STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

JANUARY 2025

MITIGATION PLAN

Thin Layer Deposition at Rocky Neck State Park

State Project No. 0104-0175
F.A.P. No. 0156(011)
Bridge No. 02713
Route 156 over Four Mile River
East Lyme & Old Lyme, Connecticut

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1.0 PROJECT DESCRIPTION

State Project No. 0104-0175 consists of the replacement of Bridge No. 02713, carrying State Route 156 over the Four Mile River in Old Lyme and East Lyme, CT. This mitigation plan addresses restoration of the permanently impacted wetlands resulting from the proposed bridge replacement.

The roadway over the existing bridge has a curb-to-curb width of 36 feet and consists of two 12-foot travel lanes with 6-foot shoulders. The bridge is composed of four 60-inch round corrugated metal pipes (CMPs), each 52-feet 8-inches long, with reinforced concrete headwalls and wingwalls.

The proposed scope of work consists of replacing the existing deteriorating bridge with a precast 28-foot wide by 8-foot tall 3-sided arch structure with reinforced concrete headwalls, footings and wingwalls. Additionally, the roadway will be shifted north approximately 30 feet and the vertical profile will be raised approximately 4.5 feet to address substandard geometry and hydraulic capacity. Unavoidable impacts to tidal wetlands are proposed because of the bridge replacement.

Wetland mitigation is required by the United States Army Corps of Engineers (USACE) and the Connecticut Department of Energy and Environmental Protection (CTDEEP) to offset the project's permanent impacts to inland and tidal wetlands. The Connecticut Department of Transportation's (CTDOT)'s Office of Environmental Planning (OEP) has been working closely with the CTDEEP and USACE to identify potential mitigation sites. Replacement of tidal marsh systems is often challenging in identifying suitable candidate sites that have a high success probability. The CTDOT OEP, CTDEEP and the USACE have agreed to approach mitigation strategy for this project as a tidal marsh restoration and utilize Thin Layer Deposition (TLD) as the construction methodology.

2.0 IMPACT AREAS

At Bridge No. 02713, the Four Mile River is tidally influenced, and tidal vegetation exists in three of the four quadrants of the bridge, the southwest quadrant excluded. Vegetation in the southwest quadrant is comprised of inland wetland vegetation. Federal and State regulated inland wetlands have been observed and delineated in all but the southwest quadrant. The High Tide Line (HTL) is the landward limit of federally (USACE) regulated tidal wetlands. Located at elevation 2.83 feet, HTL (south of the river) is also considered local extreme high water, the state CTDEEP regulatory limit at the project site. North of the river, the land supports tidal wetlands at higher elevations and the state regulatory limit for tidal wetlands extends to one foot above local extreme high water. The Mean High Water (MHW) elevation is 0.92 feet and is the waterward limit of federal and state regulated wetlands.

The proposed project is anticipated to have permanent and temporary impacts to tidal and inland wetlands. Permanent impacts are a result of removing the existing bridge, construction of the new bridge, and horizontal and vertical realignment of the roadway. Additionally, reconstruction of the natural stream channel downstream of the bridge will require fill material to stabilize the channel and prevent scour, which will permanently impact the waterway, tidal wetlands and inland wetlands. Temporary impacts are due to the installation of the temporary water handling system, required to convey flow during construction. The anticipated impacts are summarized in Table 1; all areas are approximate and based on the latest permit plans.

As agreed upon with the CTDEEP at a project meeting held on January 15, 2021, permanent impacts to tidal wetlands will be mitigated at a 3:1 ratio and permanent impacts to inland wetlands will be mitigated at a 2:1 ratio. Based on the anticipated impacts shown in Table 1, this requires a minimum of 6,900 square feet of mitigation (CTDEEP regulations used, USACE regulations would total 6,300 square feet).

Table 1

WETLAND IMPACT TABLE (DEEP)

	WETLAND SITE NO.	INLAND WETLAND IMPACTS	TIDAL WETLAND IMPACTS (TIDAL WETLAND LIMIT TO MHW)	WATERCOURSE IMPACTS (WATERWARD OF MHW)	TOTAL
PERMANENT IMPACTS	1	1200 S.F. (0.028 AC.)	1500 S.F. (0.034 AC.)	3700 S.F. (0.085 AC.)	6400 S.F. (0.147 AC.)
TEMPORARY IMPACTS	1	1900 S.F. (0.044 AC.)	2600 S.F. (0.060 AC.)	1800 S.F. (0.041 AC.)	6300 S.F. (0.145 AC.)
TOTAL IMPACTS		3100 S.F. (0.071 AC.)	4100 S.F. (0.094 AC.)	5500 S.F. (0.126 AC.)	12700 S.F. (0.292 AC.)

WETLAND IMPACT TABLE (USACE)

	WETLAND SITE NO.	INLAND WETLAND IMPACTS	TIDAL WETLAND IMPACTS (HTL TO MHW)	WATERCOURSE IMPACTS (WATERWARD OF MHW)	TOTAL
PERMANENT IMPACTS	1	1800 S.F. (0.041 AC.)	900 S.F. (0.021 AC.)	3700 S.F. (0.085 AC.)	6400 S.F. (0.147 AC.)
TEMPORARY IMPACTS	1	2900 S.F. (0.067 AC.)	1600 S.F. (0.037 AC.)	1800 S.F. (0.041 AC.)	6300 S.F. (0.145 AC.)
TOTAL IMPACTS		4700 S.F. (0.108 AC.)	2500 S.F. (0.057 AC.)	5500 S.F. (0.126 AC.)	12700 S.F. (0.292 AC.)

3.0 MITIGATION AREA

Ideally, impacts to tidal and inland wetlands are mitigated at the project site. However, sufficient area is not available without significant additional impact to privately-owned properties. Other mitigation sites along Four Mile River were considered to keep the restoration within the same subwatershed, but an accessible and adequate area of degraded tidal vegetation was not located. CTDEEP was consulted to determine if there was a potential mitigation site within the project-adjacent Rocky Neck State Park (RNSP), which is owned and maintained by CTDEEP. Through this coordination, a tidal marsh area situated within RNSP along Bride Brook was identified as a potential mitigation site.

A preliminary investigation of the tidal wetlands along Bride Brook revealed several areas of degraded marsh. The potential mitigation sites within Bride Brook exhibit similar degradation and suitability for compensatory mitigation, per the USACE guidance. As such, accessibility, constructability, and site area were important factors for site selection to minimize impacts to the state park and healthy tidal marsh.

Healthy tidal marsh within RNSP indicate there is sufficient tidal flushing and exchange to nourish a mitigation site. Salinity readings taken in the area ranged from 11 ppt (parts per thousand) to 30 ppt when taken at low and high tides, respectfully. These readings indicate adequate tidal exchange to support marsh restoration.

The proposed mitigation site is located at the southern end of Rocky Neck State Park, adjacent to the northern most parking lot for public beach access. The selected site exhibits degraded tidal wetlands characterized by saltwater pools where healthy vegetation once grew, as observed on historical aerial photographs of the area. The pools average approximately 6 to 7 inches of water depth, based on UAV and ground survey. The healthy tidal wetlands surrounding the pools exhibit substrate several inches above the existing water levels. The saltwater pools that have developed will require appropriate fill material to match an established target elevation.

The selected site area is approximately 10,000 square feet and is one of several wetland cells, defined by manmade drainage ditches, within a larger peninsular tidal wetland area encompassing roughly 1.25 acres (map and limits shown in Appendix A). The entire area includes similarly degraded tidal wetlands and potential for future additional mitigation. The adjacent parking area provides direct access to the mitigation site, which would allow for conventional construction methods to be employed. The parking lot also offers ample staging area for the wetland rehabilitation. Access to other potential mitigation sites along Bride Brook require temporary construction access, clearing, temporary or offsite staging, and are mostly inaccessible by land without imposing significant additional impacts to wetlands.

