TOGETHER SO THERE IS A SMALL GAP BETWEEN EACH MAT SECTION.
2. ADDITIONAL MEASURES MAY BE REQUIRED.
3. SWAMP MAT DIMENSIONS OF 12'x4'x6", 16'x4'x8" OR OTHER TO BE USED.
SWAMP MATS
STREAM BED
RAILROAD CAR BRIDGE
BANK
BANK
SECTION A–A
TYPICAL TEMPORARY RAILROAD CAR BRIDGE CROSSING
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NO SCALE
DATE: 2010

TAB 3C

Culvert Installation/Repair/Replacement

***When installing or replacing a culvert, you must contact Transmission Siting and Permitting.**

Applications: Stream and wetland crossings

- Installed when roads cross wetlands or streams. The culvert should maintain the wetland or stream if properly installed.

Limitations:

- May have permitting time of year restrictions on use;
- Installation may require in-stream work and possible dewatering and sedimentation concerns;
- Culverts are susceptible to washouts, sedimentation, erosion, and failure during heavy wet weather events and flooding;
- Culverts require routine and long-term maintenance, as they often become clogged with debris or other obstructions.

How to Use:

- The number and size of culverts should be designed to handle the maximum expected flow of the wetland or watercourse. Multiple culverts are discouraged. It is better to use one large culvert if feasible.
- All crossings require hydraulic calculations to determine the area that will drain the culvert. Culvert(s) must also be adequately sized to accommodate flows from the 100-year storm, at a minimum (preferably 500-year storm).
- Timber mats may be placed over culverts to help structurally protect the culvert from heavy loads.
- Culverts must be maintained to allow flow. Debris and sediment need to be removed on an as-needed basis.
- All temporary and permanent crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed to withstand and prevent the restriction of high flows, and to maintain existing low flows, and so as not to obstruct the movement of aquatic life indigenous to the waterbody.
- Open bottom culverts (semicircle arch, elliptical arch and concrete box culverts) or embedded culverts for perennial streams are required for CTGP Category 1/ Non-Reporting projects. Consultation with the U.S. Army Corps of Engineers is required if open bottom arches, bridge spans or embedded culverts are not practical.
- Open bottom structures must span at least 1.2 times the watercourse bank full width, and have an openness ratio equal to or greater than 0.25 meters.
- Open bottom structures and culverts shall be designed to allow for continuous flow of the 50-year frequency storm flows. This is a Corps requirement.
- Culverts should only be installed under Category 1 Non-Reporting when the tributary watershed to the culvert is less than 1 square mile (640 acres). The

culvert gradient shall be no greater than the streambed gradient upstream or downstream of the culvert.

- For crossings constructed using a single box or pipe arch culvert, the inverts are to be set ≥ 12 inches below the streambed elevation. For crossings with a pipe culvert, the inverts are to be set such that ≥ 25% of the pipe or 12 inches, whichever is less, is set below the streambed elevation.

- Culverts shall be backfilled with natural substrate matching upstream and downstream streambed substrate, even if fish passage is not a concern. Other aquatic organisms rely on natural stream bed sediment to aid their movement.

- The culvert shall be a minimum of 18 inches in diameter.

- The maximum velocity at the culvert outlet shall be consistent with the velocity of the natural channel, or shall be mitigated with outlet protection measures, energy dissipation, and if necessary, channel stabilization.

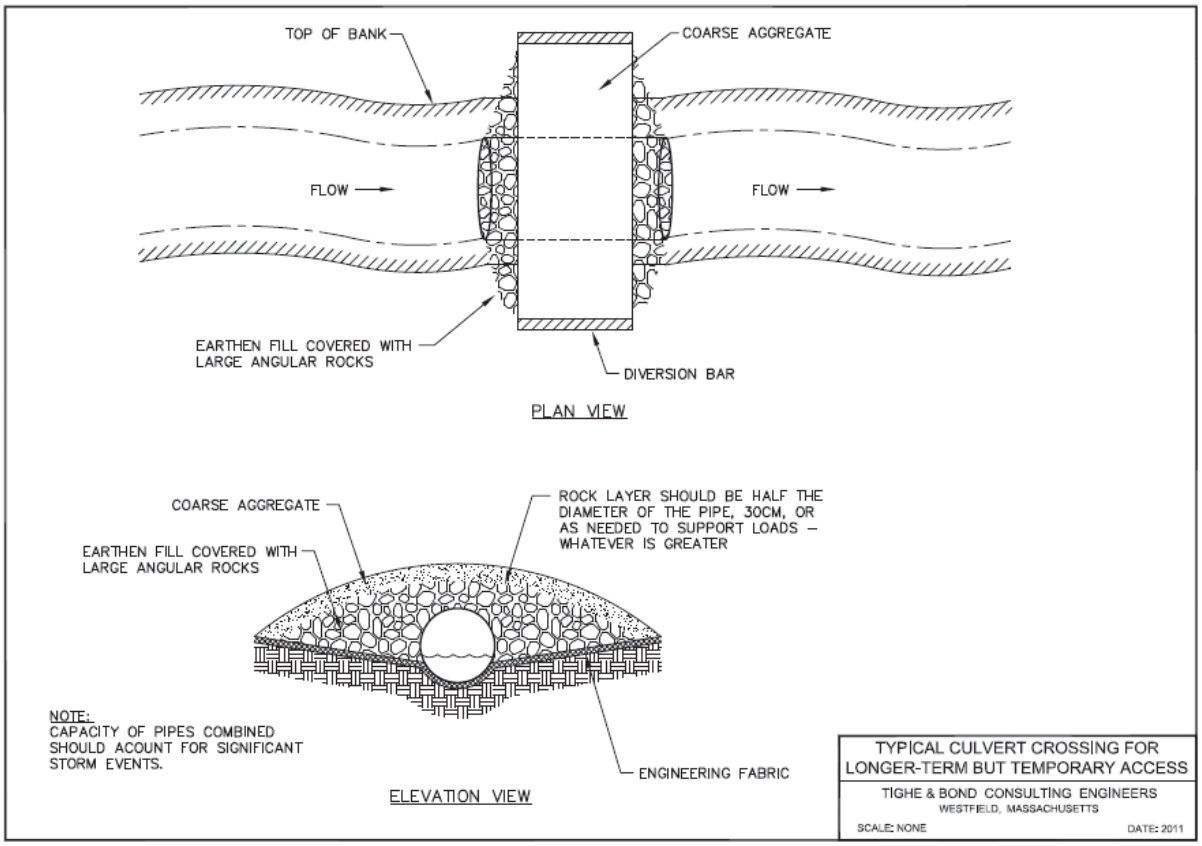
- Culverts shall be designed and installed with minimal disruption to the watercourse and riparian buffer zone.

- Culvert installations that result in the filling of a FEMA established floodway do not qualify under the Category 1 GP.

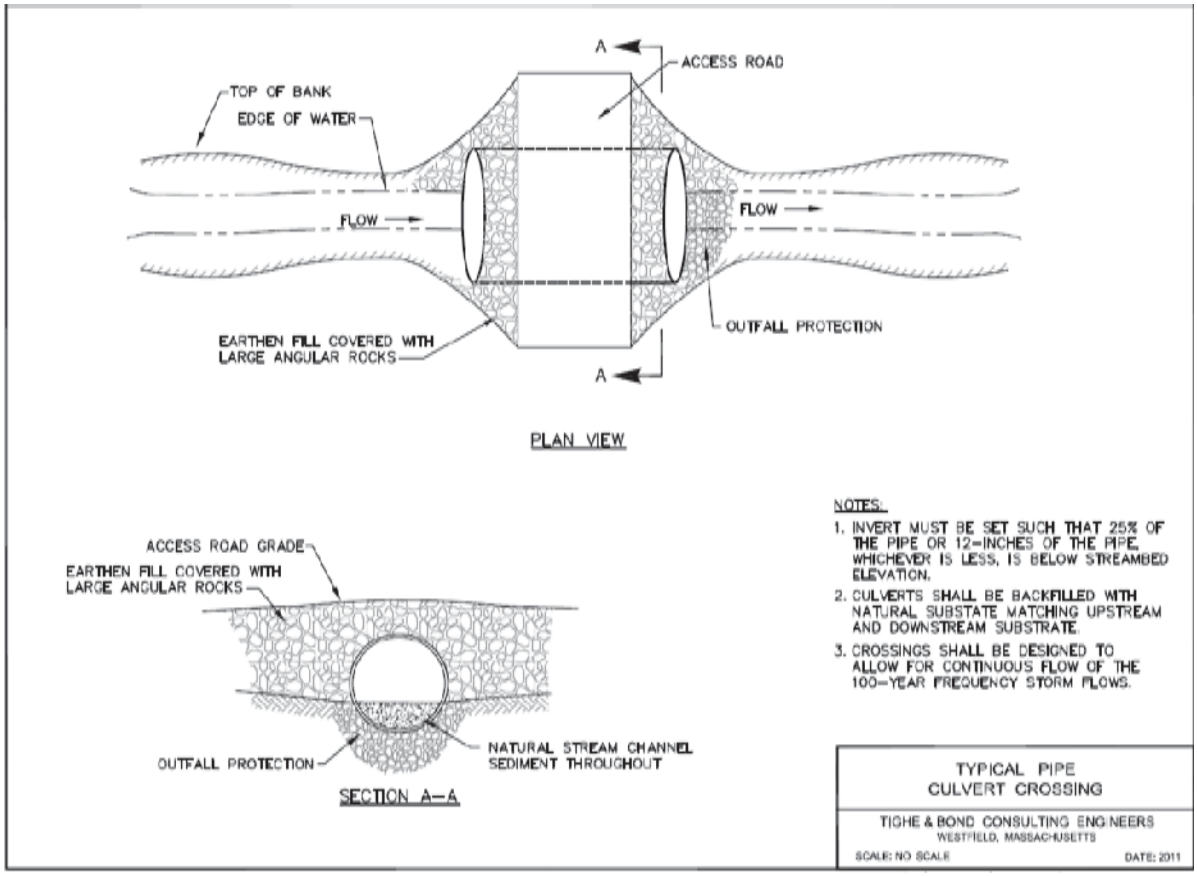
- Corrugated culverts are preferred as they slow the velocity of the water. Plastic pipes are preferred to metal.

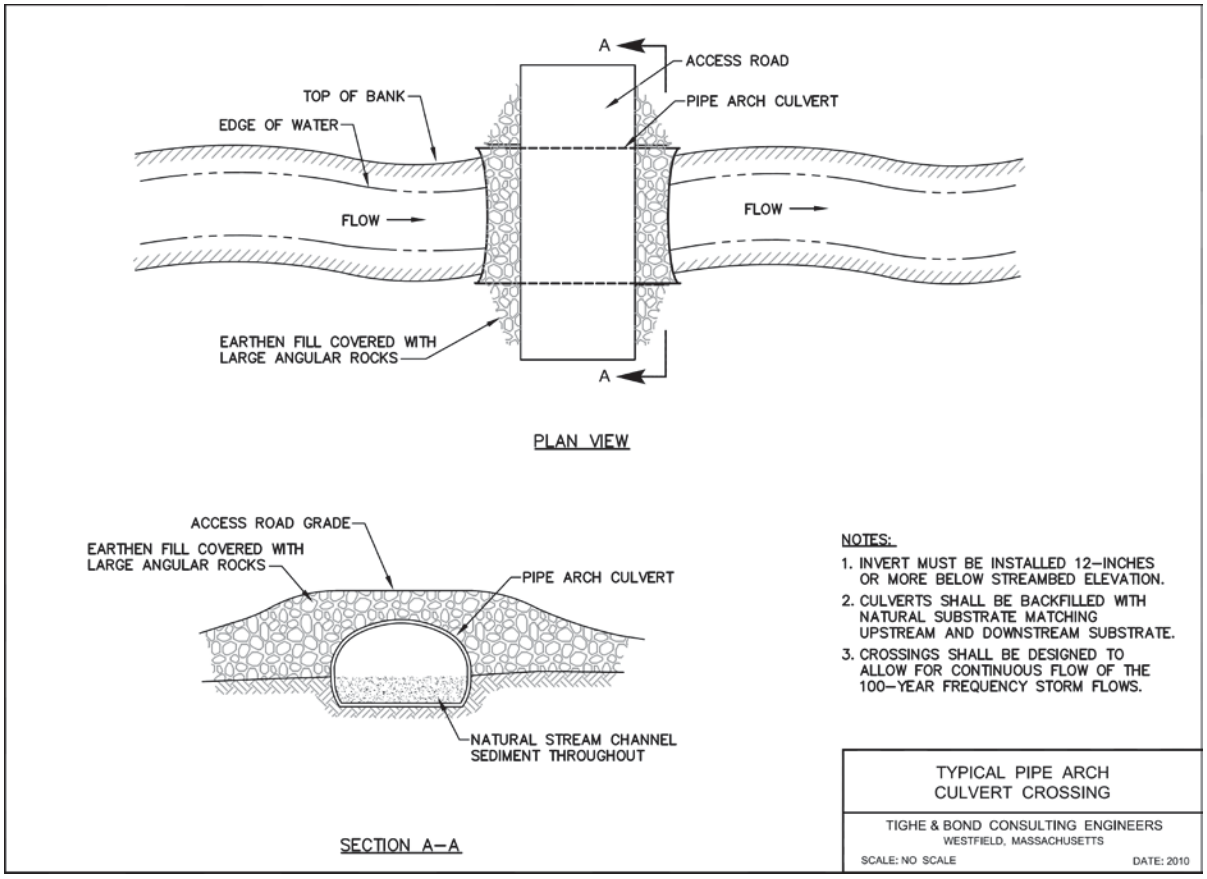
- Culvert length should be as short in length as possible. If the installed culvert extends too far into the natural stream bed it must be cut to size.

Culvert and riprap for stream crossing.

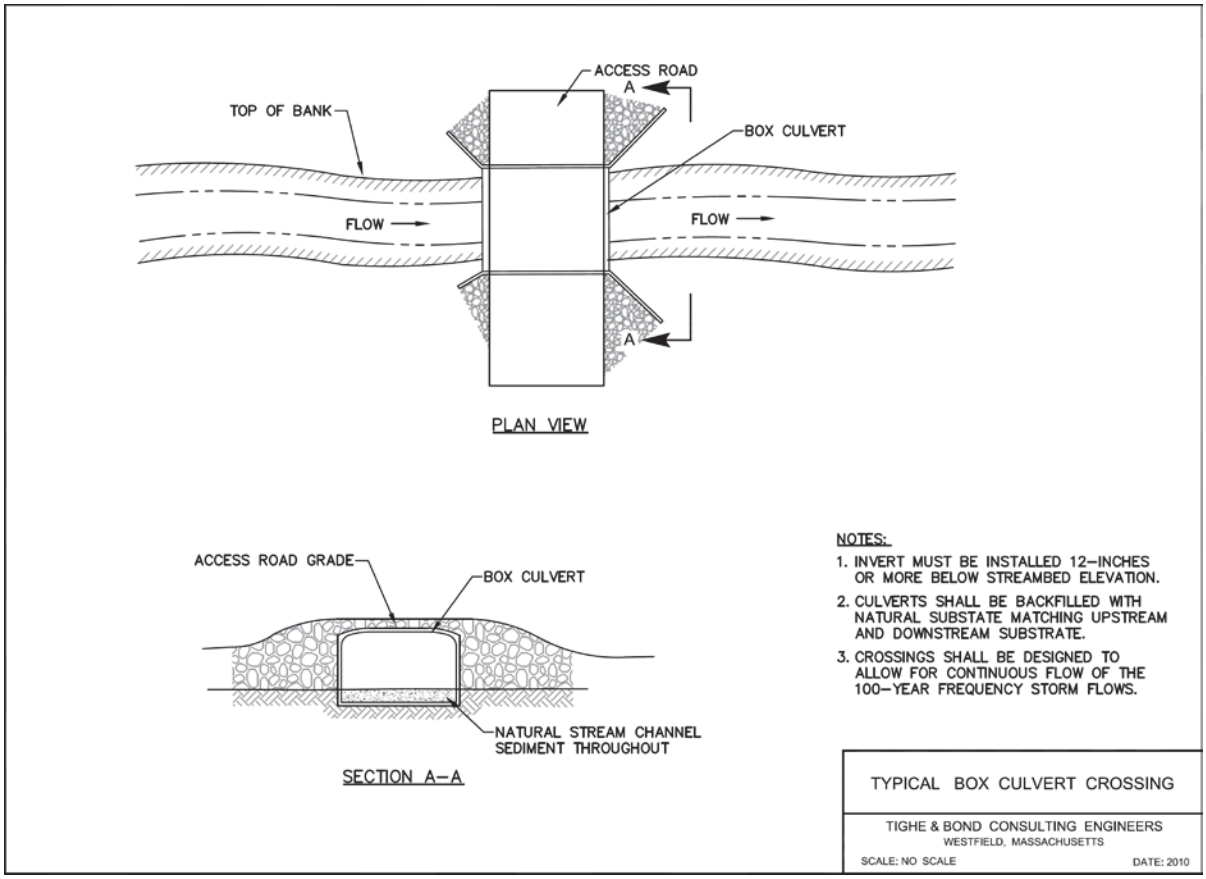


Installing a pipe culvert.


A
ACCESS ROAD
TOP OF BANK
EDGE OF WATER
FLOW
FLOW
OUTFALL PROTECTION
EARTHEN FILL COVERED WITH
LARGE ANGULAR ROCKS
A
PLAN VIEW
ACCESS ROAD GRADE
EARTHEN FILL COVERED WITH
LARGE ANGULAR ROCKS
OUTFALL PROTECTION
NATURAL STREAM CHANNEL
SEDIMENT THROUGHOUT
SECTION A–A
NOTES:
1. INVERT MUST BE SET SUCH THAT 25% OF THE PIPE OR 12-INCHES OF THE PIPE, WHICHEVER IS LESS, IS BELOW STREAMBED ELEVATION.
2. CULVERTS SHALL BE BACKFILLED WITH NATURAL SUBSTATE MATCHING UPSTREAM AND DOWNSTREAM SUBSTRATE.
3. CROSSINGS SHALL BE DESIGNED TO ALLOW FOR CONTINUOUS FLOW OF THE 100-YEAR FREQUENCY STORM FLOWS.
TYPICAL PIPE
CULVERT CROSSING
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NO SCALE
DATE: 2011



Embedded box culvert with wing walls.


ACCESS ROAD
A
TOP OF BANK
BOX CULVERT
FLOW
FLOW
A
PLAN VIEW
ACCESS ROAD GRADE
BOX CULVERT
NATURAL STREAM CHANNEL
SEDIMENT THROUGHOUT
SECTION A–A
NOTES:
1. INVERT MUST BE INSTALLED 12–INCHES OR MORE BELOW STREAMBED ELEVATION.
2. CULVERTS SHALL BE BACKFILLED WITH NATURAL SUBSTATE MATCHING UPSTREAM AND DOWNSTREAM SUBSTRATE.
3. CROSSINGS SHALL BE DESIGNED TO ALLOW FOR CONTINUOUS FLOW OF THE 100–YEAR FREQUENCY STORM FLOWS.
TYPICAL BOX CULVERT CROSSING
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NO SCALE
DATE: 2010

TAB 3D

Poled Fords

Applications: Stream Crossings

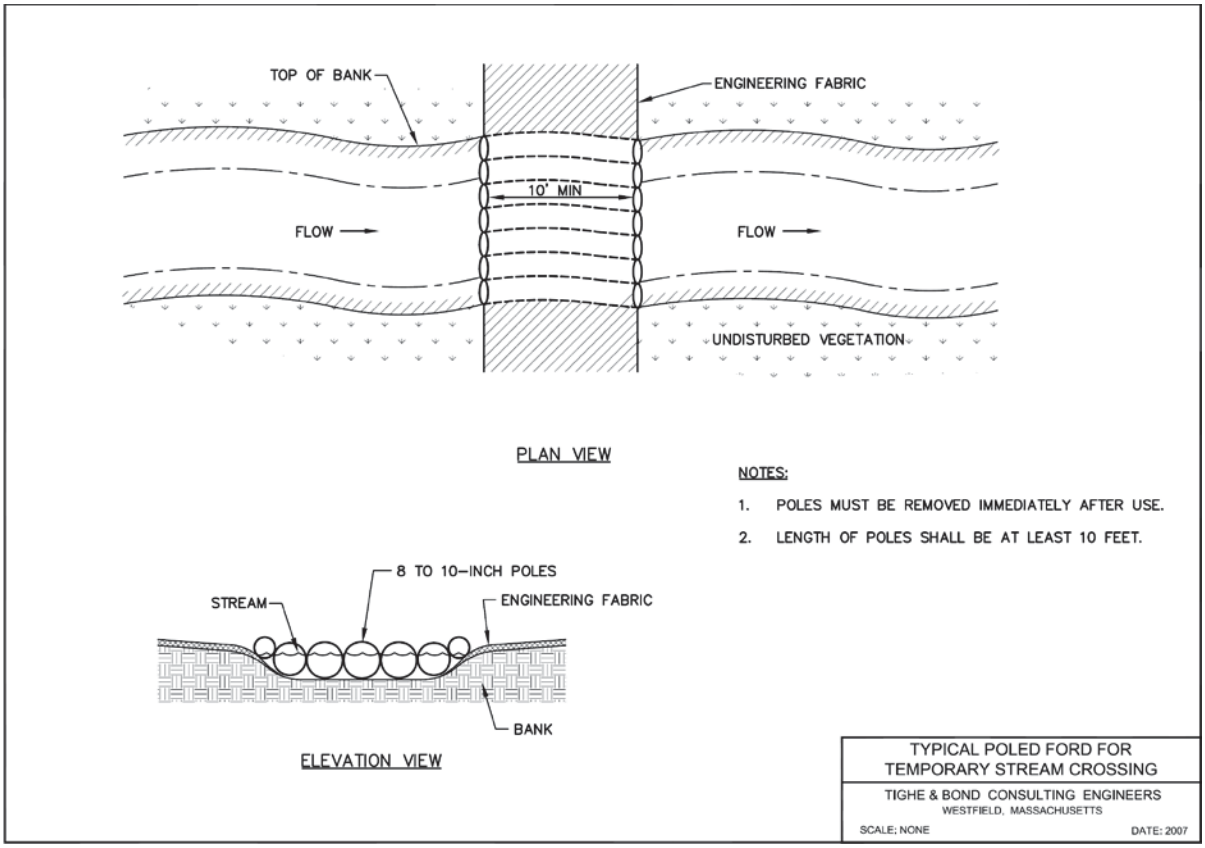
- Poled fords are typically used in remote locations where a stream crossing requires a functional BMP, but it is impractical to bring in such materials. In these situations wood poles or saw logs of sufficient length and diameter can be laid in the streambed parallel to the floor.

Limitations:

- Should be limited to streams with gently sloping adjacent land.

How to Use:

- The road should be gently sloping into and out of the stream at a maximum ration of 1:5 (V:H).
- Engineering fabric covered by an aggregate bed should be installed in the access road at the approach and exit, if necessary, to limit disturbance to the riparian area.
- Length of poles should be at least ten feet.
- Poles must be removed immediately after use.



3.2 Slope Excavation

Engineering designs may be required for any upland changes that could potentially direct or channel water across the face of a terrace escarpment slope. No snow or soil piles; construction materials; or equipment should be stored in the immediate vicinity at the top of a terrace escarpment slope.

3.3 Vegetation Removal

In constructing any stream crossing, care should be taken to limit disturbance to the extent practicable within 100 feet of the stream banks (the riparian area). The riparian area provides habitat to a number of species and provides protection and shading to the stream. It is also an area regulated by municipal Inland Wetlands and Watercourses Agencies.

Grubbing is not preferred as it results in considerable erosion and should be avoided to the extent feasible. Utilize grubbing only when all other methods cannot be used to prepare stable and safe work areas. If grubbing is necessary, the area must be covered with seed and mulch to protect it prior to the end of the work day. During mowing and trimming, large woody debris must not be placed in wetlands or watercourses. Mowing must be kept to a minimum, particularly at road crossings.

3.4 Work Pads

3.4.1 De-Energized and Energized

Applications: Work in wetlands

- Reconnaissance of each workpad area in or adjacent to wetlands should be performed to determine if the swamp mat workpad could be located outside of wetland resource areas. Wetland disturbances should be avoided or minimized where possible. Contact Transmission Siting and Permitting.

Limitations:

- Requires heavy machinery for installation;
- Significant amount of time required for installation and removal;
- Pads for live line work require a considerably larger footprint;
- Several layers of matting may be needed in deep, swampy areas;
- May not be suitable in deep/open water wetlands.

How to Use:

- Work at structures may require placement of swamp mats to provide safe and stable workpads for employees and contractors.
- Live line work, which is work that is done while the line is energized, requires a much larger workpad. Efforts should be made to stay out of wetland areas to the extent possible.
- Sizes of workpads vary based on the type of work being proposed.

- Workpads may extend into wetlands where structures that require maintenance fall within or in close proximity to these areas. Within these areas, untreated wooden swamp mats joined by galvanized steel bolts should be used to limit disturbance.
- Following construction activities all wooden mats at each workpad location and vehicle access location must be removed.
- Matting should be removed by "backing" out of the site, removing mats one at a time. Any rutting or significant indentations identified during mat removal should be regraded immediately, taking care not to compact soils.
- In areas with invasive species, plant material should be removed from matting following removal from the infested area to prevent the spread of invasive species.

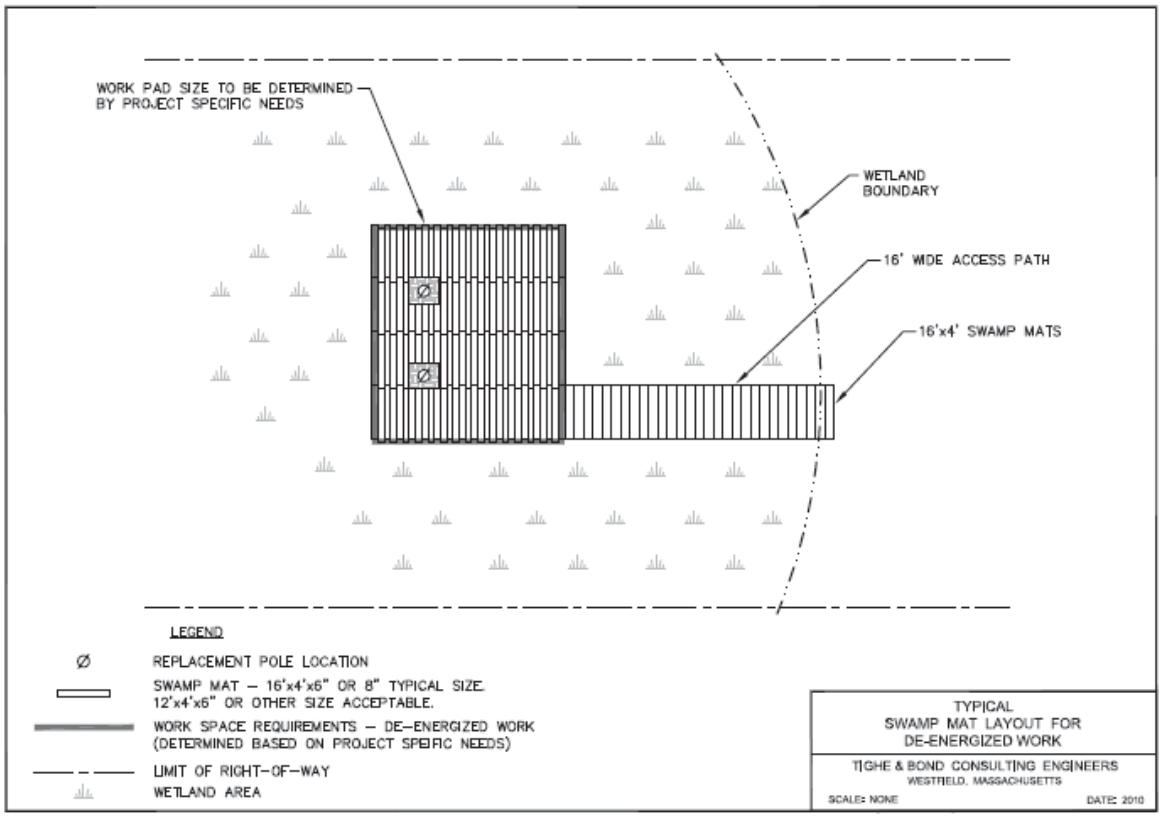
Best Management Practices

De-energized work requires small workpads, while live line work, which is work that is done while the line is energized, requires a much larger workpad.

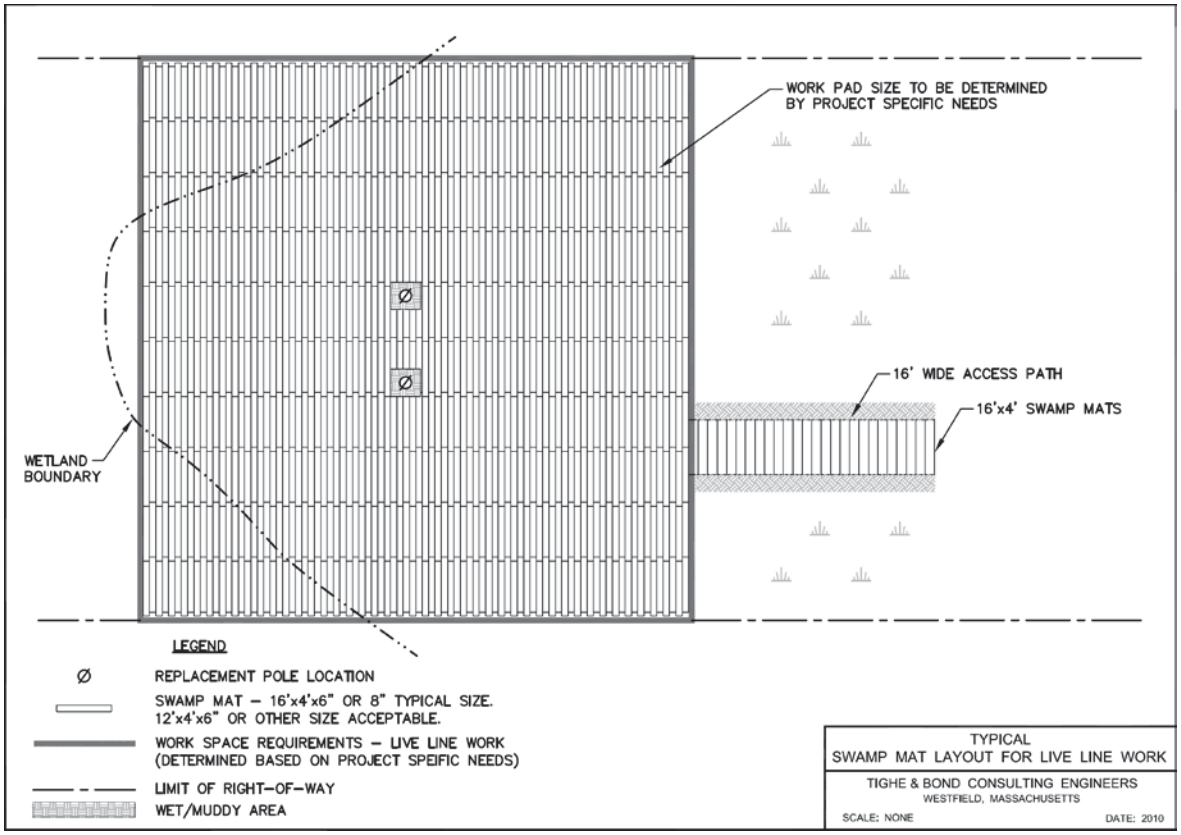
De-energized swamp mat workpads – Tab 4A

Energized swamp mat workpads – Tab 4B

TAB 4A


WORK PAD SIZE TO BE DETERMINED BY PROJECT SPECIFIC NEEDS
WETLAND BOUNDARY
16' WIDE ACCESS PATH
16'x4' SWAMP MATS
LEGEND
REPLACEMENT POLE LOCATION
SWAMP MAT – 16'x4'x6" OR 8" TYPICAL SIZE. 12'x4'x6" OR OTHER SIZE ACCEPTABLE.
WORK SPACE REQUIREMENTS – DE-ENERGIZED WORK (DETERMINED BASED ON PROJECT SPECIFIC NEEDS)
LIMIT OF RIGHT-OF-WAY
WETLAND AREA
TYPICAL SWAMP MAT LAYOUT FOR DE-ENERGIZED WORK
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2010

TAB 4B



Timber mat wetland work platform.

3.4 Structure-Related Work

3.4.1 Wetland

Structure-related activities that may occur in wetlands includes structure replacement/ installation (including casing installation), guy wire anchor installation, counterpoise installation, and pole butt removal. Access to these areas and completion of the activities can cause disturbance to wetland vegetation and soils. Therefore, structure-related activities in wetlands should entail use of adequate workpads and dewatering methods. Inspection of the construction access and associated dewatering measures should occur daily during construction to ensure that controls are in working order, and repairs to damaged/deteriorating controls are made immediately. Repairs may include regrading the traveled surface to eliminate ruts, as well as those repairs required by each erosion and sedimentation measure used.

Structure Replacement / Installation

Structure replacement may require "discharge of dredged or fill material" to install new poles and their casings. Poles that are significantly damaged must be replaced to comply with engineering and safety standards. Not replacing the structures could result in the eventual failure of one or more structures within or adjacent to wetlands and waters of the U.S.

The replacement structures will often be replaced within a few feet of the original structure to maintain the required distances and line sags between other existing structures. Therefore, options for relocating proposed replacement structures are limited. Pole replacement will also require placement of swamp mats in wetlands to provide a safe workpad for the required structure replacement activities. There are no alternatives to conduct this work from nearby upland areas or to install the replacement structures in upland areas. Each structure replacement area should be assessed to determine the required footprint needed for swamp mat workpads.

- At each pole location, remove wetland topsoil with an excavator and stockpile.
- A borehole is then drilled with a truck-mounted auger. Spoils from the drilling are collected and disposed in an upland area.
- A galvanized steel casing up to 48" in diameter and 12' long is then driven into place at least 12" below the ground surface. The new pole is installed within the casing with a crane and backfilled/compacted with crushed rock.
- Stockpiled wetland topsoil is then placed above the casing to the ground surface. No net fill in wetlands occur, as the original poles are removed.
- Following installation of the new structures, the old structures are removed. Each pole is cut with a chainsaw and allowed to fall to the ground, which in wetland areas is protected by swamp mats. Pole butts will remain in place if removing the pole butt will cause more damage than if left in place.
- Remove the pole and all appurtenant accessories (i.e. cross-arms, insulators, etc.) and properly dispose off-site. Remove each pole butt by pulling with an excavator positioned on a swamp mat. If it is apparent that pole removal will compromise the integrity of the new pole installation, or that removal will result in additional disturbance to wetland areas, cut off the old pole at least 12 inches below ground level.

