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June 28, 2021

Township of Cavan-Monaghan
988 Peterborough County Rd 10
Millbrook, ON L0A 1G0

Attn: Tyler Peters, Greenview Environmental Management
Wayne Hancock, Township of Cavan-Monaghan

Re: Buffer Enhancement Plan 1470 County Road 10, Cavan, Ontario
Cambium Reference: 9988-001

Dear Tyler Peters,

Cambium Inc. (Cambium) is pleased to provide Township of Cavan-Monaghan (the Client) with the following Buffer Enhancement Plan for 1470 County Road 10, Cavan, Ontario (the Site). We understand that the Client is pursuing redevelopment of the Public Works facility located at the Site. The Site is directly south of the Cavan Creek Provincially Significant Wetland (PSW) and Cavan Creek flows through this PSW. The entire site is currently developed with buildings, parking area, and outdoor storage. As such, a Buffer Enhancement Plan (the Study) is required in consideration of natural heritage wetland policies in order to provide a net benefit to the wetland from the proposed redevelopment.

As the Site is adjacent to wetlands and watercourses, the Study will also consider regulations on development as imposed by the local Conservation Authority's Regulation under the Conservation Authorities Act (1990): Otonabee Region Conservation Authority (ORCA). Policy 7.2(5) of ORCA's Watershed Planning & Regulation Policy Manual states:

> 7.2(5) Expansion, reconstruction or relocation of an existing building or structure within an area of interference [i.e., within 120 m of a PSW] will be permitted provided that there will be no negative impact on the hydrologic function of the wetland. Submitted plans will be required to demonstrate the following:
>
> - disturbance to natural vegetation communities will be minimized;
> - disturbed area and soil compaction will be minimized;

- impervious areas will be minimized;
- development will be located above the high water table;
- overall existing drainage patterns will be maintained; and,
- best management practices will be used to:
  - maintain water balance;
  - control sediment and erosion; and,
  - maintain or enhance as much of a wetland buffer as is feasibly possible.

Field investigations were conducted to confirm the presence of the mapped features and investigate the growing conditions of the proposed buffer lands. Recommendations regarding suitable soil removal/replacement and grading, and plant species, densities, and locations for the enhancement of the butter lands are provided based on the site plans dated April 22, 2021.

CURRENT SITE CONDITIONS

A site investigation was conducted on May 13, 2021 to investigate current conditions of the proposed buffer lands. This included the confirmation of the PSW boundary, a survey of vegetation species currently in the area, and soil characterization.

The Ecological Land Classification (ELC) System for Southern Ontario (Lee, 1998) was used to classify vegetation communities on the Site. Definitions of vegetation types are derived from the ELC for Southern Ontario First Approximation Field Guide (Lee, 1998) and the revised 2008 tables. The wetland boundary was delineated based on methods provided in the Ontario Wetland Evaluation System (OWES) (Ministry of Natural Resources, 2013). According to OWES, wetlands are delineated based on the dominance of wetland vegetation (> 50% relative cover).

The wetland to the north and west of the proposed buffer area was classified as a Cattail Organic Shallow Marsh (MAS3-1). The wetland boundary was located at

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the base of a steep slope (approximately 1:1) along the full extent of the northern property boundary and along the northern part of the western property boundary. This boundary is mapped on the enclosed Site Plan based on the toe of slope contour, which is an accurate representation of the wetland edge. Wetland species did extend to the property boundary, growing within the historical fill that has been placed on the property. This community was dominated by cattail species (*Typha spp.*) and contained standing water at the time of the field investigations. A patch of invasive *Phragmites* was identified to the north of the buffer area within the MAS3-1 community. Cavan Creek flows from west to east within the PSW, north of the Site, and crosses under County Road 10 approximately 55 m from the Site.

The proposed buffer area consisted of cultural thicket (CUT) growing on an area of historical fill, presumably used to raise the property above the floodplain and facilitate the original construction on the Site. Ground cover was sparse, and consisted of pioneer species that readily take advantage of disturbed areas. Species included Balsam Poplar, Eastern White Cedar, Willow, Staghorn Sumac, Red-osier Dogwood, Goldenrod, and grasses. The area adjacent to the buffer lands is currently used as a storage area for aggregates (i.e. gravel, screenings, etc.), which have slumped down the slope toward the wetland boundary in some locations. Surface soils within the proposed buffer area were variable due to the historical fill and aggregate stockpiles. Sampling with a hand-held soil auger was attempted and where cores were obtained the soils consisted of hard-packed sand and gravel with course fragments (cobble). Cambium also completed a Geotechnical Investigation Report (dated June 24, 2021) which provides detailed information on the soils on the Site.