The manmade ditches will remain after construction to provide clear demarcation of the boundaries of the mitigation area as well as boundaries for post-construction monitoring. The limited open-water area the ditches provide (approximately 500 square feet) does not exacerbate issues with mosquitoes and filling the ditches would not measurably decrease mosquito presence in the area.

4.0 METHODOLOGIES

Traditional mitigation sites require some level of earth movement to facilitate hydrologic reconnection or retention to achieve the desired results. Thin Layer Deposition (TLD) of sediment supports tidal marsh resilience using disposed dredge material. Recently, innovative approaches to restore degraded or over inundated tidal marsh systems have been implemented; these efforts have resulted in tidal marsh recovery through the placement of nutrient rich dredge spoils.

Healthy marsh exposed to additional inundation due to increased water levels (resulting from sea-level rise or marsh subsidence) undergoes a landward shift within the intertidal zone, thereby high marsh plants are replaced by low marsh, and the low marsh degrades and converts to mudflats. Adding sediment to restore the marsh vertical elevation is expected to enhance marsh recovery and resilience. Additionally, observation of high marsh zone expansion and the repopulation of barren mudflats by low marsh plant species occurs rapidly due to the resident seedbank and rootstock.

Tidal marsh sustainability and integrity are determined, in large part, by vertical elevation relative to sea-level, since the plants and animals that comprise tidal marshes have tolerance limits to flooding frequency and duration. Slurry mixtures may be added to increase marsh elevations in areas within the system to optimize the local plant community's location to tidal hydrology. TLD application of sediment/soils slurry to degraded marsh systems in depths ranging from 0.4" to 19.5" or more has produced very good results and is considered one of the current best practices to restore tidal marsh systems. Recovery of smooth cordgrass (*Spartina alterniflora*) has been documented in overburden applications of up to 9". This is essential for reestablishment of the marsh system along with supplemental vegetative plantings to enhance reestablishment of the marsh.

Criteria for marsh restoration methodology varies by type of marsh system, size, access, and availability of source material for the restoration substrate. A review of available literature of appropriate TLD application methods to restore degraded marsh systems was conducted, including the review of the January 2020 National Estuarine Research Reserve System (NERRS) document, "Guidance for Thin-Layer Sediment Placement as a Strategy to Enhance Tidal Marsh Resilience to Sea-Level Rise".

To aid in the selection of final elevations and the establishment of a healthy tidal marsh, two data loggers were installed within RNSP near the mitigation site in March 2022. The loggers provide water level and temperature measurements. One data logger is located along the edge of Bridge Brook. The second data logger is located near the south (upland) side of the mitigation area.

Follow up discussions with knowledgeable, experienced restoration contractors and other scientists engaged in tidal marsh restoration projects along the east coast, specifically in Rhode Island and Connecticut, were conducted to evaluate lessons learned. Scott Comings of The Nature Conservancy, Rhode Island who has completed TLD projects at the Sachuest Point National Wildlife Refuge and the Narrow River marsh restoration in Narragansett RI, Rob Deems of the U.S. Army Corps of Engineers, fisheries biologist with experience in the tristate region of NJ, PA and DE followed by conversations with other engineers conducting sediment removal and placement projects in CT, including Keith Neilson of Docko, Inc of Mystic, CT. Overall, there were mixed levels of success achieved using either traditional application of source material in the dry (ITD) or TLD spray methodology from active dredging operations.

Traditional application of source material using low ground pressure (LGP) earth moving equipment to spread ITD material was discussed to be most favorable for smaller projects (< 50 acres). The ability to control material in a smaller area was crucial for the ease of handling and placement. Placement of source material to construct access into the restoration area was accomplished by transporting source material in LGP marsh buggies or tracked dump trucks and earth movers or using light weight skid steer machines to construct an access road or utilizing HDPE matting to minimize substrate compaction. Source material is then trucked into the marsh and dumped into the desired placement cell. Global Positioning Satellite (GPS) controlled rubber tracked excavators and/or bulldozers are used to grade material to approximately 3" above the finished grade to offset settling and compaction. Concerns with marsh compaction are offset by overfilling and planting. Deep holes may be dewatered at low tide and filled to greater thicknesses using sand or additional source material and planted with plugs of *Spartina alterniflora*.

Marsh rebound following application methodology tended to vary depending on the depth of application. Positive vegetative response occurred at TLD applications of 6" and lower with very little positive vegetative recurrence when over 11" of material was applied over existing vegetation. A review of methodologies suggest that supplemental plantings will help to achieve a more rapid recovery of the marsh, however predation by herbivores and waterfowl remains an issue for some areas, while anthropogenic impacts have been detrimental in locations with high accessibility. In addition, soil strength was found to increase more rapidly with the addition of plant material to help reestablish root layers.

The use of oyster shell bags, hay bales, biodegradable compost filter sock or coconut fiber (coir) logs helped to maintain the outline of the restoration areas and contain liquid sediment. The dispersion of liquid runoff into the surrounding waterways was of concern in smaller applications and a recognized expectation during large spray applications. Containment to prevent excessive input to the water column was somewhat successful using a combination of containment methods for wet application while ITD applications saw less impact to the water column using only one or two combined containment methods.

Application of material ITD has more advantages for smaller scale marsh restoration projects, especially when on-site source material is not readily available. The most limiting and critical factor to conventional method application is marsh compaction, which can be minimized to the maximum extent practicable using LGP equipment and appropriate matting, however these impacts are an important consideration to evaluating the different methods.

A healthy marsh segment within the adjacent tidal area was sampled to determine sediment content, plant density and to observe the initial hydroperiod during tidal cycles. The healthy marsh consisted of dense vegetation comprised of *Spartina alterniflora* in the low marsh areas which incurred saturation during high tide but was not submerged. Sediment was composed of silty sand and a consolidated muck comprised of root mass and silty sand. In addition, the surrounding vegetated marsh area within the TLD site was surveyed to determine appropriate elevation for optimal vegetative cover and water levels are being monitored to determine target elevation for the placement of TLD application and to maximize success of replanted *Spartina*.

Source Material

The quantity and quality of source material is important in evaluating the overall use for TLD application. However, logistics such as handling and transport distances are also considered when determining the viability of using available source material. Low pH or high sulfide content has been shown to have deleterious effects on marsh substrate, vegetation and benthic fauna. The proposed source material may be selected from local marinas that conduct maintenance within boat docks, channels and bulkhead areas. Other potential source options may include beach replenishment material that is recovered from ocean substrate. It is important to consider potential contaminant sources so as not to import hydrocarbons, metals or semi-volatile compounds into a recovering marsh system. All source material will be utilized from previously permitted dredging activities, tested and evaluated for organic content, pH, sulfides and a range of potential contaminants that are commonly associated with dredge material within heavily traveled waterways and boat docking facilities.

Consideration to availability and transport cost considerations were utilized to narrow down the potential dredge source material to several facilities local to the TLD site. Potential sourcing sites have been reviewed to determine how often dredging is completed, how much material is typically produced, where dredged material is stockpiled, the ability to test existing dredged material, and how the dredged material is typically disposed. There are several large dredging operations planned for most of the marinas listed below at regular intervals. Timing to secure potential dredge material from donor locations is dependent upon when the TLD construction will occur. Most of the marinas contacted have available material but none of the material is of known quantity or quality at this time. TLD source material will consist of no more than 25% sand by weight, and between 25% and 40% organic material by weight.