Guy Wire Anchor Installation

There are two types of anchors: 1) screw type and 2) plate type. The screw type anchor is preferred over the plate type anchor because installation results in less disturbance to the wetland.

- Guy wire anchors supporting the structures may also require replacing. The guy wires provide extra stability and support for the associated structures.
- Load test the existing anchor to 15,000 pounds to determine whether it will support the pole structure. In the event the existing anchor cannot be re-used, remove it and install a new anchor.
- Screw in place a special triple helix ("screw type") anchor with 1 ½-inch square rods with an anchor installation rig operated from the matting area. Add rod sections in five foot increments as needed until proper holding capacity of the anchor is achieved.
- Since the anchors are turned into the ground, with only the rods protruding, disturbance to the wetland is minimal, and likely not noticeable. In the event that proper holding cannot be achieved with the screw anchor, install a plate anchor. Excavate the plate anchor to a sufficient depth and if necessary install a concrete footing several feet below surface grade.
- Set the anchor and backfill with native material.
- Segregate the top 12" of wetland topsoil during removal and replace on the surface following backfilling of underlying materials.

Counterpoise Installation/Grounding

To install grounding equipment in wetlands, use hand digging or minimally invasive methods to dig around the structure and restore soil to previous grades. In some cases grounding rods can be driven directly into the ground with hand tools. Where work is occurring in the vicinity of wetland areas, sedimentation and erosion controls will be used to limit disturbance to wetlands.

Underground facility repair/replacement

Underground facilities such as cables and conduits may be present beneath wetland areas. In the event underground facilities require repair, BMPs are required for both access and construction. Swamp mats are used for access where warranted, and sedimentation and erosion controls are used to isolate the work area. During excavation activities, excavate wetland topsoil and store separately from subsurface soils. Dewatering is often required during excavation and repair activities.

An alternative to repairing a subsurface line by excavation would be to install a new line via trenching or horizontal directional drilling. The decision to use one of these alternatives is made on a case by case basis. Consult with Siting and Permitting to determine if any permits will be needed.

Pole Butt Removal

When transmission poles are decommissioned or otherwise taken out of service, the entire pole shall be removed. Treated wood pole butts shall be removed completely from the ground and properly disposed at an off-site location. Locations where the

removal of pole butts may cause significant disturbance will be considered for exception to this practice on a site-by-site basis. The Transmission Line Maintenance Manager will be responsible for determining if a pole butt can be removed if located in a sensitive area.

All holes left by pole butts must be backfilled and compacted with appropriate fill material consistent with native soils. Existing material on-site may be reused.

Disposal

Treated and non-treated wood products owned by the Transmission Group shall be stored in an area(s) designated by the Transmission Line Construction/Contract Field Services supervisor until collected by an approved disposal vendor.

3.5 Soil Stockpile Management

Some projects may involve excavation and stockpiling of soil. Stockpiles should be located outside sensitive areas to the extent practicable and managed to prevent erosion and sedimentation of adjacent areas. Typical measures include the installation of protective measures (e.g. siltation fence and/or haybales) around the perimeter of the stockpile. The stockpile must be seeded if left in place for more than 30 days. No snow or soil piles; construction materials; or equipment should be stored in the immediate vicinity at the top of a terrace escarpment slope.

When polluted/contaminated soil is encountered, it must be handled in accordance with the appropriate regulatory requirements. In addition to the measures discussed above, contaminated soils should be stockpiled on and covered by polyethylene sheeting. Sheeting used to cover the stockpile should be weighted down to prevent the wind migration of contaminated dust.

For soil stockpiles in substations, contact Transmission Siting and Permitting.

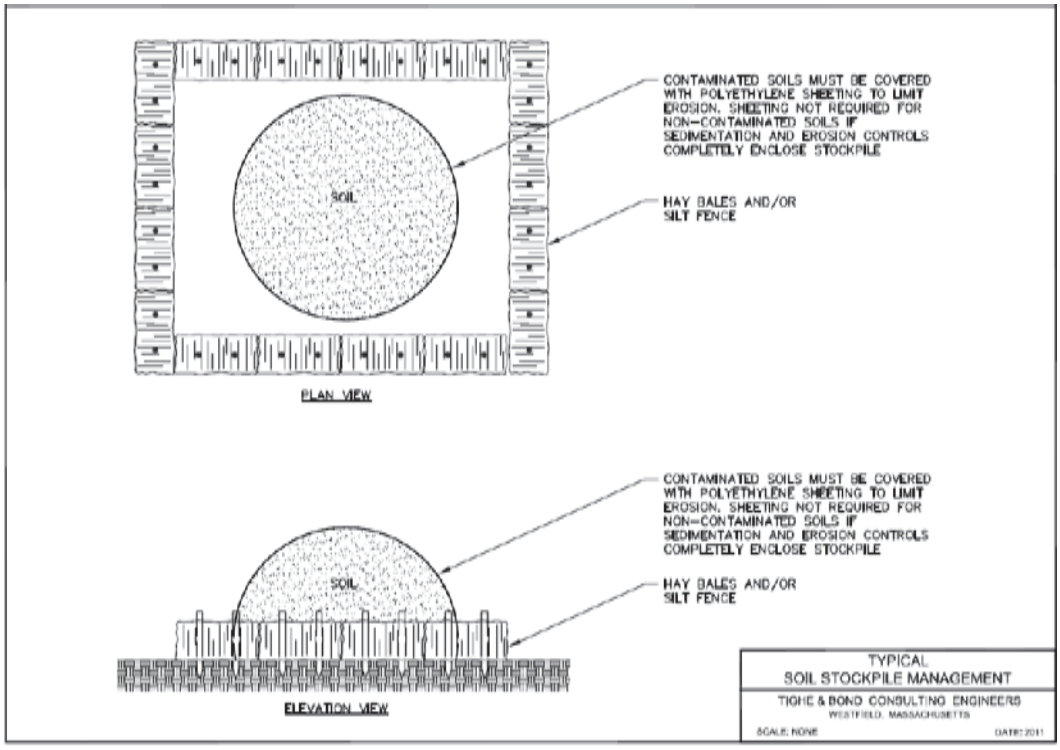
Best Management Practices

The following BMP is applicable to soil stockpile management and is described at the following tab:

Soil Stockpile Management – Tab 5A

TAB 5A

Soil stockpile management.



Section 4
Inspection and Maintenance

A pre-construction meeting will be held to discuss how often and who will be checking that all erosion and sedimentation controls are in working order. All BMP's will be inspected after major storm events (rainfall events greater than 0.25 inches) and on a weekly basis.

4.1 During Construction

Since construction sites and construction access roads are usually in constant use and undergoing continuous change, they should be closely monitored. Construction sites, construction access roads, and the associated erosion and sedimentation controls should be inspected by the person(s) designated at the pre-construction meeting, at the end of each day they are used, and any damage observed must be repaired immediately, at least within 48 hours of observation. If an access road is not used for more than a week, then inspection should occur at a frequency as required by the specific erosion and sedimentation measures in use, and number of heavy rain events. Repairs may include regrading and/or top dressing the traveled surface with additional aggregate to eliminate ruts as well as those repairs required by each erosion and sedimentation measure used.

All inspections will be documented and placed in the Transmission Siting and Permitting Inspection Database. Field supervisors have access to this database. For inspections done by third-parties, inspection forms will be stored in RIM.

4.1.1 Vehicle Storage

Unless permit conditions have been agreed to for larger, less mobile equipment such as drill rigs or large cranes, all storage and refueling of vehicles and other equipment must occur outside of and as far away as practical from sensitive areas such as wetlands, streams, and drinking water supplies. A proper location for refueling should be identified and designated before site work begins. The recommended minimum distance from wetland areas for storage of fuel and refueling is 100 feet, and the Water Quality Certification General Conditions require a minimum distance of 25 feet. Additionally, equipment should be checked regularly for evidence of leaks. Construction material storage should also be located at least 100 feet from wetlands. The Water Quality Certification General Conditions prohibit the storage of any materials at the site which are buoyant, hazardous, flammable, explosive, soluble, expansive, radioactive, or which could in the event of a flood be injurious to human, animal or plant life, below the elevation of the 500 year flood. Any other material or equipment stored at the site below this elevation must be firmly anchored, restrained or enclosed to prevent flotation. The quantity of fuel for equipment at the site stored below such elevation shall not exceed the quantity of fuel that is expected to be used by such equipment in one day.

4.1.2 Maintenance of E&S Controls

Spare erosion and sedimentation control materials such as hay/straw bales and silt fencing should be kept on site or readily available so they may be replaced if they become non-functional due to deterioration or damaged during a storm, extreme water or wind, or other unexpected event.

4.1.3 Spills

Spill kits consist of emergency cleanup and spill containment materials that can be used in the event of a fuel or other chemical spill. Spill kits must be kept on site and accessible at all times in case of an emergency spill. Such kits should generally contain multiple absorbent socks and/or pillows and wipes and temporary disposal bags. Follow the applicable NU Contractor Work Rules.

4.1.4 Post Construction

Post-construction inspections of restored areas will be conducted at regular intervals throughout the growing season, as required by any applicable permits, and/or after major storm events. Sites should be inspected for success or failure of revegetation, invasive species colonization, and erosion and sedimentation. In the event additional measures are required to achieve site restoration and stabilization, corrective actions shall be identified and implemented.

All information collected during inspections, regular maintenance, and repair procedures should be documented in written form. In addition, photographic or diagrammatic logs may be kept to help record certain events and for documentation of project progress and any noteworthy observations.

The construction work is not complete until all areas have been restored.

Section 5
Rehabilitation and Restoration

5.1 Restoration

At a minimum, all areas disturbed by construction, repair, and maintenance activities shall be restored to pre-construction conditions. Please refer to Appendix A Section I regarding photos and typicals for loaming, seeding and mulching. Minimize the extent and duration of soil exposure. Protect disturbed areas from stormwater runoff and stabilize as soon as possible.

5.1.1 Seed Mixes

Several different seed mixes are available for upland and wetland restoration. Chapter 5, Section 4 (Vegetative Soil Cover) of the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control provides a comprehensive summary of seed mixes for both temporary and permanent seeding of disturbed sites. This summary is provided in Appendix C. The Guidelines are available at the following website: http://www.ct.gov/dep/cwp/view.asp?A=2720&Q=325660.

Wetland Seed Mix. If the wetland vegetation is stressed upon removal of timber mats, a wetland seed mix shall be placed at a rate of 18 pounds per acre after regrading activities.

Wetland Plants. If significant grading or wetland alteration has occurred it may be advantageous to install new wetland plantings to restore a wetland area.

5.1.2 Upland

The following restoration techniques apply to restoration projects in upland areas.

- Soil excavated during construction and not used as backfill must be evenly spread onto disturbed areas to restore grades. Topsoil shall be stripped and separated to the greatest extent practical, for re-use. Permanent soil protection shall be provided for all areas disturbed by construction activities. All areas will be seeded. If areas cannot be seeded due to the time of year, then mulch (hay) is still required prior to the next precipitation event.
- Topsoil removed during construction activities will be replaced, seeded, and mulched.
- All seeded areas shall be treated with a layer of mulch (i.e. hay, but preferably straw) up to one inch thick to enhance moisture retention, dissipate disturbance from precipitation, and detract birds foraging on broadcast seed.
- Rehabilitation of access routes and other areas must be performed as soon as possible after construction is completed, including reestablishment of water bars or other BMPs to control erosion of the access road, and the removal and restoration of temporary wetland or waterway crossings.
    - Temporary breaks in construction activities may warrant seeding and mulching of disturbed areas as interim erosion control measures.
- Erosion control measures shall remain in place until soils are clearly stabilized.. Once soils are stable, erosion controls – especially silt fence, which presents an

obstacle to movement of small animals – shall be removed and properly disposed. Stakes should be removed from haybales and spread as mulch to remove barriers to wildlife movement.

- Straw may be used instead of hay, if preferred, to prevent spread of invasive plant species seed stock.

- If a grading operation at a site shall be suspended for a period of more than 29 consecutive days, the disturbed area shall be stabilized by seeding, mulching, and/or other appropriate means within the first 7 days of the suspension of grading.

- Within 7 days after a final grade is established in any grading operation the disturbed area shall be stabilized by seeding, loaming, and/or other appropriate means.

5.1.3 Wetland / Watercourses

Regrading of Ruts. Upon removal of timber mats, or other BMP, the wetland resource area should be inspected for rutting or disturbance from upland soils. Any rutting should be regraded to pre-existing contours and upland soils removed from wetland areas while taking care not to compact soils.

The following restoration techniques apply to restoration project in wetlands:

Maintenance, Repair, and Emergency Projects (When No Permit is Required)

- Soils excavated from wetland areas shall be segregated and stockpiled separately (i.e. topsoil/muck apart from mineral subsoil) in a dry/upland area to facilitate restoration activities at least 100 feet from wetland boundaries.
- Excavated wetland soils that have been stockpiled during underground utility installations within wetlands shall be replaced in the same order (i.e. mineral subsoil beneath organic topsoil/muck) to the extent practicable and restored to pre-disturbance grades.
    - Grading activities should include the elimination of ruts within the area to be restored.
- If replacement of soil associated with temporary wetland or watercourse crossings for access roads is necessary, disturbed areas must be restored to pre-disturbance grades, either seeded and mulched, or allowed to revegetate from the natural seed bank.
- Disturbed wetland areas shall generally be allowed to revegetate from the natural seed bank. Measures to discourage the establishment or spread of plant species identified as non-native, invasive species by federal or state agencies shall be considered. Transmission Siting and Permitting can evaluate whether to let the wetland vegetate naturally.
- Any restoration plantings or seed mixes used in restoration shall consist of species native to the project area and, if feasible, from local nursery stock (see Section 5.2).
- Any stream banks and beds damaged shall be restored through use of geotextile erosion control blankets, and or coir logs .

- All seeded areas shall be treated with a layer of mulch (i.e. hay, but preferably straw) up to one inch thick to enhance moisture retention, dissipate disturbance from precipitation, and detract songbirds foraging on broadcast seed.

- Matting should be removed by "backing" out of the site, removing mats one at a time (without dragging them). Any rutting or significant indentations identified during mat removal should be regraded immediately.

5.2 Limiting Access to Private Property

Access to and along the right-of-way over private property must be improved to the extent necessary to ensure suitable passage for construction equipment, provide erosion control, and maintenance of proper drainage. Upon completion of construction activities, altered areas must be restored to a condition equal to or better than before their use for the construction project. If access is over a property off the transmission easement, then it is the responsibility of a construction representative to determine if legal access rights are available to cross the property.

Tighe&Bond

APPENDIX A

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Adequate erosion and sedimentation control management measures shall be installed and properly maintained to reduce erosion and retain sediment on site during and after construction. These devices shall be capable of preventing erosion, collecting sediment (suspended and floating materials) and filtering fine sediment. Sediments collected by these devices shall be removed and placed in an upland location beyond buffer zones/upland review areas and any other regulatory setbacks preventing later migration into a waterway or wetland. Once work has been completed, all areas shall be stabilized with erosion control blankets and/or robust vegetation and erosion control devices shall then be removed. Erosion and sedimentation controls are provided in Section I of this Appendix. Note that stormwater management is an important part of erosion and sedimentation control. Accordingly, temporary stormwater management measures are outlined in Section II of this Appendix. Please refer to the below table for a complete list of BMP typicals and photos provided in this appendix.

Appendix A: Erosion / Sedimentation and Water Control Summary Table

Appendix A

Section I

Erosion / Sedimentation Controls

Hay (or Straw) Bales

Applications: Erosion control; mulch

Limitations:

- Haybales degrade quickly. Therefore, barriers should be checked often and replaced as needed. Additionally, sediment buildup must be routinely removed and disposed of in a stable upland area.
- Haybale height can provide an obstacle to movement of smaller wildlife
- Should not be used as a temporary check dam/ stormwater control within waterways
- Difficult to install during frozen conditions.
- Generally only effective for 3-6 months (hay) or 6-12 months (straw) before replacement

How to Use:

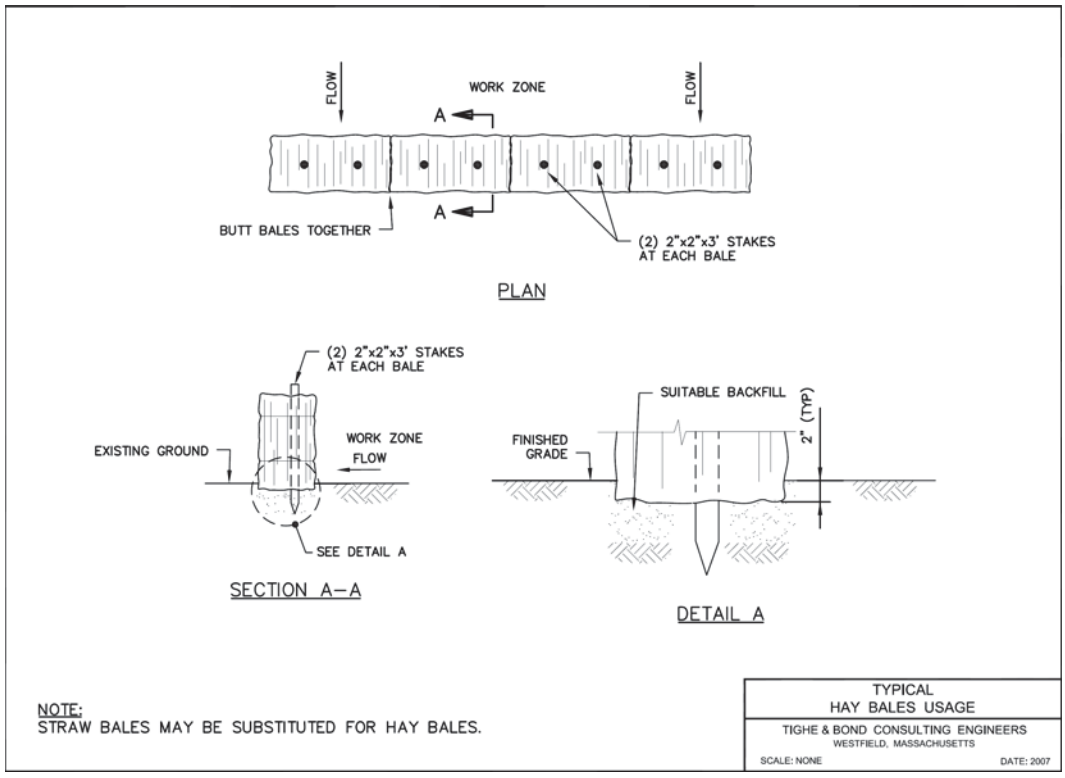
Straw bales are favored over hay bales for use as erosion control barriers. Since straw bales are composed of the dried stalks left over after a grain is harvested, they do not contain the plant's seeds and therefore will not spread growth of such species, some of which may be exotic, invasive or otherwise undesirable. Hay bales are generally less expensive, but consist of the seed heads and the upper, thinner portion of the stems which generally decay faster than straw.

Hay/straw bales should be placed end-to-end to form a temporary sedimentation control barrier. This barrier should run perpendicular to the slope and direction of runoff, and should be installed downgradient of the disturbed site (i.e., construction area). Hay/straw bales are intended to slow the velocity of flows and trap sediments behind them preventing siltation of sensitive areas – most specifically downgradient areas with open and/or flowing water. Once the project is complete and soils are stabilized with erosion control blankets and/or well-established vegetation, barriers should be removed.

- Install hay/straw bales end-to-end lengthwise along the toe of a slope or along a slope contour being sure the bales are butted tightly against each other without gaps between them. The outer ends of the barrier should be turned slightly upslope. If additional protection is needed, hay/straw bales can be set in a shallow trench and backfilled on the upslope and down-slope side to ensure better contact with the ground, so that sediment passage through or beneath them is further reduced.
- Each hay/straw bale should be staked into the ground by two stakes each approximately 3 feet long
- If a silt fence is being used with the hay/straw bale barrier, position the silt fence downgradient of the hay/straw bales (haybales filter first).

- Since hay/straw bales degrade quickly, barriers should be checked often and replaced as needed. In addition, sediment buildup should be routinely removed and disposed of in a stable upland area.
- The hay/straw bale barrier should be as far away from downgradient sensitive areas, and as close to the work areas as construction limitations allow, in order to minimize the total work area and disturb as little area as possible.
- Accumulated sediment should be removed and properly disposed outside sensitive areas when it has reached a thickness of ½ to ⅔ the height of the bale.
- Once the project is complete and soils are stabilized, hay/straw bales should generally be compacted and allowed to decay in place, as their height can provide an obstacle to movement of smaller wildlife. Spreading haybales around a site as mulch could introduce weed seeds. Using hay/straw as mulch is not generally problematic if the site is already colonized by invasive species. Plastic bailing twine should be removed from hay/straw bales. Wooden stakes should also be removed.

Properly installed hay bale barrier with silt fence.



Silt Fence

Applications: Sedimentation control, work limits, temporary animal barrier, and slow flows on steep slopes.

Limitations:

- Frozen or rocky ground
- May prevent critical movements of sensitive wildlife species
- Disposal

How to Use:

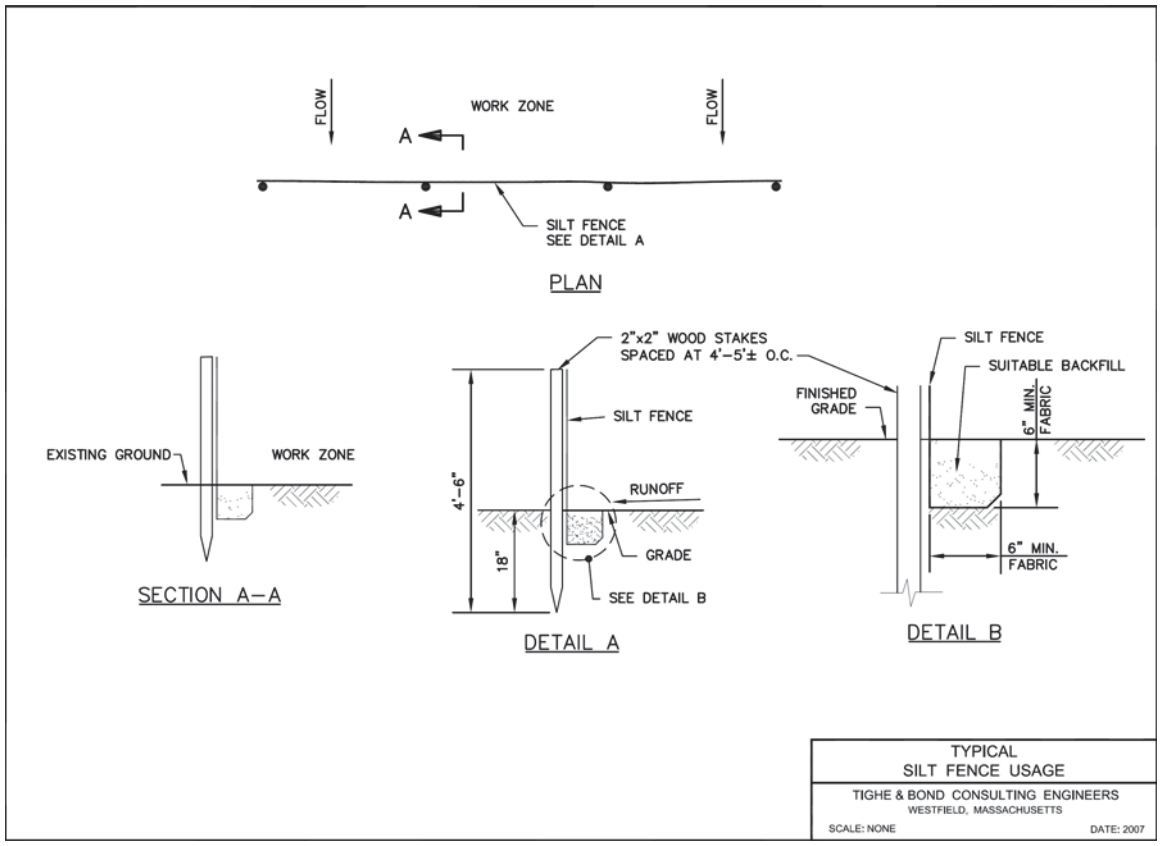
Silt fence is constructed of a permeable geotextile fabric secured by wooden stakes driven into the ground. It is installed as a temporary barrier to prevent sediments from flowing into an unprotected and/or sensitive area from a disturbed site. A silt fence should be installed downgradient of the work area. Once the project is complete and soils are stabilized, silt fence materials (i.e., geotextile fabric and wooden stakes) must be removed and properly disposed off-site (see environmental scientist to determine if area is stabilized).

- Install silt fence along the toe of a slope or along a fairly level contour with the outermost ends directed upslope. The fabric should be laid into a 6-inch wide by 6-inch deep trench dug on the upslope side of the fence and tamped down with fill material to ensure a sturdy base and so sediments will not flow beneath the fabric. Use of a Ditch Witch® or similar equipment is suggested for this task.
- The silt fence stakes should be driven into the ground until secure (≥6 inches below grade).
- If a hay bale or straw bale barrier is being used with the silt fence, position the silt fence downgradient of the bales.
- The silt fence should be as far away from down-gradient sensitive areas, and as close to the work areas as construction limitations allow, in order to disturb as little area as possible.

Silt fence should be inspected often and replaced or repaired as needed, especially during long-term projects. In addition, sediment buildup up should be routinely removed and properly disposed in a stable upland area. Sediment should be removed and properly disposed outside sensitive areas when it has accumulated to a thickness of ½ the height of the silt fence.

A silt fence must be installed in an excavated trench and must be located where shallow pools can form so sediment can settle, and the fence must be placed along the contour. If placed otherwise, water may concentrate to a low point and is likely to flow beneath the fence.

Properly installed and functioning silt fence. Direction of flow indicated by blue arrow.


FLOW
WORK ZONE
FLOW
A
A
SILT FENCE
SEE DETAIL A
PLAN
EXISTING GROUND
WORK ZONE
SECTION A–A
2"x2" WOOD STAKES
SPACED AT 4'–5'± O.C.
SILT FENCE
RUNOFF
GRADE
SEE DETAIL B
4'–6"
18"
DETAIL A
SILT FENCE
SUITABLE BACKFILL
FINISHED
GRADE
6" MIN.
FABRIC
6" MIN.
FABRIC
DETAIL B
TYPICAL
SILT FENCE USAGE
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2007

Erosion Control Blankets

Applications: Slope stabilization; erosion and sedimentation control

Limitations:

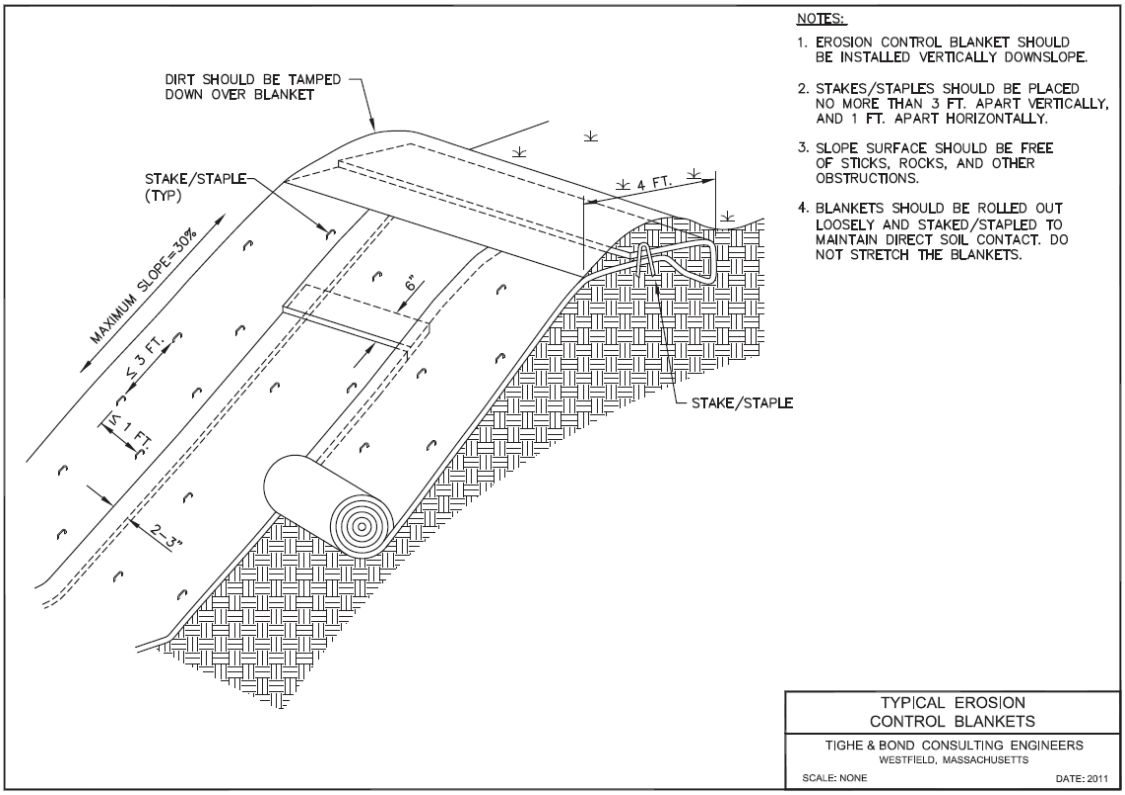
- Can be used on steep (i.e. greater than 45 degrees) slopes but not on rocky soils.
- Mulches may be more cost effective on flatter areas.

How to Use:

Erosion control blankets are generally composed of biodegradable or synthetic materials and are used as a temporary or permanent aid in the stabilization of disturbed soil on slopes. These blankets are used to prevent erosion, stabilize soils, and protect seeds from foragers while vegetation is recolonized. Representative erosion control blanket photos are included at the end of this Section.

- Always follow manufacturer's instructions for properly installing erosion control blankets. Different composition blankets are recommended for site-specific conditions (e.g. slope grades, contributing watershed areas) and use requirements (e.g. biodegradable, photodegradable, non-biodegradable).
- Prior to installation, the slope should be cleared of any rocks, branches, or other debris.
- Blankets should be rolled out in a downward direction starting at the highest point of installation and should be secured above the crest of the slope by a berm tamped down along the top of the disturbed area.
- Blankets should be tacked down with stakes or staples every 11 to 12 inches (or closer) horizontally and every 3 feet (or closer) vertically. Biodegrable staples are preferred.

Each section of the blanket should overlap the next section horizontally by approximately 2 or 3 inches. Vertical overlaps should be approximately 6 inches, with the upslope section overlaying that of the down-slope section.


DIRT SHOULD BE TAMPED DOWN OVER BLANKET
STAKE/STAPLE (TYP)
MAXIMUM SLOPE=30%
≤ 3 FT.
1 FT.
2"-3"
4 FT.
6"
STAKE/STAPLE
NOTES:
1. EROSION CONTROL BLANKET SHOULD BE INSTALLED VERTICALLY DOWNSLOPE.
2. STAKES/STAPLES SHOULD BE PLACED NO MORE THAN 3 FT. APART VERTICALLY, AND 1 FT. APART HORIZONTALLY.
3. SLOPE SURFACE SHOULD BE FREE OF STICKS, ROCKS, AND OTHER OBSTRUCTIONS.
4. BLANKETS SHOULD BE ROLLED OUT LOOSELY AND STAKED/STAPLED TO MAINTAIN DIRECT SOIL CONTACT. DO NOT STRETCH THE BLANKETS.
TYPICAL EROSION CONTROL BLANKETS
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2011

Straw Wattles

Applications: Erosion and sedimentation control; work limits

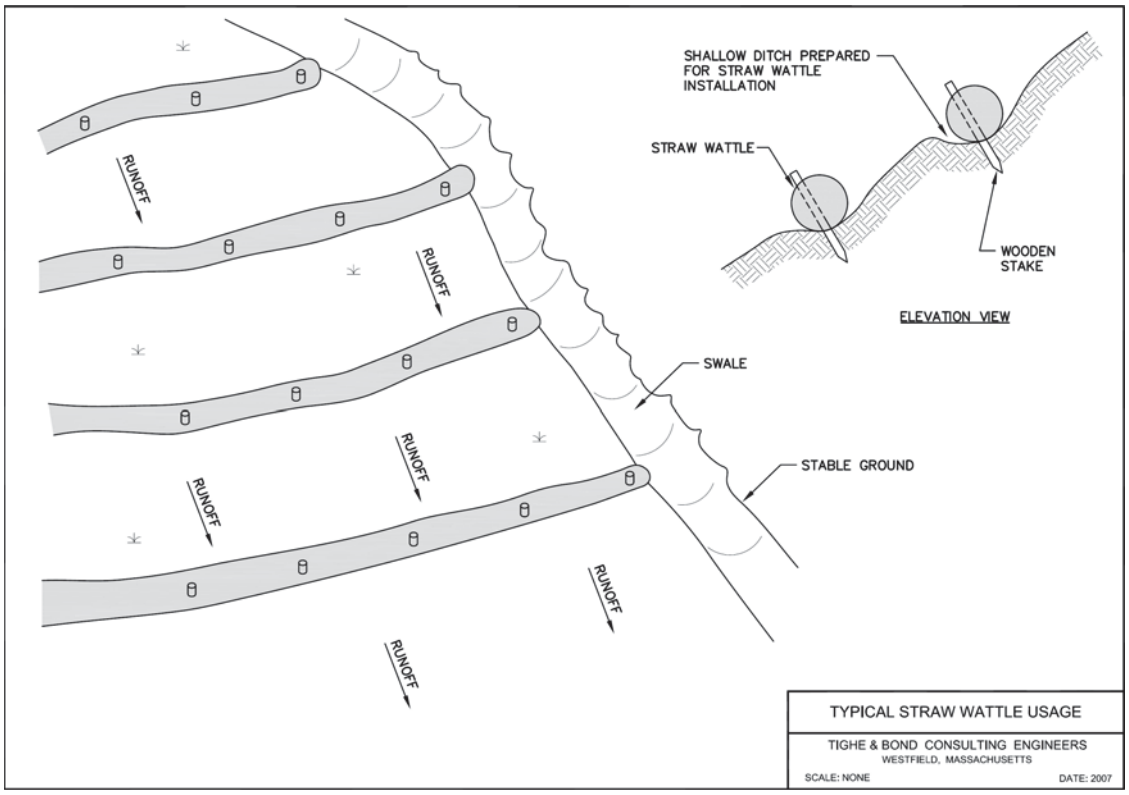
Limitations:

- Not recommended for steep slopes.

How to Use:

Straw wattles are used as an erosion control device to slow runoff velocities, entrain suspended sediments, and also promote vegetation growth until an area is stabilized. They are not generally intended for steep slopes, but rather, to stabilize low to moderate grades where there is a broad area of disturbance. They should be placed lengthwise, perpendicular to the direction of runoff. Straw wattles may also be used along small stream banks to protect areas before vegetation has stabilized the soils. The wattles are constructed from a biodegradable netting sock stuffed with straw and may be left to biodegrade in place once a project is complete.