BUFFER ENHANCEMENT PLAN

The goal of the buffer enhancement is to establish vegetation that will provide both a visual and physical buffer between the Public Works facility and the adjacent PSW. The buffer will also act as a barrier to erosion and sedimentation resulting from potential runoff from the works yard. Finally, the established buffer should enhance the ecological value of the buffer area by providing potential

foraging and shelter opportunities for wildlife. A Conceptual Planting Plan (the Plan) is enclosed with this letter.

SITE PREPARATION

During the Site Preparation phase, erosion and sediment control (ESC) measures should be put into place that provide protection to the adjacent PSW during construction. This can be accomplished through the installation of light-duty silt fence at the base of the slope. Light-duty silt fence is recommended in order to avoid entanglement risk to wildlife. If deemed necessary by the ESC designer, this light-duty silt fence could be further stabilized using straw bales. The silt fence should remain in place until the buffer area has been stabilized through the establishment of vegetation.

The slope/berm should be constructed following the recommendations of the Geotechnical Investigation Report (Cambium, 2021). Areas with stockpiles of aggregate (cobble, gravel, etc.) should be removed and disposed/re-used as appropriate to construct the berm.

To reduce the instances of erosion due to runoff from the works yard and to allow for access to the north and west sides of the building, a 2 m wide herbaceous (i.e., grasses/flower mix) strip should be seeded at the top of the slope (shown in pink on the Plan). This herbaceous strip would cover the 1 m flat area next to the building and 1 m of the top of the slope. Clean topsoil should be brought in and placed on the strip to a depth of 15 cm. Details regarding appropriate seed mixes are provided in the following sections.

Clean topsoil should be brought in and placed on the remainder of the slope such that there is the equivalent of 20 cm depth over the area of the slope. The top soil does not need to be graded but can be roughly distributed on the slope.

Given the current state of the buffer area, soils will need to be modified to allow for the establishment of vegetation. Following the slope/berm construction, compaction within the buffer area with heavy equipment should be avoided, as hard surfaces can increase the instances of runoff events, erosion and sedimentation. Erosion and sedimentation can effectively mitigated by leaving

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the surface rough and loose. A rough and loose soil surface will slow the travel of water down the slope and allow it to easily infiltrate into the soil surface. In addition, a rough and loose soil surface provides diverse topographic conditions for the establishment of a higher diversity of vegetation species. As such, the slope should be constructed such that topographic diversity is maximized, and the potential for erosion is minimized. This can be accomplished using the pit and mound technique (Polster, 2011)(see enclosed Technical Note). Briefly, an excavator using a digging bucket takes a bucket of soil and places it to the left of the hole that was just opened, half a bucket width from the hole so it is half in and half out of the hole. A second hole is then excavated half a bucket width to the right of the first hole. Material from this hole is then placed between the first and second holes. These steps are repeated until a line of pits and mounds are created along the length of the slope. The excavator then backs up the width of a hole and repeats this process, being sure to line up the holes in a new row with the mounds in the previous row. The end result is a 'checkerboard' of pits and mounds on the slope. The combination of top soil and pits/mounds will provide the soil depths of at least 30 cm that are generally tolerable for most tree species (OMAFRA, 2008).

RESTORATION PLANTINGS

In order for restoration to be successful, it is essential that appropriate vegetation materials are selected. All vegetation materials should be native to the area and sourced as locally as possible. As such, species for the buffer enhancement were selected based on those observed during the field investigations. A conceptual planting plan is provided appended to this letter.

In order to create a physical and visual barrier between the works yard and the buffer area, a coniferous hedgerow should be planted at the top end of the slope next to the vegetated strip. The establishment of a coniferous hedgerow will help prevent encroachment into the buffer area. Given the abundance of Eastern White Cedar in the area, cedar trees can be sourced and transplanted from local sources or obtained from a local nursery. Trees should be planted along the entire length of the buffer area (approximately 113 m long) and spaced 2 m apart

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(55 trees total) to allow for future growth. If required, these trees can be trimmed once established (i.e., after 5 years) in order to allow access to the building's exterior and roof.

The slope beyond the hedgerow should be planted with a mixture of native shrub species. Shrubs should be planted in groups of 3 (of the same species), and randomly placed on the slope to create a naturalized appearance. Shrub species and quantities are provided in Table 1.