In addition, local area reviews will be conducted to determine if known contaminant sources are located within the watershed. A few local sources of potential source material have been evaluated and the Little Gull Marine facility located in Mystic, CT appears to have suitable substrate material. The following local facilities have also been identified as potential source material resources in the event the Little Gull Marine facility does not have adequate material:

River Landing Marina and Four Mile River Marina - Old Lyme, CT – 3.1 miles from site

Old Lyme Marina - Old Lyme, CT – 7.8 miles from site

Harbor One Marina - Old Saybrook, CT – 12.7 miles from site

Port Niantic Marina - Niantic, CT – 4.9 miles from site

The Point Marina - Waterford, CT – 6 miles from site

Three Bells Marina - Niantic, CT – 6 miles from site

Pine Island Marina - Groton, CT – 18 miles from site

Conversations with marina owners to identify dredging intervals and typical yields vary widely depending on where the marina is located. Many marinas have a 3, 5 or approximately 10-year dredge cycle that typically yields thousands of cubic yards of material. Most of the sites located within large river basins contain higher amounts of silt and lower amounts of sand, while those located in tidal basins tend to have a higher sand concentration. There tended to be varied degrees of impacted dredged material, typically with petroleum hydrocarbons, and some of the sites did contain elevated levels of heavy metals.

Prior to any placement, sediment samples with be analyzed and results submitted to OEP for acceptance on suitability for use within the mitigation area. A Certified Soil Test Report for TLD source material shall include the following:

- ***Washed Sieve Analysis ASTM D422/D1140***
  Sieve Size:
  No. 4
  No. 10
  No. 40
  No. 200

- ***Bulk Sediment Metals***

Parameters:	Acceptable Limits/Background Limits	SW846 EPA Method
Arsenic, Total mg/kg	3.0 mg/kg	SW 6010D
Antimony, Total mg/kg	ND*	SW 6010D
Barium, Total mg/kg	385 mg/kg	SW 6010D
Beryllium, Total mg/kg	ND	SW 6010D
Cadmium, Total mg/kg	ND	SW 6010D
Chromium, Total mg/kg	31 mg/kg	SW 6010D
Lead, Total mg/kg	18 mg/kg	SW 6010D
Mercury, Total mg/kg	0.03 mg/kg	SW 7471B
Selenium, Total mg/kg	ND	SW 6010D
Silver, Total mg/kg	ND	SW 6010D
Copper, Total mg/kg	17 mg/kg	SW 6010D
Nickel, Total mg/kg	13 mg/kg	SW 6010D
Zinc, Total mg/kg	44 mg/kg	SW 6010D
Thallium Total mg/kg	ND	SW 6010D
Vanadium, Total-mg/kg	ND	SW 6010D

  *ND - Non-Detect

- ***Bulk Sediment***

Parameters:		
Chromium, Hexavalent mg/kg	ND	SW 6010D-7196A
Cyanide, Total mg/kg	ND	SW 6010D
Total Petroleum Hydrocarbons (TPH)-mg/kg	ND	SW 8015
Total Water %	As reported	SW 9001

- ***Bulk Sediment TOC/ Water***

Parameters		
Total Organic Carbon %	As reported	SW 9060A

• ***PCB's***	ND	SW8082RCP
• ***Bulk Sediment Pesticides***	ND	SW 8081
• ***Bulk Sediment Herbicides***	ND	SW 8051
• ***Bulk Sediment Volatile Organic Compounds***	ND	SW 8260

- ***Bulk Sediment SVOC*** ND for all listed SVOC's Method SW 8270 for All SVOC's

Parameters:	
Naphthalene µg/kg	ND
Acenaphthylene µg/kg	ND
Fluorene µg/kg	ND
Phenanthrene µg/kg	ND
Anthracene µg/kg	ND
Fluoranthene µg/kg	ND
Pyrene µg/kg	ND
Benzo(a)anthracene µg/kg	ND
Benzo(b)fluoranthene µg/kg	ND
Benzo(k)fluoranthene µg/kg	ND
Benzo(a)pyrene µg/kg	ND
Phenol µg/kg	ND
Bis(2-Chloroethyl) Ether µg/kg	ND
2-Chlorophenol µg/kg	ND
Bis(2-chloroisopropyl) Ether µg/kg	ND
Hexachloroethane µg/kg	ND
2,4-Dichlorophenol µg/kg	ND
Hexachlorobenzene µg/kg	ND
Atrazine µg/kg	ND
Pentachlorophenol µg/kg	ND
Alachlor µg/kg	ND
Di-n-Butyl phthalate µg/kg	ND
Butylbenzylphthalate µg/kg	ND
Bis-(2-Ethylhexyl phthalate µg/kg	ND
Di-n-octylphthalate µg/kg	ND
Phenol-d6 %	ND
2-Fluorophenol %	ND
Nitrobenzene-d5 %	ND
2-Flurobiphenyl %	ND
2,4,6-Tribomophenol %	ND
p-Terphenyl-d14	ND

In addition to the above organic testing parameters, potential TLD source material shall be tested for acid sulfate compounds to ensure soils are suitable for application within the TLD area. Literature reviews indicate that acid sulfate soils with redox potential ranges between 100 mV and 400 mV and percent sulfur <0.3% (dry weight) may be used for TLD application without treatment. Literature reviews indicate that acid sulfate soils with redox potential ranges between -200 and 100 mV, or net acidity less than 0.03% sulfur content (dry weight) are more practically treated prior to application within the TLD area. Soils with a higher sulfur content, greater than 0.06% sulfur (dry weight) are more expensive to treat and may not be a viable option for use within the TLD area. Soils that contain low levels of acid sulfate must be treated prior to use within the TLD area by applying and mixing commonly used agricultural lime or calcium carbonate ($CaCO_3$) into the soil.

The following formula must be used to calculate $CaCO_3$ loading rates to reduce soil acidity:

• Lime needed (kg $CaCO_3$/tonne soil) = net acidity (kg H_2SO_4/tonne of soil) x 1.028 x safety factor x 100.

Or for calculating acidity by percent sulfur content:

• Lime needed (kg $CaCO_3$/tonne soil) = net acidity (S% x 30.59) x 1.028 x 100.

The bulk density (BD) of the soil needs to be taken into account when calculating the amount of lime needed to treat a given volume of soil.

The liming rate calculation for volumes of soil in cubic meters is shown below.

• Lime needed (kg $CaCO_3$/m^3 soil) = bulk density soil (tonne/m^3) x net acidity (S% x 30.59) x 1.028 x 100.

Or the following calculator may be used to determine the $CaCO_3$ application rate:

https://www.wa.gov.au/service/environment/lime-rate-calculator

Please note that some conversions may be required between standard and metric units of measurement.

Acid sulfate soils that contain higher sulfur content or exceed the above recommended ranges for redox potential may be placed below the lowest low tide limit within the mitigation area.

5.0 EROSION CONTROLS

Refer to the Mitigation Plan Set in Appendix A for the proposed erosion control layout, details and notes.

Part of the proposed erosion controls will be the use of fiber (coir) logs around the perimeter of the TLD site. The intent of the coir logs is to retain substrate during and after construction. Once vegetation is established, the substrate is expected to be retained by the vegetative root mass and function similar to the surrounding marsh sediment.

6.0 INVASIVE SPECIES CONTROL

Invasive species control will be conducted following the CTDOT OEP invasive species control specification and the tidal wetland creation specification (see Appendices B and C). Prior to construction, an initial site review will identify invasive species present in proximity to the mitigation site. Five full growing seasons are anticipated to be required for this inspection. Source material will be inspected prior to TLD placement at the mitigation area to minimize the potential to introduce invasive species.

The mitigation site will be inspected at the beginning of construction and throughout the monitoring period to identify the presence and control of invasive species. Higher salinity levels will minimize the species that may occur in the TLD areas and control of invasive species will be performed using both physical removal and herbicide treatment to be applied directly to the plant leaves and avoiding overspray onto native vegetation.

7.0 OFF-ROAD VEHICLE USE

The mitigation site is located within Rocky Neck State Park and there is no off-road vehicle traffic allowed within the park. The mitigation site is also within tidal marsh flat that is comprised of organic muck and sand. Access to this area is unlikely as vehicles will sink into the marsh.

8.0 PRESERVATION AND SITE PROTECTION

Rocky Neck State Park (RNSP) is located within a Connecticut State Park that is perpetually preserved. Express written permission is required from the Commissioner to impact any areas within the RNSP. Further the tidal marsh is protected by both federal U.S. Army Corps of Engineers Section 404 and Section 401 programs and Connecticut state statues that limit or prohibit development or impacts to wetland resources without first obtaining a permit. These restrictions are expected to provide adequate protection for the long-term preservation and protection of the TLD mitigation site.