- The spacing of each row of wattles on a slope depends on the angle of the slope, and typically ranges from about 10 to 40 feet apart. Additionally, the texture of the soil should also be taken into consideration – for soft, loamy soils, wattles should be placed closer together; for coarse, rocky soils, they may be placed further apart.
- The ends of each row of wattles on a slope should be slightly turned downhill to prevent ponding behind them.
- Where straw wattles are installed end-to-end, the wattles should be butted tightly together so as not to allow water/sediments to flow between them.
- Straw wattles should be placed in a shallow trench to assure stabilization and soil should be packed against the wattle on the uphill side.
- Straw wattles should be staked securely to the ground by driving a stake directly through the wattle approximately every four feet. A portion of each stake should remain approximately 2 to 3 inches above the wattle.


SHALLOW DITCH PREPARED FOR STRAW WATTLE INSTALLATION
STRAW WATTLE
WOODEN STAKE
ELEVATION VIEW
RUNOFF
SWALE
STABLE GROUND
TYPICAL STRAW WATTLE USAGE
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2007

Wood Chip Bags

Applications: Erosion and sedimentation control; mulch

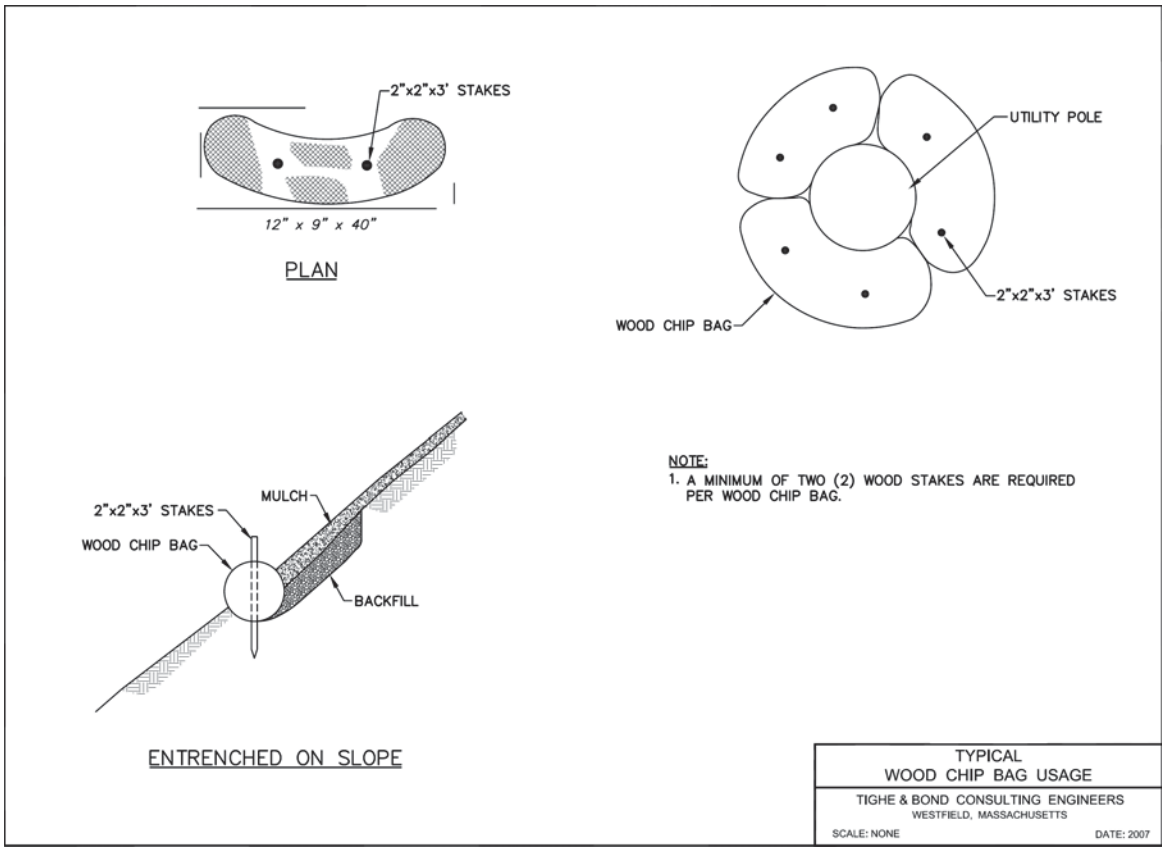
Limitations:

- Frozen ground or rocky ground (for installing stakes).
- Can pose a barrier to small animal movements.
- Requires close attention for maintenance and repair.
- Remove accumulated sediment when it reaches two thirds the height of the bag.

How to Use:

- Install wood chip bags end-to-end lengthwise in a single row, lengthwise along the toe of a slope or along a slope contour being sure the bags are butted tightly against each other without gaps between them.
- Wood chip bags can stabilize soils in a number of applications. They may be left in place as they eventually photo-degrade, as long as they do not pose a barrier to small animal movements.
- Each hay/straw bale should be staked into the ground by two stakes each approximately 3 feet long

Wood chips in photo-degradable bags used to stabilize soils.


2"x2"x3' STAKES
12" x 9" x 40"
PLAN
UTILITY POLE
2"x2"x3' STAKES
WOOD CHIP BAG
2"x2"x3' STAKES
MULCH
WOOD CHIP BAG
BACKFILL
ENTRENCHED ON SLOPE
NOTE:
1. A MINIMUM OF TWO (2) WOOD STAKES ARE REQUIRED PER WOOD CHIP BAG.
TYPICAL
WOOD CHIP BAG USAGE
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2007

Inlet Catch Basin Sediment Filter

Applications: Erosion and sedimentation control

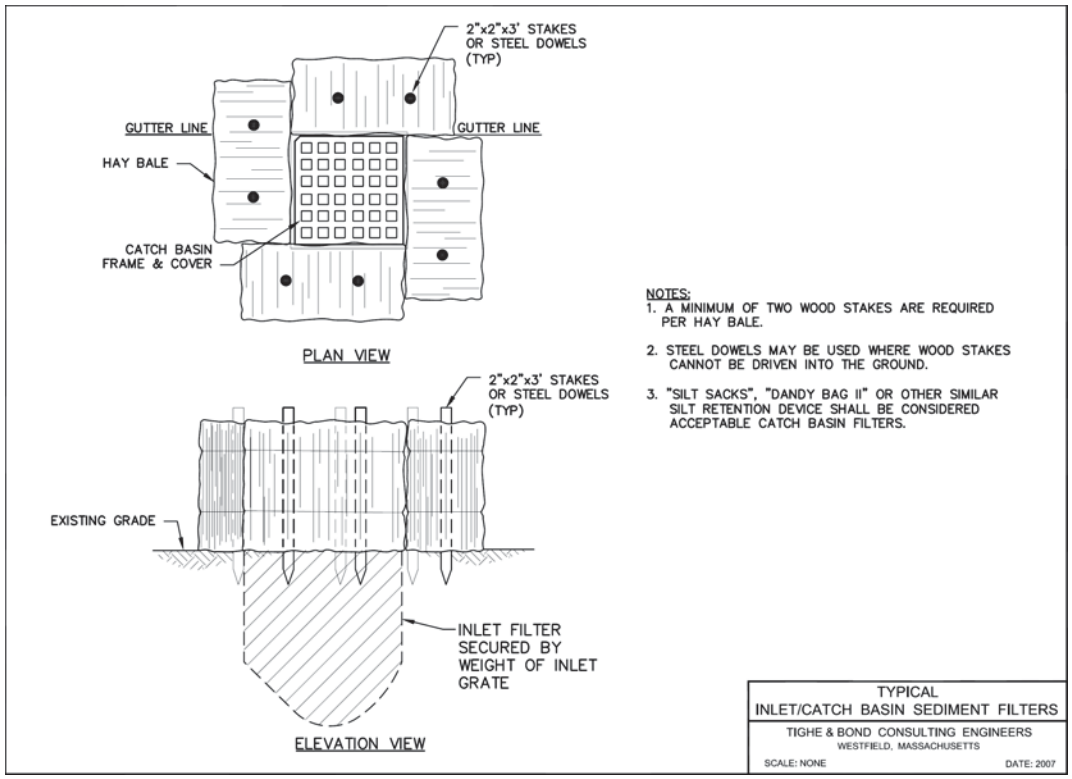
Limitations:

- Ineffective for very silty water
- May require authorization from local government for discharge to municipal system
- Fabric drop inlet should be used where stormwater runoff velocities are low and where the inlet drains a small, nearly level area.
- Undercutting and erosion under filter fabric if fabric is not buried at bottom.

How to Use:

- Installation is similar to perimeter hay/straw bale barriers.
- Hay/straw bales should be installed in a box configuration around the drop inlet and the ends of the bales should be placed tightly against each other.
- If the area is unpaved, anchor bales using two stakes driven through the bale and into the ground.
- Hay bales can be placed around the perimeter of the inlet in order to extend the life of the filter by removing much of the sediment before-hand.
- Discharge of clean water into municipal system catch basins may be an option for certain sites. However, this activity must be coordinated with the municipality and shall not occur without their written consent.
- To protect catch basins from excessive sediment, filters can be installed into the basin that are specifically designed for this purpose.
- In cases of curb drop inlets, additional protective measures (e.g. filter sock, gutter buddy) should be utilized in conjunction with a silt sack.
- Avoid setting top of fabric too high, which will lead to flow bypassing the inlet.
- Inspect and remove accumulated sediment on a regular basis.
- Remove after area is permanently stabilized.

Catchbasin protected from sedimentation by filter fabric.


2"x2"x3' STAKES
OR STEEL DOWELS
(TYP)
GUTTER LINE
GUTTER LINE
HAY BALE
CATCH BASIN
FRAME & COVER
PLAN VIEW
2"x2"x3' STAKES
OR STEEL DOWELS
(TYP)
EXISTING GRADE
INLET FILTER
SECURED BY
WEIGHT OF INLET
GRATE
ELEVATION VIEW
NOTES:
1. A MINIMUM OF TWO WOOD STAKES ARE REQUIRED PER HAY BALE.
2. STEEL DOWELS MAY BE USED WHERE WOOD STAKES CANNOT BE DRIVEN INTO THE GROUND.
3. "SILT SACKS", "DANDY BAG II" OR OTHER SIMILAR SILT RETENTION DEVICE SHALL BE CONSIDERED ACCEPTABLE CATCH BASIN FILTERS.
TYPICAL
INLET/CATCH BASIN SEDIMENT FILTERS
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2007

Temporary Sedimentation Basin

Applications: Erosion and sedimentation control

- Used to filter and settle out sediment in stormwater runoff before water is released into a wetland or other unprotected and/or sensitive area and may be used for drainage areas of various sizes.

Limitations:

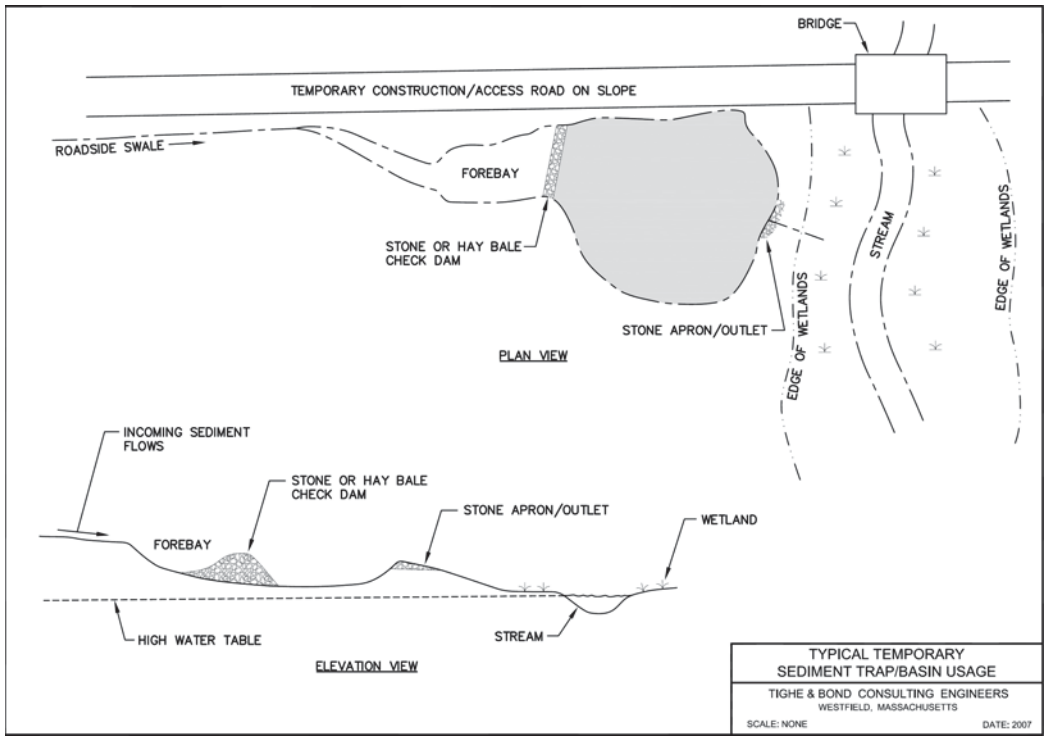
- Needs to be adequately sized based on expected rain events and the contributing drainage area.

How to Use:

- Direct stormwater runoff to sedimentation basins. Basin formed by excavating a depression similar to a small pond, or placing an earthen embankment across an existing drainage swale or naturally low area.
- 9:1 (L:W) ratio is recommended. The ratio between the basin length and width should be greater than 3:1.
- Clear, grub and strip all vegetation and root material from area of embankment and place embankment fill in lifts, 9 inches per lift at maximum. Compact fill and construct side slopes 2:1 or flatter. Excavate rectangular outlet section from compacted embankment.
- Filter fabric can be installed on bottom and sides of basin, and covered by riprap.
- Extend outlet apron/spillway below toe of dam on level grade until stable conditions are reached (5 feet minimum). Cover inside face of stone outlet section with a 1-foot layer of ½ to ¼ inch aggregate. Vegetate embankments, spillways and disturbed areas down gradient of the basin, either with permanent or temporary seeding.
- Monitor the amount of sedimentation in the basin. Inspect after every rain event and maintain as needed, including removing accumulated sediment, repairing erosion and piping holes, cleaning or replacing the spillway gravel, and re-seeding or planting vegetation.
- Should ideally consist of a forebay where debris and some sediment begins to settle out of the water; a check dam constructed of stone or hay bales which water must flow through, filtering out more sediments; and the actual sediment basin, which is a pool with a slow enough velocity that sediments have time to settle out of the water column before the water flows over the dam at the outlet and is released.
- Sediment basins should be sized to provide a minimum of 12 to 24 hours of detention to maximum expected runoff amounts for the duration of the basin's use.
- Often a critical stormwater management component for larger construction sites, and/or those with poorly drained upland soils.
- Construction of temporary sediment basins should occur before primary construction on a project begins.

- If compatible with the eventual (post-construction) site use, it may be appropriate to leave sediment basins in place indefinitely.

Sedimentation basin with haybale filters.



Loaming and Seeding

Applications: Erosion control, site restoration

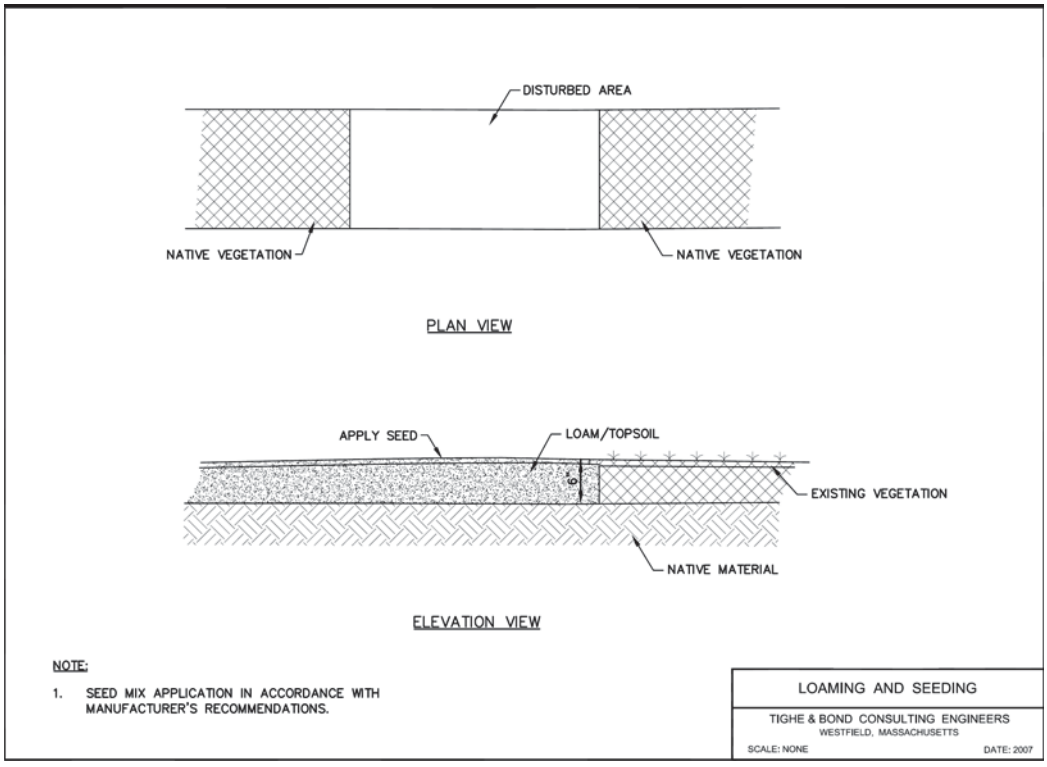
Limitations:

- May be site specific limitations (e.g. permit or State requirements); otherwise none.
- Applies to upland areas only.

How to Use:

- Permanent seeding is appropriate for vegetated swales, steep slopes, or filter strips. Temporary seeding is appropriate if construction has ceased and if an area will be exposed.
- Apply loam/topsoil prior to spreading seed mix per manufacturer's recommendations. Apply water, fertilizer and mulch as needed to seedbed.
- Plant native species of grasses and legumes where possible.
- Inspect on regular basis until vegetation has established.
- If appropriate, repair surface, re-seed, re-mulch and install new netting if washout or erosion occurs.
- Follow permit requirements regarding use of wetland seed mix in wetlands where required.

Loaming and seeding of recently disturbed right-of-way.



Mulching with Hay/Straw/Woodchips

Applications: Erosion control; site restoration

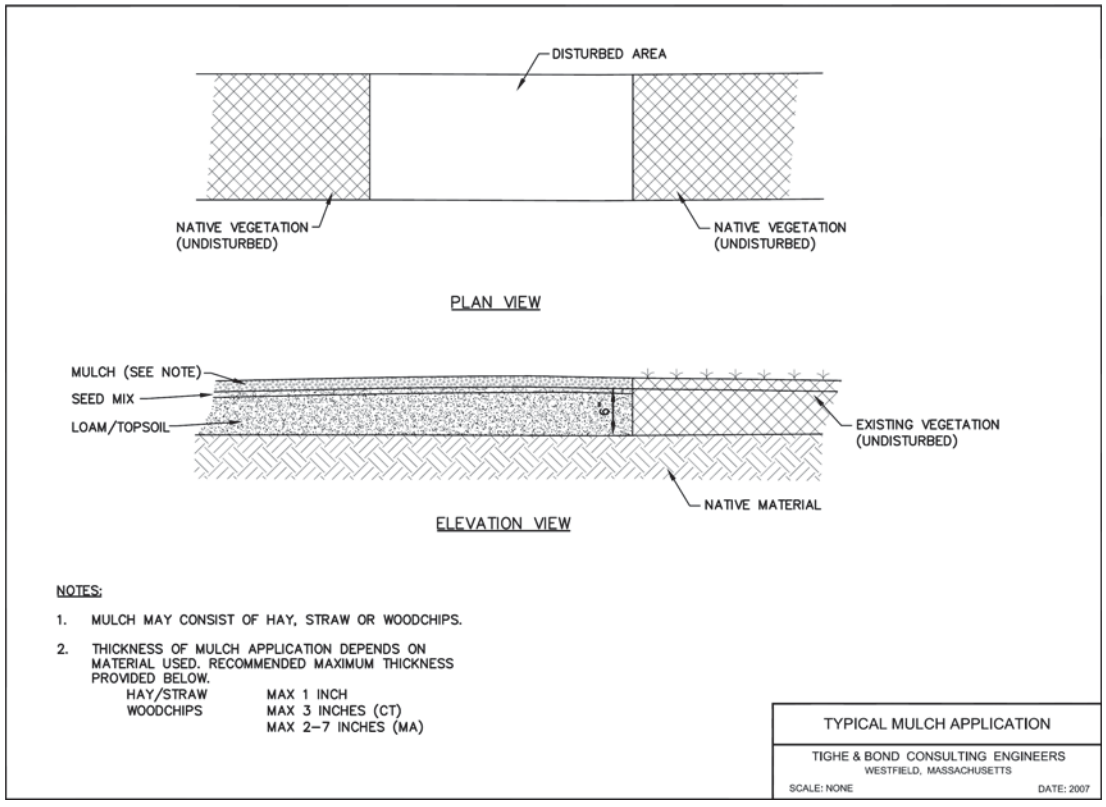
Limitations:

- May be site specific limitations (e.g. permit or State requirements); otherwise none.
- Applies to upland areas only.
- Thick mulch may prevent seed germinations.
- Mulch on steep slopes must be secured with netting to prevent it from being washed away.

How to Use:

- Use in areas which have been temporarily or permanently seeded.
- Use mulch netting on slopes greater than 3% or in concentrated flows.
- Mulch prior to winter (ideally in mid summer).
- Note that application rates and technique depend on material used. Select mulch material based on soil type, site conditions and season. Straw/hay provides the densest cover if applied at the appropriate rate (at least ½ inch). and should be mechanically or chemically secured to the soil surface. Woodchip application can be less expensive if on-site materials are used.
- Inspect on regular basis until vegetation has established.
- If appropriate, repair surface, re-seed, re-mulch and install new netting if washout or erosion occurs.

Typical view of light mulching atop unstable, seeded soils.



Coir Log Use for Bank Stabilization

Applications: Bank stabilization; wetlands and watercourse restoration

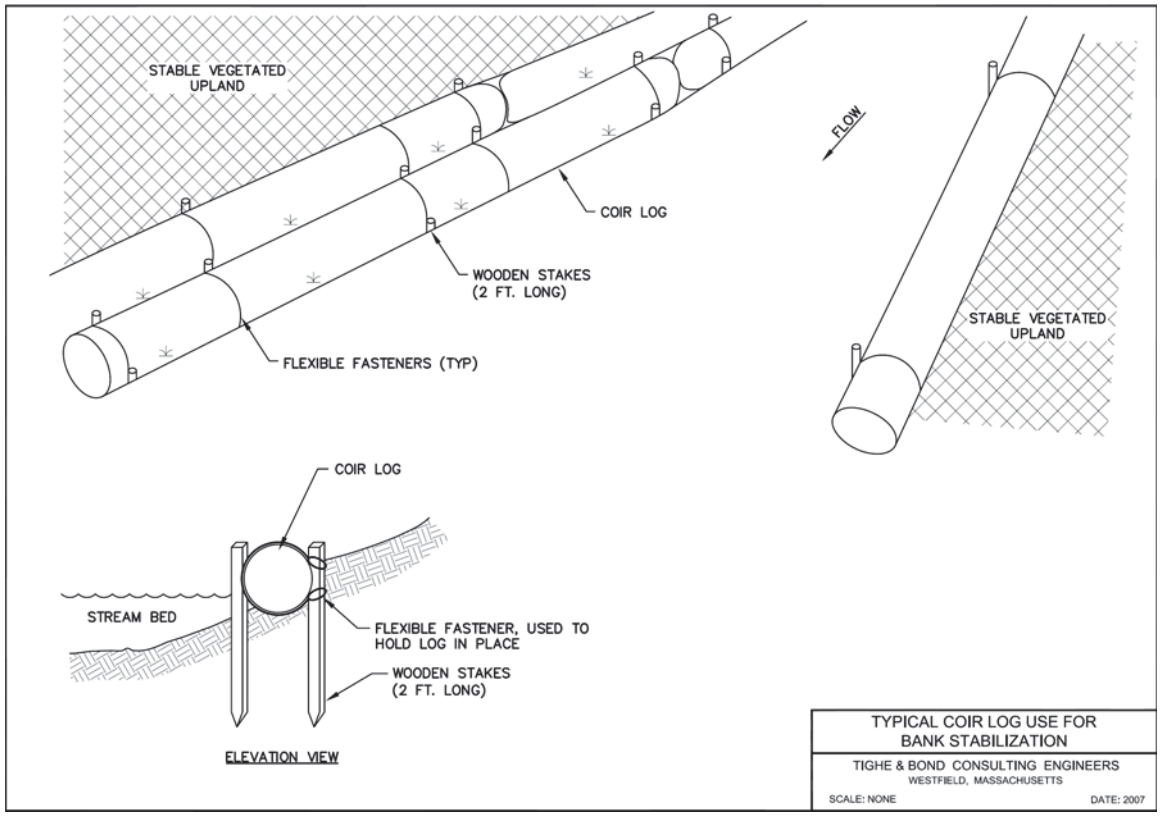
Limitations:

- Need to be installed with heavy machinery.

How to Use:

- Refer to permit requirements (if applicable) and manufacturer's specifications.
- Install along banks between upland and watercourse using wooden stakes (2 foot long) and flexible fasteners (to hold log in place).

Coir logs used to restore a stream bed and banks.


STABLE VEGETATED UPLAND
COIR LOG
WOODEN STAKES (2 FT. LONG)
FLEXIBLE FASTENERS (TYP)
FLOW
STABLE VEGETATED UPLAND
COIR LOG
STREAM BED
FLEXIBLE FASTENER, USED TO HOLD LOG IN PLACE
WOODEN STAKES (2 FT. LONG)
ELEVATION VIEW
TYPICAL COIR LOG USE FOR BANK STABILIZATION
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2007

Check dams

Applications: Stormwater management; erosion control

Limitations:

- Need to be adequately sized based on expected rain events

How to Use:

Check dams are structures placed across a drainageway to reduce the velocity of concentrated stormwater flows, thereby reducing erosion of the drainageway and/or to temporarily pond stormwater runoff to allow sediment in the water column to settle out. Permanent or long-term check dams are typically constructed of rip rap or other stone material. Short-term check dams can be constructed of rip rap. Staked haybales have been proven ineffective (sediment does not stay trapped).

- Place stone by hand or machine, making side slopes no steeper than 1:1 with a maximum height of 3 feet at the center of the check dam. A geotextile may be used under the stone to provide a stable foundation and/or to facilitate removal of the stone.
- The minimum height of the check dam shall be the flow depth of the drainageway, but shall not exceed 3 feet at the center.
- The width of the check dam shall span the full width of the drainageway, plus 18 inches on each side leaving the center of the check dam approximately 6 inches lower than the height of the outer edges.
- The maximum spacing between check dams shall be such that the toe of the upstream check dam is at the same elevation as the top of the center of the downstream check dam.
- For permanent stone check dams, inspect and maintain the check dam in accordance with the standards and specifications provided in the design for the site.
- For temporary check dams, inspect at least once per week and within 24 hours of the end of a precipitation event of 0.5 inches or more to determine maintenance needs.
- Maintenance may include, but are not limited to, the replacement of stone, repair of erosion around or under the structure, and/or the removal and proper disposal of accumulated sediment.

Stone check dams at construction site.

Stone check dam at construction site.

Appendix A

Section II

Water Control

Several methods exist for temporarily diverting and dewatering surface water from work areas. No untreated groundwater shall be discharged to wetlands or water bodies. A variety of methods may be employed to prevent sedimentation due to dewatering. These methods, which are primarily appropriate during construction of capital projects, are described below.

Discharge Hose Filter Socks

Applications: Dewatering

Limitations:

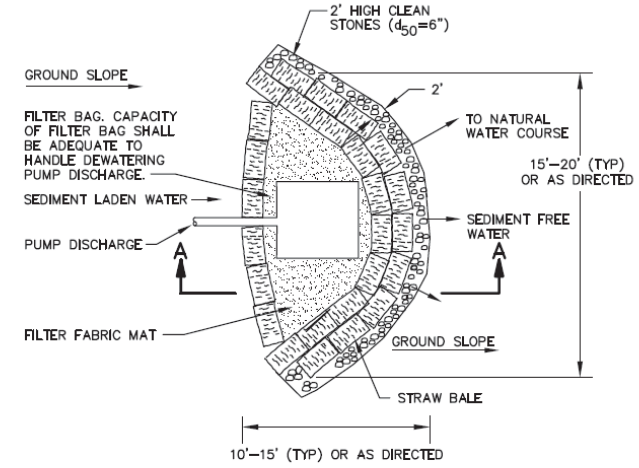
- Ineffective for very silty water

How to Use:

- At sites where there isn't sufficient space to construct sediment basins or enough suitable uplands for overland flow and infiltration to be an option, filter "socks" or bags can be affixed to the end for the discharge hose of the pump and used for dewatering.
- It is important that enough socks be on hand at the site to accommodate the anticipated need, as they fill fast with more turbid water.
- Additional measures such as hay or straw bales can be installed around the filter device for added protection.

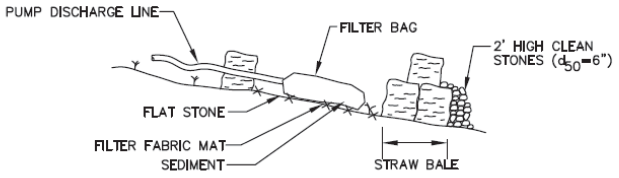
Dewatering to filter “sock” surrounded by haybales.

Riprap underlain by geotextile fabric



NOTES:

1. LOCATION OF SEDIMENT TRAP SUBJECT TO APPROVAL OF ENGINEER.
2. SEDIMENT TRAPS OR SETTLING BASINS SHALL BE USED FOR CONSTRUCTION DEWATERING.
3. DISCHARGE AWAY FROM WORK AREA/DEWATERING AREA.



SECTION A–A

TYPICAL
SEDIMENT TRAP

TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS

SCALE: NONE DATE: 2011

Coffer Dam and Stream Bypass Pumping

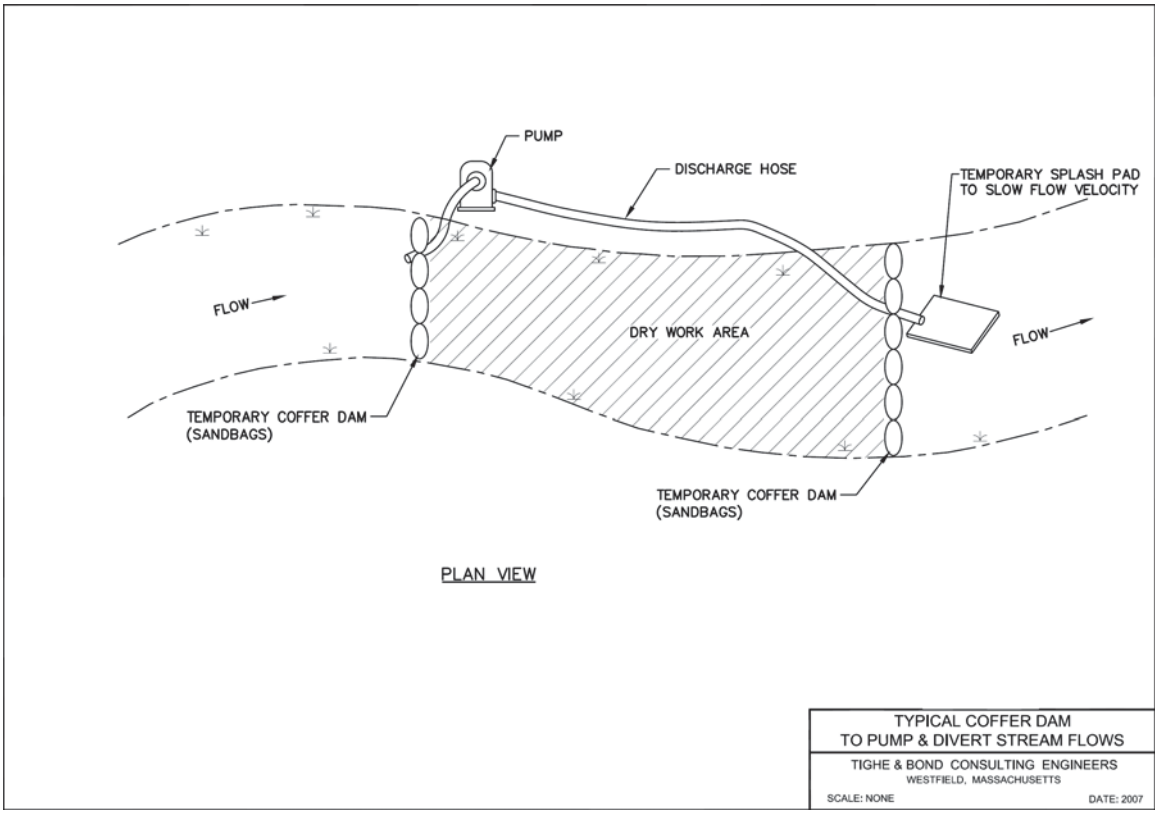
Applications: Dewatering/ Water diversion

Limitations:

- Pipes need to be adequately sized to accommodate heavy rain events
- Coffer dams require careful maintenance at all times.

How to Use:

- Dewatering measures may be necessary if groundwater is encountered within an excavation (e.g., during installation or repair of a buried cable, footings, foundations or structure replacement) or other area if the presence of water is incompatible with construction. In rare cases, surface water diversions will be necessary in order to create dry working conditions for subsurface work in water bodies.
- Coffer dams may be used to make an impoundment upstream of a work area, and then pumps used to remove the water from inside the dammed (isolated) area, and down beyond the work area
- Where gravity flows cannot be circumvented through a coffer dam and temporary flexible pipe via gravity, a pump, discharge hose and downstream temporary splash pad to slow flow velocity can be used.
- Use in areas with high flows where siltation barriers are not effective.
- Construction of coffer dams for instream work is site specific.
- Coffer dams can consist of sandbags, concrete structures or pre-manufactured products and should be used on a site by site basis according to engineering specifications and/or manufacturer's instructions.