On areas of the buffer lands where access is easier and there is more space to grow, tree species can also be planted. Areas suitable for trees could include the southwest corner and the northeast corner of the buffer lands. Trees have not been shown on the Conceptual Planting Plan as their placement would be subject to access needs of the Township. If space permits, deciduous tree species could also be included in the buffer plantings as provided in Table 1.

Bare root and transplanted trees are best planted in the spring. Potted stock can be planted at any time of year; however, watering would be required during dry periods.

All tree and shrub plantings should be mulched to limit competition using a partially composted seed-free mulch with no dye. Mulch application rates should be a max depth of 5-7cm and a radius of 30-40 cm.

Finally, the entire area should be seeded using a native seed mixture. The seed mixture should consist of native species, and contain species that prevent erosion. The native seed mix is best sowed in the fall (between October 15th and November 15th). The native seed mixture can also be sown in the spring; however, temperature variability in the spring may cause the seed to remain dormant until spring of the following year. To prevent the establishment of invasive species while the native species are getting established, a quick-germinated native nurse crop of Annual Rye (*Lolium multiflorum*) should be used. The nurse crop can be seeded at the same time as the native seed mixture. This will reduce the potential for soil/wind erosion and seed movement, reduce weed competition, and provide shelter for the native seed mix during the early establishment period. Due to the aggressive nature of Annual Rye, it is important

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that it is not applied at a greater rate than what is recommended by the supplier, or it may outcompete the desired native species. Seed mixes and application rates are provided in Table 1.

Table 1 Recommended Plant Materials and Seed Mixes

Plant Species/Seed Mix	Scientific Name	Quantity	Stock/Size Application Rate
Eastern White Cedar	*Thuja occidentalis*	55	Transplants/bare root
Red-osier Dogwood	*Cornus sericea*	30	Bare root (40-80 cm)
Willow varieties	*Salix petiolaris; S. bebbiana; S. discolor*	30	Rooted cuttings and bare root
Staghorn Sumac	*Rhus typhina*	30	Bare root (45-60 cm)
Red Maple	*Acer rubrum*	TBD	Potted stock
Bur Oak	*Quercus macrocarpa*	TBD	Potted stock
American Elm	*Ulmus Americana*	TBD	Potted stock
Stormwater Pond Native Seed Mixture (8190)	*Variety of species*	TBD	500g/180 m^2 or 25 kg/ha
Annual Rye Seed (7115)	*Lolium multiflorum*	TBD	22 kg/ha or 20 lbs/acre

ADAPTIVE MONITORING PLAN

It is recommended that an adaptive monitoring plan be implemented for the buffer enhancement area. The buffer should be monitored once a year for the next two growing seasons after installation to ensure plantings have established, and determine the need for replacement plantings. An 80% survival rate for planted trees and shrubs should be obtained. Replacement plantings should be

completed after two years in order to bring the total number of living plants to 80%, ensuring survival is spread between trees and shrubs. Given the local seed source available from adjacent wetland areas, it is anticipated that other native species will establish on their own within the buffer. The buffer enhancement area should also be monitored for the presence of invasive species. Should invasive species be found, recommendations regarding methods for removal and management will be provided. Monitoring results should be reported to ORCA at the end of each of the two growing seasons.

PLANT MATERIAL SUPPLIERS

Below is a list of potential supplies – these are provided as guidance and other sources of native stock can be used.

Trees and Shrubs:

- Richardson's Pineneedle Farms: Pontypool, ON: 705.277.9993
- Kobes Nursery: Bowmanville, ON: 905.263.8814
- Uxbridge Nurseries: Brooklin, ON: 905.655.3379

Seed Mixtures:

- Ontario Seed Company: Kitchener, ON: 226.210.3704
  Note: Seed mixture species composition and pricing can be viewed online at: www.oscseeds.com (Search via OSC Product Number).

SUMMARY OF RECOMMENDATIONS

1. Prior to commencement of work, heavy duty silt fence should be installed at the bottom of the slope to prevent erosion and sedimentation into the adjacent PSW during site preparations. Silt fence should remain in place until the buffer area has been stabilized through the establishment of vegetation.
2. Areas with abundant coarse stony material (i.e. cobble, rip rap, gravel) should be removed as part of the site preparation phase.