A woody shrub buffer will be planted along the landward side of the TLD mitigation area. The shrubs will provide a physical barrier to access from the park to the TLD and screening from the park.

9.0 MONITORING PLAN

Monitoring of the mitigation site will be conducted following regulatory guidance issued by the USACE, recommendations made by NOAA, and general guidance used at other mitigation sites. Monitoring will be conducted at the beginning of the growing season and following the growing season for the first five (5) years following TLD. CTDOT OEP, or their representative, will be responsible for monitoring the site during the first five years. Annual reports will be submitted to the CTDEEP. CTDOT's wetland plantings specification for mitigation planting requires all plantings to have a two-year replacement warranty. Any plants that are dead or lack sufficient vigor are to be replaced following the first two years after construction.

Monitoring will occur across the entire mitigation site, not within plots and will be conducted to assess the success or need for additional TLD adjustments at the site. Vegetative species inventories and growth, species density, species diversity, sediment deposits, marsh surface flooding, habitat utilization and spot elevations will all be utilized to evaluate the ongoing success of the mitigation site and documented in the monitoring report. Representative photo plots will be established within the mitigation site to visually document development.

The monitoring plan will include twice a year monitoring for five (5) years. A coverage rate of 85% of native plant species throughout the TLD site will be the target success benchmark, with a presence of 10% or less of invasive species in and immediately adjacent to the TLD site. Invasive species will be treated during each monitoring event and documented in the monitoring report. Monitoring reports will include photo documentation from GPS located benchmark locations, species lists, invasive species present and any action required to reduce or control the invasive species population's along with any additional remedial actions recommended or taken for mitigation success. Elevations within the mitigation area will be surveyed, using a method approved by OEP, in years 1, 3 and 5 of the monitoring period. Visual assessment of existing hydrology (water depth) in spring and summer and substrate/sediment stability will be included in the monitoring report.

Annual monitoring reports will be submitted to CTDEEP no later than December 15th of each monitoring year which will begin following the first full growing season after the completion of site construction and planting (after the 2-year plant warranty period). A copy of the monitoring reports will also be submitted to the NOAA National Marine Fisheries Service, Habitat and Ecosystem Services Division.

The CTDEEP has agreed to maintain control of the property and assume maintenance of the mitigation site following the 5-year monitoring period. Field adjustments may be required during the monitoring period to ensure site success and that the mitigation success criteria are met. Adjustments may include supplemental plantings, additional invasive vegetation control or other measures, as necessary.

10.0 CONTINGENCY

Unanticipated events that may occur at the project site may require alterations to the TLD or additional measures to be implemented at the site to ensure success. Contingencies will be developed to include locally relevant potential impacts (predation, excessive flooding, vegetation survival, etc.).

Field surveys will be conducted during construction and planting to ensure target elevations are achieved. Construction of the TLD site will be overseen by a CTDOT OEP Environmental inspector. OEP reserves the right, through their contract specifications, to make adjustments to grading or planting plans to ensure a successful mitigation site.

11.0 LONG TERM STEWARDSHIP

The RNSP is owned and maintained by CTDEEP and is preserved in perpetuity. The mitigation site is located within RNSP. Therefore, any impacts to the mitigation area would be denied by CTDEEP as part of the RNSP preservation stewardship. CTDEEP has ultimate authority to deny permits to conduct any type of encroachment or activity in the area.

The TLD site is located within RNSP and following the completion of the TLD construction and successful monitoring period, the TLD site will revert back to CTDEEP as part of the RNSP oversite of the Bride Brook marsh.

Changes to site hydrology is not anticipated as the adjacent land use will remain the same within the RNSP. Site hydrology is reliant upon daily tidal flushing to maintain vigor, the tidal flushing is not anticipated to change due to the location within RNSP.

12.0 FINANCIAL ASSURANCES

The CTDOT is a state funded agency with the resources to address the relatively minor costs that may be associated with the replacement or restoration of the mitigation area. The project will be funded utilizing state/federal transportation funds.

13.0 REFERENCES

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APPENDIX A – MITIGATION PLAN SET

APPENDIX B – TIDAL WETLAND CREATION SPECIFICATION

ITEM #0948015A – TIDAL WETLAND CREATION (THIN LAYER DEPOSITION)

Description: The work under this item shall consist of construction of a tidal wetland area, tidal restoration area, and/or tidal enhancement area, collectively herein referred to as Thin Layer Deposition (TLD) area at the Site(s) identified on the Tidal Wetland Mitigation Plans. The work generally consists of furnishing TLD material and preparing appropriate Site grades under the direction of an Environmental Scientist from the Connecticut Department of Transportation's Office of Environmental Planning (OEP).

Materials: The TLD source material selected by the Contractor may include, but is not limited to, man-made soil, materials excavated from local marinas during maintenance activities around boat docks, channels and bulkhead areas, or beach replenishment material that is recovered from ocean substrate. Clean leaf compost is the preferred soil amendment to achieve the organic content criteria. If other soil amendments are more readily available than clean leaf compost, they can be used to meet the requirement for organic content. Contractor shall test all TLD material (as outlined below), and a Certified Test Report must be submitted to OEP for review and acceptance.

The TLD material must consist of no more than 25% sand by weight, and between 25% and 40% organic material by weight.

The soils must be analyzed by USDA-approved methodology for organic matter by loss-on-ignition of oven-dried samples dried at 105ºC. The mineral fraction must be analyzed to determine weight percentage of sand, as determined after passing a 2-millimeter (mm) sieve. Sand particles are defined to be between 0.05 and 2.0 mm in diameter. Certified Materials Test results are to be submitted to OEP for acceptance. The soils must be free of seeds and roots of invasive species and shall be inspected and accepted by OEP prior to their application.

If soil must be supplemented with organic material, the following sources are acceptable, but must meet the TLD material gradation specified above:

a) **Compost:** Compost shall meet the requirements of **Article M.13.06–Compost.**

b) **Peat:** Peat shall meet the requirements of **Article M.13.07–Plant Materials: 10. Peat.** Peat material excavated from the Project Site may be substituted for commercially packaged peat, at the discretion of the Engineer, if the on-Site peat meets all the requirements of the specification.

The Contractor shall consider potential contaminant sources, so as not to import hydrocarbons, metals, or semi-volatile compounds. If any TLD source material is obtained from previously permitted dredging activities, the Contractor shall test, and evaluate all material for organic content, pH, sulfides, and a range of potential contaminants that are commonly associated with dredge material, as noted below.

The Certified Test Report for TLD source material from permitted dredging activities shall include the following:

1. ***Washed Sieve Analysis ASTM D422/D1140***
   Sieve Size:
   No. 4
   No. 10
   No. 40
   No. 200

2. ***Bulk Sediment Metals***

Parameters:	Acceptable Limits/Background Limits	SW846 EPA Method
Arsenic, Total mg/kg	3.0 mg/kg	SW 6010D
Antimony, Total mg/kg	ND*	SW 6010D
Barium, Total mg/kg	385 mg/kg	SW 6010D
Beryllium, Total mg/kg	ND	SW 6010D
Cadmium, Total mg/kg	ND	SW 6010D
Chromium, Total mg/kg	31 mg/kg	SW 6010D
Lead, Total mg/kg	18 mg/kg	SW 6010D
Mercury, Total mg/kg	0.03 mg/kg	SW 7471B
Selenium, Total mg/kg	ND	SW 6010D
Silver, Total mg/kg	ND	SW 6010D
Copper, Total mg/kg	17 mg/kg	SW 6010D
Nickel, Total mg/kg	13 mg/kg	SW 6010D
Zinc, Total mg/kg	44 mg/kg	SW 6010D
Thallium Total mg/kg	ND	SW 6010D
Vanadium, Total-mg/kg	ND	SW 6010D