PUMP
DISCHARGE HOSE
TEMPORARY SPLASH PAD
TO SLOW FLOW VELOCITY
FLOW
DRY WORK AREA
FLOW
TEMPORARY COFFER DAM
(SANDBAGS)
TEMPORARY COFFER DAM
(SANDBAGS)
PLAN VIEW
TYPICAL COFFER DAM
TO PUMP & DIVERT STREAM FLOWS
TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS
SCALE: NONE
DATE: 2007

Coffer Dam and Stream Bypass via Gravity

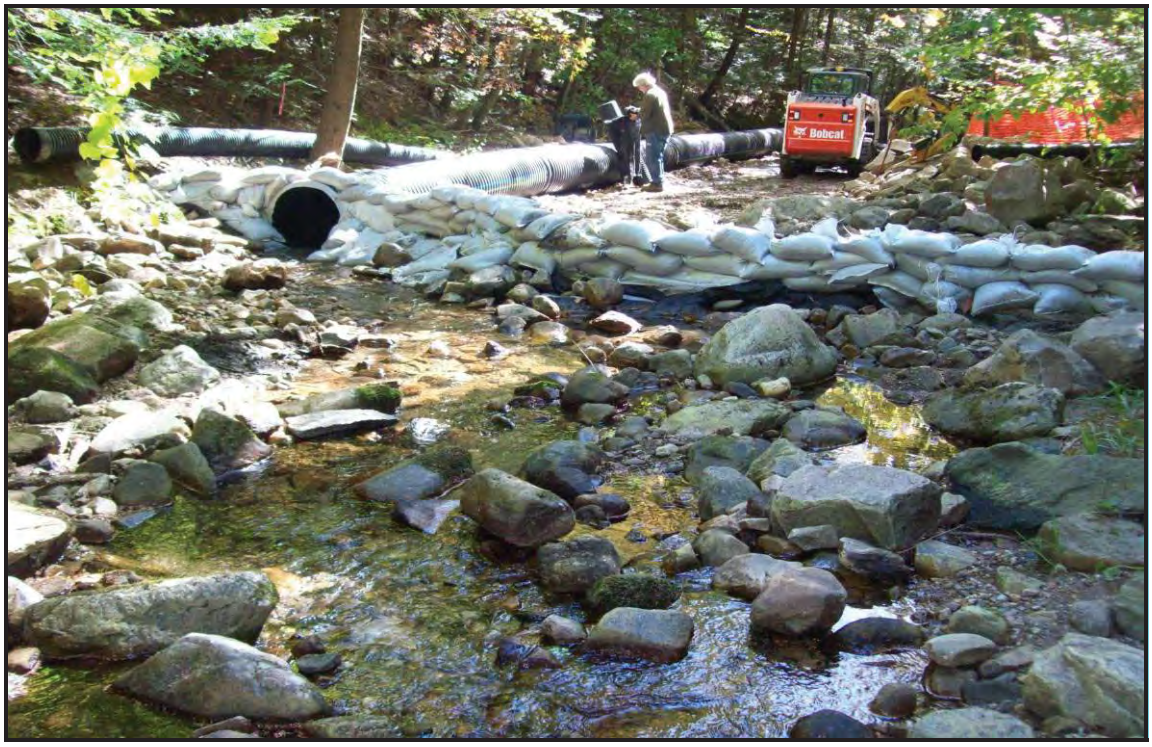
Applications: Dewatering/ Water diversion

Limitations:

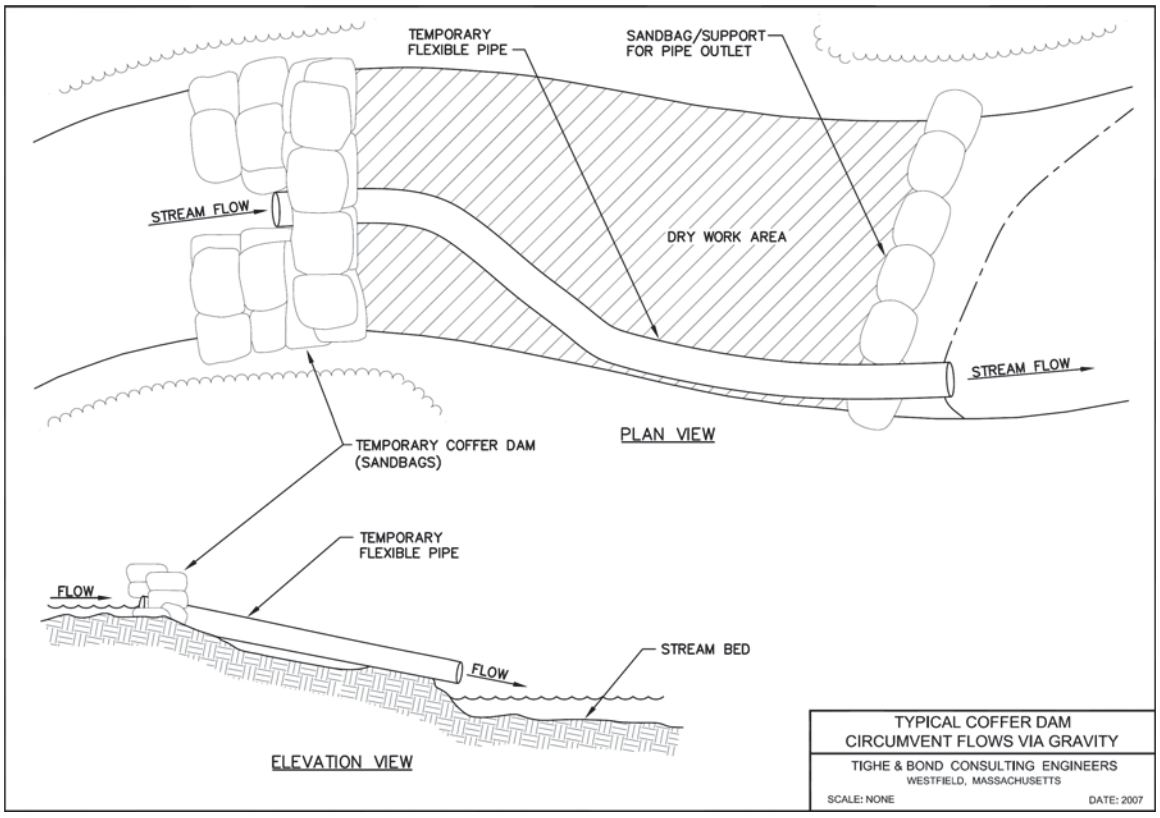
- Pipes need to be adequately sized to accommodate heavy rain events
- Coffer dams require careful maintenance at all times.

How to Use:

- Dewatering measures may be necessary if groundwater is encountered within an excavation (e.g., during installation or repair of a buried cable, footings, foundations or structure replacement) or other area if the presence of water is incompatible with construction. In rare cases, surface water diversions will be necessary in order to create dry working conditions for subsurface work in water bodies.
- Coffer dams and temporary pipes can be used to divert flows and dry out a work area where use of pumps is impractical.
- Where gravity flows cannot be circumvented through a coffer dam and temporary flexible pipe via gravity, a pump, discharge hose and downstream temporary splash pad to slow flow velocity can be used.
- Use in areas with high flows where siltation barriers are not effective.
- Construction of coffer dams for instream work is site specific.
- Coffer dams can consist of sandbags, concrete structures or pre-manufactured products and should be used on a site by site basis according to engineering specifications and/or manufacturer's instructions.



Sand bag coffer dam and streamflow gravity bypass.



Overland Flow

Applications: Dewatering

Limitations:

- Space constraints and adjacent wetlands or watercourses may prevent use of this dewatering method.

How to Use:

- Excess water may be discharged overland to well drained, upland areas and allowed to naturally infiltrate into soils.
- Select discharge location where there is no potential for discharged water to flow overland into wetlands or watercourses.

Frac Tank

Applications: Dewatering; Managing contaminated groundwater

Limitations:

- May be site specific limitations (e.g. extremely unlevel ground); expensive; may require proper disposal at a regulated facility (in cases of contaminated groundwater)

How to Use:

- Frac tanks are pre-fabricated self-contained units that are shipped to construction sites. They contain a series of baffles that allow fine materials to settle out of the water column.

- Use of frac tanks is most appropriate when work that requires dewatering will occur in an area with contaminated groundwater and/or very silty water.

Frac tank on-site for dewatering activities.

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Tighe&Bond

APPENDIX B

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Section 1 Appendix B

Section 1
Appendix B

1.1 Applicable Laws/Regulations

In Connecticut, there are no fewer than nine potentially pertinent regulatory programs associated with activities proposed in environmentally sensitive areas. The following list of laws and regulations are most likely to apply to electrical utility projects in the State.

- Connecticut Inland Wetlands and Watercourses Act (C.G.S. §§ 22a-36 through 22a-45a)
- Municipal inland wetland and zoning regulations
- Stream Channel Encroachment Lines (C.G.S. §§ 22a-342 through 22a-349a)
- Connecticut General Permit for Placement of Utilities and Drainage within Inland Wetlands and Stream Channel Encroachment Lines (C.G.S. §§ 22a-6, 22a-45a through 22a-349a)
- Connecticut Environmental Policy Act (C.G.S. §§ 22a-1a through 22a-1h)
- Connecticut Coastal Management Act (C.G.S. §§ 22a-359 through 22a-363; 22a-28 through 22a-35; 22a-90 through 22a-112; 33 U.S.C. § 1314)
- Connecticut Water Diversion Policy Act (C.G.S. §§ 22a-365 through 22a-379)
- Connecticut Endangered Species Act (C.G.S. §§ 26-303 through 26-315)
- Section 10 of the Rivers and Harbors Act of 1899 (C.G.S. §§ 22a-426; 33 U.S.C. § 403)
- Section 401 of the Clean Water Act (33 U.S.C. § 1251)
- Section 404 of the Clean Water Act (33 U.S.C. § 1344)

1.2 Geographic Areas Subject to Jurisdiction

The following areas are subject to regulatory jurisdiction by at least one of the regulatory programs discussed in this section: It is important to note that more than one jurisdictional resource type may be present at any given location.

- Inland wetlands, watercourses (rivers, streams, lakes, ponds), and floodplains
- Areas subject to municipal wetlands bylaws or ordinances. (These vary by town.)
- Coastal Resource Areas (beaches, dunes, bluffs, escarpments, coastal hazard areas, coastal waters, nearshore waters, offshore waters, estuarine embayments, developed shorefront, intertidal flats, islands, rocky shorefronts, shellfish concentration areas, shorelands, and tidal wetlands)
- Navigable waters
- Essential Fish Habitat (EFH)
- Rare species habitat as mapped by the Connecticut Natural Diversity Database

1.3 Applicable Regulatory Agencies

Activities subject to jurisdiction under the above-referenced programs will generally be subject to review by one or more regulatory agencies (refer to list below). Most stream and wetland crossings will require notification or consultation with municipal Inland Wetland and Watercourses Agencies, and may require permitting with the U.S. Army Corps of Engineers (Corps) and Connecticut Department of Energy & Environmental Protection (CT DEEP) under Sections 404 and 401 of the Clean Water Act. Any work within established stream encroachment lines will require permitting with the CT DEEP Inland Water Resources Division. Coordination with CT DEEP may also be required for projects located within areas mapped by the Connecticut Natural Diversity Database. For work within tidal, coastal or navigable waters or in tidal wetlands, permitting will be required with the Connecticut Department of Energy & Environmental Protection (CT DEEP) Office of Long Island Sound Program (OLISP).

- Municipal Conservation Commissions
- Connecticut Department of Energy & Environmental Protection (CT DEEP) Bureau of Water Management, Inland Water Resources Division
- CT DEEP Wildlife Division
- CT DEEP Office of Environmental Review
- CT DEEP Office of Long Island Sound Programs (OLISP)
- United States Army Corps of Engineers (Corps) New England District

The State of Connecticut and the Federal Government define wetlands differently. According to the Inland Wetlands and Watercourses Act, inland wetlands are defined as “land, including submerged land, not regulated pursuant to Sections 22a-28 through 22a-35 of the Connecticut General Statutes, as amended, which consists of any of the soil types designated as poorly drained, very poorly drained, alluvial, and floodplain by the National Cooperative Soil Survey, as it may be amended from time to time by the United States Department of Agriculture Natural Resource Conservation Service. Such areas may include filled, graded, or excavated sites which possess an aquic (saturated) soil moisture regime as defined by the National Cooperative Soil Survey.” State wetland identification is based solely on the presence of these soil types.

“Watercourses" means rivers, streams, brooks, waterways, lakes, ponds, marshes, swamps, bogs and all other bodies of water, natural or artificial, vernal or intermittent, public or private, which are contained within, flow through or border upon this state or any portion thereof. Intermittent watercourses shall be delineated by a defined permanent channel and bank and the occurrence of two or more of the following characteristics: (A) Evidence of scour or deposits of recent alluvium or detritus, (B) the presence of standing or flowing water for a duration longer than a particular storm incident, and (C) the presence of hydrophytic vegetation.

The Federal Government defines wetlands as “Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” Federal wetland identification is based on a three parameter approach, where a prevalence of hydrophytic vegetation, hydric soils, and wetland hydrology is used to make a wetland determination.

1.4 Maintenance, Repair, or Emergency Projects

Most regulatory programs contain provisions that allow normal maintenance of existing structures and/or response to emergency situations that require immediate attention.

Prior to commencement of new construction, all jurisdictional wetland areas within the work corridor should be delineated by a qualified wetland and soil scientist. The specialist shall delineate areas in accordance with the General Statutes of Connecticut (revised January 1, 2007) as set forth at Title 22a Chapter 440 "Inland Wetlands and Watercourses Act", the U.S. Army Corps of Engineers 1987 Wetland Delineation Manual, and any local inland wetland regulations, ordinances or bylaws that may exist. Refer to each set of regulations regarding applicable wetland definitions. Wetland areas shall be clearly demarcated using appropriate flagging tape or similar means. It is important to note that certain jurisdictional wetland areas in Connecticut can actually occur in uplands, such as floodplains. In addition, Upland Review Areas generally apply to work activities and vary in each community. This makes consultation with a wetland specialist particularly important.

1.4.1 Maintain, Repair and/or Replace

Exemptions or considerations for maintenance, repair, and/or replacement of existing electrical utility structures exist in some environmental regulations, but not all. The exemptions are limited to work related to existing and lawfully located structures where no change in the original structure or footprint is proposed. It is not for the selected contractor of a particular project to make a determination as to whether an activity is exempt. This determination will be made prior to work by the NU project manager, in consultation with NU environmental staff.

These exemptions/considerations are afforded at:

- CT Inland Wetlands & Watercourses Act (RCSA § 22a-39-4)
- CT General Permit (Section 3)
- CT Coastal Management Act (RCSA § 22a-363b)
- CT GP [33 CFR 323.4(a)(2)]
- CT Water Diversion Policy Act (RCSA § 22a-377(b)1)

1.4.2 Emergency Projects

Emergency provisions are generally afforded to activities that need to abate conditions that pose a threat to public health or safety. These provisions generally do not allow work beyond what is necessary to abate the emergency condition, and will generally require an after-the-fact permit. It is not for the selected contractor of a particular project to make a determination as to whether an activity is an emergency. This determination will be made prior to work by the NU project manager, in consultation with NU environmental staff.

It is important to note that invocation of an emergency provision does not release the project proponent from reporting requirements.

Emergency provisions are afforded at:

- CEPA (RCSA § 22a-1a-3)
- CT Coastal Management Act (RCSA § 22a-29)
- CT GP [33 CFR Part 323.4(a)(2)]

1.5 Municipal Permitting

Work within wetlands, watercourses and designated Upland Review Areas typically requires notification to municipal staff, (Department of Public Works and/or the Inland Wetland and Watercourse Agency staff). In October 1996 the Connecticut Department of Public Utility Control opened a docket (Docket Number 95-08-34) to conduct a generic investigation on the allocation of siting jurisdiction over utility plant facilities. This included an investigation as to whether local authorities (including local Inland Wetlands and Watercourses Agencies) have jurisdiction over public utility projects.

The investigation resulted in several orders which provide guidance on how public utility companies should coordinate with municipalities on the construction of new facilities, upgrades, significant maintenance activities, and routine maintenance activities.

- For the construction of new facilities, alterations to existing facilities (including upgrades) or significant maintenance involving substantial disturbance of soil, water or vegetation which would regularly fall under the review requirements of certain local authorities (ie. Planning and Zoning Authority; Inland Wetlands Commission; Public Works Department; Historic District Commission), the utility shall at least notify and consult with such local authority, or its designated agent or staff, toward the development of mutually agreeable schedules and procedures for the proposed activity.
- For routine maintenance activities or alterations to existing facilities (including upgrades) involving minor disturbance of soil, water or vegetation which would regularly fall under the review and approval requirements of certain local authorities, the utility shall make local authorities or their designated agent or staff aware of such ongoing activities.

1.6 CT Department of Energy & Environmental Protection

If the project requires formal permitting with the Corps (Category 2 or Individual Permit), copies of the application should be forwarded to CT DEEP for review under Section 401 of the Clean Water Act. The CT DEEP requires that a GP Addendum form be completed and submitted along with the Corps application. If the project qualifies as Category 1 under the Corps GP, the project also is granted authorization (Water Quality Certification, WQC) with no formal application under Section 401 of the Clean Water Act, provided the project meets the additional WQC general conditions. The general conditions commonly applicable to utility projects include:

- Prohibiting dumping of any quantity of oil, chemicals, or other deleterious material on the ground;

- Immediately informing the CT DEEP Oil and Chemical Spill Response Division at (860) 424-3338 (24 hours) of any adverse impact or hazard to the environment including any discharge or spillage of oil or chemical liquids or solids;

- Separating staging areas at the site from the regulated areas by silt fences or stray/hay bales at all times;

- Prohibiting storage of any fuel and refueling of equipment within 25 feet from any wetland or watercourse;

- Following the document "Connecticut Guidelines for Soil and Erosion Control," inspecting employed controls at least once per week, after each rainfall, and at least daily during prolonged rainfall, and correcting any deficiencies within 48 hours of being found.

- Prohibiting the storage of any materials at the site which are buoyant, hazardous, flammable, explosive, soluble, expansive, radioactive, or which could in the event of a flood be injurious to human, animal or plant life, below the elevation of the 500 year flood. Any other material or equipment stored at the site below this elevation must be firmly anchored, restrained or enclosed to prevent flotation. The quantity of fuel for equipment at the site stored below such elevation shall not exceed the quantity of fuel that is expected to be used by such equipment in one day.

- Immediately informing DEEP at (860) 424-3019 and the Corps at (617) 647-8674 of the occurrence of pollution or other environmental damage in violation of the WQC, and within 48 hours support a written report including information specified in the general conditions.

If the project falls within areas mapped by the Connecticut Natural Diversity Database, or is less than 0.50 miles upstream or downstream of a mapped area, a data request and possible coordination will be required with the Natural Diversity Database.

In some circumstances a wetland or stream crossing may fall within designated stream channel encroachment lines. Approximately 270 linear miles of riverine floodplain in Connecticut have been assigned stream channel encroachment lines to lessen the hazards to life and property due to flooding. Any work riverward of a designated stream channel encroachment line requires a permit from the CT DEEP Inland Water Resources Division. The CT DEEP should be consulted regarding temporary crossings within established stream channel encroachment lines.

If a project is located within tidal, coastal or navigable waters of the state or in tidal wetlands, permitting may be required with the CT DEEP OLISP. For the routine maintenance of previously permitted structures or structures that were in place prior to June 24, 1939, no permitting is required. For significant maintenance of previously permitted structures or structures that were in place prior to June 24, 1939, a Certificate of Permission is required. For new projects a Structures, Dredging and Fill Permit and/or a Tidal Wetlands Permit may be required. The CT DEEP OLISP should be consulted prior to preparing permits to conduct a pre-application meeting and determine the appropriate permitting route.

1.7 U.S. Army Corps of Engineers

Work within wetlands and waters of the United States is subject to jurisdiction under Section 404 of the Clean Water Act, which is administered by the Corps. Work within navigable waters is also administered by the Corps under Section 10 of the Rivers and Harbors Act of 1899. The Corps has issued a General Permit (GP) which establishes categories for projects based on their nature of impacts. The current permit was issued on July 15, 2011, and expires on July 15, 2016. The permit will be reissued by July 15, 2016 for another five years. Applications are not required for Category 1 projects, but submittal of a Category 1 Form before the work occurs and submittal of a Compliance Certification Form within one month after the work is completed is required. The Category 1 Form and Compliance Certification Form entails self-certification by applicants that their project complies with the terms and conditions of Category 1 of the GP. Category 2 projects require the submittal of an application to the Corps, followed by a screening of the application by the Corps, the U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, National Marine Fisheries Service and CT DEEP, and consultation with the Connecticut Commission on Culture and Tourism and Tribal Historic Preservation Officers. Category 2 projects may not proceed until written approval from the Corps is received. Written approval is generally provided within 45 days of the multi-agency screening. After written approval is received, a Work-Start Notification Form must be submitted before the work occurs, and a Compliance Certification Form must be submitted within one month after the work is completed.

For work proposed within a FEMA floodway or floodplain, the Corps recommends that the applicant apply for and receive a Flood Management Certification (if required), prior to applying to the Corps. Additionally, applications for Category 2 inland projects that propose fill in Corps jurisdiction must include an Invasive Species Control Plan (ISCP), unless otherwise directed by the Corps.

An Individual Permit requires a formal permit application to be submitted to the Corps. The application is reviewed in detail by both state and federal agencies, and a Public Notice is released for public comment. Projects which trigger an Individual Permit generally result in significant impacts to wetlands and/or watercourses.

Stream and wetland crossings are only subject to jurisdiction under the Corps if there is **a discharge of dredge or fill material into wetlands or waters of the United States**. Equipment access through a stream or wetland with no structural BMP is not regulated by the Corps if there is no discharge of dredge or fill material (note that equipment rutting as a result of not using an appropriate BMP can be considered a "discharge of dredge material"). Similarly, the use of a timber or rail car bridge that extends from bank to bank with no stream impacts is not regulated by the Corps. Additionally, the use of timber mats and stone is considered "fill material" by the Corps, and must be calculated to determine overall impacts. Temporary mats are not counted towards the 1 acre threshold under Category 2 if they are adequately cleaned after previous use, removed immediately after completion of construction and disposed of at an upland site.

Maintenance, including emergency reconstruction of currently serviceable structures, is exempt from Corps jurisdiction and does not require formal permitting. Maintenance does not include any modification that changes the character, scope, or size of the original fill design. Emergency reconstruction must occur within a reasonable period of time after damage occurs to qualify for this exemption.

Stream and wetland crossings that involve the discharge of dredge and fill material may be conducted under Category 1 if the work complies with the general conditions and Category 1 criteria of the GP. The following are Category 1 criteria that are commonly applicable to stream and wetland crossings in utility rights of way. See Section 1.8 for additional criteria for culvert crossings:

- The work results in less than 5,000 square feet of impacts to wetlands or waters of the United States. Replacement of utility line projects with impacts solely within wetlands greater than 5,000 square feet may be eligible for Category 1 Authorization after consultation with the Corps about the specific project;
- Temporary fill, with the exceptions of swamp and timber mats, discharged to wetlands shall be placed on geotextile fabric laid on the pre-construction wetland grade. Unconfined temporary fill discharged into flowing water (rivers and streams) shall consist only of clean stone. All temporary fill shall be removed as soon as it is no longer needed, and disposed of at an appropriate upland site.
- Any unconfined in-stream work, including construction, installation or removal of sheet pile cofferdam structures, is conducted during the low-flow period between July 1 and September 30. However, installation of cofferdams, other than sheet pile cofferdams, is not restricted to the low-flow period;
- No work will occur in the main stem or tributary streams of the Connecticut River watershed that are being managed for Atlantic salmon (*Salmo salar*). (Work of this nature requires screening for potential impacts to designated Essential Fish Habitat.);
- The work does not result in direct or secondary impacts to Special Wetlands, Threatened, Endangered or Special Concern Species, or Significant Natural Communities identified by the Connecticut Natural Diversity Database. Work within 750 feet of vernal pools shall be minimized;
- The project does not require a Corps permit with associated construction activities within 100 feet of Special Wetlands;
- The project does not result in fill placed within a FEMA established floodway, unless the applicant has a State of Connecticut Flood Management Certification pursuant to Section 25-68d of the Connecticut General Statutes;
- The project does not result in fill placed within a FEMA established floodplain that would adversely affect the hydraulic characteristics of the floodplain;
- The project does not entail stormwater detention or retention in inland waters or wetlands;
- The project is not located in a segment of a National Wild and Scenic River System (includes rivers officially designated by Congress as active study status rivers for possible inclusion) or within 0.25 miles upstream or downstream of the main stem or tributaries to such a system;
- The project has no potential for an effect on a historic property which is listed or eligible for listing in the National Register of Historic Places;
- The project does not impinge upon the value of any National Wildlife Refuge, National Forest, or any other area administered by the U.S. Fish and Wildlife Service, U.S. Forest Service or National Park Service;

- Section 106 needs to be taken into account for all work that requires federal permitting – including Category 1;
- The project does not use slip lining, plastic pipes, or High Density Polyethylene Pipes (HDPP).
- Appropriate BMPs are employed in regards to heavy equipment in wetlands (General Condition 16) and sedimentation and erosion controls (General Condition 20).
- Disturbed inland wetland areas are restored in accordance with General Condition 18.

Stream and wetland crossings that involve the discharge of dredge and fill material may be conducted under Category 2 if the work complies with the general conditions and Category 2 criteria of the GP. The following are Category 2 criteria that are commonly applicable to stream and wetland crossings in utility right of ways.. See Section 1.8 for additional criteria for culvert crossings:

- The work results in less than one acre of impacts to wetlands or waters of the United States;
- The project does not result in fill placed within a FEMA established floodplain that would adversely affect the hydraulic characteristics of the floodplain;
- The project does not entail stormwater detention or retention in inland waters or wetlands.
- Temporary fill, with the exceptions of swamp and timber mats, discharged to wetlands shall be placed on geotextile fabric laid on the pre-construction wetland grade. Unconfined temporary fill discharged into flowing water (rivers and streams) shall consist only of clean stone. All temporary fill shall be removed as soon as it is no longer needed, and disposed of at an appropriate upland site.
- Appropriate BMPs are employed in regards to heavy equipment in wetlands (General Condition 16) and sedimentation and erosion controls (General Condition 20).
- Disturbed inland wetland areas are restored in accordance with General Condition 18.

Stream and wetland crossings that cannot meet Category 1 or Category 2 criteria may require review under an Individual Permit. The Corps should be consulted before assuming an Individual Permit will be required, as exceptions can be made under certain circumstances.

1.8 Culvert Installation

New culvert installation or existing culvert replacements will require notification or consultation with municipal staffers which might include the Department of Public Works and/or the inland wetlands officer, and may require permitting with the Corps under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act of 1899, and the CT DEEP under Section 401 of the Clean Water Act. Any work within established stream encroachment lines or work which requires a water diversion will require

permitting with the CT DEEP Inland Water Resources Division. Coordination with CT DEEP may also be required for projects located within areas mapped by the Connecticut Natural Diversity Database. For work within tidal, coastal or navigable waters or in tidal wetlands, permitting will be required with the CT DEEP Office of Long Island Sound Program (OLISP).

1.8.1 Municipal Permitting

See Section 1.5 for general local permitting guidance.

- For the installation of new culverts and the replacement of culverts that involve substantial disturbance of soil, water or vegetation which would regularly fall under the review and approval requirements of certain local authorities (ie. Planning and Zoning Authority; Inland Wetlands Commission; Public Works Department; Historic District Commission), the utility shall at least notify and consult with such local authority, or its designated agent or staff, toward the development of mutually agreeable schedules and procedures for the proposed activity.
- For the replacement of culverts involving only minor disturbance of soil, water or vegetation which would regularly fall under the review and approval requirements of certain local authorities, the utility shall make local authorities or their designated agent or staff aware of such ongoing activities.

1.8.2 CT Department of Energy & Environmental Protection

If the project requires formal permitting with the Corps, copies of the application should be forwarded to CT DEEP for review under Section 401 of the Clean Water Act. The CT DEEP requires that a PGP Addendum form be completed and submitted along with the Corps application.

If a culvert project falls within areas mapped by the Connecticut Natural Diversity Database, or falls within 0.50 miles upstream or downstream of a mapped area, a data request and possible coordination will be required with the Natural Diversity Database.

In some circumstances a culvert project may fall within designated stream channel encroachment lines. Approximately 270 linear miles of riverine floodplain in Connecticut have been assigned stream channel encroachment lines to lessen the hazards to life and property due to flooding. Any work riverward of a designated stream channel encroachment line requires a permit from the CT DEEP Inland Water Resources Division. Additionally, work which requires a water diversion may require also require permitting with the CT DEEP Inland Water Resources Division.

If a culvert project is located within tidal, coastal or navigable waters of the state or in tidal wetlands, permitting will be required with the CT DEEP OLISP. For new projects a Structures, Dredging and Fill Permit and/or a Tidal Wetlands Permit will be required. For replacement structures which were previously permitted, or which were in place prior to June 24, 1939, a Certificate of Permission may only be required, which entails a shorter permitting process.

1.8.3 U.S. Army Corps of Engineers

See Section 1.7 for general Corps permitting requirements. Open bottom arches, bridge spans or embedded culverts are preferred over traditional culverts and are required for

Category 1 projects. However, where site constraints make these approaches impractical, the Corps should be consulted.

New bridge or open-bottom structure crossings may be conducted under Category 1 or Category 2 if the following criteria are met in addition to meeting any applicable general criteria listed in section 1.7 of this manual:

- The work spans at least 1.2 times the watercourse bank full width;
- The structure has an openness ratio equal to or greater than 0.25 meters;
- The structure allows for continuous flow of the 50-year frequency storm flows.

New culvert installations may be conducted under Category 1 if the work complies with the general conditions and Category 1 criteria of the GP. The following are Category 1 criteria that are commonly applicable to new culvert installations in utility right of ways:

- Work is conducted in accordance with the design requirements listed in Section 3.1.3 of the Best Management Practices Manual;
- Plastic and High Density Polyethylene Pipes (HDPE) are not used;
- The work results in less than 5,000 square feet of impacts to wetlands or waters of the United States;
- Any unconfined in-stream work, including construction, installation or removal of sheet pile cofferdam structures, is conducted during the low-flow period between July 1 and September 30, except in instances where a specific written exception has been issued by the Connecticut Department of Energy & Environmental Protection. However, installation of cofferdams, other than sheet pile cofferdams, is not restricted to the low-flow period;
- No open trench excavation is conducted within flowing waters. Work within flowing waters can be avoided by using temporary flume pipes, culverts, cofferdams, etc. to isolate work areas and maintain normal flows;
- The tributary watershed to the culvert does not exceed 1.0 square mile (640 acres);
- The culvert gradient (slope) is not steeper than the streambed gradient immediately upstream or downstream of the culvert;
- For a single box or pipe arch culvert crossing, the inverts are set not less than 12 inches below the streambed elevation;
- For a multiple box or pipe arch culvert crossing, the inverts of one of the boxes or pipe arch culverts are set not less than 12 inches below the elevation of the streambed;
- For a pipe culvert crossing, the inverts are set such that not less than 25% of the pipe diameter or 12 inches, whichever is less, is set below the streambed elevation;
- The culvert is backfilled with natural substrate material matching upstream and downstream streambed substrate;
- The structure does not otherwise impede the passage of fish and other aquatic organisms;

- The structure allows for continuous flow of the 50-year frequency storm flows;
- The work does not result in direct or secondary impacts to Special Wetlands, Threatened, Endangered or Special Concern Species, or Significant Natural Communities identified by the Connecticut Natural Diversity Database. Work within 750 feet of vernal pools shall be minimized;
- The project does not require a Corps permit with associated construction activities within 100 feet of Special Wetlands;
- The project does not result in fill placed within a FEMA established floodway, unless the applicant has a State of Connecticut Flood Management Certification pursuant to section 25-68d of the Connecticut General Statutes;
- The project does not result in fill placed within a FEMA established floodplain that would adversely affect the hydraulic characteristics of the floodplain;
- The project does not entail stormwater detention or retention in inland waters or wetlands;
- The project is not located in a segment of a National Wild and Scenic River System (includes rivers officially designated by Congress as active study status rivers for possible inclusion) or within 0.25 miles upstream or downstream of the main stem or tributaries to such a system;
- The project has no potential for an effect on a historic property which is listed or eligible for listing in the National Register of Historic Places;
- The project does not impinge upon the value of any National Wildlife Refuge, National Forest, or any other area administered by the U.S. Fish and Wildlife Service, U.S. Forest Service or National Park Service.
- Appropriate BMPs are employed in regards to sedimentation and erosion controls (General Condition 20).

New culvert installations may be conducted under Category 2 if the work complies with the general conditions and Category 2 criteria of the GP. The following are Category 2 criteria that are commonly applicable to new culvert installations in utility right of ways:

- Work is conducted in accordance with the design requirements listed in Section 3.1.3 of the Best Management Practices Manual;
- The work results in less than one acre of impacts to wetlands or waters of the United States;
- The project does not result in fill placed within a FEMA established floodplain that would adversely affect the hydraulic characteristics of the floodplain;
- There is no practicable alternative location for the crossing that would have less environmental impacts;
- The use of a bridge or open-bottom structure is determined to be not practicable;
- For a single box or pipe arch culvert crossing, the inverts are set not less than 12 inches below the streambed elevation;
- For a multiple box or pipe arch culvert crossing, the inverts of one of the boxes or pipe arch culverts are set not less than 12 inches below the elevation of the streambed;

- For a pipe culvert crossing, the inverts are set such that not less than the pipe diameter or 12 inches, whichever is less, is set below the streambed elevation;
- The culvert is backfilled with natural substrate material matching upstream and downstream streambed substrate;
- The culvert has an openness ratio equal to or greater than 0.25 meters;
- The structure does not result in a change in the normal water surface elevation of the upstream waters or wetlands;
- The structure allows for continuous flow of the 50-year frequency storm flows;
- Appropriate BMPs are employed in regards to sedimentation and erosion controls (General Condition 20).

New culvert installations that cannot meet Category 1 or Category 2 criteria may require review under an Individual Permit. The Corps should be consulted before assuming an Individual Permit will be required, as exceptions can be made under certain circumstances.

In-kind replacement of culverts using the same materials is exempt from Section 404 of the Clean Water Act, and does not require permitting with the Corps. The Corps, however, should be consulted before assuming an activity is exempt from their jurisdiction. Consult with Siting and Permitting.

Bridge or open-bottom structure replacements may be conducted under Category 1 if the conditions for a new bridge or open-bottom structure replacement have been met. In addition, bridge or open-bottom structure replacements should not result in a change in the normal surface elevation of the upstream waters or wetland, and the replacement structure should have a riparian bank on one or both sides for wildlife passage. Culvert replacements may be conducted under Category 1 if the conditions for new culvert installation are met.

