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Wetland Replication Protocol
Prospect Hill Village
Bellingham, MA
DEP File No. 105-940

Prepared by:



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Introduction: The proposed Prospect Hill Village townhouse development is depicted on the Plan set prepared by GLM Engineering Consultants Inc. ("GLM"). As detailed on the plans, including sheet SUP-A, Wetland Replication Plan, the proposed primary roadway into the project makes use of an existing gravel road that crosses a wetland system consisting of mapped Hoag Brook and an associated area of Bordering Vegetated Wetland ("BVW"). The Replication Plan identifies proposed BVW impacts at the existing/proposed wetland crossing to be 480 sf (160 sf on north side of the crossing and 320 sf on south side). This calculation conservatively includes the defined stream channel.

The Massachusetts Wetland Regulations at 310 CMR 10.55(4)(b) state that discretionary wetland filling and replication may be allowed consistent with the criteria listed below ("and any additional, specific conditions the issuing authority deems necessary to ensure that the replacement area will function in a manner similar to the area that will be lost"). Although the project is filed as a "limited project" in accordance with 310 CMR 10.53(3)(e), which allows for potential deviation from the BVW replication provisions of the Regulations, the following criteria for discretionary BVW filling and replication are satisfied. Although it is never possible to fully replicate the horizontal configuration of a wetland crossing in a replication area, it is EcoTec's opinion that the proposed replication area complies with the BVW replication criteria listed below.

Note that the proposed replication area serves as mitigation for the BVW filling and for proposed filling of Isolated Vegetated Wetland ("IVW") located in the western portion of the site which is a remnant of past excavations in the former mining area. The BVW and IVW areas are described in a separate Performance Standards evaluation by EcoTec. Consistent with discussions on the site with BSC Group, the Commission's peer review consultant, mitigation for the proposed IVW filling has been paired with the smaller replication area required for BVW mitigation. Rather than replicate the poorly developed wetland conditions in the IVW, the replication proposed includes a layer of more productive topsoil, and includes a grading plan to provide a range of hydrologic conditions, including seasonal standing water, to enhance wildlife habitat.

The BVW replication area regulations at 310 CMR 10.55(4)(b) specify the following provisions for a replication area (adherence to the provisions is provided below each).

BVV Replication Regulatory Requirements and Project Conformance - From 310 CMR 10.55(4)(b):

1. *the surface of the replacement area to be created ("the replacement area") shall be equal to that of the area that will be lost ("the lost area");*
 - A larger area is proposed (2:1 for both IVW and BVW);
2. *the ground water and surface elevation of the replacement area shall be approximately equal to that of the lost area;*
 - The replication area has similar elevation (in part) to the BVW impact area, and provides for a wetter hydrology than the existing IVW, to enhance wetland function and wildlife habitat;
3. *the overall horizontal configuration and location of the replacement area with respect to the bank shall be similar to that of the lost area;*
 - The configuration and location of the replication is adjacent to Hoag Brook, which is similar to the BVW impact area, but the IVW is mitigated as BVW along the brook, rather than in the middle of the pit;
4. *the replacement area shall have an unrestricted hydraulic connection to the same water body or waterway associated with the lost area;*
 - The replication area has an unrestricted hydraulic connection to the Hoag Brook BVW. The IVW is not hydraulically connected to any water body or waterway, but will be connected to Hoag Brook;
5. *the replacement area shall be located within the same general area of the water body or reach of the waterway as the lost area;*
 - The replication area is in the same general area along Hoag Brook, and satisfies this criterion for the BVW. The IVW is not hydraulically connected to any water body or waterway;
6. *at least 75% of the surface of the replacement area shall be reestablished with indigenous wetland plant species within two growing seasons, and prior to said vegetative reestablishment any exposed soil in the replacement area shall be*

temporarily stabilized to prevent erosion in accordance with standard U.S. Soil Conservation Service methods;

- The details below provide for soils and planting consistent with this requirement;

7. *the replacement area shall be provided in a manner which is consistent with all other General Performance Standards for each resource area in Part III of 310 CMR 10.00.*

- As detailed in the EcoTec performance Standards Analysis, the replication area and all project components satisfy the Performance Stands for all Resource Areas on the site.