*ND - Non-Detectable

3. ***Bulk Sediment***

Parameters:		
Chromium, Hexavalent mg/kg	ND	SW 6010D-7196A
Cyanide, Total mg/kg	ND	SW 6010D
Total Petroleum Hydrocarbons (TPH)-mg/kg	ND	SW 8015
Total Water %	As reported	SW 9001

4. ***Bulk Sediment TOC/ Water***

Parameters		
Total Organic Carbon %	As reported	SW 9060A

5. ***PCB's***	ND	SW8082RCP
6. ***Bulk Sediment Pesticides***	ND	SW 8081
7. ***Bulk Sediment Herbicides***	ND	SW 8051

8. ***Bulk Sediment Volatile Organic Compounds*** ND SW 8260

9. ***Bulk Sediment SVOC*** ND for all listed SVOC's Method SW 8270 for All SVOC's

Parameters:	
Naphthalene µg/kg	ND
Acenaphthylene µg/kg	ND
Fluorene µg/kg	ND
Phenanthrene µg/kg	ND
Anthracene µg/kg	ND
Fluoranthene µg/kg	ND
Pyrene µg/kg	ND
Benzo(a)anthracene µg/kg	ND
Benzo(b)fluoranthene µg/kg	ND
Benzo(k)fluoranthene µg/kg	ND
Benzo(a)pyrene µg/kg	ND
Phenol µg/kg	ND
Bis(2-Chloroethyl) Ether µg/kg	ND
2-Chlorophenol µg/kg	ND
Bis(2-chloroisopropyl) Ether µg/kg	ND
Hexachloroethane µg/kg	ND
2,4-Dichlorophenol µg/kg	ND
Hexachlorobenzene µg/kg	ND
Atrazine µg/kg	ND
Pentachlorophenol µg/kg	ND
Alachlor µg/kg	ND
Di-n-Butyl phthalate µg/kg	ND
Butylbenzylphthalate µg/kg	ND
Bis-(2-Ethylhexyl phthalate µg/kg	ND
Di-n-octylphthalate µg/kg	ND
Phenol-d6 %	ND
2-Fluorophenol %	ND
Nitrobenzene-d5 %	ND
2-Flurobiphenyl %	ND
2,4,6-Tribomophenol %	ND
p-Terphenyl-d14	ND

Hazardous or residual waste parameters shall not exceed the acceptable limits for all parameters listed above.

10. In addition to the above organic parameters testing, potential TLD source material shall be tested for acid sulfate compounds to ensure soils are suitable for application within the TLD area. Literature reviews indicate that acid sulfate soils with redox potential ranges between 100 mV and 400 mV and percent sulfur less than 0.3% (dry weight) may be used for TLD application without treatment. Literature reviews indicate that acid sulfate soils with redox potential ranges between -200 and 100 mV, or net acidity less than 0.03% sulfur content (dry weight) are more practically treated prior to application within the TLD area. Soils with a higher sulfur content, greater than 0.06% sulfur (dry weight) are more expensive to treat and may not be a viable option for use within the TLD area. Soils that contain low levels of acid sulfate must be treated prior to use within the TLD area. Soils that contain low levels of acid sulfate may be treated prior to applying to TLD area by applying and mixing commonly used agricultural lime or calcium carbonate ($CaCO_3$) into the soil.

The following formula must be used to calculate $CaCO_3$ loading rates to reduce soil acidity:

- Lime needed (kg $CaCO_3$/tonne (metric ton) soil) = net acidity (kg H_2SO_4/tonne of soil) x 1.028 x safety factor x 100.

  Or for calculating acidity by percent sulfur content:

- Lime needed (kg $CaCO_3$/tonne soil) = net acidity (S% x 30.59) x 1.028 x 100.

The bulk density (BD) of the soil needs to be taken into account when calculating the amount of lime needed to treat a given volume of soil.

The liming rate calculation for volumes of soil in cubic meters is shown below.

• Lime needed (kg $CaCO_3/m^3$ soil) = bulk density soil (tonne/m^3) x net acidity (S% x 30.59) x 1.028 x 100.

Or the following calculator may be used to determine the $CaCO_3$ application rate:

https://www.wa.gov.au/service/environment/lime-rate-calculator

Please note that some conversions may be required between standard and metric units of measurement.

Construction Methods: An Environmental Scientist from the OEP will be on-Site to oversee and monitor construction of the TLD area(s) to ensure compliance with the Tidal Wetland Mitigation Plans.

The Contractor shall submit to OEP for review and acceptance a construction schedule and an outline of construction methodologies (called the Contractor's Mitigation Plan). The Plan shall outline the required work of the TLD area according to the general construction sequence and requirements outlined below. No work associated with the TLD area(s) shall commence until the OEP has reviewed and accepted the submittal.

The Contractor must schedule TLD activities to begin as soon as access allows and within the established time-of-year restriction of December 1 through February 15, inclusive. There shall be no inactive period of longer than 10 days between the beginning of the TLD area preparation and the time when final grades are reached. When applicable, and when conditions warrant, placement of TLD material and final grading shall be completed during and near times of low tide. The installation and removal of temporary construction access, placement of fiber rolls, placement of TLD material, final grading, seeding, and planting shall be scheduled, so that planting will occur within the planting season in accordance with the requirements of Item #0949875A – Wetland Plantings.

Prior to submitting the Plan, the Contractor shall obtain acceptance from OEP of the TLD material as specified in the Materials article of this specification. Upon OEP acceptance, the Contractor will be allowed to submit the Plan for review and acceptance, The Contractor's Mitigation Plan submittal shall include, but not be limited to, the following work at the TLD area(s):

(a) TLD approved Certified Materials Test Report.

(b) Identification of proposed temporary stockpile and staging locations.

(c) Verification and delineation of established Limit of Disturbance as shown on the plans. Prior to placing of TLD material, the Contractor shall set reference stakes for Site-specific tidal data at the TLD area in order to establish appropriate elevations for final grading and as directed by OEP staff.

1. Obtain (survey) elevation of existing tidal vegetation and stake in field as directed by OEP.
2. Stake CJL, HTL, MHW, MLW and other jurisdictional limits as required by the Project permits.

(d) Temporary sedimentation and erosion control measures to be installed.

(e) Removal of nuisance vegetation and all invasive plant species in accordance with Contract Item #0952051A – Control and Removal of Invasive Vegetation.

(f) Identification of clearing and construction limits of any required access road(s).

~~(f)~~a. The Contractor shall submit an equipment plan with a maximum live load rating which shall not exceed, at any given time, 5 psi on the proposed access road and 3 psi at existing grade. Any change or modification to the proposed access road detail, as shown on the plan, will need to be submitted to CTDOT for review and acceptance.

Construct access roads in a manner that minimizes disturbance to existing native vegetation and archaeological resources. No additional impacts shall occur to the existing tidal wetland vegetation or native upland vegetation other than the impacts depicted on the plans. Access roads are to be maintained throughout the duration of the Project and access road locations shall be restored to their original condition or to finished grade as shown on the plans.

TLD Material, as specified above, shall be placed to meet the proposed final grade, or as directed by an Environmental Scientist from OEP.

Upon completion of final grades, the Site shall be exposed to tidal flushing for a minimum of 7 and a maximum of 14 calendar days to allow for settlement of the TLD material and to evaluate final grades. At the end of the first 7 calendar days, the TLD area will be evaluated by an Environmental Scientist from OEP and if deemed necessary, will direct the Contractor to place additional TLD material to ensure success of the TLD area.

Wetland plantings and seeding shall be installed in the spring immediately following achievement of final grades during the period of April 15 through June 15, inclusive. Wetland plantings, when applicable, and when conditions warrant shall be installed during and near times of low tide. Seeding shall only be placed above the HTL.

Any substitutions to the plantings and/or seeding must be submitted to OEP for review and acceptance. Final regulatory approval will be required before any substitutions are accepted. The Contractor shall schedule with OEP, through the Engineer, 30-days in advance of installation of all proposed plantings and seeding.