Bridge or open-bottom structure replacements may be conducted under Category 2 if the conditions for a new bridge or open-bottom structure replacement have been met. Culvert replacements may be conducted under Category 2 if the following conditions are met:

- The work results in 5,000 square feet to less than one acre of impacts to wetlands or waters of the United States;
- The use of a bridge or open-bottom structure is determined to be not practicable;
- For a single box or pipe arch culvert crossing, the inverts are set not less than 12 inches below the streambed elevation;
- For a multiple box or pipe arch culvert crossing, the inverts of one of the boxes or pipe arch culverts are set not less than 12 inches below the elevation of the streambed;
- For a pipe culvert crossing, the inverts are set such that not less than the pipe diameter or 12 inches, whichever is less, is set below the streambed elevation;
- The culvert is backfilled with natural substrate material matching upstream and downstream streambed substrate;
- The culvert has an openness ratio equal to or greater than 0.25 meters;

- The structure does not result in a change in the normal water surface elevation of the upstream waters or wetlands;
- The structure allows for continuous flow of the 50-year frequency storm flows.
- Appropriate BMPs are employed in regards to sedimentation and erosion controls (General Condition 20).

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APPENDIX C

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Planning Considerations

The measures included in the vegetative soil cover group include **Temporary Seeding, Permanent Seeding, Sodding** and **Landscape Planting.** These measures serve the common function of stabilizing the soil through the establishment of a vegetative cover.

The **Temporary Seeding** measure is applicable to those areas where the phasing and sequencing of a project require an initial disturbance followed by an extended period of inactivity that is greater than 30 days but less than 1 year. It is important to note that temporary seedings will not provide the same level of protection that permanent vegetation will provide. Temporary seeding mixtures do not develop a "turf" or "sod." Temporary seedings do not generally receive the same level of maintenance as permanent seedings. This measure is used with the **Mulch for Seed** measure.

The **Permanent Seeding** measure is applicable to those areas that have been disturbed and will remain so for 1 year or more. It is also applicable to those areas that have been brought to a final grade and ready for final vegetation establishment. This measure is used with the **Mulch for Seed**, **Topsoiling, Temporary Erosion Control Blanket** and **Permanent Turf Reinforcement Mat** measures.

The **Sodding** measure is recommended for lands needing rapid establishment and highly effective grass cover. It provides almost instantaneous soil protection with high aesthetic value and is very useful in critical watersheds, particularly at times outside of the recommended seeding dates. This measure may be used following the **Topsoiling** and **Permanent Turf Reinforcement Mat** measures.

The **Landscape Planting** measure is most commonly used where aesthetics, wildlife habitat and noise control are needed. It is frequently used in conjunction with the **Landscape Mulch** measure.

The early establishment of either temporary or permanent vegetative cover can reduce and even prevent costly maintenance operations for other erosion control systems. For example, the frequency of cleaning out sediment basins will be reduced if the drainage area of the basin is seeded where grading and construction are not taking place. The establishment of grass cover is essential to preserve the integrity of earthen structures used to control sediment, such as dikes, diversions, and the banks and dams of sediment basins.

3-Vegetative Soil Cover

Temporary Seeding (TS)

Definition
Establishment of temporary stand of grass and/or legumes by seeding and mulching soils that will be exposed for a period greater than 1 month but less than 12 months.

Purpose
To temporarily stabilize the soil and reduce damage from wind and/or water erosion and sedimentation until permanent stabilization is accomplished.

Applicability
- Within the first 7 days of suspending work on a grading operation that exposes erodible soils where such suspension is expected to last for 1 to 12 months. Such areas include soil stockpiles, borrow pits, road banks and other disturbed or unstable areas.
- Not for use on areas that are to be left dormant for more than 1 year. Use permanent vegetative measures in those situations.

Specifications

Seed Selection
Select grass species appropriate for the season and site conditions from **Figure TS-2**.

Timing Considerations
Seed with a temporary seed mixture within 7 days after the suspension of grading work in disturbed areas where the suspension of work is expected to be more than 30 days but less than 1 year. Seeding outside the optimum seeding dates given in **Figure TS-2** may result in either inadequate germination or low plant survival rates, reducing erosion control effectiveness.

Site Preparation
Install needed erosion control measures such as diversions, grade stabilization structures, sediment basins and grassed waterways in accordance with the approved plan.

Grade according to plans and allow for the use of appropriate equipment for seedbed preparation, seeding, mulch application, and mulch anchoring. All grading should be done in accordance with the **Land Grading** measure.

Seedbed Preparation
Loosen the soil to a depth of 3-4 inches with a slightly roughened surface. If the area has been recently loosened or disturbed, no further roughening is required. Soil preparation can be accomplished by tracking with a bulldozer, discing, harrowing, raking or dragging with a section of chain link fence. Avoid excessive compaction of the surface by equipment traveling back and forth over the surface. If the slope is tracked, the cleat marks shall be perpendicular to the anticipated direction of the flow of surface water (see **Surface Roughening** measure).

Apply ground limestone and fertilizer according to soil test recommendations (such as those offered by the University of Connecticut Soil Testing Laboratory or other reliable source). Soil sample mailers are available from the local Cooperative Extension System office. Appendix E contains a listing of the Cooperative Extension System offices.

If soil testing is not feasible on small or variable sites, or where timing is critical, fertilizer may be applied at the rate of 300 pounds per acre or 7.5 pounds per 1,000 square feet of 10-10-10 or equivalent. Additionally, lime may be applied using rates given in **Figure TS-1**.

Figure TS-1 Soil Texture vs. Liming Rates

Soil Texture	Tons / Acre of Lime	Lbs / 1000 ft² of Lime
Clay, clay loam and high organic soil	3	135
Sandy loam, loam, silt loam	2	90
Loamy sand, sand	1	45

Seeding
Apply seed uniformly by hand, cyclone seeder, drill, cultipacker type seeder or hydroseeder at a minimum rate for the selected seed identified in **Figure TS-2**. Increase

seeding rates by 10% when hydroseeding.

Mulching

Temporary seedings made during optimum seeding dates shall be mulched according to the **Mulch for Seed** measure. Note when seeding outside of the optimum seeding dates, increase the application of mulch to provide 95%-100% coverage.

Maintenance

Inspect seeded area at least once a week and within 24 hours of the end of a storm with a rainfall amount of 0.5 inch or greater for seed and mulch movement and rill erosion.

Where seed has moved or where soil erosion has occurred, determine the cause of the failure. Bird feeding may be a problem if mulch was applied too thinly to protect seed. Re-seed and re- mulch. If movement was the result of wind, then repair erosion damage (if any), reapply seed and mulch and apply mulch anchoring. If failure was caused by concentrated runoff, install additional measures to control water and sediment movement, repair erosion damage, re-seed and re-apply mulch with anchoring or use **Temporary Erosion Control Blanket** measure.

Continue inspections until the grasses are firmly established. Grasses shall not be considered established until a ground cover is achieved which is mature enough to control soil erosion and to survive severe weather conditions (approximately 80% vegetative surface cover).

Figure TS-2 Temporary Seeding Rates and Dates

Species[4]	Seeding Rates (pounds) /Acre	Seeding Rates (pounds) /1000 sq. ft.	Optimum Seed Depth[2] (inches)	Optimum Seeding Dates[1] 3/1 4/1 5/1 6/1 7/1 8/1 9/1 10/1 (3/15 4/15 5/15 6/15 7/15 8/15 9/15 10/15)	Plant Characteristics
Annual ryegrass Lolium multiflorum	40	1.0	0.5		May be added in mixes. Will mow out of most stands
Perennial ryegrass Lolium perenne	40	1.0	0.5		Use for winter cover. Tolerates cold and low moisture.
Winter Rye Secale cereale	120	3.0	1.0		Quick germination and heavy spring growth. Dies back in June with little regrowth.
Oats Avena sativa	86	2.0	1.0		In northern CT. will winter kill with the first killing frost and may through-out the state in severe winters.
Winter Wheat Triticum aestivum	120	3.0	1.0		Quick germination with moderate growth. Dies back in June with no regrowth.
Millet Echinochloa crusgalli	20	0.5	1.0		Warm season small grain. Dies with frost in September.
Sudangrass Sorghum sudanense	30	0.7	1.0		Tolerates warm temperatures and droughty conditions.
Buckwheat Fagopyrum esculentum	15	0.4	1.0		Hardy plant that will reseed itself and is good as a green manure crop.
Weeping lovegrass Eragostis curbula	5	0.2	0.25		Warm-season perennial. May bunch. Tolerates hot, dry slopes, acid infertile soils. Excellent nurse crop. Usually winter kills.
DOT All Purpose Mix[3]	150	3.4	0.5		Suitable for all conditions.

[1] May be planted throughout summer if soil moisture is adequate or can be irrigated. Fall seeding may be extended 15 days in the coastal towns.

[2] Seed at twice the indicated depth for sandy soils.

[3] See Permanent Seeding **Figure PS-3** for seeding mixture requirements.

[4] Listed species may be used in combinations to obtain a broader time spectrum. If used in combinations, reduce each species planting rate by 20% of that listed.

Source: USDA–NRCS

Permanent Seeding (PS)

Definition
Establishment of permanent stand of grass and/or legumes by seeding and mulching exposed soils with a seed mixture appropriate for long term stabilization.

Purpose
To permanently stabilize the soil with a vegetative cover that will prevent damage from wind and/or water erosion and sedimentation.

Applicability
- On disturbed or erodible soils have been brought to final grade or where the suspension of work is expected to exceed 1 year, and
- Where slopes gradients are no steeper than 2:1. For slopes steeper than 2:1, use slope stabilization measures from the Stabilization Structures Functional Group.

Planning Considerations
There are several factors that should be considered when evaluating a site for the establishment of permanent vegetation.

Time Of Year
Seeding dates in Connecticut are normally April 1 through June 15 and August 15 through October 1. Spring seedings give the best results and spring seedings of all mixes with legumes is recommended. There are two exceptions to the above dates. The first exception is when seedings will be made in the areas of Connecticut known as the Coastal Slope and the Connecticut River Valley. The Coastal Slope includes the coastal towns of New London, Middlesex, New Haven, and Fairfield counties. In these areas, with the exception of crown vetch[1], the final fall seeding dates can be extended an additional 15 days. The second exception is frost crack or dormant seeding. In this type of seeding, the seed is applied during the time of year when no germination can be expected, normally November through February. Germination will take place when weather conditions improve. In this type of seeding, mulching is extremely important to protect the seed from wind and surface erosion and to provide erosion protection until the seeding becomes established.

Topsoiling Needs
The need to topsoil is determined by a combination of existing soil fertility and intended use. The poorer the site is in terms of natural fertility and soil texture, the greater the need for topsoil. This is especially true on sites where a high quality vegetative cover is needed either for erosion control or aesthetics.

Soil Texture
Soil texture (ratio of gravel, sand, silt, clay and organic matter) can affect the choice of a seed mixture for vegetating disturbed areas. For example, sites which have soils with a large percentage of sands and gravels will tend to be droughty and therefore require a drought tolerant mixture. Conversely, sites that exhibit somewhat poorly or poorly drained characteristics will require a mixture that will tolerate wet conditions. Soil texture of the site may warrant consideration for the use of topsoil (see **Topsoiling** measure) or sodding (see **Sodding** measure).

Intended Use
Referring to **Figure PS-2**, consider the ultimate use and maintenance requirements of the area when choosing a seed mixture to be used. There are two levels of maintenance: areas that will be mowed and areas that will not.

Areas that will be mowed can have different levels of maintenance and mowing. Golf courses and recreation areas will require more intensive management than roadside banks and medians.

Areas such as spoil banks, gravel pits and steep roadbanks once seeded and established will require no further mowing and little, if any, maintenance.

Topography or Finished Grade
Do not use permanent seeding on slopes steeper than 2:1. Under saturated conditions slopes could develop deep or shallow surface failures. In cases such as this, maintenance can be a constant problem and there can be danger to structures. A thorough site investigation is needed to determine if alternatives such as benching or

[1] When crown vetch is seeded in late summer, at least 35% of the seed should be hard seed (unscarified).

other structural methods are needed to ensure soil stability before seeding is done.

Cool Season versus Warm Season Grasses

Cool season grasses are those species that normally begin growth very early in the spring (late March to early April) and will continue to grow until warm weather sets in mid-June. At the onset of hot weather, cool season grasses will enter a stage of dormancy and exhibit little growth. They will maintain that dormant state until the cooler weather of the fall (end of August) and will then begin to grow again until late fall (end of October). Warm season grasses on the other hand, do not begin vigorous growth until warm weather (late May) and will continue growth until cool weather in the late fall (mid-September). Cool season grasses generally are the sod formers, such as bluegrass, while the warm season grasses, such as the perennial ryes, do not form sod.

Presence of Mulch

Sometimes seeding will occur after a previous application of mulch. If wood chips, bark or similar materials were used on the seeding area, plan on either removing the mulch or incorporating it into the soil and applying more nitrogen (see **Seed Bed Preparation**). Previously applied hay and straw mulch can be incorporated into the soil without adding supplemental nitrogen.

Specifications

Seed Selection and Quantity

Select a seed mixture appropriate to the intended use and soil conditions from **Figure PS-2** and **Figure PS-3** or use mixture recommended by the NRCS. For seed mixtures containing legumes, select the type and amount of inoculant that is specific for the legume to be used.

When buying seed make sure the quality of the seed is given for pure live seed and germination rate. Ask the supplier for an affidavit of purity and germination rate if there is any question. Expect a purity between of 95% and 98% and a germination rate between 70% and 90%. Some seeding mixtures call for pure live seed. An example of calculating pure live seed is given in **Figure PS-3**.

Increase seeding rates 10% when using frost crack seeding[2] or hydroseeding.

Timing

Seed with a permanent seed mixture within 7 days after establishing final grades or when grading work within a disturbed area is to be suspended for a period of more than 1 year. Seeding is recommended from April 1 through June 15 and August 15 through October 1, with the following exceptions:

- *for the coastal towns and in the Connecticut River Valley final fall seeding dates can be extended an additional 15 days, and*
- *dormant or frost crack seeding is done after the ground is frozen.*

Site Preparation

Grade in accordance with the **Land Grading** measure.

Install all necessary surface water controls.

For areas to be mowed remove all surface stones 2 inches or larger. Remove all other debris such as wire, cable, tree roots, pieces of concrete, clods, lumps or other unsuitable material.

Note: *On areas where wood chips and/or bark mulch was previously applied, either remove the mulch or incorporate it into the soil with a nitrogen fertilizer added. Nitrogen application rate is determined by soil test at time of seeding; anticipate 12 lbs nitrogen per ton of wood chips and/or bark mulch.*

Seedbed Preparation

Apply topsoil, if necessary, in accordance with the **Topsoiling** measure.

Apply fertilizer and ground limestone according to soil tests conducted by the University of Connecticut Soil Testing Laboratory or other reliable source. A pH range of 6.2 to 7.0 is optimal for plant growth of most grass species.

Where soil testing is not feasible on small or variable sites, or where timing is critical, fertilizer may be applied at the rate of 300 pounds per acre or 7.5 pounds per 1,000 square feet using 10-10-10 or equivalent and limestone at 4 tons per acre or 200 pounds per 1,000 square feet. Additionally, lime may be applied using rates given in **Figure PS-1**. A pH of 6.2 to 7.0 is optimal.

For areas that were previously mulched with wood chips or bark and the wood chips or bark are to be incorporated into the soil, apply additional nitrogen at a rate that is determined by soil tests at time of seeding.

Figure PS-1 Soil Texture vs. Liming Rates

Soil Texture	Tons / Acre of Lime	Lbs / 1000 ft² of Lime
Clay, clay loam and high organic soil	3	135
Sandy loam, loam, silt loam	2	90
Loamy sand, sand	1	45

[2] Frost crack or dormant seeding is a method used to establish a seeding during the off season and should be used only in extreme cases as there is a smaller chance of success. It can be an effective way to plant grass seed during late winter or early spring. This method is most effective on frozen ground where a seedbed has been prepared, or on areas that have been disturbed and where topsoil exists but vegetation has not been established. Frost crack or dormant seeding can also be used to re-seed or over-seed an area previously seeded, but where the survival was poor. The existing plants will remain undamaged, while the frost works the seed into the soil in bare areas. In all cases, seedings of this type need to be mulched to protect the seed from wind and water until satisfactory growing conditions occur (See Mulch for Seed measure). This method works particularly well with legumes, such as crown vetch and flat pea, which have a hard seed coat and the freezing action breaks down the seed coat to allow for germination.

Work lime and fertilizer into the soil to a depth of 3 to 4 inches with a disc or other suitable equipment.

Continue tillage until a reasonably uniform, fine seedbed is prepared. For areas to be mowed the final soil loosening and surface roughening operation is by hand, harrow or disk. If done by harrow or disc, it is generally done on the contour. Areas not to be mowed can be tracked with cleated earthmoving equipment perpendicular to the slope (see **Surface Roughening** measure). However, for areas where **Temporary Erosion Control Blankets** are to be used instead of **Mulch for Seed** prepare the seed bed in accordance with blanket manufacturer's recommendations.

Inspect seedbed just before seeding. If the soil is compacted, crusted or hardened, scarify the area prior to seeding.

Seed Application

Apply selected seed at rates provided in **Figure PS-3** uniformly by hand, cyclone seeder, drill, cultipacker type seeder or hydroseeder (slurry including seed, fertilizer.). Normal seeding depth is from 0.25 to 0.5 inch. Increase seeding rates by 10% when hydroseeding or frost crack seeding.

Seed warm season grasses during the spring period only.

Apply mulch according to the **Mulch for Seed** measure.

Irrigation for Summer Seeding

When seeding outside of the recommended seeding dates in the summer months, watering may be essential to the establish a new seeding. Irrigation is a specialized practice and care needs to be taken not to exceed the infiltration rate of the soil. Each application must be uniformly applied with 1 to 2 inches of water applied per application, soaking the ground to a depth of 4 inches.

Maintenance

Initial Establishment

Inspect seeded area at least once a week and within 24 hours of the end of a storm with a rainfall amount of 0.5 inch or greater during the first growing season.

Where seed has been moved or where soil erosion has occurred determine the cause of the failure. Bird damage may be a problem if mulch was applied too thinly to protect seed. Re-seed and re-mulch. If movement was the result of wind, repair erosion damage (if any), re-apply seed and mulch, and apply mulch anchoring. If failure was caused by concentrated water, (1) install additional measures to control water and sediment movement, (2) repair erosion damage, (3) re-seed and (4) re-apply mulch with anchoring or use **Temporary Erosion Control Blanket** measure and/or **Permanent Turf Reinforcement Mat** measure).

If there is no erosion, but seed survival is less than 100 plants per square foot after 4 weeks of growth, re-seed as planting season allows.

Continue inspections until at least 100 plants per square foot have grown at least 6 inches tall or until the first mowing.

First Mowing

Allow the majority of plants to achieve a height of least 6 inches before mowing it the first time. Do not mow while the surface is wet. Mowing while the surface is still wet may pull many seedlings from the soil and often leaves a series of unnecessary ruts. The first mowing should remove approximately one third of the growth, depending upon the type of grass and where it is being used. Do not mow grass below 3 inches.

If the seeding was mulched, do not attempt to rake out the mulching material. Normal mowing will gradually remove all unwanted debris.

Long Term Maintenance

Mow and fertilize at a rate that sustains the area in a condition that supports the intended use. If appropriate the height of cut may be adjusted downward, by degrees, as new plants become established. Carry out any fertilization program in accordance with approved soil tests that determine the proper amount of lime and fertilizer needed to maintain a vigorous sod yet prevent excessive leaching of nutrients to the groundwater or runoff to surface waters.

Although weeds may appear to be a problem, they shade the new seedlings and help conserve surface moisture. Do not apply weed control until the new seeding has been mowed at least four times.

Figure PS-2 Selecting Seed Mix to Match Need

Area To Be Seeded	Mixture Number[1]	
	Mowing Desired	Mowing Not Required
BORROW AREAS, ROADSIDES, DIKES, LEVEES, POND BANKS AND OTHER SLOPES AND BANKS		
A) Well or excessively drained soil[2]	1,2,3,4,5 or 8	5, 6, 7, 8, 9, 10, 11, 12, 16, ***22***
B) Somewhat poorly drained soils[2]	2	5, 6
C) Variable drainage soils[2]	2	5, 6, 11
DRAINAGE DITCH AND CHANNEL BANKS		
A) Well or excessively drained soils[2]	1, 2, 3, or 4	9, 10, 11, 12
B) Somewhat poorly drained soils[2]	2	
C) Variable drainage soils[2]	2	
DIVERSIONS		
A) Well or excessively drained soils[2]	2, 3 or 4	9, 10, 11
B) Somewhat poorly drained soils[2]	2	
C) Variable drainage soils[2]	2	
EFFLUENT DISPOSAL		5 or 6
GRAVEL PITS[3]		26, 27, 28
GULLIED AND ERODED AREAS		3, 4, 5, 8, 10, 11, 12
MINESPOIL & WASTE, AND OTHER SPOIL BANKS (If toxic substances & physical properties not limiting)[3]		15, 16, 17, 18, 26, 27, 28
SHORELINES (Fluctuating water levels)		5 or 6
SKI SLOPES		4, 10
SOD WATERWAYS AND SPILLWAYS	1, 2, 3, 4, 6, 7, or 8	1, 2, 3, 4, 6, 7, or 8
SUNNY RECREATION AREAS (Picnic areas and playgrounds or driving and archery ranges, nature trails)	1, 2 or ***23***	
CAMPING AND PARKING, NATURE TRAILS (Shaded)	19, ***21*** or ***23***	
SAND DUNES (Blowing sand)	25	
WOODLAND ACCESS ROADS, SKID TRAILS AND LOG YARDING AREAS		9, 10, 16, ***22***, 26
LAWNS AND HIGH MAINTENANCE AREAS	1, 19, ***21*** or ***29***	

[1] The numbers following in these columns refer to seed mixtures in **Figure PS-3**. Mixes for shady areas are in ***bold-italics*** print (including mixes 20 through 24).

[2] See county soil survey for drainage class. Soil surveys are available from the County Soil and Water Conservation District Office.

[3] Use mix 26 when soil passing a 200 mesh sieve is less than 15% of total weight. Use mix 26 & 27 when soil passing a 200 mesh sieve is between 15 and 20% of total weight. Use mix 26, 27 & 28 when soil passing a 200 mesh sieve is above 20% of total weight.

Source: USDA-NRCS

Figure PS-3 Seed Mixtures for Permanent Seeding

No.	Seed Mixture (Variety) [4]	Lbs/Acre	Lbs/1,000 Sq. Ft.
1[5]	Kentucky Bluegrass Creeping Red Fescue (Pennlawn, Wintergreen) Perennial Ryegrass (Norlea, Manhatten)	20 20 5 Total 45	.45 .45 .10 1.00
2[5]	Creeping Red Fescue (Pennlawn, Wintergreen) Redtop (Streeker, Common) Tall Fescue (Kentucky 31) or Smooth Bromegrass (Saratoga, Lincoln)	20 2 20 Total 42	.45 .05 .45 .95
3[5]	Creeping Red Fescue (Pennlawn, Wintergreen) Bird's-foot Trefoil (Empire, Viking) with inoculant[1] Tall Fescue (Kentucky 31) or Smooth Bromegrass (Saratoga, Lincoln)	20 8 20 Total 48	.45 .20 .45 1.10
4[5]	Creeping Red Fescue (Pennlawn, Wintergreen) or Tall Fescue (Kentucky 31) Redtop (Streeker, Common) Bird's-foot Trefoil (Empire, Viking) with inoculant[1]	20 2 8 Total 30	.45 .05 .20 .70
5[5]	White Clover Perennial Rye Grass	10 2 Total 12	.25 .05 .30
6[5]	Creeping Red Fescue Redtop (Streeker, Common) Perennial Rye Grass	20 2 20 Total 42	.50 .05 .50 1.05
7[5]	Smooth Bromegrass (Saratoga, Lincoln) Perennial Ryegrass (Norlea, Manhatten) Bird's-foot Trefoil (Empire, Viking) with inoculant[1]	15 5 10 Total 30	.35 .10 .25 .79
8[6]	Switchgrass (Blackwell, Shelter, Cave-in-rock) Weeping lovegrass Little Bluestem (Blaze, Aldous, Camper)	10[1] 3 10[1] Total 23	.25 .07 .25 .57
9[5]	Creeping Red Fescue (Pennlawn, Wintergreen) Crown Vetch (Chemung, Penngift) with inoculant[1] (or Flatpea (Lathco) with inoculant[1]) Tall Fescue (Kentucky 31) or Smooth Bromegrass (Saratoga, Lincoln) Redtop (Streeker, Common)	10 15 (30) 15 2 Total 42 (or 57)	.25 .35 (.75) .35 .05 1.00 (or 1.40)
10[5]	Creeping Red Fescue (Pennlawn, Wintergreen) Redtop (Streeker, Common) Crown Vetch (Chemung, Penngift) with inoculant[1] (or Flatpea (Lathco) with inoculant[1])	20 2 15 (30) Total 37 (or 52)	.45 .05 .35 (.75) .85 (or 1.25)
11[5]	Bird's-foot Trefoil (Empire, Viking) with inoculant[1] Crown Vetch (Chemung, Penngift) with inoculant[1] Creeping Red Fescue (Pennlawn, Wintergreen) or Tall Fescue (Kentucky 31) or Smooth Bromegrass (Saratoga, Lincoln)	8 15 20 Total 43	.20 .35 .45 1.00

continued

Figure PS-3 Seed Mixtures for Permanent Seeding (con't)

No.	Seed Mixture (Variety) [4]	Lbs/1,000 Lbs/Acre	No. Sq. Ft.
12[6]	Switchgrass (Blackwell, Shelter, Cave-in-rock)	101	.25
	Perennial Ryegrass (Norlea, Manhatten)	5	.10
	Crown Vetch (Chemung, Penngift) with inoculant[1]	15	.35
		Total 45	1.05
13[6]	Crown Vetch (Chemung, Penngift) with inoculant[1]	10	.25
	(or (Flatpea (Lathco) with inoculant[1])	(30)	(.75)
	Switchgrass (Blackwell, Shelter, Cave-in-rock)	5[1]	.10
	Perennial Ryegrass (Norlea, Manhatten)	5	.10
		Total 20 (or 40)	.45 (or .95)
14[5]	Crown Vetch (Chemung, Penngift) with inoculant[1]	15	.35
	(or (Flatpea (Lathco) with inoculant[1])	(30)	(.75)
	Perennial Ryegrass (Norlea, Manhatten)	10	.25
		Total 25 (or 40)	.60 (or 1.00)
15[6]	Switchgrass (Blackwell, Shelter, Cave-in-rock)	5[1]	.10
	Big Bluestem (Niagra, Kaw) or Little Bluestem (Blaze, Aldous, Camper)	5[1]	.10
	Perennial Ryegrass (Norlea, Manhatten)	5	.10
	Bird's-foot Trefoil (Empire, Viking) with inoculant[1]	5	.10
		Total 20	.40
16[5]	Tall Fescue (Kentucky 31)	20	.45
	Flatpea (Lathco) with inoculant[1]	30	.75
		Total 50	1.20
17[6]	Deer Tongue (Tioga) with inoculant[1]	10[1]	.25
	Bird's-foot Trefoil (Empire, Viking) with inoculant[1]	8	.20
	Perennial Ryegrass (Norlea, Manhatten)	3	.07
		Total 21	.52
18[6]	Deer Tongue (Tioga) with inoculant[1]	10[1]	.25
	Crown Vetch (Chemung, Penngift) with inoculant[1]	15	.35
	Perennial Ryegrass (Norlea, Manhatten)	3	.07
		Total 28	.67
19[3]	Chewings Fescue	35	.80
	Hard Fescue	30	.70
	Colonial Bentgrass	5	.10
	Bird's-foot Trefoil (Empire, Viking) with inoculant[1]	10	.20
	Perennial Ryegrass	20	.50
		Total 100	2.30
20[5]	Deleted due to invasive species		
21[5]	Creeping Red Fescue (Pennlawn, Wintergreen)	Total 60	1.35
22[5]	Creeping Red Fescue (Pennlawn, Wintergreen)	40	.90
	Tall Fescue (Kentucky 31)	20	.45
		Total 60	1.35
23[5]	Creeping Red Fescue (Pennlawn, Wintergreen)	15	.35
	Flatpea (Lathco) with inoculant[1]	30	.75
		Total 45	3.60
24[5]	Tall Fescue (Kentucky 31)	Total 150	3.60

Figure PS-3 Seed Mixtures for Permanent Seeding (con't)

No.	Seed Mixture (Variety)[4]	Lbs/Acre	Lbs/1,000 Sq. Ft.
25[5]	American Beachgrass (Cape)	58,500 culms/acre	1,345 culms/ 100 sq. ft.
26[6]	Switchgrass (Blackwell, Shelter, Cave-in-rock) Big Bluestem (Niagra, Kaw) Little Bluestem (Blaze, Aldous, Camper) Sand Lovegrass (NE-27, Bend) Bird's-foot Trefoil (Empire Viking)	4.0 4.0 2.0 1.5 2.0 Total 13.5	.10 .10 .05 .03 .05 .33
27[5]	Flatpea (Lathco) Perennial Pea (Lancer) Crown Vetch (Chemung, Penngift) Tall Fescue (Kentucky 31)	10 2 10 2 Total 24	.20 .05 .20 .20 .65
28[5]	Orchardgrass (Pennlate, Kay, Potomac) Tall Fescue (Kentucky 31) Redtop (Streeker, Common) Birds-foot Trefoil (Empire Viking)	5 10 2 5 Total 22	.10 .20 .05 .10 .45
29	Turf Type Tall Fescue (Bonanza, Mustang, Rebel II, Spartan, Jaguar) or Perennial Rye ("Future 2000" mix; Fiesta II, Blazer II, and Dasher II)	175 to 250	6 to 8

[1] Use proper inoculant for legume seeds, use four times recommended rate when hydroseeding.

[2] Use Pure Live Seed (PLS) = $\frac{\%\ \text{Germination X}\ \%\ \text{Purity}}{100}$

EXAMPLE: Common Bermuda seed with 70% germination and 80% purity=

$\frac{70 \times 80}{100}$ or $\frac{56}{100}$ or 56%

$\frac{10\ \text{lbs PLS/acre}}{56\%}$ = 17.9 lbs/acre of bagged seed

[3] DOT All purpose mix

[4] Wild flower mix containing New England Aster, Baby's Breath, Black Eye Susan, Catchfly, Dwarf Columbine, Purple Coneflower, Lance-leaved Coreopsis, Cornflower, Ox-eye Daisy, Scarlet Flax, Foxglove, Gayfeather, Rocky Larkspur, Spanish Larkspur, Corn Poppy, Spurred Snapdragon, Wallflower and/or Yarrow may be added to any seed mix given. Most seed suppliers carry a wild flower mixture that is suitable for the Northeast and contains a variety of both annual and perennial flowers. Seeding rates for the specific mixtures should be followed.

[5] Considered to be a cool season mix.

[6] Considered to be a warm season mix.

Sodding (SO)

Definition

Stabilizing fine-graded disturbed areas with the use of cut pieces of turf.

Purpose

- To permanently stabilize the soil.
- To immediately reduce erosion and the production of dust.
- To filter runoff water, reduce pollution.
- To improve site aesthetics.

Applicability

- On slopes 2:1 or flatter, except on very short slopes where the slope length is no longer than the width of the cut sod.
- In channels where the design velocity does not exceed 5 feet per second (fps) with a duration of 1 hour or less when the velocity is at or near 5 fps. For design velocities that exceed 5 fps, refer to the **Riprap** and **Permanent Turf Reinforcement Mat** measures.
- On sediment producing areas such as drainageways carrying intermittent flows, around drop inlets, in grassed drainageways, cut and fill slopes and other areas where conventional methods of turf establishment may be difficult or risky.
- In watersheds where maintenance of high water quality is particularly important.
- Where establishing turf grass and lawn is needed in the shortest time possible.

Planning Considerations

While the initial cost of sod is much higher than seed and mulch/erosion control blankets, sodding has some distinct advantages. Properly installed, sodding provides the following benefits which may justify the initial added expense:

- ❍ *Provides initial higher level of erosion control than seeding and mulching, capable of withstanding heavier rainfalls and velocities without failure and subsequent need for repair;*
- ❍ *Is an immediate soil cover and erosion protection where concentrated surface runoff would prevent the establishment of sod by normal seeding procedures;*
- ❍ *Establishes of a grass cover outside of the non-seeding dates.*
- ❍ *Offers immediate filtration of storm water runoff;*
- ❍ *Allows use of site in a much shorter length of time;*
- ❍ *Provides a quality controlled product, free from weeds, with predictable results; and*
- ❍ *Is aesthetically impressive.*

These reasons are particularly true where quick establishment and protection is important, such as sites in public water supply watersheds or near watercourses, where maintenance of high water quality may be particularly important to fisheries or human consumption.

Additionally, in drainageways and intermittent waterways where concentrated flow will occur, properly installed sod is preferable to seed because there is no time lapse between installation and the time when the channel is protected. Sodding can reduce maintenance to other sediment controls by keeping them free from the silts, sediments and other debris that can result from conventional methods of turf establishment. However, sod is limited in its ability to withstand high velocity and/or long duration flows.

Note: *The application of sod within a drainage way should be based on a determination that vegetation will satisfactorily resist channel velocities. Channel velocities for the design storm should not exceed 5 fps with a duration of less than 1 hour at or near 5 fps.*

As with any other seeding or planting of vegetation, a decision on top soiling must be made. Generally speaking, the poorer the site in terms of natural fertility and soil texture, and where a high quality vegetative cover is needed either for erosion control or aesthetics, the

greater the need for topsoil.

Specifications

Materials

Sod consists of:

- *stoloniferous or rhizomatous grasses that form a dense mat of plants, being cut at a uniform soil thickness of 0.75 inch ±0.25 inch) at the time of cutting, excluding the shoot growth and thatch, and*

- *standard size sections of sod strong enough to support their own weight and retain their size and shape when suspended from a firm grasp on one end of the section.*

For sodded waterways, the sod type shall consist of plant materials able to withstand the design velocity (see **Vegetated Waterway** measure).

Timing Limitations

Sod may be placed anytime during the year for slope stabilization but shall not be installed on frozen ground, nor for waterway applications during the months of December, January or February.

Sod shall be harvested, delivered, and installed within 36 hours. Plan site preparation (see below) and delivery of sod accordingly. Have sod delivered to the site as soon as practical after harvesting. During hot weather, delivery should be made within 6 hours and may be extended to 48 hours during cool seasons. It is generally unwise to move sod during July and August. If moved during this period, sod may need to be cut thicker and will require frequent irrigation.

Selection of Sod

Select sod grown from seed of adapted varieties or types and under cultural practices conducive to quality sod that will be free of any serious thatch, weed, insect, disease, and other pest problems.

Select species and varieties best suited for the sites to be stabilized. Use mixtures tested and approved by state experiment stations.

Select sod at least 15 months old but no older than three years. Cultivated turf grass is usually considered ready for harvest when a cut portion of sod 3 feet long by 1 to 1.5 feet wide will support its own weight when suspended vertically from the upper 10% of the section. The most common age of sod when cut is 15 to 24 months.