The Bellingham Wetlands Bylaw Regulations contain similar provisions, with additional criteria, including the requirement that: "*The area of the wetland replication shall be at a 2:1 ratio to that area of wetland loss.*" As noted on the Replication Plan, an area of replication of 37,000 sf is proposed, in excess of the 2:1 mitigation ratio, including both the BVW fill (480 sf) and IVW fill (16,860 sf). The local regulations also include several provisions for which a waiver is sought, including replication area proximity to the proposed impact area and similarity of elevation and physical characteristics. As detailed in the EcoTec Performance Standards Analysis, it is our opinion that the proposed replication area significantly enhances the wetland function relative to the existing IVW area.

Details regarding construction, planting, and monitoring are proposed below. BVW replication requirements are summarized below.

Hydrology:

As indicated above and on the proposed replication area grading plan (Sheet "SUP-A" by GLM Engineering) the replication area has been designed to provide a range of hydrologic conditions. Information informing the proposed grading and anticipated hydrology includes the elevation of the adjacent BVW, and test pits within the proposed replication area. The replication area is located adjacent to the native BVW bordering Hoag Brook, which has a generally southerly flow. The replication area is approximately 300-feet long along measured parallel to the brook, and the elevation of the brook and wetland increases to the north (upstream). The BVW boundary at delineation flags along the length of the replication area is at the following approximate elevations:

<u>Wetland Flag</u>	<u>Elev at Flag</u>
• Flag E-39	224'
• Flag E-32	225'
• Flag E-27	226'
• Flag E-22	227'

Test pit data which includes detailed soil descriptions and estimated seasonal high water table (“ESHWT”) depths/ elevations were also evaluated. The plan includes two test pits (TP 22-7 and TP 22-8) with surface elevation and depth to ESHWT. Based on the plan information, the ESHWT at test pits in the replication area is:

- TP22-7: 223.1
- TP22-8: 222.7.

The replication area is proposed to have a fringe of wooded swamp wetland hydrology, with most of the area at a hydrology in the range of shrub swamp to wet meadow, and a central area that is proposed to be seasonally inundated.

As noted below, it is proposed that at the time of the replication area construction, the excavation to sub-grade be completed to conform approximately to the grades indicated on the replication plan, but that final sub-grade elevation across the replication area be determined based on a field determination by a qualified wetland/ soil scientist of hydrologic indicators in the area, to achieve the proposed hydrology.

We note that the proposed invert of the box culvert is designed to match the existing culvert invert (221.5). The proposed culvert is designed in compliance with Stream Crossing Standards and therefore is much larger than the existing culvert orifice. It will therefore be less prone to clogging with plant matter. We considered the possible effect that this change might have on groundwater levels in the wetland immediately upstream of the culvert. The interior of the BVW upstream of the culvert for the first +/- 100-feet has deep organic soils, lacks woody vegetation, and appears to be subject to periodic ponding under existing conditions. This area exists at elevation 222 – 223 for the most part. Nearby test pits in the upland indicate ESHWT elevations of 222.7 and 223.1, at or above the surface elevation of the existing BVW. Due to the extensive area of sand and gravel soils around the site, and a large area of wooded swamp tributary to the wetland at the subject location, it appears that the BVW at that location receives groundwater flow from the surrounding upland, as well as stream flow from the wetland to the north, which flows well into the growing season. Based upon this assessment, we expect that the hydrology of the BVW will be maintained from these two sources of water, and the loss of the periodic clogging of the existing culvert pipe would not have a substantive effect on the hydrology of the BVW upgradient of the culvert.