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3. A 2 m wide herbaceous strip should be established at the top of the slope to slow any runoff that may drain towards the edge of the slope. Clean topsoil should be brought in and placed on the strip to a depth of 15 cm.
4. Clean topsoil should be brought in and placed on the slope such that there is the equivalent of 20 cm depth over the area of the slope.
5. Soil compaction should be avoided on the slope to allow for the quick establishment of roots. The implementation of the pit and mound method described herein will reduce compaction and minimize the potential for erosion.
6. A coniferous hedgerow should be established along the top end of the slope next to the vegetated strip. Tree species and quantities are provided in Table 1.
7. The area below the coniferous hedgerow should be planted with native shrubs at a density as described herein. Shrub species and quantities are provided in Table 1.
8. If space permits, deciduous tree species could also be included in the buffer plantings as provided in Table 1
9. Bare root/transplanted trees should be planted in the spring for best results.
10. All tree and shrub plantings should be mulched to limit competition using a partially composted seed-free mulch with no dye. Mulch application rates include a max depth of 5-7cm and a radius of 30-40 cm.
11. The entire buffer enhancement area should be seeded with a native seed mix and a nurse crop. Recommended seed mixes and application rates are provided in Table 1. The native seed mix is best sowed in the fall (between October 15th and November 15th).
12. The buffer enhancement area should be monitored for two full growing seasons to ensure overall success as described herein. Planting success

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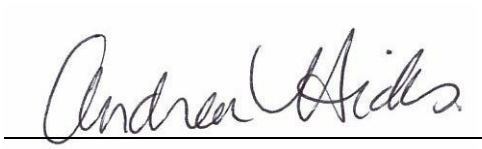
should be reported to ORCA at the end of each of the two growing seasons.

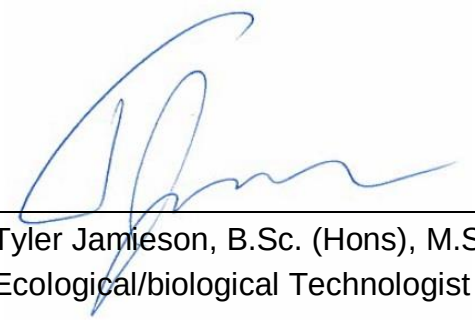
CLOSING

Cambium trusts that this Buffer Enhancement Plan meets ORCA's requirements for the subject property. Should any of the involved parties have any questions or require clarification on any aspect of this submission, please do not hesitate to contact the undersigned at (705) 742-7900.

Best regards,

Cambium Inc.





Andrea Hicks, M.Sc.
Natural Science Group Manager

Tyler Jamieson, B.Sc. (Hons), M.Sc.
Ecological/biological Technologist

TJ/alh

Encl. *Conceptual Planting Plan*
Technical Note: Making Sites Rough and Loose: A Soil Adjustment Technique

P:\9900 to 9999\9988-001 Twp of Cavan-Monaghan - EIS - 1470 County Road 10, Cavan\Deliverables\REPORT - Buffer Plan\2021-06-28 LTR Buffer Enhancement Plan - 1470 CR 10, CM FINAL.docx