Select sod cuts of width and length suited to the equipment and job. Generally, sod cuts are from 12 to 24 inches wide with 18 inches being the most common width in New England. Lengths of cuts vary from 4 to 8 feet. Sod may also be available in rolls 16-48" wide with lengths as much as 100 feet in length. In New England, this "big roll" system commonly cuts sod in 200 sq. ft. or 250 sq. ft. rolls made up of 3 units, each 16 inches wide (4 ft. total) and 50 ft. or 62.3 ft long. Mechanical equipment is required for installation. Sod may be cut and rolled or folded in the middle and stacked on pallets.

Folded sod is cut shorter than rolled sod, about 3 to 4 feet in length. About 80% of all rhizomes are in the top fl inch of soil. The thinner the sod is cut the more quickly it will knit to the soil. However, the thinner the sod, the greater the need for irrigation as the thin sod will be more susceptible to drying out.

Site Preparation

Prior to soil preparation, bring to grade areas to be sodded in accordance with the approved plan.

Install and/or repair other sediment control measures needed to control water movement into the area to be sodded.

Clean soil surface of trash, debris, large roots, branches, stones and clods in excess of 1 inch in length or diameter. Do not apply sod to gravel or non-soil surfaces.

Place topsoil as needed, meeting the requirements of Topsoiling measure.

Perform soil tests to determine the exact requirements for lime and fertilizer. The soil tests may be conducted by the agronomy laboratory at the University of Connecticut Soil Testing Laboratory or a reputable commercial laboratory. Information on soil tests and procedures are available from county Cooperative Extension System, commercial nurserymen, lawn care professionals or other reliable source.

When required, spread these amendments evenly over the area to be sodded, and incorporate into the top 3 to 6 inches of the soil (if possible) by discing, harrowing or other acceptable means.

Fill or level any irregularities in the soil surface resulting from top soiling or other operations in order to prevent the formation of depressions or water pockets.

Note: *If the soil is hot or dry, lightly irrigate the soil immediately prior to laying the sod to cool the soil and reduce root burning and die back.*

Sod Installation (see **Figure SO-1**)

Install the first row of sod in a straight line with subsequent rows placed parallel to and butting tightly against each other. Stagger lateral joints to promote more uniform growth and strength. Take care to ensure that sod is not stretched or overlapped and that all joints are butted tight in order to prevent voids which would cause drying of the roots.

On slopes 3:1 or steeper or wherever erosion may be a problem, lay sod with staggered joints perpendicular to the direction of flow (i.e. on the contour) and secure by pegging or other approved methods. If the site of sodding is to be mowed, the use of wood pegs or biodegradable staples is recommend over metal staples for anchoring to reduce problems caused by mowing equipment hitting metal staples should they get lifted over time from the sod surface. Also, for these areas, sod cut into long strips and rolled for transport is desired because it minimizes the number of sections.

As sodding is completed, roll and tamp the sod to ensure contact with the soil.

After rolling, irrigate the sod to a depth sufficient to

thoroughly wet the underside of the sod pad and the 4 inches of soil below the sod.

Sodded Waterway Installations

Follow site preparation requirements listed above.

Use a sod capable of withstanding the design velocity. Lay sod strips perpendicular to the direction of channel flow, taking care to butt the ends of strips tightly.

As sodding of clearly defined areas is completed; roll or tamp the sod to ensure contact with the soil.

Peg or staple to resist washout during the establishment period. Fasten every 3 inches on the leading edge and 1 to 2 ft. laterally. If the site of sodding is to be mowed, the use of wood pegs or biodegradable staples is recommended over metal staples for anchoring to reduce problems caused by mowing equipment hitting metal staples should they get lifted over time from the sod surface.

After rolling, sod shall be irrigated to a depth sufficient to thoroughly wet the underside of the sod pad and the 4 inches below the sod.

Maintenance

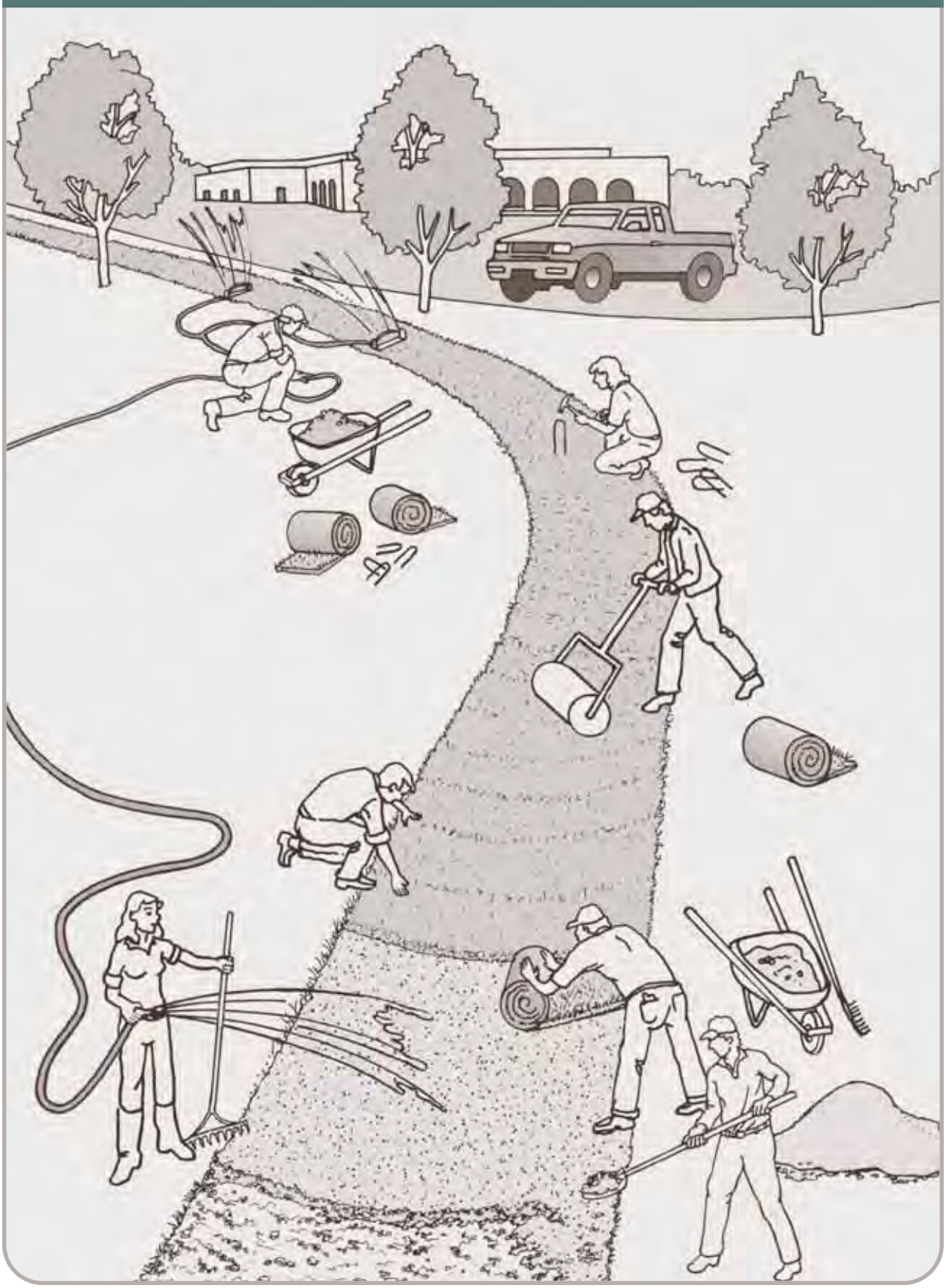
During the first week, inspect daily and if rainfall is inadequate, then water the sod as often as necessary to maintain moist soil to a depth of at least 4 inches below the sod. Subsequent waterings may be necessary to ensure establishment and maintain adequate growth.
After the first week, inspect sodded area at least once a week and within 24 hours of the end of a storm with a rainfall amount of 0.5 inch or greater during the first growing season.

Where sod has died or has been moved or where soil erosion has occurred, determine if the failure was caused by inadequate irrigation, poorly prepared surface, improper anchoring, excessive sedimentation or excessive flows. If the failure was caused by concentrated flow, check water velocities and duration to ensure it does not exceed 5 fps or a duration greater than 1 hour at or near 5 fps. Install additional measures to control water and sediment, repair erosion damage, and reinstall sodding with anchoring.

Do not mow until the sod is firmly rooted, usually 2 to 3 weeks. Do not remove more than 1/3 of the grass leaf at any one cutting.

Long term maintenance of the sod should be commensurate with the planned use of the area. For liming and fertilization, follow soil test recommendations when possible.

Figure SO-1 Sod Installation



3-Vegetative Soil Cover

Landscape Planting (LP)

Definition

Planting trees, shrubs, or ground covers for stabilization of disturbed areas.

Purpose

- To aid in protecting and stabilizing soil.
- To intercept precipitation and retard runoff while providing increased plant diversity, food and shelter for wildlife, and improved air quality; to develop high quality riparian buffers and enhanced site aesthetics.

Applicability

- On steep or irregular terrain, where mowing to maintain an herbaceous plant cover is not feasible.
- Where ornamental plantings are desired to improve site aesthetics.
- In shady areas where turf establishment is difficult.
- Where woody plants are desirable for soil conservation, plant diversity, or to create or enhance wildlife habitat.
- Where permanent plantings will reduce the extent of lawn and lawn maintenance requirements.
- Where riparian or other functional buffers need to be extended, re-established or created.
- Where wind breaks are needed.

Planning Considerations

The initial function of any vegetation to be established on disturbed soils is to prevent soil detachment and subsequent erosion. However, other factors are considered when choosing whether to plant grass and/or other herbaceous vegetation, or whether woody landscape plantings should be utilized.

Some disadvantages to using grass are:

- *Permanent grass cover requires periodic mowing to prevent the area from being occupied with shrubs and tree seedlings through the process of natural succession.*
- *Grass cover does little to control access by pedestrians or vehicles. In areas of heavy pedestrian use, soil compaction may result in death of the plants, increasing erosion potential.*
- *Grass provides limited value for wildlife. However, extensive turf may also provide an attractive feeding habitat for wildlife which may become a nuisance. (e.g. Canada Geese).*

Landscape plantings of trees, shrubs, and ground covers have particular attributes which provide benefits that grass or herbaceous cover cannot. These benefits include:

- *Improving air quality;*
- *Modifying air circulation patterns;*
- *Reducing heating and cooling costs;*
- *Providing shade;*
- *Preventing blinding reflections;*
- *Softening architectural features;*
- *Screening undesirable views;*
- *Controlling or screening undesirable noises;*
- *Calming and controlling traffic;*
- *Providing wildlife food and shelter; and*
- *Restoring natural conditions to a disturbed site.*

Landscape planting plan

If landscape plantings are intended, then a landscape planting plan should be developed. The landscape planting plan should identify the species, location, number of each planting specified to be planted, the type of planting stock (i.e. bare-root, balled and burlapped, etc.), and the timing for planting.

Newly transplanted trees and shrubs which are carefully selected to match the site conditions will need the least aftercare, and will become established quickly. Conversely, plants put under stress by being transplanted into an environment they are not well adapted to will need extraordinary and long term maintenance. The following characteristics should be taken into account when developing a landscape planting plan and selecting plant material:

Adaptability to Site Conditions: Proper selection of landscape plants requires a careful study of the characteristics of the site, a thorough knowledge of the species available and hardy to the area, and a thorough knowledge of all the potential insect, disease, and cultural problems which may weigh against the plant selected for the required function.

Site characteristics such as soil type, surface and subsurface drainage, and light availability are primary limiting factors that determine if a given plant will survive. Other site specific factors such as exposure to salt at shoreline or roadsides, high winds, polluted air, or heat from reflected sun may limit plant survivability. The specific conditions at each site must be taken into account when selecting the appropriate plant for the site.

Hardiness Zones: Woody landscape plants must be hardy to the area in which they are planted in order to survive. Hardiness zones are geographical areas mapped according to the approximate range of average annual minimum temperatures. Plants adaptable to conditions in specific zones are said to be hardy in those zones (see **Figure LP-1**). Connecticut has three hardiness zones, reflecting the milder conditions along the southwestern shoreline, cooler weather in the eastern and western highlands, and a transitional area dominating the bulk of the central and eastern portions of the state.

Mature Height and Spread: To minimize future maintenance and replacement costs and to enhance long term plant health, select plants to match the species to the site, and place plants to provide adequate space for the plant to grow to its natural mature size.

Consideration must be given to the height and location of overhead utilities, the location and depth of underground facilities, lines of sight around intersections of roadways, road and sidewalk clearance needed for snow removal operations, clearance from buildings, and all other potential situations where the maturing plant will become an obstruction, nuisance, or hazard.

If the space allotted to the plant selected is inadequate, suitable periodic maintenance pruning must be planned in accordance with the needs of the species, limitations of the site, or the intended effect. Normally, plants installed for erosion control purposes are not intended to be pruned, and should be selected and placed with knowledge and consideration of mature sizes.

Growth and Establishment Rate: Some trees and shrubs attain their mature sizes very rapidly, whereas others are slow to grow to mature size. Some shrubs and vines will become established quite rapidly, with growth characteristics like rooting from the growing tips of the stem and sprouting from root systems and underground stems. Knowing how fast a tree, shrub, or vine will become established and how quickly it will grow to mature size is important in order to select the right plant, and the number of plants (spacing) for the particular situation. Growth and establishment rates are also linked to how well the plant has been selected to match the site conditions. Plants that are well adapted to the site will become established quicker, live longer and will require less aftercare.

Ornamental Characteristics, Sanitation: Since these Guidelines are intended to be concerned primarily with landscape planting as it relates to soil erosion and sediment control, no attempt has been made to provide guidance on plant selection for ornamental or aesthetic purposes. However, plants in a landscape design can and should be selected for specific functional attributes which contribute to the goal of soil erosion and sediment control.

Functional characteristics of specific plants should be considered carefully so that the plant chosen will fulfill its intended role. For instance, to control soil erosion, plants with rapidly growing aggressive root systems may be selected. To absorb sound or screen views in winter conditions, deep, dense planting of evergreens may be selected. To filter dust from summer winds, a deciduous tree with coarse, hairy leaves could be chosen for its enhanced ability to trap airborne dust. Plants that provide a variety of nuts and berries as sources of food for wildlife may contribute significantly to the habitat value of a particular location.

Undesirable attributes of plants must also be considered. Aggressive root systems beneficial in one application may create problems in other applications where the roots may enter and obstruct underground pipelines. Root penetration from trees and shrubs may create internal pathways for water in earthen dams and dikes, and roots may also damage sidewalks, structures, pavement, and underground utility installations. Trees with large leaves or that drop excessive quantities of seed pods, nuts, fruits, or other debris may be undesirable for aesthetic, safety, or convenience reasons. Potential clogging of drainage systems with debris from trees must be considered in selecting street trees. Tree species that don't drop troublesome parts, and trees with smaller, thinner leaves, or with leaves that drop gradually are preferred in situations where clogging of drainage systems is a primary concern.

Timing of Transplanting: When plants may be transplanted depends on how they are grown and supplied. Balled and burlapped and container grown plants can be planted any time of the year, provided that the soil at the planting site is not waterlogged or frozen.

Deciduous trees are normally dug and balled for transplanting in the early spring, before flowers or leaves develop. Some species transplant best in either the spring or fall of the year, and balled in burlap stock may not be available other than during the optimal season for transplanting. Normally, spring flowering trees are not dug while flowering, so summer availability of field grown balled and burlapped trees is usually somewhat restricted to those dug early in the season.

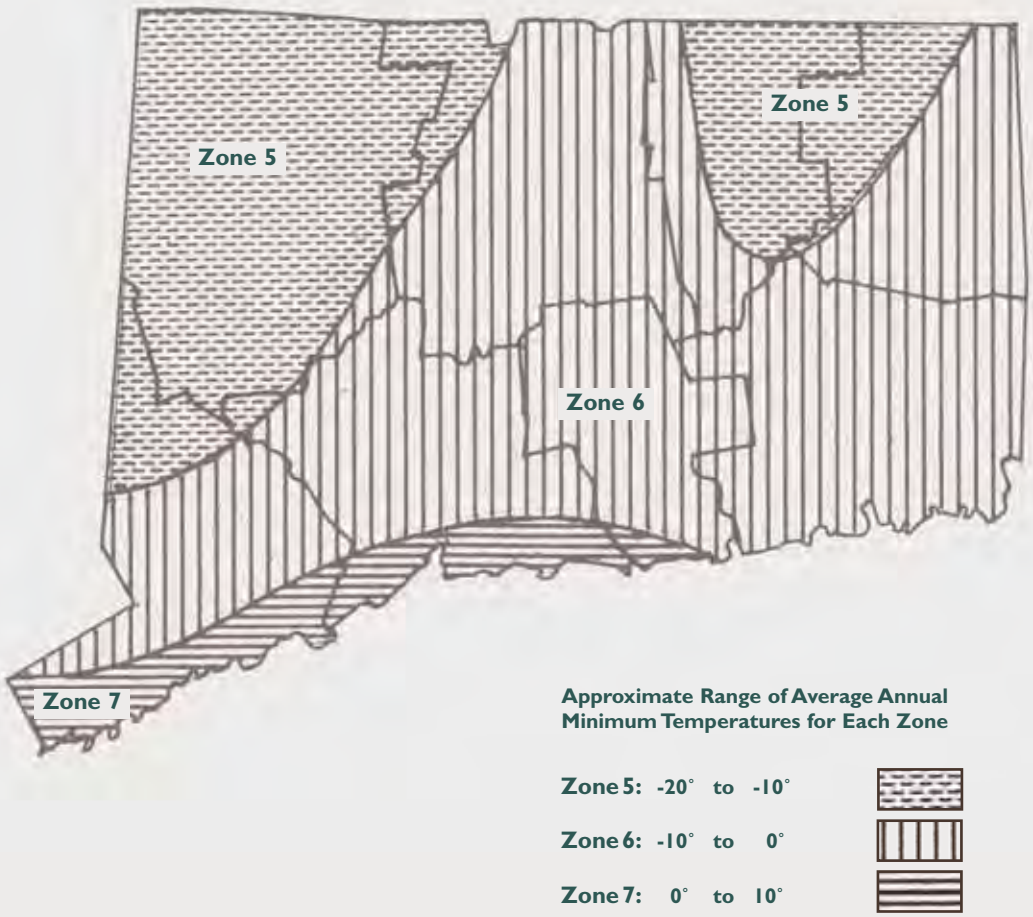
Balled and burlapped plants may lose 90% or more of their root system from the digging operation. If dug during the active summer growth period, significant stress may be placed on the plant. For this reason, digging and balling operations normally cease during the summer months. Summer digging of deciduous trees may be done, but requires special preparation and aftercare to minimize potentially fatal stresses on the plant. Evergreens may also be dug and balled in burlap in the early spring, but are also successfully dug and transplanted in summer after new growth has hardened off.

Trees and shrubs to be planted as bare-root plants should be handled only when dormant in spring, or after leaf fall in autumn.

Landscape Plant Forms, Standards, and Sources: Landscape plants may be bought as balled in burlap or similar material, containerized, or as bare rooted stock. All plants shall comply with the American Standard for Nursery Stock (ANSI Z60.1), produced by the American Association of Nurserymen, which provides a comprehensive and consistent set of measurement and specification standards for all types of plant material.

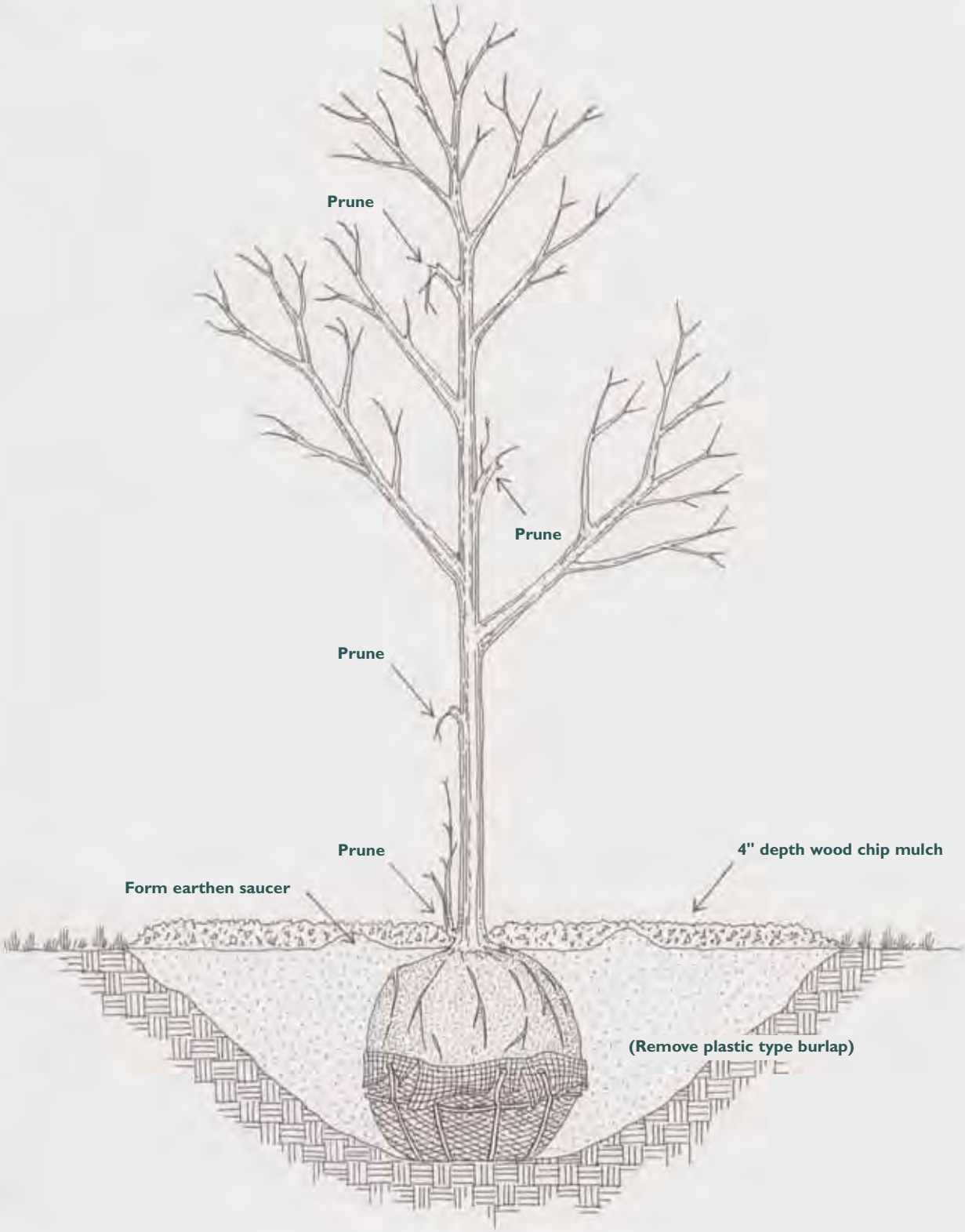
The plants identified in **Figure LP-4, Figure LP-5** and **Figure LP-6** are usually available at commercial nurseries balled in burlap, or in containers. Trees and shrubs may also be purchased from the state nursery or from county Soil and Water Conservation Districts.

Figure LP-1 Hardiness Zone Map of Connecticut



Source: Adapted from USDA-NRCS FOTG Section I iii Maps. July 1994.

Figure LP-2 Transplanting Balled and Burlapped Plants



A broad range of plant material is available to fulfill the desired functions of a landscape planting. Although some plants known to be hardy to Connecticut are included in the list below, information on additional appropriate plants may be obtained from Connecticut licensed Arborists, a landscape architects licensed to practice in Connecticut, the USDA Natural Resources Conservation Service, the Connecticut Agricultural Experiment Station, and the Connecticut Cooperative Extension System.

Invasive Species: Certain introduced shrubs, like Autumn Olive (Elaegnus umbellata), Honeysuckles (Lonicera spp), Multiflora Rose (Rosa multiflora), Winged Euonymus (Euonymus alatus), and Asiatic Bittersweet (Celastrus orbiculatus) have been identified as undesirable because they are not native, and are invasive into otherwise naturally vegetated areas. Native plants are preferred in most soil erosion and sediment control applications. The Center for Conservation and Biodiversity at The University of Connecticut maintains a list entitled: "Invasive, Non-Native Plant Species Occurring in Connecticut", listed as Publication #1, which should be consulted to avoid selecting undesirable, non-native invasive plants.

Specifications

Delivery and Storage of Materials

Upon receipt of plant stock, check to see that adequate protection during transit has been provided. If shipped by open truck, the plants should have been covered with a tarpaulin or canvas to minimize desiccation from exposure to the sun and wind. When delivery is made by an enclosed vehicle, the plants should have been carefully packed and adequately ventilated to prevent "sweating" of the plants. Physical injuries should have been prevented by careful packing.

In all cases, plants must be kept cool and moist until planting.

Insofar as practical, all plant material should be planted on the day of delivery. Plants which must be temporarily stored on site should be kept in the shade and protected from drying winds. For balled stock, root balls must be protected by covering the root ball with soil or other acceptable material and must be kept moist. Container stock held on site may also require watering if planting is delayed. Bare root plant may be stored in a cool, shaded area for as long as 10 days. If bare root plants must be kept for longer than 10 days, they should be "heeled in" (temporarily planted in a trench) until they can be permanently planted. All stock should be handled carefully and as few times as possible.

Transplanting Procedures

Transplanting Balled in Burlap Plant Material: Figure LP-2 shows the proper planting of balled and burlapped plant material, using a deciduous tree as an illustration.

Stock Examination: Determining Proper Planting Depth - Proper planting depth of a plant balled in burlap may vary depending upon how the plant was dug and balled. Each plant should be examined to determine if the plant was dug and balled properly. To do this, locate the crown of the plant - the point where the root mass or first major root originates from the stem. This point should be at or slightly below the top of the soil. Also use this point as a reference to determine if excess soil cover has been placed over the root ball by improper digging and balling.

Ball sizes should always be of a diameter and depth to encompass enough of the fibrous and feeding root system as necessary for the full recovery of the plant. Recommended ball depth to diameter ratios are shown in **Figure LP-3**. Under certain soil and regional conditions, plants have roots systems of proportionally less depth and greater diameter. Those require a more shallow but wider ball to properly encompass the roots. Conversely, in other soils and in certain regions roots develop greater depth and less spread, requiring an exceptionally deep ball which may be smaller in diameter and greater in depth than the size recommended.

Compare the ball size in relation to the size of the plant, using the current American Standard for Nursery Stock (ANSI Z60.1) and note the size of the roots cut when dug to be balled in burlap. Undersize root balls or large cut roots are a clue that digging may have been improper, and that actual root mass may be inadequate to support the plant during its establishment period.

Site Preparation (see **Figure LP-2**)**:** Thoroughly examine the root ball to determine the proper planting depth for each plant (see Stock Examination above). Excavate a planting site whose top width is 3 times the width of the root ball to a depth that is no deeper than the proper planting depth with sloped sides tapering to the surface. The soil under the root ball should remain undisturbed, or if disturbed, should be tamped prior to planting, to prevent settling of the root ball. Since most new roots will grow horizontally from the root ball, compacted soil under the ball will not inhibit rooting.

Planting site preparation should focus on providing the highest quality environment possible for root development during the first year or two after transplanting. Long term survival depends on selecting the proper species for the site. More intensive site preparation will be necessary in urban soil conditions and on disturbed sites than when planting in high quality undisturbed soil.

Handling and Setting the Plant: Set the plant in the planting site so that it is plumb, level, and centered. Do not use the trunks of trees as levers to adjust the position of the root ball, as this may fracture the root ball and damage roots. Instead, move the root ball itself, being careful not to pull on ropes which may lay against bark (especially in spring, when bark slips easily).

When the plant is properly positioned in the planting site, **cut all twines and other tying material encircling the trunk**. For natural burlap wrapping pull it back and cut off the excess and discard, do not tuck it into the hole where it can cause problems with air pockets and moisture retention, both of which may lead to rotted roots. Remove synthetic burlap completely. To test fabric to see if it is synthetic, burn an edge with a match. If it melts, it is synthetic and must be completely removed.

Figure LP-3 Ball Depth to Diameter Ratio

Diameter less than 20". Depth not less than 75% of diameter or 3/4 of width.

Diameter 20 to 30". Depth not less than 66.6% or 2/3 of width.

Diameter 31 to 48". Depth not less than 60% or 3/5 of width.
Balls with a diameter of 30" or more should be drum laced.

Wire baskets are commonly used to contain and transport some balled and burlapped plant material. Cut and remove as much of the wire basket as possible to avoid future interference with root growth.

Backfilling, Watering and Mulching: After all tying materials and wire baskets are removed as appropriate, backfill the site to original grade with original soil. Soil amendments are unnecessary in most planting situations. Water the backfill soil thoroughly, allowing the water to settle the soil, removing air pockets. Do not pack with feet or tools. Use enough water to ensure thorough saturation of the soil. Add soil to bring the soil level back up to grade when the water has infiltrated. As a temporary measure to aid in establishment, a low (3" to 6") rim of tamped soil can be built to help hold water for subsequent watering. Locate the inside edge of the rim at or outside the edge of the root ball. Mulch the disturbed area with **Landscape Mulch** (see **Figure LP-2**).

Fertilization: Under normal circumstances, it is not recommended to fertilize woody plants upon initial planting.

Staking: Staking or guying trees using wire covered with rubber hose sections is not recommended in most circumstances. Failure to remove stakes and wires has caused severe damage to trees by girdling the trees at the point of wire attachment. By allowing the tree to flex somewhat in the wind, the tree will be able to develop a proper taper and anchoring roots to naturally resist movement in the wind. Staking and guying may become necessary due to loose root balls, unusually high or persistent prevailing winds, or other specific conditions. In these cases, use of a flexible and biodegradable type of tree tying material is preferred.

Transplanting Bare Root Plant Material

Figure LP-7 shows how to properly plant bare rooted plants and shows the proper minimum root spread for bare root deciduous shrubs. Dig the hole deep and wide enough to accommodate all the roots, and allow them to spread out without bunching or curling. (No "J"- shaped roots.) If the roots are excessively long, they may be pruned back to a length of 10 to 12 inches. Place the plant at the same depth in the soil at which it was planted when rooted in the nursery. Add soil as necessary to fill planting hole to existing grade. Water thoroughly after planting. Make sure that there are no turned up roots or air pockets in the soil.

Either use **Landscape Mulch** or prepare the site by very low cutting of grass and weeds to reduce initial competition. It is very important to prevent grasses, vines, and other vegetation from competing with the newly transplanted plants for sunlight, water, and soil nutrients.

While this section is meant to refer primarily to the planting of relatively small, bare root shrubs, larger plants including trees may be obtained as bare root stock. When larger shrubs or trees are planted bare root, staking and guying will likely be necessary. As above, use of a flexible and biodegradable type of tree tying material is preferred to the traditional hose and wire system.

Transplanting Container Grown Plants

Stock Examination: For plants grown in containers, carefully remove the plant from the container, and inspect the root mass to determine if the plant has well developed roots, and to be sure it has not been recently repotted to a larger pot size. Containerized stock should have well developed roots, but should not be pot bound, which causes roots to encircle the container, resulting in difficulties in establishment.

Site Preparation: Site preparation for container grown plants is the same as for balled and burlapped plants.

Handling and Setting the plant: When container grown plants have well developed root systems that encircle the pot, either loosen the roots or slice the root ball with a sharp knife vertically three or four times, cutting about an inch deep. This will promote new roots to develop and spread out, rather than continuing to follow the circular rooting pattern. If excess soil in the pot had buried the original soil level just above the crown of the plant, be sure to adjust the planting depth to place the plant back at or slightly above the original soil level.

Backfilling, Watering and Mulching: Backfill the site to original grade with original soil. Soil amendments are unnecessary in most planting situations. Water the backfill soil thoroughly, allowing the water to settle the soil, removing air pockets. Do not pack the soil tightly with feet or tools. Use enough water to ensure thorough saturation of the soil. Add soil to bring the soil level back up to grade when the water has infiltrated. Mulch the disturbed area with **Landscape Mulch**.

Fertilization: Under normal circumstances, it is not recommended to fertilize woody plants upon initial planting.

Maintenance

Maintenance of trees, shrubs, and ground covers is an exhaustive topic which is not addressed by these Guidelines. Instead, the most critical maintenance needs for the first year of a newly transplanted plant are described below.

Inspection Requirements

Inspect plants until they are established or at least monthly for 1 year following planting, and more frequently during hot dry periods for mulch adequacy, soil moisture and general plant condition. When a plant has regrown a sufficient root system such that it can withstand normal variations in climate and soil conditions, and has resumed normal growth, it is considered to be established. An established plant will exhibit normal growth patterns of bud break and leaf fall, and will have resumed a growth rate considered normal for the species.

Larger plants, especially balled in burlap trees which have lost a significant amount of their roots systems upon transplanting will need the most attention during

the initial establishment period.

Mulch and Water

Apply additional landscape mulch around landscape plants as needed to keep soil covered and to inhibit weed growth. Keeping all newly transplanted plants adequately mulched is important to moderate fluctuations in soil moisture and temperature. Trees that are mulched will recover from transplanting, become established, and resume normal growth more quickly than trees planted without the benefit of mulch.

Water plants during hot dry periods when soil around the plants begins to dry out. If leaves of recent landscape plantings are wilted, severe water deficiency is indicated, and permanent damage to the plantings may result if supplemental water is not provided promptly. For successful establishment of summer plantings, adequate watering during the balance of the summer and into the fall is especially important.

Note: *A useful rule of thumb in Connecticut is that new plantings should receive at least 1 inch of rain per week.*

Pruning

Prune to remove only dead or damaged limbs on newly planted trees unless an arborist has recommended otherwise. Pruning the top of the tree will severely weaken the tree's ability to grow a healthy new root system in the new site. This is especially important for trees balled in burlap, which lose a large portion of their original root system when the are dug from the field. For new roots to form from plants grown in containers, top pruning should be delayed for at least a year. Ideally, newly planted trees should not be pruned until after their third year, and then only to remove dead and weak branches, and to train the tree's future growth by removing or pruning any wayward branches which will lead to future problems, or detract from the natural shape of the plant.

Insect and Disease Control

All plants in the natural environment are host to a wide variety of insect and disease organisms. When insects or disease problems on a plant become threatening to the life or practical value of the plant, corrective or preventative actions may become necessary. When a problem occurs, positive identification of the host, and then of the insect or disease problem is vital to successfully resolving the problem. Plants should be selected to avoid common insect or disease problems by choosing those species resistant to common plant diseases, or unpalatable to common insect problems.

The Cooperative Extension System or a state licensed arborist can help identify insect and disease problems and suggest solutions.