Restoration plan for stockpile and staging Site(s) and access roads at the TLD area(s) to their original condition or as depicted in the Mitigation Plan.

Upon Site completion, clear the Site of any debris, rubbish, garbage, and other manmade litter.

Provide post construction as-built plans of the TLD area signed and certified by a Professional Land Surveyor to OEP.

Install tidal creation signs as directed by OEP.

Upon acceptance of the Contractor's Mitigation Plan submittal, the Contractor shall coordinate and meet at least 10 days prior to the commencement of these activities identified in the Plan to ensure that the Environmental Scientist from OEP is available prior to on-Site mobilization to discuss work operations within the TLD area(s).

Method of Measurement: Tidal Wetland Creation (Thin Layer Deposition) will be measured for payment by the number of square yard of TLD area(s) graded, covered with TLD material, and accepted.

Basis of Payment: This work will be paid for at the Contract unit price per square yard for "Tidal Wetland Creation (Thin Layer Deposition)" within the TLD area(s) complete in place, including all materials, equipment, maintenance, tools, labor, and work incidental thereto.

The unit price shall also include: survey and staking of reference elevations and work associated with maintaining field stakes for the duration of construction to the point of acceptance of the Site by OEP; testing, mixing, and providing TLD material; restoring stockpile and staging Site(s); and, removing and off-Site disposal of debris, garbage and litter.

The cost of installing and removing sedimentation and erosion controls, including sedimentation control systems, anti-tracking pads and coir/fiber rolls will be paid for under their respective Contract items.

The installation, maintenance, and removal/restoration of access roads will be paid for under Item #0202590A – Protective Matting System Access Road.

The cost of excavation within TLD area(s) will be paid for under Earth Excavation.

The cost of plantings within TLD area(s) will be paid for under Item #0949875A – Wetland Plantings.

The cost of seeding within TLD area(s) will be paid for under their respective Contract items.

The cost of installing wetland creation signs within the TLD area(s) (Sign #31-5478) will be paid for under Contract Item #1208931A – Sign Face – Sheet Aluminum (Type IX Retroreflective Sheeting).

The cost of removing invasive species within the TLD area(s) will be paid for under the Contract Item #0952051A - Control and Removal of Invasive Vegetation.

Pay Item	Pay Unit
Tidal Wetland Creation (Thin Layer Deposition)	s.y.

APPENDIX C – WETLAND PLANTINGS SPECIFICATION

ITEM #0949875A – WETLAND PLANTINGS

Amend Section 9.49 as follows ***for Thin Layer Deposition Area(s) only****:*

Article 9.49.01—Description: *Add the following:*

Work under this item shall also include furnishing, installing, trees, shrubs and herbaceous stock of the type and size indicated in the Tidal Mitigation Landscape Plant Schedule on the Thin Layer Deposition Planting Plan herein referred to as Thin Layer Deposition (TLD) area(s) and in the Permit Planting Items on the Permit Planting Plan (Bridge No. 02713). Work in the TLD area(s) and areas identified on the Permit Planting Plan (Bridge No. 02713) will be performed under the direction of an Environmental Scientist from the Connecticut Department of Transportation's Office of Environmental Planning (OEP).

Article 9.49.02—Materials: *Add the following:*

The trees, shrubs and herbaceous stock to be planted within the TLD area(s) and planting area at Bridge No. 02713 must be native varieties of those species listed in the Tidal Mitigation Landscape Plant Schedule as shown on the Thin Layer Deposition Planting Plan and in the Permit Planting Items on the Permit Planting Plan (Bridge No. 02713). OEP's Environmental Scientist must review and accept any plant species substitutions from the Thin Layer Deposition Planting Plan and/or Permit Planting Plan (Bridge 02713) a minimum of 30 days in advance and receive regulatory approval of any substitutions prior to plant inspection by OEP's Environmental Scientist and delivery to the Site. If substitutions are proposed, the Contractor must provide OEP with documentation from 5 wholesale plant material sources of supply indicating that the species type or size listed in the Tidal Mitigation Landscape Plant Schedule and or Permit Planting Items are not available. No cultivars or hybrids of any species will be allowed as a substitution.

Article 9.49.03—Construction Methods:

1. **Planting Season:** *Add the following:*

All Plant Material to be Installed (Including Deciduous and Evergreen)

For TLD area(s), installation of all trees, shrubs, and herbaceous plantings must be initiated in the spring immediately following achievement of final grades during the period of April 15 through June 15, inclusive. Wetland plantings, when applicable, and when conditions warrant shall be installed during and near times of low tide.

For the planting area(s) identified on the Permit Planting Plan (Bridge No. 02713) all plant material must be installed during the period of April 15 and June 15, inclusive or August 15 and October 15, inclusive. Installation of all trees, shrubs, and herbaceous plantings must be initiated after final grade of the Site has settled and has been evaluated for tidal flows during a specified time period provided by the Environmental Scientist. Upon OEP review and evaluation of tidal conditions, planting must be performed and completed within the specified period, or as otherwise directed by the Environmental Scientist.

3. **Field Coordination:** *Add the following:*

For TLD area(s) and areas identified on the Permit Planting Plan (Bridge No. 02713), a schedule for planting must be submitted by the Contractor for review and acceptance by OEP's Environmental Scientist at least 30 days prior to planting. Plant locations shall be as generally depicted in the Thin Layer Deposition Planting Plan for the TLD area(s) and areas identified on the Permit Planting Plan (Bridge No. 02713) or as directed by the Environmental Scientist.

4. **Planting Layout:** *Add the following:*

For the TLD area(s) and areas identified on the Permit Planting Plan (Bridge No. 02713) the Contractor shall review Site conditions and inform the Environmental Scientist of any conflicts. The Contractor shall coordinate planting layout with the Environmental Scientist for review and acceptance.

5. **Preparation of Planting Areas:** *Add the following:*

For the TLD area(s) and areas identified on the Permit Planting Plan (Bridge No. 02713), the planting areas shall be prepared by use of approved tools or machinery. All undesirable invasive species shall be removed in accordance with the requirements detailed in the Control and Removal of Invasive Vegetation special provision. All undesirable material shall be removed from the Site and disposed of by the Contractor in a manner satisfactory to the Engineer.

6. **Pit Excavation:** *Add the following:*

Plant pits within the TLD area(s) must be hand dug. Machinery may be allowed for use in limited areas, with prior review and acceptance by OEP's Environmental Scientist.

7. **Setting Plants:** *Add the following:*

   d. **Setting of Herbaceous Stock in the TLD areas and areas identified on the Permit Planting Plan (Bridge No. 02713):** Plantings shall be installed as shown on the Thin Layer Deposition Planting Plan and areas identified on the Permit Planting Plan (Bridge No. 02713) according to their wetland indicator status or as directed by OEP's Environmental Scientist.

   e. **Setting of Trees and Shrubs in the TLD areas and areas identified on the Permit Planting Plan (Bridge No. 02713):** Trees and shrubs shall be installed as shown on the Thin Layer Deposition Planting Plan and areas identified on the Permit Planting Plan (Bridge No. 02713) or as directed by OEP's Environmental Scientist. All trees and shrubs in the TLD area(s) and areas identified on the Permit Planting Plan (Bridge No. 02713) shall be set so that they are level with the microtopography within the immediate area.

f. All plants shall be set manually, and any relocated plants shall be placed in locations with suitable hydrology and soils, and where appropriate structural context with other plants can be maintained, as determined by OEP's Environmental Scientist.

8. Fertilizing: *Add the following:*

Fertilizing within the TLD area(s) and areas identified on the Permit Planting Plan (Bridge No. 02713) is strictly prohibited.

9. Watering: *Add the following*

Watering within the TLD area(s) and areas identified on the Permit Planting Plan (Bridge No. 02713) is strictly prohibited.