BVV/ IVW Replication Protocol:

1. Prior to initiating work at the replication area, the boundary of the existing BVW will be protected with a properly entrenched silt fence and minimum 6-inch staked straw wattle between the wetland and the work area, including access ways.
2. Access to the proposed replication area will be from the existing gravel road which is proposed to be upgraded to serve as the main project roadway.

3. Existing trees and other woody vegetation within the proposed replication area will be removed. A portion of this woody material will be set aside and used to provide coarse woody debris in the replication area, as described below (step #8). A minimum of 20 logs of at least 8-feet in length will be saved for use as habitat enhancement in the replication area. Smaller woody debris will also be saved for this use.
4. The replication area will be excavated to subgrade (approximately 12-inches below final grade). As indicated on the Replication Plan sheet, the precise depth of the subgrade excavation will be determined in the field by a qualified soil/ wetland scientist based upon soil features observed in the excavation. Subgrade will be 1-foot below the proposed finish grade. Side slopes will be graded as indicated on the plans, no steeper than 3:1 (H:V) and allowing for 4- to 6-inches of topsoil placement. Excess soil will be removed from the replication area vicinity for use in other areas of the site or stockpiled outside of the wetland Buffer Zone.
5. During the replication area excavation and grading, large boulders encountered may be left in place as habitat features, and several rockpiles may be formed at multiple locations (not more than 10% of the area to be covered by boulders or rock piles).
6. Because the BVW fill area is much smaller than the proposed replication area, and the IVW areas have developed only a trace of topsoil, the opportunity for translocation of wetland topsoil is very limited. To the extent feasible, organically enriched topsoil will be removed from the BVW proposed to be filled and transported to a storage location near the replication area, where it will be mixed with a 1:1 mixture of high quality, loamy topsoil and leaf mold compost, as necessary, to provide for 12 inches in thickness throughout the replication area.

Topsoil for wetland restoration shall be harvested from an upland area of the site (where wetland invasives are not anticipated) with well-composted leaf mold added to increase organic matter content. This combination should minimize the possible introduction of invasives to the replication area. The specifications for the mineral soil and compost separates are found below. The organic matter content of finished wetland restoration soil shall be between 12 and 20 percent. The textural class shall be Mucky Sandy Loam or Mucky Fine Sandy Loam. Typically a field mix of 50% rough-screened (1 inch-minus screen size), weed-free, loamy mineral soil and 50% compost results in an organic matter content within the suitable range.

Sandy loam mineral soil properties:

Particle Class	% of Total Weight	Average %
Sand (0.05 - 2.0 mm dia. range)	45-75	60
Silt (0.002-0.05 mm dia. range)	15-35	25
Clay (less than 0.002 mm dia. range)	5-20	15
Gravel & Stone (>2.0 mm dia.)	<15%	

Field assessment by a qualified soil scientist will be used to assess compliance with the above criteria.

Compost- Compost shall be derived from leaf mould, clean ground wood, bark and/or sawdust that meets all State Environmental Agency requirements. The product shall be well composted, free of viable weed seeds and/or propagules and contain material of a generally humified nature capable of sustaining growth of vegetation, with no materials toxic to plant growth.

- Following topsoil mix placement, the substrate will be roughly graded to provide an appropriate microtopography to mimic natural wetlands.
- Wildlife enhancement measures including tree snags (logs installed to stand vertically), coarse woody debris, and rock piles will be installed within the replication area, to provide food, forage and cavity nesting opportunities. The rock piles will consist of multiple boulders/ cobbles each piled to extend above final grade to create crevices and cavities for shelter and nesting. The wetland scientist will oversee this process.
- Planting of the replication area will be conducted, as summarized in Table 1, below:
 - Planting will be done only during the beginning (April 15 through June) or end (September 1 to November 15) of the growing season. Alternatively, planting in the mid-growing season is only acceptable if irrigation is provided;
 - The plant species identified in the table below will be planted in the replication area from nursery stock;
 - No planting is proposed in the central depression;
 - The wetland seed mix is proposed throughout the replication area (excluding the central depression);
 - The red maple saplings will be planted only at the periphery of the replication area;
 - The shrubs will be planted randomly throughout the flatter portions of the replication area, not planted in rows;
 - Woody vegetation planting will be conducted first, followed by herbaceous seeding;