Figure LP-4 Trees for Landscape Planting

Common Name (*Botanical Name*)	Leaf type[1]	Height	Soil Moisture Preferred Wet	Moist	Dry	pH range	Users: Lawns	Seashore	Street	Shade tolerance	Salt tolerance[2]	Pollution Tolerance[2] O_3	SO_2	F	Remarks
BEECH *(Fagus grandifolia)*	D	70-120		X		6.5-7.5	X			Fair	S	-	S	-	Long-lived. Has edible nuts. Needs lots of space.
BIRCH, BLACK, WHITE and GRAY *(Betula spp.)*	D	50-80	X	X		4.0-5.0	X			Good	-	S	S	-	Prefers deep, moist soils such as stream banks. Graceful form.
CEDAR, EASTERN RED *(Juniperus virginiana)*	E	20-50	X	X	X	6.0-6.5	X			Good	-	T	T	T	Long-lived.
CHERRY, JAPANESE *(Prunus serrulata)*	D	15-20		X		6.5-7.5	X	X		Good	-	-	-	T	Very showy pink or white flowers. Usually grafted on 6-7 ft. stem.
CRABAPPLE *(Malus spp.)*	D	15-20		X		6.5-7.5	X	X	X	Fair	I	S	S	-	White or pink flowers. Many varieties, some with edible fruit.
DOGWOOD, FLOWERING *(Cornus kousa)*	D	30-40		X		5.0-6.5	X	X		Good	-	T	T	T	Ideal street tree. White or pink flowers. Has poor drought resistance.
HAWTHORN *(Crataegus spp.)*	D	15-25		X		6.0-7.5	X	X		Fair	I	-	S	-	Thorny, Washington and Lavalle types are good ornamentals. Tolerates parking lot conditions. Has some insect and disease problems.
LOCUST, HONEY *(Gleditsia tri-acanthos inermis)*	D	50-75	X	X	X	6.5-7.5	X	X	X	Good	T	S	-	-	Sturdy, wind-firm tree. Overused in urban areas.
MAPLE, HEDGE *(Acer campestre)*	D	20-30		X	X	6.5-7.5	X	X		Good	-	T	T	I	Prefers well-drained, deep fertile soil. May be used in clipped hedges.
MAPLE, RED *(Acer rubrum)*	D	50-80	X	X		4.5-7.5	X	X	X	Good	S	T	T	-	Grows rapidly when young. Good tree for suburbs but not city.
MAPLE, SUGAR *(Acer saccharum)*	D	50-70	X	X	X	6.5-7.5	X			Fair	I	T	T	-	Outstanding fall foliage. Suburban, but not city tree. Slow-growing and shapely. Intolerant of salt.
OAK, PIN *(Querus palustris)*	D	60-80	X	X	X	5.5-6.5	X	X		Good	T	S	S	I	Most easily transplanted of the oaks.
OAK, RED NORTHERN *(Querus rubra borealis)*	D	70-90		X	X	4.5-6.0	X	X	X	Good	T	T	T	I	Most rapid-growing oak. Needs room.
OAK, SCARLET *(Querus coccinea)*	D	60-80			X	6.0-6.5	X	X		Good	T	S	T	I	Prefers sandy or gravelly soils.
OAK, WHITE *(Querus alba)*	D	60-80		X	X	6.5-7.5	X	X	X	Fair	T	S	S	I	Long-lived, stately tree. Grows slowly.
PINE, AUSTRIAN *(Pinus nigra)*	E	30-50		X	X	4.0-6.5	X		X	Good	T	-	-	-	Very hardy and rapid-growing. Will tolerate shallow soil and drought.
PINE, JAPANESE BLACK *(Pinus thunbergii)*	E	30-50		X	X	4.0-6.5	X		X	Fair	T	-	-	-	Disease problems.
PINE, SCOTCH *(Pinus sylvestris)*	E	60-90			X	4.0-6.5	X			Good	I	S	S	S	Disease problems.
PINE, WHITE *(Pinus strobus)*	E	80-100			X	4.0-6.5	X			Fair	S	S	S	S	Very attractive, rapid-growing tree. Prefers deep sandy loam. Subject to white pine blister rust.
YEW, JAPANESE *(Taxus cuspidata)*	E	15-20		X		6.0-6.5	X			Good	-	T	-	I	Hedges and borders. Preferred food of white-tailed deer.

[1] D is deciduous plants
E is evergreen or coniferous plant

[2] Pollution tolerance and salt tolerance: "S" Sensitive. Will show physical damage.
"T" Tolerant.
"I" Intermediate. Damage depends on growing conditions and exposure to pollutant.
"-" No information at this time.

Source: USDA-NRCS

Figure LP-5 Shrubs for Landscape Planting

Common Name (Botanical Name)	Leaf type[1]	Drainage Tolerance	Shade tolerance	pH range	Mature Height	Uses
AMERICAN CRANBERRY BUSH *(Viburnum trilobum)*	D	Moderately Well-Drained to Poorly Drained	Fair	6.5-7.5	6-7	Hedges and borders. Flowers inconspicuous, red berries, winter food for birds. Fruits in 4-5 years.
ARROWWOOD *(Viburnum recognitum or dentatum)*	D	Well-Drained to Poorly Drained	Good	5.5-7.0	5-10	Hedges and borders.White flowers, blue to blue-black berries. Screens or naturalized mass. Edible by both birds and humans
BAYBERRY *(Myrica pensylvanica)*	E	Droughty to Moderately Well-Drained	Poor	5.0-6.0	6-8	Revegetating sand dunes; ornamental for droughty areas. Flowers inconspicuous, waxy grey berries. Fixes nitrogen in soil.
BEACH PLUM *(Prunus maritima)*	D	Droughty to Moderately Well-Drained	Fair	6.0-8.0	7	Revegetating sand dunes and droughty areas. Flowers white, fruit purple, plum-like and edible. Fruit used for jelly and baking, also favored by wildlife.
BLUEBERRY HIGHBUSH *(Vaccinium corymbosum)*	D	Droughty to Somewhat Poorly Drained	Good	4.5-5.5	8-12	Borders and hedges or individual. Flowers white to pinkish, berries blue-black.
BLUEBERRY LOWBUSH *(Vaccinium angustifolium or vacillan)*	D	Droughty to Somewhat Poorly Drained	Good	4.5-5.5	1-3	An excellent ground cover. Flowers white, berries blue.
BRISTLY LOCUST "ARNOT" *(Robinia fertilis)*	D	Droughty to Moderately Well-Drained	Fair	5.0-7.5	6	Steep slopes, gravelly infertile areas. Fixes nitrogen. Spread by sprouting from roots. Flowers pink, seeds in pods.
GRAY DOGWOOD *(Cornus racemosa)*	D	Droughty to Poorly Drained	Fair	4.5-6.0	7-10	Good for stream banks.
CORALBERRY *(Symphoricarpos orbiculatus)*	D	Droughty to Well-Drained	Fair	4.5-6.0	4-6	Flowers yellow.
ELDERBERRY *(Sambucus canadensis)*	D	Well-Drained to Poorly Drained	Fair	6.0-7.5	12	Provides food for birds and deer. Flowers white, fruit edible purple berries. Fruit in 4-5 years.
FIRETHORN *(Pyracantha coccinea)*	E	Droughty to Moderately Well-Drained	Fair	6.0-8.0	10-15	Southern CT only. Screens, barriers. Flowers white, fruit orange or red berries. Food for songbirds. Low-growing and upright types available.
HORIZONTAL JUNIPER *(Juniperus spp.)*	E	Droughty to Well-Drained	Poor	5.0-6.0	1-2	Used as ground cover or ornamental. Set plants 2 feet apart for cover in 2-3 years. Flowers and fruit inconspicuous.
JAPANESE YEW *(Taxus cuspidata)*	E	Moderately Well-Drained to Somewhat Poorly Drained	Good	6.0-6.5	15-20	Used for hedges and screens. Flowers and fruit inconspicuous.
MOUNTAIN LAUREL *(Kalmia latifolia)*	E	Droughty to Somewhat Poorly Drained	Fair	4.5-5.5	7-15	Erect shrub, naturalized mass. Flowers white, pink to deep rose, fruit inconspicuous and poisonous to both humans and animals in quantity.
RED OSIER DOGWOOD *(Cornus stolonifera)*	D	Moderately Well-Drained to Poorly Drained	Fair	4.5-6.0	4-6	Good for stream banks, damp soils.
RUGOSA ROSE *(Rosa rugosa)*	D	Droughty to Moderately Well-Drained	Fair	6.0-7.0	3-5	Stabilizing sand dunes and landscaping. Flowers white to pink, fruits red hips in 1-2 years. Food and cover for songbirds and rabbits. Sprawling growth habit, but not aggressive.
SHADBUSH *(Amelanchier canadensis)*	D	Well-Drained to Somewhat Poorly Drained	Fair	5.5-6.5	3-6	Natural mass, specimen. Flowers white, fruit red to black.

continued

Figure LP-5 Shrubs for Landscape Planting (con't)

Common Name (Botanical Name)	Leaf type[1]	Drainage Tolerance	Shade tolerance	pH range	Mature Height in Ft.	Uses
SHORE JUNIPER "EMERALD SEA" *(Juniperus conferta)*	E	Droughty to Well-Drained	Fair	5.0-6.0	1	Stabilizing sand dunes and sandy road banks. Flowers and fruits inconspicuous.
SIEBOLD FORSYTHIA *(Forsythia suspensa seibold)*	D	Droughty to Well-Drained	Poor	4.5-6.0	4-6	Over used. Flowers yellow, fruit inconspicuous.
SWEETFERN *(Comptonia peregrina)*	D	Droughty to Moderately Well-Drained	Fair	5.0-6.0	3-4	Natural masses. Flowers inconspicuous.
SWEET PEPPERBUSH *(Clethra alnifolia)*	D	Moderately Well-Drained to Poorly Drained	Good	5.5-6.5	3-8	Borders and hedges. Flowers white, fruit inconspicuous.
WINTERBERRY *(Ilex verticillata)*	D	Well-Drained to Poorly Drained	Fair	5.0-6.0	10	Ornamental screens. Flowers inconspicuous, fruits red berries in 3-4 years. Winter food for songbirds.
WYTHEROD VIBURNUM *(Viburnum cassinoides)*	D	Well-Drained to Somewhat Poorly Drained	Good	5.5-6.5	4-6	Natural mass. Flowers white, fruit green to black. Very showy in fall.

[1] E-Evergreen D-Deciduous

Source: USDA-NRCS

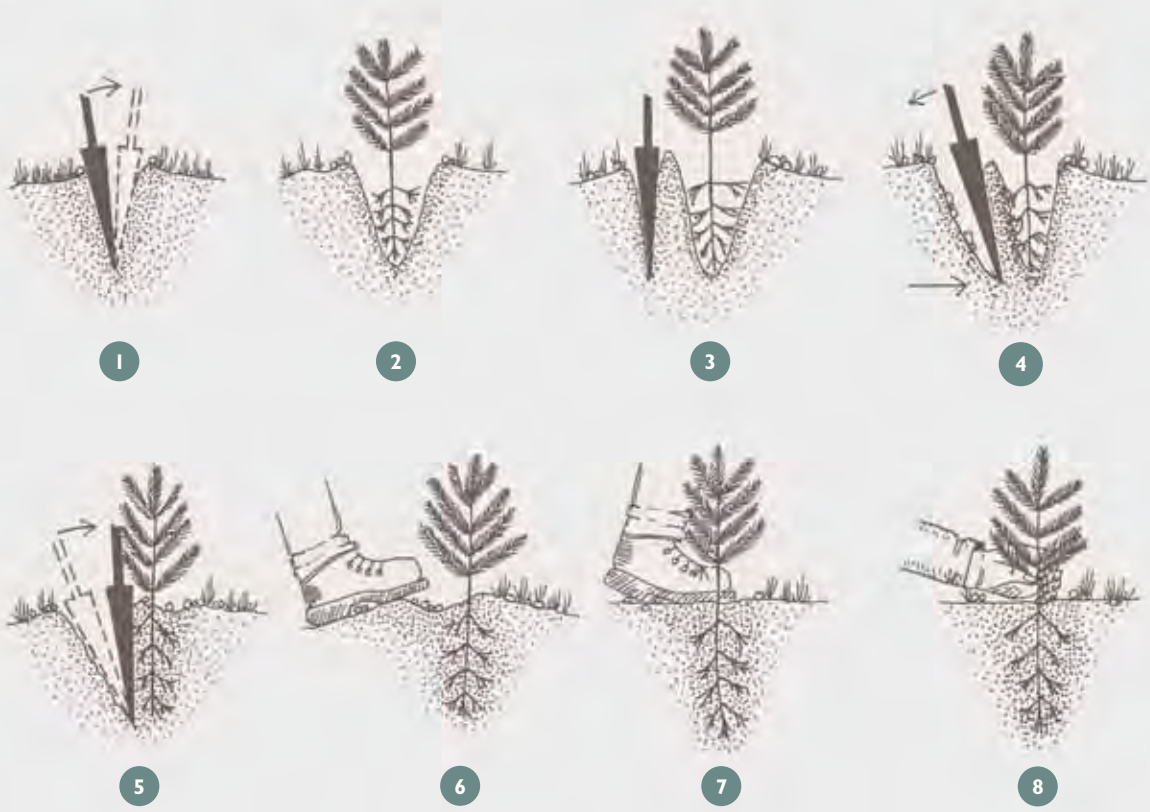
Figure LP-6 Vines and Ground Covers for Landscape Planting

Common Name (Botanical Name)	Leaf Type[1]	Drainage Tolerance	Shade Tolerance	pH Range	Characteristics
BEARBERRY *(Arctostaphylos uva-ursi)*	E	Droughty to Well Drained	Good	4.5-6.0	Trailing groundcover. Low-fertility sandy areas, dunes, flowers inconspicuous. Set plants 18 in. apart for cover in 2-4 years.
BUGLEWEED *(Ajuga reptans)*	E	Well Drained to Moderately Well Drained	Excl.	6.0-7.5	Small, low-growing broad-leafed herbaceous plants, in bronze or green, flowers blue, white or red spiles. Set plants 1 ft. apart for cover in 1 year.
CROWN VETCH *(Coronilla varia)*	D	Droughty to Moderately Well Drained	Fair	4.0-7.5	Slow growing, 1-2 ft. high. Prefers sun, 2-3 years to form a cover. Flowers pink.
DAYLILY *(Hemerocallis fulva)*	D	Droughty to Poorly Drained	Fair	6.0-8.0	Grass-like foliage, flowers orange, showy. Unusually adaptable and free of pests and disease.
DUSTY MILLER (Beach Wormwood) *(Artemisia stelleriana)*	E	Droughty to Well Drained	Poor	6.0-7.5	Silvery foliage, 1-2 ft. tall, flowers inconspicuous. Spreads by underground stems. Stabilizing groundcover on coastal dunes. Set plants 2 ft. apart for cover in 2 years.
ENGLISH IVY *(Hedera helix)*	E	Droughty to Moderately Well Drained	Good	6.0-8.0	Low maintenance vine for large areas, flowers inconspicuous. Will climb on trees, walls, etc. Set plants or rooted cuttings 1 ft. apart for cover in 2 years.
LILY-OF-THE-VALLEY *(Convallaria majalis)*	E	Droughty to Somewhat Poorly Drained	Excl.	4.5-6.0	Low maintenance cover for partial or full shade, flowers fragrant white bells on short stalks. Set plants 1 ft. apart for cover in 2-3 years.
LILY-TURF *(Liriope specata)*	E	Droughty to Poorly Drained	Good	4.5-6.0	Grass-like low maintenance cover for droughty, infertile soils. Spreads by underground stems. Available in variegated form. Set plants 6-12 in. apart for cover in 2 years.
PACHYSANDRA *(Pachysandra terminalis)*	E	Well Drained to Moderately Well Drained	Excl.	4.5-5.5	Low-growing, attractive cover for borders and as lawn substitute under trees and other shady areas. Flowers small white spikes. Set plants 1 ft. apart for cover in 1-2 years.
PERIWINKLE (Vinca) *(Vinca minor)*	E	Well Drained to Moderately Well Drained	Excl.	6.0-7.5	Lawn substitute for shady areas. Small blue flowers. Spreads by stolons; not aggressive. Grows in full sun as well as shade. Set plants 1 ft. apart for cover in 1-2 years.
SMALL-LEAVED COTONEASTER *(Cotoneaster microphylla)*	E	Well Drained to Moderately Well Drained	Fair	6.0-7.0	Prostrate shrub, tiny white flowers. Informal cover for large areas. Set plants 2 ft. apart for cover in 2 years.
VIRGINIA CREEPER *(Parthenocissus quinquefolia)*	D	Droughty to Well Drained	Fair	5.0-7.5	Ground cover for dunes and other dry areas; will climb trees. Flowers inconspicuous. Attractive crimson foliage in fall. Berries eaten by songbirds. Set plants 18" apart for cover in 1-2 years.

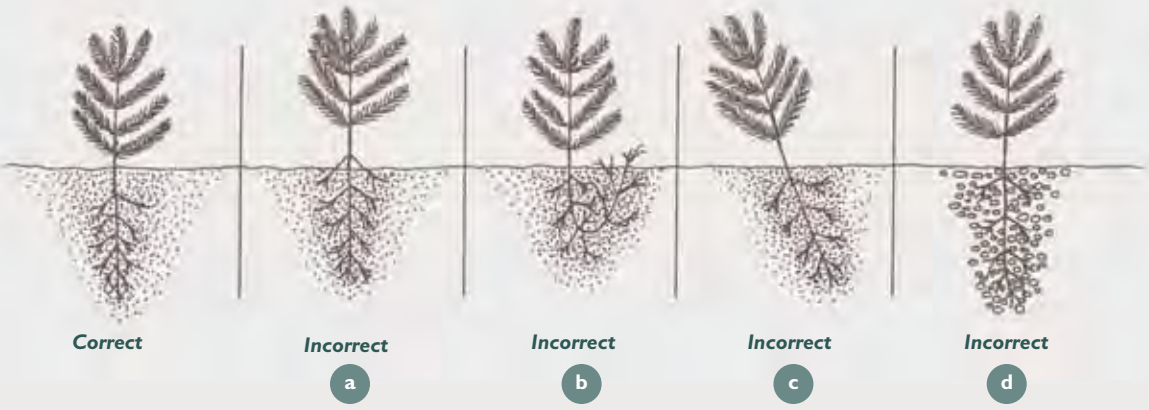
[1] E-Evergreen D-Deciduous

Source: USDA-NRCS

Figure LP-7 Planting Bare Root Stock



1. Insert bar at angle shown and push forward to upright position.
2. Remove bar and place seedling at correct depth.
3. Insert bar two inches toward planter from seedling.
4. Pull bar toward planter firming soil at bottom of roots.
5. Push bar forward from planter firming soil at top of roots.
6. Fill in last hole by stamping with heel.
7. Firm soil around seedling with feet.
8. Test planting by pulling lightly on seedling.



a. Don't expose roots to air during freeze or plant in frozen ground.
b. Don't bend roots so that they grow upwards out of the ground.
c. Plant seedlings upright – not at an angle.
d. Always plant in soil – never loose leaves or debris. Pack soil tightly.

Source: Virginia Erosion and Sediment Control Handbook, 1992.

ATTACHMENT F

CT DEEP GENERAL PERMIT FOR THE DISCHARGE OF STORMWATER AND DEWATERING WASTEWATERS ASSOCIATED WITH CONSTRUCTION ACTIVITIES

INTERSTATE RELIABILITY PROJECT

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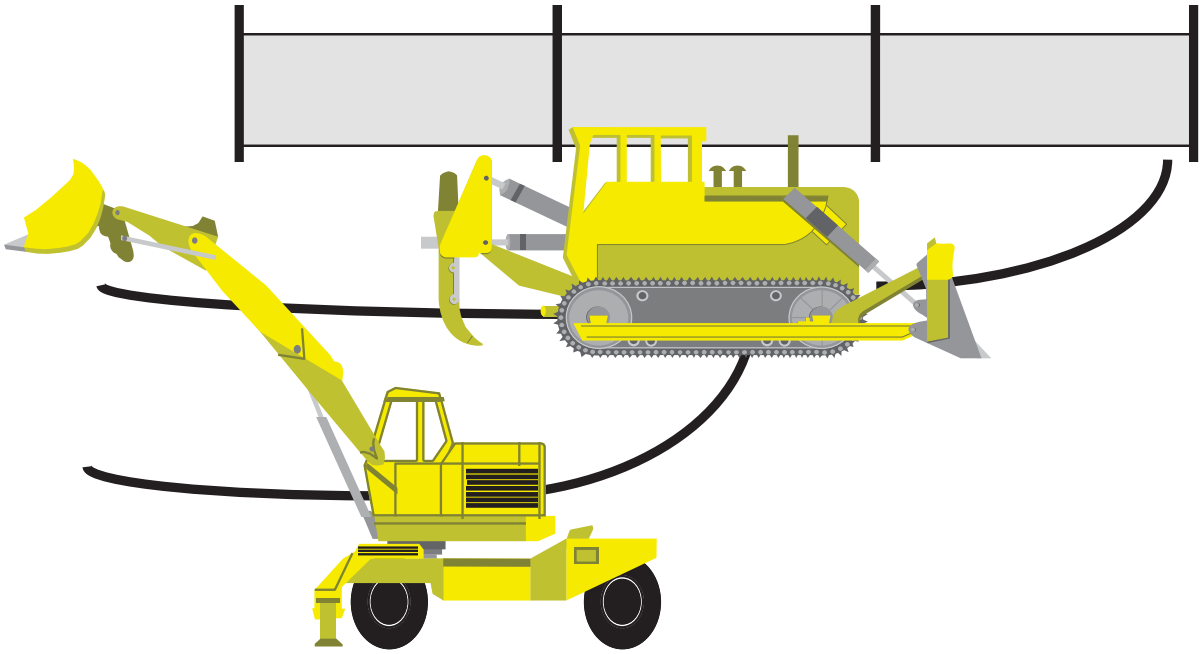
Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

79 Elm Street • Hartford, CT 06106-5127 www.ct.gov/deep Affirmative Action/Equal Opportunity Employer



General Permit for the Discharge of Stormwater and Dewatering Wastewaters Associated with Construction Activities

Issuance Date: April 8, 2004
Re-Issuance Date: October 1, 2012

Bureau of Materials Management and Compliance Assurance
Water Permitting and Enforcement Division
860-424-3018

General Permit for Discharge of Stormwater and Dewatering Wastewaters from Construction Activities

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Section 1. Authority

This general permit is issued under the authority of Section 22a-430b of Connecticut General Statutes.

Section 2. Definitions

The definitions of terms used in this general permit shall be the same as the definitions contained in Section 22a-423 of the Connecticut General Statutes and Section 22a-430-3(a) of the Regulations of Connecticut State Agencies. As used in this general permit, the following definitions shall apply:

"*Authorized activity"* means any activity authorized under this general permit.

"*Coastal area"* means coastal area as defined in Section 22a-93(5) of the Connecticut General Statutes.

"*Coastal waters"* means coastal waters as defined in Section 22a-29 of the Connecticut General Statutes.

"*Commissioner"* means commissioner as defined in Section 22a-2(b) of the Connecticut General Statutes.

"*Construction activities"* means activities including but not limited to clearing and grubbing, grading, excavation, and dewatering.

"*Department"* means the department of energy and environmental protection.

"*Developer"* means a person who or municipality which is responsible, either solely or through contract, for the design and construction of a project site.

"*Dewatering wastewater"* means wastewater generated from the lowering of the groundwater table, the pumping of accumulated stormwater from an excavation, or the pumping of surface water from a cofferdam, or pumping of other surface water that has been diverted into a construction site.

"*Disturbance"* means the execution of any of the construction activities defined above.

"*Erosion"* means the detachment and movement of soil or rock fragments by water, wind, ice and gravity.

"*Fresh-tidal wetland"* means a tidal wetland with an average salinity level of less than 0.5 parts per thousand.

"*Guidelines"* means the Connecticut Guidelines for Soil Erosion and Sediment Control, as amended, or as may be amended, established pursuant to Section 22a-328 of the Connecticut General Statutes.

"*High tide line"* means high tide line as defined in Section 22a-359(c) of the Connecticut General Statutes.

"*Individual permit"* means a permit issued to a named permittee under Section 22a-430 of the Connecticut General Statutes.

"*Inland wetland"* means wetlands as defined in Section 22a-38 of the Connecticut General Statutes.

"*Municipal separate storm sewer"* means conveyances for stormwater (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels or storm drains) owned or operated by any municipality and discharging directly to surface waters of the state.

"Municipality" means a city, town or borough of the state.

"*Permittee"* means any person who or municipality which initiates, creates or maintains a discharge in accordance with Section 3 of this general permit.

"*Person"* means person as defined in Section 22a-423 of the Connecticut General Statutes.

"*Point Source"* means any discernible, confined and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharged.

"*Registrant"* means a person who or municipality which files a registration.

"*Registration"* means a registration form filed with the commissioner pursuant to Section 4 of this general permit.

"*Retain"* means to permanently hold on-site with no subsequent point-source release as in a detention system where there is a temporary holding or delaying of the delivery of stormwater downstream.

"*Sediment"* means solid material, either mineral or organic, that is in suspension, is transported, or has been moved from its site of origin by erosion.

"*Site"* means geographically contiguous land or water on which a authorized activity takes place or on which an activity for which authorization is sought under this general permit is proposed to take place. Non-contiguous land or water owned by the same person and connected by a right-of-way, which such person controls, and to which the public does not have access shall be deemed the same site.

"*Soil"* means any unconsolidated mineral and organic material of any origin.

"*Stabilize"* means the use of pavement, establishment of vegetation, use of geotextile materials, use or organic of inorganic mulching materials, or retention of existing vegetation to prevent erosion.

"*Stormwater"* means waters consisting of precipitation runoff.

"*Tidal wetland"* means a wetland as that term is defined in Section 22a-29(2) of the Connecticut General Statutes.

"*Total disturbance"* means the total area on a site that will be exposed or susceptible to erosion during the course of a project.

"Total sediment load" means the total amount of sediment carried by stormwater runoff on an annualized basis.

"*Upland soils"* means soils which are not designated as poorly drained, very poorly drained, alluvial, or flood plain by the National Cooperative Soils Survey, as may be amended from time to time, of the Soil Conservation Service of the United States Department of Agriculture and/or the Inland Wetlands Commission of the community in which the project will take place.

"*Water company"* means water company as defined in Section 25-32a of the Connecticut General Statutes.

Section 3. Authorization Under This General Permit

(a) Eligible Activities

The following activity is authorized by this general permit, provided the requirements of subsection (b) of this section are satisfied:

The discharge of stormwater and dewatering wastewater from construction activities which result in the disturbance of one or more total acres of land area on a site regardless of project phasing. In the case of a larger plan of development (such as a subdivision), the estimate of total acres of site disturbance shall include, but is not limited to, road and utility construction, individual lot construction (i.e. house, driveway, septic system, etc.), and all other construction associated with the overall plan, regardless of the individual parties responsible for construction of these various elements.

(b) Requirements for Authorization

This general permit authorizes the activity listed in subsection (a) of this section provided:

(1) Coastal Management Act

Such activity must be consistent with all applicable goals and policies in Section 22a-92 of the Connecticut General Statutes, and must not cause adverse impacts to coastal resources as defined in Section 22a-93(15) of the Connecticut General Statutes.

(2) Endangered and Threatened Species

Such activity must not threaten the continued existence of any species listed pursuant to Section 26-306 of the Connecticut General Statutes as endangered or threatened and must not result in the destruction or adverse modification of habitat designated as essential to such species.

(3) Historic Places

Such activity must at all times be in compliance with State and Federal Historic Preservation statutes, regulations and policies including identification of any potential impacts on property listed or eligible for listing on the State and/or National Registers of Historic Places and a description of measures necessary to avoid or minimize those impacts.

(4) The stormwater is *not* discharged to a Publicly Owned Treatment Works or to ground water;

(5) The discharge shall *not* cause pollution due to acute or chronic toxicity to aquatic and marine life, impair the biological integrity of aquatic or marine ecosystems, or result in an unacceptable risk to human health.

(6) Any construction site that is registered under the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities, issued April 8, 2004, is authorized by this general permit provided that the site continues to meet the conditions listed in Section 6 of this general permit.

(c) Registration

Pursuant to Section 4 of this general permit, a completed registration with respect to the construction activity shall be filed with the commissioner 30 days prior to the commencement of the activity unless exempted by Section 3(d) of this general permit.

(d) Small Construction

For construction projects with a total disturbed area (regardless of phasing) of between one and five acres, the permittee shall agree to adhere to the erosion and sediment control land use regulations of the town in which the construction activity is conducted. No registration pursuant to Section 4 of this general permit shall be required for such construction activity as long as it receives town review and written approval of its erosion and sediment control measures and follows the Guidelines. If no review is conducted by the town, the permittee must register and comply with Section 6.

(e) Geographic Area

This general permit applies throughout the State of Connecticut.

(f) Effective Date and Expiration Date of this General Permit

This general permit is effective on October 1, 2012, and expires on September 30, 2013.

(g) Effective Date of Authorization

Any activity is authorized by this general permit on the date the general permit becomes effective or on the date the activity is initiated, whichever is later.

(h) Revocation of an Individual Permit

If an activity is eligible for authorization under this general permit and such activity is presently authorized by an individual permit, the existing individual permit may be revoked by the commissioner upon a written request by the permittee. If the commissioner revokes such individual permit in writing, such revocation shall take effect on the effective date of authorization of such activity under this general permit.

(i) Issuance of an Individual Permit

If the commissioner issues an individual permit under Section 22a-430 of the Connecticut General Statutes, authorizing an activity authorized by this general permit, this general permit shall cease to authorize that activity beginning on the date such individual permit is issued.

Section 4. Registration Requirements

(a) Who Must File a Registration

With the exception noted below or in Section 3(d) of this general permit, any person who or municipality which initiates, creates, originates or maintains a discharge described in Section 3(a) of this general permit shall file with the commissioner a registration form that meets the requirements of Section 4 of this general permit along with the applicable fee at least thirty (30) days before the initiation of construction activities.

If a site has been previously registered under the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities issued April 8, 2004, the permittee does *not* need to submit a new registration under this general permit, unless the ownership of the site has been transferred.

If the site for which a registration is submitted under this permit is owned by one person or municipality but is leased or, in some other way, the legal responsibility of another person or municipality (the developer), the developer is responsible for submitting the registration required by this permit. The registrant is responsible for compliance with all conditions of this permit.

(b) Scope of Registration

A registrant shall register on one registration form only those discharges that are operated by such permittee on one site.

(c) Contents of Registration

(1) Fees

(A) The registration fee of $500.00 shall be submitted with a registration form, provided that the registration fee for a municipality shall be $250.00. A registration shall not be deemed complete and no activity shall be authorized by this general permit (with the exception of activities previously registered under the general permit issued April 8, 2004), unless the registration fee has been paid in full.

(B) Registrants required to submit a stormwater pollution control plan (Plan) in accordance with Section 6(b)(3)(C) of this permit shall pay an additional plan review fee of $500.00 with the submittal of the Plan, the registration form and registration fee, provided that the plan review fee for a municipality shall be $250.00.

(C) The registration fee and plan review fee shall be paid by check or money order payable to the **Department of Energy and Environmental Protection**.

(D) The registration fee and plan review fee are non-refundable.

(2) Registration Form

A registration shall be filed on forms prescribed and provided by the commissioner and shall include the following:

(A) Legal name, address, and telephone number of the registrant. If the registrant is a person (as defined in Section 2) transacting business in Connecticut and is registered with the Connecticut Secretary of the State, provide the exact name as registered with the Connecticut Secretary of the State.

(B) Legal name, address and telephone number of the owner of the property on which the activity will take place.

(C) Legal name, address and telephone number of the primary contact for departmental correspondence and inquiries, if different from the registrant.

(D) Legal name, address and telephone number of the developer of the property on which the subject activity is to take place.

(E) Legal name, address and daytime and off-hours telephone numbers of the general contractor or other representative, if different from the developer.

(F) Legal name, address and telephone number of any consultant(s) or engineer(s) retained by the permittee to prepare the registration and Stormwater Pollution Control Plan.

(G) Location address or description of the site with respect to which the registration is submitted.

(H) The estimated duration of the construction activity.

(I) A brief description of the construction activity, including, but not limited to:

(i) Number of acres disturbed.

(ii) Assurance that construction is in accordance with the Guidelines and local erosion and sediment control ordinances.

(iii) A determination of whether or not a coastal consistency review is necessary for the activity.

(iv) Assurance that there are no endangered or threatened species suspected or known to be impacted by the activity.

(J) A brief description of the stormwater discharge, including:

(i) The name of the municipal separate storm sewer system or immediate surface water body or wetland to which the stormwater runoff discharges, and whether or not the site discharges within 500 feet of a tidal wetland.

(ii) The name of the watershed or nearest waterbody to which the site discharges.

(K) An 8 ½" by 11" copy of the relevant portion or a full-sized original of a United States Geological Survey (USGS) quadrangle map, with a scale of 1:24,000, showing the exact location of the site and the area within a one mile radius of the site. Identify the quadrangle name on such copy.

(L) For all sites that will disturb 10 acres or more (regardless of phasing), a copy of the Stormwater Pollution Control Plan shall be submitted (with the $500 plan review fee) in accordance with Section 6(b)(3)(C) of this general permit.

(M) The signature of the registrant and of the individual or individuals responsible for actually preparing the registration, each of whom shall certify in writing as follows:

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that, based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I certify that this permit registration is on complete and accurate forms as prescribed by the commissioner without alteration of the text. I understand that a false statement made in the submitted information may be punishable as a criminal offense, in accordance with Section 22a-6 of the Connecticut General Statutes, pursuant to Section 53a-157b of the

Connecticut General Statutes, and in accordance with any other applicable statute.

I also certify under penalty of law that I have read and understand all conditions of the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities issued on April 8, 2004, that all conditions for eligibility for authorization under the general permit are met, all terms and conditions of the general permit are being met for all discharges which have been initiated and are the subject of this registration, and that a system is in place to ensure that all terms and conditions of this general permit will continue to be met for all discharges authorized by this general permit at the site. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowingly making false statements."

(N) The following certification must be signed by a professional engineer, licensed to practice in Connecticut:

"I certify that I have thoroughly and completely reviewed the Stormwater Pollution Control Plan for the site. I further certify, based on such review and on my professional judgment, that the Stormwater Pollution Control Plan has been prepared in accordance with the Connecticut Guidelines for Soil Erosion and Sediment Control, as amended, and the conditions for the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities issued on April 8, 2004, and the controls required for such Plan are appropriate for the site. I am aware that there are significant penalties for false statements in this certification, including the possibility of fine and imprisonment for knowingly making false statements."

(d) Where to File a Registration

A registration shall be filed with the commissioner at the following address:

CENTRAL PERMIT PROCESSING UNIT
DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5127

(e) Additional Information

The commissioner may require a registrant to submit additional information that the commissioner reasonably deems necessary to evaluate the consistency of the subject activity with the requirements for authorization under this general permit.

(f) Additional Notification

For discharges through a municipal separate storm sewer system authorized by this general permit, a copy of the registration shall also be submitted to the owner and operator of that system.