10. Guying and Staking: *Add the following:*

For TLD area(s) and areas identified on the Permit Planting Plan (Bridge No. 02713), the guying and staking within coastal areas may occur above the higher elevation between the Coastal Jurisdictional Limit (CJL) or High Tide Limit (HTL) or as directed by the Environmental Scientist to stabilize plantings due to tidal flows.

11. Pruning: *Delete Section.*

12. Spraying: *Delete Section.*

13. Mulching: *Add the following:*

For TLD area(s) and areas identified on the Permit Planting Plan (Bridge No. 02713), the mulching within coastal areas may occur above the higher elevation between the Coastal Jurisdictional Limit (CJL) or High Tide Limit (HTL) or as directed by the Environmental Scientist.

15. One-Year Establishment Period: *Add the following:*

For the TLD area(s) and areas identified on the Permit Planting Plan (Bridge No. 02713), a **two-year** review will be required from the date of initial plant installation within the areas identified on the Thin Layer Deposition Planting Plan and Permit Planting Plan (Bridge No. 02713). The Environmental Scientist will, annually, identify, list and quantify dead or rejected plants. The Contractor shall furnish and install new plants as directed by the Environmental Scientist. Dead or rejected plants need not be removed from TLD area(s) and areas identified on the Permit Planting Plan (Bridge No. 02713).

Add the following at the end of Article 9.49.03:

Article 9.49.04—Method of Measurement:

Add the following ***for Thin Layer Deposition Area(s)*** *only:*

Wetland Plantings will be measured for payment as a Contract lump sum item.

Article 9.49.05—Basis of Payment: *Add the following:*

Wetland Plantings will be paid for at the Contract lump sum price for "Wetland Plantings," which price shall include all materials, tools, equipment, labor and work incidental thereto. The Contractor shall submit to the Department a Schedule of payment values for review and comment prior to payment.

Replacement of dead or rejected plants required within two years of the initial planting installation will not be measured for payment. OEP's Environmental Scientist will inspect the wetland plants annually, for two years after initial installation, and determine the number and types of replacement plants to be provided. Forty percent (40%) of the Contract value for this item will be withheld until final acceptance of the wetland plantings following the two-year replacement period.

Pay Item	Pay Unit
Wetland Plantings	l.s.

APPENDIX D – CONTROL AND REMOVAL OF INVASIVE VEGETATION SPECIFICATION

ITEM #0952051A - CONTROL AND REMOVAL OF INVASIVE VEGETATION

Description: This work shall include the development and implementation of an Invasive Vegetation Removal Plan (IVRP) to outline the identification and treatment methods for the control of invasive vegetation, including trees if present, as directed by the Engineer or their authorized delegate. This work will also include the removal and off-Site disposal of invasive vegetation from within the Project limits in accordance with the accepted IVRP.

The list of invasive vegetation to be controlled, removed, and disposed off-Site under this item can be found on the following websites:

- Connecticut Invasive Plant Working Group (CIPWG) Invasive Plants Council (http://cipwg.uconn.edu/invasive_plant_list/)
- US Army Corps of Engineers (ACOE) New England District Compensatory Mitigation Guidance Appendix K (http://www.nae.usace.army.mil/portals/74/docs/regulatory/Mitigation/2016_New_England_Compensatory_Mitigation_Guidance.pdf)

Materials: The herbicide shall be formulated as applicable for target-species foliar treatment or a flush cut/stump treatment. All herbicide applications shall be in accordance with Product label rates and in conjunction with Sections 22a-46 to 22a-66z of the Connecticut General Statutes (CGS).

Flagging tape, if used, shall be fluorescent, 'All-Weather' type, resistant to UV and water damage.

Stakes shall be survey-grade, as specified under Article 9.80.02.

Construction Methods: The Contractor shall be responsible to identify invasive vegetation at all times of the year and to prepare a plan for its control, removal, and off-Site disposal without assistance.

1. Thin Layer Deposition Planting Plan: Within the Thin Layer Deposition (TLD) area, no ground disturbance or grubbing is permitted at any time throughout the duration of the Project. The invasive vegetation within the TLD area shall be treated between October 15 and April 14 by flush cutting and paid under Clearing and Grubbing. The invasive vegetation within the TLD area shall be treated with herbicide between April 15 and October 14. Herbicide is to take root for 7-10 calendar days. After the 7–10 calendar day period and review of the area(s) by the Environmental Scientist, the Contractor shall manually flush cut any invasive vegetation present as close to the existing grade as possible.

2. Permit Planting Plans (Bridge No. 06896 and Bridge No. 02713): Removal of invasive vegetation between October 15 and April 14 shall be done by mechanical means only to a depth approved by OEP's Environmental Scientist to ensure complete removal of the entire root system with the exception of phragmites which shall be manually flush cut as close to the existing grade as possible. Invasive vegetation shall be treated with herbicide between April 15 and October 14.

3. IVRP: Prior to any ground disturbance within the Project limits, the Contractor shall submit a proposed IVRP to the Engineer or their authorized delegate for review and comment. The Contractor shall address any comments to the satisfaction of the Engineer and resubmit their revised IVRP for review and acceptance.

The IVRP for the Thin Layer Deposition Planting Plan and Permit Planting Plans (Bridge No. 06896 and Bridge No. 02713) shall include separate schedules and the following information:

1) Proposed dates for the initial walk through of the invasive vegetated areas to be controlled and removed for off-Site disposal.
2) Schedule identifying specific dates when herbicide treatment or mechanical excavation or removal of invasive species is to occur for the life of the Contract, including the 2-year warranty period that begins at Substantial Completion. The treatment schedule shall coincide with the Contractor's schedule.
3) Plan sheets identifying the species of invasive vegetation and trees within the Project limits showing the total square yards proposed to be controlled and removed for off-Site disposal. For each species of invasive vegetation present on-Site, the following shall be described:
    a. Types and concentrations of any herbicides to be used to control the identified species for the life of the Contract, including any adjuvants, SDS sheets, types of tools, equipment, or machinery to be used.
    b. Mechanical excavation and removal methods including the type of machinery to be used.
4) Provide proof of DEEP Pesticide Application Business registration pursuant to CGS Section 22a-66b, and certifications for each supervisor and operational commercial applicator on-Site or as required under CGS Sections 22a-54 to 22a-58. All Contractors physically applying pesticides on Department construction Projects to treat invasive vegetation in the State highway right-of-way must ensure that the "6 Rights-of-Way Pest Control" certification is held by at least one Commercial Supervisory Pesticide Applicator employed at the Pesticide Application Business. If the applicator does not have a commercial supervisory certificate, then the applicator must have a junior operator certificate in "6 Rights-of-Way Pest Control" and operate under the written or in-person directions of the supervisor who is certified in "6 Rights-of-Way Pest Control." More information on DEEP certifications and permits for applying pesticides is available at the Pesticide Management Program page website. The Department reserves the right to require additional DEEP certifications based on Project Site specific requirements.
5) A description of safety equipment required.
6) Procedures for handling chemical spills.
7) Proposed disposal methods:
    a. Procedures for off-Site removal of invasive vegetation including trees.
    b. Provide address of disposal location, current permits / letters from the town authorizing such activity and a Site map (showing regulated areas).
    c. **Invasive vegetation shall not be buried on-Site.**

No equipment or vehicles to complete the work will be permitted within the TLD area. Treatment within the TLD area shall be done manually. Any equipment used to process invasive vegetation must be cleaned prior to further use.

If changes are required to the accepted IVRP during the life of the Contract (including registration/certification changes for the personnel applying pesticides or new invasive species not previously identified in the original IVRP submission) or additional invasive vegetation control and/or removal are ordered by the Engineer, these changes shall be documented by the Contractor and resubmitted to the Engineer or their authorized delegate for review and acceptance. Only those changes recommended by the appropriately licensed supervisor/ applicator will be considered. At no time shall the Contractor direct or advise workforces on the pesticide treatment. All direction must be generated from the licensed Pesticide Application Business and approved by the Engineer.