Table 1: Planting Plan for Wetland Replication Area

SPECIES; SIZE; SPACING	NUMBER ¹
Saplings; min 6 to 8' height, container or balled, burlapped; Planted around perimeter Red Maple (<i>Acer rubrum</i>)	30
Shrubs; 2.5 to 3' in height, min 1 gal container; Planted in the interior of the replication area, excluding the central depression Highbush blueberry (<i>Vaccinium corymbosum</i>) Arrow-wood (<i>Viburnum recognitum</i>) Sweet pepperbush (<i>Clethra alnifolia</i>) Nannyberry (<i>Viburnum lentago</i>) Winterberry (<i>Ilex verticillata</i>) Silky dogwood (<i>Cornus amomum</i>)	300 total ¹
Herbaceous; Seed: New England Wetland Plants, New England Wetmix (or approved substitute)	10 lb.
Plugs: A mixture of plugs of native wetland pollinators shall be planted in the replication area near the boundary of the proposed seasonal ponding area Cardinal flower (<i>Lobelia cardinalis</i>) Northern blueflag (<i>Iris versicolor</i>) Water Plantain (<i>Alisma subcordatum</i>) Swamp Milkweed (<i>Asclepias incarnata</i>) Marsh Marigold (<i>Caltha palustris</i>) Lurid Sedge (<i>Carex lurida</i>) Boneset (<i>Eupatorium perfoliatum</i>) Spotted Joe-Pye Weed (<i>Eutrochium maculatum</i>) Soft-Stem Bulrush (<i>Schoenoplectus tabernaemontani</i>) Swamp Aster (<i>Aster puniceum</i>) NOTE: The proposed herbaceous plug plantings may be especially susceptible to wildlife herbivory, and therefore, the success of these plantings cannot be ensured. It is anticipated that by planting a variety of species, some will thrive in the long term, but it is not feasible to predict with any certainty.	200 total ¹

¹ Depending upon availability from local nursery stock, at least four (4) of the listed species will be selected, with at least twenty (30) specimens of each selected species planted, for a total of 300 shrubs.

10. The coarse woody debris salvaged during the initial clearing shall be replaced within the replication area to mimic a natural forested wetland surface. This may include short vertical snags. A minimum of 200 linear feet of 2-inch diameter or larger logs and branches will be placed haphazardly throughout the replication area. Any stones encountered during the replication area excavation may also be allowed to remain.

11. An erosion control barrier of silt fence or straw wattle will be placed around the outer edge of the replication area, at the toe of the side slopes;
12. A minimum of 4- to 6-inches of topsoil will be spread throughout the side slopes and any other areas disturbed for construction of the replication area;
13. The side slopes and access path will be planted with a native upland seed mix (e.g. New England Wetland Plants Restoration Mix for Wet Sites) designed to provide permanent cover. After seeding, the side-slopes may be mulched with a thin layer of straw to provide for temporary erosion control.
14. After the wetland replication area and side slopes have become vegetatively stabilized and following approval of the issuing authority, the perimeter siltation fence and all wooden stakes will be removed and disposed of properly.
15. The replication areas will be inspected, by a qualified Wetland Scientist, at the end of each growing season for a minimum of two years or until such time as the required 75% of vegetative cover with wetland species has been established. Monitoring will include vegetative species and cover assessment, soil evaluation and observation of groundwater/soil saturation. If invasive species are noted (e.g., knotweed, phragmites, etc.) these species will be removed by either hand-pulling the entire plant out by the roots or by cutting the above-ground portion and applying glyphosate herbicide to the stem with a drip applicator. The cut or pulled plants will be properly disposed of outside the wetlands and buffer zones and care will be taken not to distribute any seeds or berries that may be present.