For discharges within a public drinking water supply watershed or aquifer area, a copy of the registration and the Plan described in Section 6(b) of this general permit shall be submitted to the water company.

In addition, a copy of this registration and the Plan shall be available upon request to the local wetlands agency or its equivalent, or its duly authorized agent.

(g) Action by Commissioner

(1) The commissioner may reject without prejudice a registration if he determines that it does not satisfy the requirements of Section 4(c) of this general permit or more than 30 days have elapsed since the commissioner requested that the registrant submit additional information or the required fee and the registrant has not submitted such information or fee. Any registration refiled after such a rejection shall be accompanied by the fee specified in Section 4(c)(1) of this general permit.

(2) The commissioner may disapprove a registration if he finds that the subject activity is inconsistent with the requirements for authorization under Section 3(b) of this general permit, or for any other reason provided by law.

(3) Disapproval of a registration under this subsection shall constitute notice to the registrant that the subject activity must be authorized under an individual permit.

(4) Rejection or disapproval of a registration shall be in writing.

Section 5. Termination Requirements

(a) Notice of Termination

At the completion of a construction project registered pursuant to Section 4 of this general permit, a Notice of Termination must be filed with the commissioner. A project shall be considered complete after the site has been stabilized for at least three months following the cessation of construction activities. A site is not considered stabilized until there is no active erosion or sedimentation present and no disturbed areas remain exposed.

(b) Termination Form

A termination notice shall be filed on forms prescribed and provided by the commissioner and shall include the following:

(1) The permit number as provided to the permittee on the permit certificate.

(2) The name of the registrant as reported on the general permit registration form (DEP-PED-REG-015).

(3) The address of the completed construction site.

(4) The date all storm drainage structures were cleaned of construction debris pursuant to Section 6(b)(6)(C)(iv) of this general permit, the date of completion

of construction, and the date of the final inspections pursuant to Section 6(b)(6)(D) of this general permit.

(5) A description of the post-construction activities at the site.

(6) Signature of the permittee.

(c) Where to File a Termination Form

A termination form shall be filed with the commissioner at the following address:

PERMIT COORDINATOR
BUREAU OF MATERIALS MANAGEMENT & COMPLIANCE ASSURANCE
DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5127

Section 6. Conditions of this General Permit

The permittee shall at all times continue to meet the requirements for authorization set forth in Section 3 of this general permit. In addition, a permittee shall assure that authorized activities are conducted in accordance with the following conditions:

(a) Conditions Applicable to Certain Discharges

(1) Any person who or municipality that discharges stormwater into coastal tidal waters for which a permit is required under either the Structures and Dredging Act in accordance with Section 22a-361 of the Connecticut General Statutes or the Tidal Wetlands Act in accordance with Section 22a-32 of the Connecticut General Statutes, shall obtain such permit(s) from the commissioner. A tidal wetland permit is required for the placement of any sediment upon tidal wetland, whether it is deposited directly or indirectly.

(2) Any site which has a post-construction stormwater discharge that is located less than 500 feet from a tidal wetlands which is not a fresh-tidal wetland, shall discharge such stormwater through a system designed to retain the volume of stormwater runoff generated by 1 inch of rainfall on the site.

(b) Stormwater Pollution Control Plan

A registrant shall develop a Stormwater Pollution Control Plan ("Plan") for each site authorized by this general permit. Once the construction activity begins, the permittee shall perform all actions required by such Plan and shall maintain compliance with the Plan thereafter. The Plan shall be designed to address two components of stormwater pollution: (1) pollution caused by soil erosion and sedimentation during and after construction; and (2) stormwater pollution caused by use of the site after construction is completed, including, but not limited to, parking lots, roadways and the maintenance of grassed areas.

(1) Development of Plan

(A) The registrant shall develop a Plan for the site. Plans shall be prepared in accordance with sound engineering practices. The Plan shall ensure and demonstrate compliance with the Guidelines.

(B) For any stormwater discharges that were permitted under the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities issued April 8, 2004, the existing Plan shall be updated in accordance with subsection (b)(6) of this section. The permittee shall maintain compliance with such Plan thereafter.

(2) Deadlines for Plan Preparation and Compliance

For construction activities authorized by this general permit that are initiated after the date of issuance of this general permit, the registrant shall prepare the Plan no later than thirty days before the date of initiation of the construction activity.

(3) Signature and Plan Review

(A) The Plan shall be signed by the registrant in accordance with Section 6(h) of this general permit. The Plan shall be certified by all contractors and subcontractors in accordance with subsection (b)6(E) of this section.

(B) The registrant shall provide a copy of the Plan, and the registration form required in Section 4 of this general permit to the following persons immediately upon request:

(i) the commissioner;

(ii) the local agency approving sediment and erosion plans, grading plans, or stormwater management plans, and the local official responsible for enforcement of such plans;

(iii) in the case of a stormwater discharge through a municipal separate storm sewer system, the municipal operator of the system;

(iv) in the case of a stormwater discharge located within a public drinking water supply watershed or aquifer area, the water company.

The registrant shall also provide a copy of the Plan to all contractors or developers conducting construction activities on individual lots or buildings within the overall plan of development, regardless of ownership. These additional contractors or developers shall sign the certification in Section 6(b)(6)(E)(ii).

For all registrants or permittees submitting a Plan in accordance with subsection (b)(3)(B)(i) of this section, a plan review fee of $500.00 shall be submitted with the Plan.

(C) For construction activities that result in the disturbance of ten or more total acres of land area on a site (regardless of phasing), the Plan shall be submitted to the commissioner no later than thirty days before the initiation of construction activities. Plans shall be submitted in conjunction with the registration submitted in compliance with Section 4 of this general permit.

(D) The commissioner may notify the registrant at any time that the Plan and/or the site do not meet one or more of the minimum requirements of this permit. Within 7 days of such notice, or such other time as the commissioner may allow, the permittee shall make the required changes to the Plan and perform all actions required by such revised Plan. Within 15 days of such notice, or such other time as the commissioner may allow, the permittee shall submit to the commissioner a written certification that the requested changes have been made and implemented and such other information as the commissioner requires, in accordance with Sections 6(g) and 6(h) of this general permit.

(4) Keeping Plans Current

The permittee shall amend the Plan whenever there is a change in contractors or subcontractors at the site, or a change in design, construction, operation, or maintenance at the site which has the potential for the discharge of pollutants to the waters of the state and which has not otherwise been addressed in the Plan or if the actions required by the Plan fail to prevent pollution.

(5) Failure to Prepare, Maintain or Amend Plan

In no event shall failure to complete, maintain or update a Plan in accordance with subsections (b)(1) and (b)(4) of this section relieve a permittee of responsibility to implement any actions required to protect the waters of the state and to comply with all conditions of the permit, including but not limited to installation and maintenance of all controls and management measures described in subsection (b)(6)(C) of this section and in the Guidelines.

(6) Contents of the Plan

The Plan shall include, at a minimum the following items:

(A) Site Description

(i) A description of the nature of the construction activity;

(ii) Estimates of the total area of the site and the total area of the site that is expected to be disturbed by construction activities;

(iii) An estimate, including calculations if any, of the average runoff coefficient of the site after construction activities are completed and existing data describing the soil or the quality of any discharge from the site;

(iv) A site map indicating drainage patterns and approximate slopes anticipated after major grading activities, areas of soil disturbance,

the location of major structural and non-structural controls identified in the Plan, the location of areas where stabilization practices are expected to occur, areas which will be vegetated following construction, surface waters (including inland wetlands, tidal wetlands, and fresh-tidal wetlands), and locations where stormwater is discharged to a surface water (both during and post-construction); and

(v) The name of the immediate receiving water(s) and the ultimate receiving water(s) of the discharges authorized by this general permit and areal extent of wetland acreage on the site.

(B) Construction Sequencing

Each Plan shall clearly identify the expected sequence of major construction activities on the site, including but not limited to installation of erosion and sediment control measures, clearing, grubbing, grading, cut and fill operations, drainage and utility installation, and paving and stabilization operations. This section shall include an estimated timetable for all activities, which shall be revised in accordance with subsection (4) above as necessary. Wherever possible, the site shall be phased to avoid the disturbance of over five acres at one time. The Plan shall clearly show the limits of disturbance for the entire activity and for each phase. Any Plan that shows a site disturbance of over ten acres total (regardless of phasing) requires submittal of the Plan to the commissioner, in accordance with subsection (b)(3)(C) of this section.

(C) Controls

Each Plan shall include a description of appropriate controls and measures that will be performed at the site to prevent pollution of the waters of the state. The Plan shall clearly describe for each major activity identified in subsection (b)(6)(B) of this section, the appropriate control measures and the timing during the construction process that the measures would be implemented. (For example, perimeter controls for one portion of the site will be installed after the clearing and grubbing necessary for installation of the measure, but before the clearing and grubbing for the remaining portions of the site. Perimeter controls will be actively maintained until final stabilization of those portions of the site upgradient of the perimeter control. Temporary perimeter controls will be removed after final stabilization.) Controls shall be designed in accordance with the Guidelines. Use of controls to comply with subsection (b)(6)(C)(i) of this section that are not included in the Guidelines must be approved by the commissioner or his designated agent. The description of controls shall address the following minimum components:

(i) Erosion and Sediment Controls

1) Stabilization Practices

The Plan shall include a description of interim and permanent stabilization practices, including a schedule for implementing the practices. Site plans shall ensure that existing vegetation is

preserved where attainable and that disturbed portions of the site are stabilized. Stabilization practices may include but not be limited to: silt fences, temporary seeding, permanent seeding, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of trees, preservation of mature vegetation, and other vegetative and non-structural measures as may be identified by the Guidelines. Where construction activities have permanently ceased or have temporarily been suspended for more than seven days, or when final grades are reached in any portion of the site, stabilization practices shall be implemented within three days. Areas that will remain disturbed but inactive for at least thirty days shall receive temporary seeding in accordance with the Guidelines. Areas that will remain disturbed beyond the planting season, shall receive long-term, non-vegetative stabilization sufficient to protect the site through the winter. In all cases, stabilization measures shall be implemented as soon as possible in accordance with the Guidelines. Areas to be graded with slopes steeper than 3:1 (horizontal:vertical) and higher than 15 feet shall be graded with appropriate slope benches in accordance with the Guidelines.

2) Structural Practices

The Plan shall include a description of structural practices to divert flows away from exposed soils, store flows or otherwise limit runoff and the discharge of pollutants from the site. Such practices include but may not be limited to earth dikes (diversions), drainage swales, sediment traps, check dams, subsurface drains, pipe slope drains, level spreaders, storm drain inlet protection, outlet protection, reinforced soil retained systems, gabions, and temporary or permanent sediment basins and chambers. Unless otherwise specifically approved in writing, structural measures shall be installed on upland soils.

At a minimum, for discharge points that serve an area with between 2 and 5 disturbed acres at one time, a sediment basin, sediment trap, or other control as may be defined in the Guidelines for such drainage area, designed in accordance with the Guidelines, shall be designed and installed. All sediment traps or basins shall provide a minimum of 134 cubic yards of water storage per acre drained and shall be maintained until final stabilization of the contributing area. This requirement shall not apply to flows from off-site areas and flows from the site that are either undisturbed or have undergone final stabilization where such flows are diverted around the sediment trap or basin. Any exceptions must be approved in writing by the commissioner.

For discharge points that serve an area with more than five (5) disturbed acres at one time, a sediment basin designed in accordance with the Guidelines, shall be designed and installed, which basin shall provide a minimum of 134 cubic yards of water storage per acre drained and which basin shall be maintained until final stabilization of the contributing area. This requirement shall not apply to flows from off-site areas and flows from the site that are either undisturbed or have undergone final stabilization where such flows are diverted around the sediment basin. Outlet structures from sedimentation basins shall not encroach upon a wetland. Any exceptions must be approved in writing by the commissioner.

3) Maintenance

Maintenance shall be performed in accordance with the Guidelines, provided that, if additional maintenance is required to protect the waters of the state from pollution, the Plan shall include a description of the procedures to maintain in good and effective operating conditions all erosion and sediment control measures, including vegetation, and all other protective measures identified in the site plan.

(ii) Dewatering Wastewaters

Where feasible and appropriate, dewatering wastewaters shall be infiltrated into the ground. Dewatering wastewaters discharged to surface waters shall be discharged in a manner that minimizes the discoloration of the receiving waters. Each plan shall include a description of the operational and structural practices that will be used to ensure that all dewatering wastewaters will not cause scouring or erosion or contain suspended solids in amounts that could reasonably be expected to cause pollution of waters of the State.

(iii) Post Construction Stormwater Management

Each plan must include a description of measures that will be installed during the construction process to control pollutants in stormwater discharges that will occur after construction operations have been completed. Unless otherwise specifically provided by the commissioner in writing, structural measures shall be placed on upland soils. This general permit only addresses the installation of stormwater management measures, and not the ultimate operation and maintenance of such structures included in such measures after the construction activities have been completed and the site has undergone final stabilization. The following measures must be implemented:

1) For construction activities initiated after October 1, 1992, the permittee shall install post-construction stormwater management measures designed to remove suspended solids

and floatables (i.e. oil and grease, other floatable liquids, floatable solids, trash, etc.) from stormwater. A goal of 80 percent removal of total sediment load from the stormwater discharge shall be used in designing and installing stormwater management measures. Such measures may include but are not limited to: stormwater detention structures (including wet ponds); stormwater retention structures; flow attenuation by use of open vegetated swales and natural depressions; infiltration of runoff on-site; vegetated buffer strips; sediment removal chambers or structures; and sequential systems (which combine several practices). Provisions shall be included to address the maintenance of any system installed.

2) Velocity dissipation devices shall be placed at discharge locations and along the length of any outfall channel as necessary to provide a non-erosive velocity flow from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected (e.g., maintenance of hydrologic conditions, such as the hydrodynamics present prior to the initiation of construction activities).

3) Any site which has a post-construction stormwater discharge located less than 500 feet from a tidal wetlands which is not a fresh-tidal wetland, shall discharge such stormwater through a system designed to retain the volume of stormwater runoff generated by 1 inch of rainfall on the site.

(iv) Other Controls

A description of other controls used at the site. The following controls must be implemented:

1) Waste Disposal

A description of best management practices to be performed at the site, which practices shall ensure that no litter, debris, building materials, or similar materials are discharged to waters of the State.

2) Off-site vehicle tracking of sediments and the generation of dust shall be minimized.

3) All post-construction stormwater structures shall be cleaned of construction sediment and any remaining silt fence shall be removed prior to filing of a termination notice pursuant to Section 5 of this general permit.

(D) Inspection

A description of the inspection procedures that must be addressed and implemented in the following manner:

Qualified personnel (provided by the permittee) shall inspect disturbed areas of the construction activity that have not been finally stabilized, structural control measures, and locations where vehicles enter or exit the site at least once every seven calendar days and within 24 hours of the end of a storm that is 0.1 inches or greater. Where sites have been temporarily or finally stabilized, such inspection shall be conducted at least once every month for three months.

(i) Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Erosion and sediment control measures shall be observed to ensure that they are operating correctly. Where discharge locations or points are assessable, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Locations where vehicles enter or exit the site shall be inspected for evidence of off-site sediment tracking.

(ii) Based on the results of the inspection, the description of potential sources and pollution prevention measures identified in the Plan shall be revised as appropriate as soon as practicable after such inspection. Such modifications shall provide for timely implementation of any changes to the site within 24 hours and implementation of any changes to the Plan within 3 calendar days following the inspection. The Plan shall be revised and the site controls updated in accordance with sound engineering practices, the Guidelines, and subsections (4) and (6)(C)(i) 3) of this section.

(iii) A report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the Plan, and actions taken shall be made and retained as part of the Plan for at least three years after the date of inspection. The report shall be signed by the permittee or his/her authorized representative in accordance with the requirements of Section 6(h) of this general permit.

(E) Contractors

(i) The Plan shall clearly identify each contractor and subcontractor that will perform actions on the site which may reasonably be expected to cause or have the potential to cause pollution of the waters of the State, and shall include a copy of the certification statement shown below signed by each such contractor and subcontractor. All certifications shall be included in the Plan.

(ii) Subdivisions

Where individual lots in a subdivision or other common plan of development are conveyed or otherwise the responsibility of another contractor, those individual lot contractors shall be required to

comply with the provisions of this general permit and shall sign the certification statement below regardless of lot size or disturbed area. The permittee shall provide a copy of the Plan to each of these contractors.

(iii) Certification Statement

The Plan shall include the following certification signed by each contractor and subcontractor identified in the Plan as described above:

"I certify under penalty of the law that I have read and understand the terms and conditions of the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities. I understand that as a contractor or subcontractor at the site, I am authorized by this general permit, and must comply with the terms and conditions of this permit, including but not limited to the requirements of the Stormwater Pollution Control Plan prepared for the site."

The certification shall include the name and title of the person providing the signature; the name, address and telephone number of the contracting firm; the address (or other identifying description) of the site; and the date the certification is made.

(c) Reporting and Record Keeping Requirements

(1) The permittee shall retain copies of the Plan and all reports required by this general permit, and records of all data used to complete the registration to be authorized by this general permit, for a period of at least three years from the date that construction at the site is completed unless the commissioner specifies another time period in writing.

(2) The permittee shall retain an updated copy of the Plan required by this general permit at the construction site from the date construction is initiated at the site until the date construction at the site is completed.

(3) Upon completion of construction, for sites authorized by the General Permit for the Discharge of Stormwater Associated with Commercial Activity or the General Permit for the Discharge of Stormwater Associated with Industrial Activity, the Plan shall be kept as an appendix to the Stormwater Management Plan or Stormwater Pollution Prevention Plan (as applicable) for a period of at least three years from the date of completion of construction.

(d) Regulations of Connecticut State Agencies Incorporated into this General Permit

The permittee shall comply with the following Regulations of Connecticut State Agencies which are hereby incorporated into this general permit, as if fully set forth herein:

(1) Section 22a-430-3:

Subsection (b) General - subparagraph (1)(D) and subdivisions (2),(3),(4) and (5)

Subsection (c) Inspection and Entry
Subsection (d) Effect of a Permit - subdivisions (1) and (4)
Subsection (e) Duty to Comply
Subsection (f) Proper Operation and Maintenance
Subsection (g) Sludge Disposal
Subsection (h) Duty to Mitigate
Subsection (I) Facility Modifications, Notification - subdivisions (1) and (4)
Subsection (j) Monitoring, Records and Report Requirements - subdivisions (1), (6), (7), (8), (9) and (11) (except subparagraphs (9) (A) (2) and (9) (c)
Subsection (k) Bypass
Subsection (m) Effluent Limitation Violations
Subsection (n) Enforcement
Subsection (p) Spill Prevention and Control
Subsection (q) Instrumentation, Alarms, Flow Recorders
Subsection (r) Equalization

(2) Section 22a-430-4

Subsection (t) Prohibitions
Subsection (p) Revocation, Denial, Modification
Appendices

(e) Reliance on Registration

In evaluating the registrant's registration, the commissioner has relied on information provided by the registrant. If such information proves to be false or incomplete, the registrant's authorization may be suspended or revoked in accordance with law, and the commissioner may take any other legal action provided by law.

(f) Duty to Correct and Report Violations

Upon learning of a violation of a condition of this general permit, a permittee shall immediately take all reasonable action to determine the cause of such violation, correct and mitigate the results of such violation, prevent further such violation, and report in writing such violation and such corrective action to the commissioner within five (5) days of the permittee's learning of such violation. Such information shall be filed in accordance with the certification requirements prescribed in Section 6(h) of this general permit.

(g) Duty to Provide Information

If the commissioner requests any information pertinent to the authorized activity or to compliance with this general permit or with the permittee's authorization under this general permit, the permittee shall provide such information within fifteen (15) days of such request. Such information shall be filed in accordance with the certification requirements prescribed in Section 6(h) of this general permit.

(h) Certification of Documents

Any document, including but not limited to any notice, information or report, which is submitted to the commissioner under this general permit shall be signed by the permittee, or a duly authorized representative of the permittee, and by the individual

or individuals responsible for actually preparing such document, each of whom shall certify in writing as follows:

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that, based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that a false statement made in this document or its attachments may be punishable as a criminal offense, in accordance with Section 22a-6 of the Connecticut General Statutes, pursuant to Section 53a-157b of the Connecticut General Statutes, and in accordance with any other applicable statute."

(i) Date of Filing

For purposes of this general permit, the date of filing with the commissioner of any document is the date such document is received by the commissioner. The word "day" as used in this general permit means the calendar day; if any date specified in the general permit falls on a Saturday, Sunday, or legal holiday, such deadline shall be the next business day thereafter.

(j) False Statements

Any false statement in any information submitted pursuant to this general permit may be punishable as a criminal offense, in accordance with Section 22a-6 of the Connecticut General Statutes, pursuant to Section 53a-157b of the Connecticut General Statutes.

(k) Correction of Inaccuracies

Within fifteen (15) days after the date a permittee becomes aware of a change in any information in any material submitted pursuant to this general permit, or becomes aware that any such information is inaccurate or misleading or that any relevant information has been omitted, such permittee shall correct the inaccurate or misleading information or supply the omitted information in writing to the commissioner. Such information shall be filed in accordance with the certification requirements prescribed in Section 6(h) of this general permit.

(l) Transfer of Authorization

Authorizations under this general permit are non-transferable. However, any person or municipality registering a discharge that has previously been registered under this permit may adopt by reference the Plan developed by the previous permittee. The new permittee shall amend the Plan as required by Section 6(b)(4) prior to submitting a new registration.

(m) Other Applicable Law

Nothing in this general permit shall relieve the permittee of the obligation to comply with any other applicable federal, state and local law, including but not limited to the obligation to obtain any other authorizations required by such law.

(n) Other Rights

This general permit is subject to and does not derogate any present or future rights or powers of the State of Connecticut and conveys no rights in real or personal property nor any exclusive privileges, and is subject to all public and private rights and to any federal, state, and local laws pertinent to the property or activity affected by such general permit. In conducting any activity authorized hereunder, the permittee may not cause pollution, impairment, or destruction of the air, water, or other natural resources of this state. The issuance of this general permit shall not create any presumption that this general permit should or will be renewed.

Section 7. Commissioner's Powers

(a) Abatement of Violations

The commissioner may take any action provided by law to abate a violation of this general permit, including but not limited to penalties of up to $25,000 per violation per day under Chapter 446k of the Connecticut General Statutes, for such violation. The commissioner may, by summary proceedings or otherwise and for any reason provided by law, including violation of this general permit, revoke a permittee's authorization hereunder in accordance with Sections 22a-3a-2 through 22a-3a-6, inclusive, of the Regulations of Connecticut State Agencies. Nothing herein shall be construed to affect any remedy available to the commissioner by law.

(b) General Permit Revocation, Suspension, or Modification

The commissioner may, for any reason provided by law, by summary proceedings or otherwise, revoke or suspend this general permit or modify to establish any appropriate conditions, schedules of compliance, or other provisions which may be necessary to protect human health or the environment.

(c) Filing of an Individual Application

If the commissioner notifies a permittee in writing that such permittee must obtain an individual permit if he wishes to continue lawfully conducting the authorized activity, the permittee must file an application for an individual permit within thirty (30) days of receiving the commissioner's notice. While such application is pending before the commissioner, the permittee shall comply with the terms and conditions of this general permit and the subject approval of registration. Nothing herein shall affect the commissioner's power to revoke a permittee's authorization under this general permit at any time.

Issued Date: October 1, 2012

MACKY MCCLEARY

Deputy Commissioner

This is a true and accurate copy of the general permit executed on October 1, 2012 by the Department of Energy and Environmental Protection.

ATTACHMENT G

AGENCY CORRESPONDENCE
AND
PUBLIC OUTREACH DOCUMENTATION

INTERSTATE RELIABILITY PROJECT

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AGENCY CORRESPONDENCE

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University of Connecticut
Connecticut State Museum of Natural History
Connecticut Archaeology Center

College of Liberal Arts and Sciences

25 February 2013

Chris Fritz, Senior Environmental Scientist
Burns & McDonnell
New England Office
35 Thorpe Ave, suite 201
Wallingford, CT 06492

RE: Intersection Station site Archaeological Assessment
NEEWS IRP CT

Dear Mr. Fritz,

The Office of State Archaeology (OSA) has had a chance to review the above-named archaeological assessment dated 8 February 2013. In our capacity in representing the Connecticut State Historic Preservation Office (SHPO), we concur with the findings of the Public Archaeology Laboratory (PAL) in its assessment of the Card Street Substation, Lebanon, the Lake Road Switching Station, Killingly, and the Killingly Substation, Killingly, that due to previous construction related disturbances at these sites the areas of construction are assessed as not being sensitive to contain potentially significant cultural resources.

In addition, it is our understanding that where stone walls exist, they will not be disturbed during the proposed use of these site areas. As a result, we concur that no further archaeological investigations are warranted.

Please do not hesitate to contact me at the university should you have any questions.

Sincere regards,

Nicholas F. Bellantoni, PhD
Connecticut State Archaeologist

Cc: Stacey Vairo, DSHPO

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2019 Hillside Road Unit 1023
Storrs, Connecticut 06269-1023

Telephone: (860) 486-4460
Facsimile: (860) 486-0827
web: www.mnh.uconn.edu

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PUBLIC OUTREACH DOCUMENTATION

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The Interstate Reliability Project Development and Management Plans

In January 2013, the Connecticut Siting Council (CSC) issued its decision approving CL&P's application to construct a transmission upgrade project called the Interstate Reliability Project. The Connecticut portion of this Project spans 37 miles in 11 towns, beginning in Lebanon and continuing through Columbia, Coventry, Mansfield, Chaplin, Hampton, Brooklyn, Pomfret, Killingly, and Putnam, before ending in Thompson at the Connecticut/Rhode Island border. Pending the respective state siting approvals, the Project route would then continue through portions of Rhode Island and Massachusetts, ending in Millbury, MA.

As the next step in the Connecticut siting process, CL&P has prepared draft construction plans, known as "Development and Management (D&M) Plans," for public review and comment. Copies of the draft D&M Plans will be available at your public library or online at **www.NEEWSprojects.com.**

Comments Welcome

You are invited to participate in a Public Review Session where you can discuss the plans with Project representatives.

Questions?

Call 1-866-99-NEEWS (63397)
www.NEEWSprojects.com

Please join us at one of these Public Review Sessions:

Wednesday, June 12, 6-8 p.m.
Mansfield Community Center
10 South Eagleville Road
Mansfield, CT

Thursday, June 13, 6-8 p.m.
Quinebaug Valley Senior Center
69 South Main Street
Brooklyn, CT

NEEWS
Interstate Reliability Project

Connecticut
Light & Power

A Northeast Utilities Company

P.O. Box 270
Hartford, CT 06141-0270

Information on a transmission project in your area

Get plugged in.

Interstate
Reliability Project

You are invited to join Connecticut Light & Power (CL&P) to learn more about the construction plans for the Interstate Reliability Project, a new transmission upgrade in eastern Connecticut.

The Connecticut portion of the Project includes 37 miles of new overhead transmission line within an existing right-of-way, and three station upgrades. Spanning 11 towns, the Project begins in Lebanon and continues through Columbia, Coventry, Mansfield, Chaplin, Hampton, Brooklyn, Pomfret, Killingly, and Putnam before ending in Thompson at the Connecticut/Rhode Island border.

The Project is part of the New England East-West Solution, a group of transmission projects designed to strengthen the reliability of the power grid in New England.

Copies of the construction plans, called Development & Management Plans (D&M), will be available at the Public Review Sessions and are also available online and in local town libraries along the Project route.

The two D&M Public Review Sessions are:

Wednesday, June 12, 2013
6 p.m. – 8 p.m.
Mansfield Community Center
10 South Eagleville Road
Mansfield, CT 06268

Thursday, June 13, 2013
6 p.m. – 8 p.m.
Quinebaug Valley Senior Center
69 South Main Street
Brooklyn, CT 06234

Questions?

www.NEEWSprojects.com
1-866-99-NEEWS (63397)

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NEEWS
Interstate Reliability Project

Your Guide to Overhead Transmission Line Construction

State regulators have granted approval to Connecticut Light & Power (CL&P) for the Connecticut portion of the Interstate Reliability Project (Interstate). Interstate is part of the New England East-West Solution (NEEWS), a group of transmission line upgrades designed to improve the reliability of the region's electric grid.

This guide provides an illustrated overview of how the construction of overhead transmission lines typically proceeds. It also shows the kind of equipment likely to be used during the construction process.

For timely and more specific updates on Project construction activity, please visit **www.NEEWSprojects.com**.

What

The Interstate Reliability Project (Interstate) is part of the New England East-West Solution (NEEWS).

Why

The Interstate Reliability Project is designed to address weaknesses in the east/west and west/east transmission of power across Connecticut, Rhode Island and Massachusetts. Providing more direct routes between power sources and eastern Connecticut, and increasing the overall capacity of the transmission system, will mean that access to cleaner, competitively priced power will be routinely possible.

Where

This Project spans three states: Connecticut, Rhode Island and Massachusetts. The Connecticut portion of the Project is in the service territory of Connecticut Light & Power and the Rhode Island and Massachusetts portions of the Project are in the service territory of National Grid. In Connecticut, a total of 37 right-of-way miles of new transmission lines will be built. The 37-mile Connecticut portion will pass through 11 towns -- Lebanon, Columbia, Coventry, Mansfield, Chaplin, Hampton, Brooklyn, Pomfret, Killingly, Putnam and Thompson, within existing CL&P right-of-way. It will also include station upgrades of the Killingly Substation and Lake Road Switching Station in Killingly, and the Card Street Substation in Lebanon.

When

In Connecticut, overhead line construction is expected to begin in early 2014 (depending when all necessary permits are received). The lines are expected to be in service in late 2015.

Learn More About It

Visit www.NEEWSprojects.com

As with all construction projects, some noise and disruption are likely during the Project. CL&P strives to keep any inconveniences to a minimum.

Keeping the lines of communication open is an important part of our work in your community. Feel free to contact us with any questions or concerns you may have about the Project:

- Access timely Project updates via www.NEEWSprojects.com
- Call us at 1.866.99NEEWS (1.866.996.3397)
- E-mail us at NEEWS@nu.com

Thanks in advance for your patience as we work to keep our electric system reliable.

Overhead transmission line construction typically, but not always, occurs in the following sequence...

Right-of-Way Clearing

Initially, the right-of-way is cleared of trees and brush to provide the necessary access for construction equipment and a safe work area for crews. Clearing the right-of-way ensures an environment that safely and reliably supports the construction and ongoing operation of the transmission lines. No herbicides are used for clearing during construction.

Although the right-of-way will appear very different after clearing, brush grows back quickly. To meet electric industry vegetation clearance standards, non-compatible species of trees must be permanently removed. These are trees that could become tall enough to grow or fall into the high-voltage transmission lines. You can read more about how CL&P manages vegetation on its rights-of-way at www.NURightsOfWay.com.

Work Area Preparation

Construction vehicles must be able to access the location of each structure that will support the transmission lines. Gravel roads approximately 25 feet wide are needed for the large equipment used during construction. Large level work areas (generally 100 feet by 120 feet), are needed to stabilize equipment, such as drill rigs and cranes.

Timber mats may be used in or around wetlands to protect these environmentally sensitive areas. Silt fencing and other environmental controls are also used to stabilize the soil and protect wetlands during construction.

With the consent of property owners, gates are placed across new access roads where these intersect with town or state roads. These gates help deter unauthorized access to the right-of-way. By landowner request, gates are also installed where access roads cross agricultural land containing livestock. Access road/work area development averages two to three days on each property.

Structure Foundation Installation

The next step in the construction process is installing foundations for the new transmission structures. For H-Frame structures, this typically involves drilling large holes, setting the base section of the structure, and then filling the hole with processed rock. This type of foundation, called a direct embed foundation, involves the use of drilling rigs. The foundation installation process takes about three days per H-Frame structure location.

In areas where monopole structures are installed, drill rig operations occur for a few days at each structure location. Once drilling is complete, a steel rebar cage is placed in each hole, concrete is poured to secure the foundation for the new steel structure, and the concrete then cures. Concrete trucks are used to deliver the concrete mix for the foundations.

New Structure Installation

Once the foundations are complete, transmission structure installation can begin. The new steel structures often come in sections that are assembled on or near the foundation. Cranes and/or bucket trucks are used to lift the structures and set them into position on the foundations.

The structure components are delivered to the right-of-way well in advance of this installation process. Generally, it takes one to three days to assemble and erect each new structure. After installation, the structure is grounded.

Wire Stringing

With the new steel structures in place, the next step is to install the wire ("conductor"). The wire-stringing operation requires equipment at each end of the section being strung. Wire is pulled between these "pulling sites" through stringing blocks (pulleys) at each structure. These pulling sites are set up at various intervals along the right-of-way, typically one to three miles apart. Specific pulling sites are determined close to the time the stringing activity takes place. CL&P notifies property owners about the sites chosen at that time. Once the wire is strung, the stringing blocks are removed and the wire clipped into its final hardware attachment. Helicopters may be used during wire-stringing operations.

Restoration

When construction is complete, disturbed areas will be restored. Native shrubs and ground cover are allowed to regrow. Environmental controls are removed, though some may remain until the area is stabilized.

In areas that were previously landscaped, CL&P works with property owners to restore the area to its pre-construction condition. Before construction is complete, a Project representative will visit affected property owners to develop property-specific restoration plans. These plans will require the final approval of both the property owner and CL&P.

Questions?

Call 1-866-99-NEEWS (63397)

www.NEEWSprojects.com

Connecticut Light & Power

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NEEWS

Interstate Reliability Project

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HARTFORD CT 06101-9975

Connecticut Light & Power

A Northeast Utilities Company

Interstate Reliability Project

Development & Management Plans

Public Review Comment Card

YOUR COMMENTS, PLEASE

NEEWS
Interstate Reliability Project

We appreciate your feedback. Please use this form to provide your comments on the draft construction plans, called the Development and Management (D&M) Plans, for the Interstate Reliability Project.

FIRST NAME: _____ LAST NAME: _____

STREET ADDRESS: _____

TOWN: _____ STATE: _____ ZIP: _____

EMAIL ADDRESS: _____ PHONE #: _____

Where did you learn about the D&M Plans for the Interstate Reliabilty Project?

Mansfield Public Review Session (6/12/13) ___ Brooklyn Public Review Session (6/13/13) ___

D&M Plans at Public Library ___ Other: _____

Your comments on the D&M Plan for the Overhead Transmission Line:

Your comments on the D&M Plan for the Station upgrades (Killingly Substation and Lake Road Switching Station in Killingly; Card Street Substation in Lebanon):

Please let us know if you have any questions or concerns specific to your property:

Instructions:

Place your completed card in the "Comment Station" (only if attending a Public Review Session) or mail your comment card back to us **by July 1, 2013**. CL&P will share a copy of your comments with the Connecticut Siting Council and your town officials.

Thank you,

Connecticut Light & Power
A Northeast Utilities Company