The IVRP or any amended version must be accepted by the Engineer or their authorized delegate prior to beginning of any mechanical excavation or herbicide treatment in the areas which require invasive species control, removal and off-Site disposal as identified Contractor's marked up plan sheets. The accepted methods must be capable of total control and removal of all identified invasive species in the identified areas throughout the life of the Contract and the 2-year warranty period.

4. Special Handling of Invasive Species Vegetation: The Contractor will be allowed to mechanically excavate invasive vegetation and underlying soils using the accepted methods in the IVRP. The accepted methods must be capable of the removal of all soil to a depth where invasive plant material and root system is no longer evident, to the satisfaction of the Engineer or their authorized delegate. Suitable material shall be provided and placed to final grade as shown on the plans or as directed by the Engineer.

All excavated invasive vegetation and underlying soils shall be considered an unsuitable material and must be removed separately from clearing and grubbing operations and disposed of off-Site at an approved location as described in the Contractor's IVRP.

Whether the Contractor's method of removal is by flush cutting/stump treatment or spraying of herbicides, invasive species, including trees identified as invasive in the above websites or IVRP, must be removed separately from clearing and grubbing operations and disposed of at an approved location as described in the Contractor's IVRP.

The Contractor will not be allowed to strip/cut topsoil from any location and reuse this material within the Project limits identified within the IVRP as an area requiring treatment. The stripped/cut material is considered unsuitable material and is to be taken off-Site to an approved disposal facility as described in the Contractor's IVRP.

Wood chips from invasive species are not allowed to be stockpiled or reused on-Site. Wood chipping on-Site may be allowed to remain on-Site if temporarily stored in a properly contained enclosure and removed off-Site at the end of the treatment cycle, to the satisfaction of the Engineer or their authorized delegate.

No equipment or vehicles other than those required to complete the work as described in the Contractor's IVRP will be permitted in the areas designated for invasive vegetation removal. Any equipment used to process invasive vegetation, such as chippers and transport vehicles, must be cleaned prior to further use.

5. Site Maintenance: Broadcast or uncontrolled spray application will not be permitted, and care must be taken to avoid contacting non-target native species. If any non-target native species to remain within the Project limits are inadvertently treated with herbicide and perish, they shall be replaced with in-kind species at the Contractor's expense.

Vines shall be cut from the ground to the tree canopy. Twining vines within a tree canopy shall be removed to the greatest extent possible without damaging the existing tree to remain. Should branches be damaged, the Contractor shall prune damaged limbs at their expense. All corrective pruning shall meet the requirements of the National Arborists Association Pruning Standards. Note: Use of aerial equipment is encouraged; use of a pole saw to cut vines leaving unsightly debris hanging from the trees will not be allowed.

Flush cutting/stump treatment of brush and trees shall not be more than 2 inches above the ground line.

Any invasive species control and removal work performed throughout the duration of the Contract that causes damage or soil disturbance shall be repaired at the Contractor's expense within 7 days. Disturbed areas shall be vegetatively stabilized with the appropriate seed mix and protected with hay mulch, cellulous fiber mulch, or erosion control matting.

Limits for control and removal of invasive vegetation shall be maintained for the life of the Contract. Should stakes or flagging be damaged during the course of construction, the Contractor shall re-establish limits. Use of reference staking is permissible.

6. Field Meetings: The Contractor's IVRP must receive acceptance from the Engineer, or their authorized delegate and have the Site surveyed, staked, and flagged prior to any field meeting.

The Contractor shall provide at least 10 working days' notice to the Engineer for any scheduled field meeting(s) as described in the IVRP. During the meeting, the Contractor's IVRP shall be reviewed to verify the identified invasive species and to review the square yardage on the marked-up plan sheet(s). At this time, the Engineer or their authorized delegate may identify additional invasive species or designate additional areas for removal that are not included within the Contractor's submitted IVRP.

Additional field meetings may be warranted at any time, as directed by the Engineer or their authorized delegate, to ensure the Contractor is compliant with the IVRP or amended versions.

7. Treatment: The treatment schedule as identified in the IVRP may be modified based on changes to the Contractor's construction schedule or based on existing field conditions. The Contractor shall provide at least 10 working days' notice to the Engineer or their authorized delegate prior to proceeding with each treatment.

Treatment of invasive species will not be permitted without notifying the Engineer or their authorized delegate prior to activity and such personnel shall be on-Site to observe the work, unless specifically authorized otherwise. Treatment shall not be permitted outside of normal working hours, unless specifically authorized.

Prior to any herbicide treatment on-Site, the Contractor shall provide proof of DEEP Pesticide registration/certification, as specified above in **3. IVRP**. The Contractor shall not perform, nor allow subcontractors to perform, any treatment work at any time unless proof of current registration/certification for the actual supervisor and operator conducting or overseeing the herbicide application is available to the Engineer, upon request.

At a minimum, the Contractor shall treat all areas as identified in **1. Thin Layer deposition Planting Plan and 2. Permit Planting Plans (Bridge No. 06896 and Bridge No. 02713).** Additional spot treatment measures may be warranted within the same optimal growing season in any year throughout the life of the Contract if full control and removal of the invasive species is not achieved within the Project limits as outlined in the IVRP or as identified by the Engineer or their authorized delegate. When herbicide is used, a minimum of 10 working days is required prior to clearing and grubbing, planting, and seeding operations, so the herbicide application can take effect. Annual warranty treatment (2 years) of invasive species, shall be completed between April 15 and October 14 as identified in **1. Thin Layer deposition Planting Plan and 2. Permit Planting Plans (Bridge No. 06896 and Bridge No. 02713).**

Mechanical excavation and disposal may occur at any time of the year as specified above in **4. Special Handling of Invasive Species Vegetation**.

If rain or windy conditions are anticipated on the day of the scheduled treatment, the Contractor will not be allowed to proceed, unless authorized by the Engineer or their authorized delegate.

Method of Measurement: The work to remove invasive vegetation, as defined above, will be measured for payment by the number of square yards of invasive vegetation surveyed, treated, and removed as required, including any required re-treatment of any regrowth or new growth. This work shall also include the removal of invasive trees, if present. No additional payment will be made for subsequent treatments.

All areas for removal shall be surveyed, flagged, and measured prior to treatment. After a review of the surveyed limits during the field meeting(s), the Engineer may designate additional areas for removal not indicated on the plans which will be measured for payment by the number of square yards treated.

Basis of Payment: The work for the removal of invasive vegetation and trees will be paid for at the Contract unit price per square yard for "Control and Removal of Invasive Vegetation." Payment shall include all labor, surveys, materials, tools, and equipment necessary for limits of the invasive area(s); development and required revisions of the IVRP; maintenance of the limits throughout the Project; species identification; proof of DEEP pesticide registration/certification; and cutting, excavation and replacement of in-kind material, treating, re-treating, removal, and off-Site disposal of designated invasive plant and tree material. Off-Site disposal of residue shall include the loading, transport, dumping, and fees associated with legal off-Site disposal.

- Upon Engineer's acceptance of the required IVRP, the Contractor will receive payment equal to 10% of the estimated Contract Item value.
- Upon completed initial herbicide or mechanical removal treatment methods as described in

the IVRP, the Contractor will receive payment equal to 20% of all areas receiving treatment.

- The Contractor will receive incremental payments for each additional treatment throughout the duration of the Project of all areas receiving treatment. The total of incremental payments will not exceed 40% of the Contract item value.
- Upon successful completion of the 2-year warranty period covering all treated areas on the Project, the Contractor will receive final payment.
- Any fines levied against the Department due to the Contractor's or Subcontractor's failure to comply with the specifications or applicable regulations will be deducted from the monies due the Contractor.

All other vegetation to be removed which is not designated as invasive vegetation or invasive tree shall be removed in accordance with the Item "Clearing and Grubbing" or other Contract items. Vegetative stabilization of disturbed areas will be paid for under the respective Contract items.

Pay Item	Pay Unit
Control and Removal of Invasive Vegetation	s.y.