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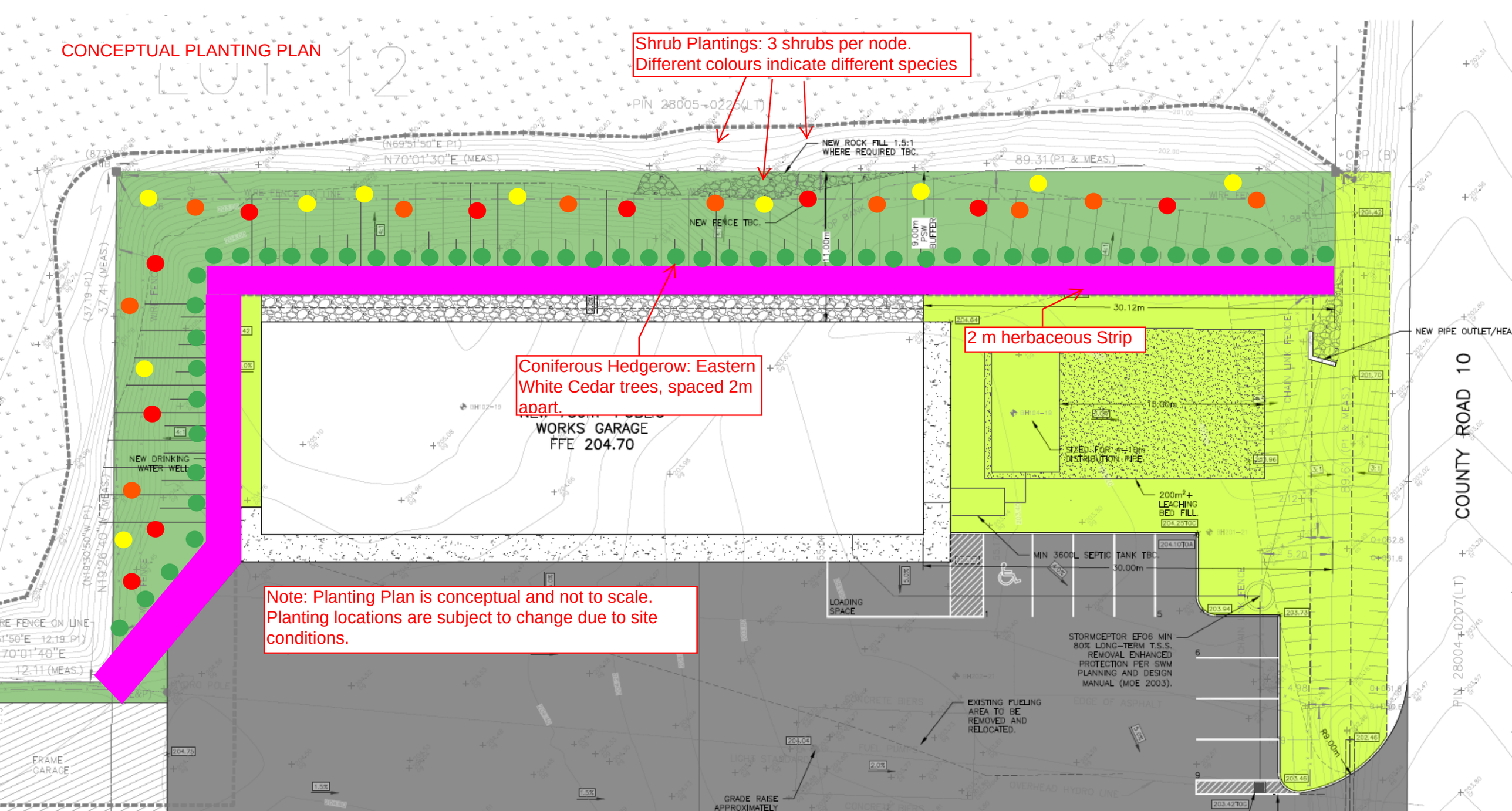
CONCEPTUAL PLANTING PLAN
Shrub Plantings: 3 shrubs per node.
Different colours indicate different species
NEW ROCK FILL 1.5:1
WHERE REQUIRED TBC.
NEW FENCE TBC.
9.00m
PSW
BUFFER
11.00m
Coniferous Hedgerow: Eastern White Cedar trees, spaced 2m apart.
2 m herbaceous Strip
30.12m
WORKS GARAGE
FFE 204.70
NEW DRINKING WATER WELL
18.60m
SIZED FOR 4-10m DISTRIBUTION PIPE
200m²+ LEACHING BED FILL
MIN 3600L SEPTIC TANK TBC.
30.00m
LOADING SPACE
STORMCEPTOR EF06 MIN 80% LONG-TERM T.S.S. REMOVAL ENHANCED PROTECTION PER SWM PLANNING AND DESIGN MANUAL (MOE 2003).
EXISTING FUELING AREA TO BE REMOVED AND RELOCATED.
GRADE RAISE APPROXIMATELY
NEW PIPE OUTLET/HEA
COUNTY ROAD 10
PIN 28004-0207(LT)
FRAME GARAGE
Note: Planting Plan is conceptual and not to scale. Planting locations are subject to change due to site conditions.

BOREAL RESEARCH INSTITUTE

BOREAL RECLAMATION PROGRAM



Technical Note, June 2013

Making Sites Rough and Loose: A Soil Adjustment Technique

DAVID POLSTER

Rough and loose surface treatments (Polster 2009) provide an effective way to control erosion and create conditions that promote the revegetation of the site. By creating topographic heterogeneity (Larkin et al. 2008) the rough and loose surface configurations provides increased diversity of habitats therefore improves ecological resilience (Holling 1973). This brief document shows how sites can be made rough and loose to gain these ecosystem benefits and initiate natural successional processes (Polster 1989).

Rough and loose surface configurations (Photographs 1 and 2) can be achieved by using an excavator to open holes on the slope, dumping the material that is generated from the holes in mounds between the holes. The excavator, using a digging bucket (not clean-up), takes a large bucket full of soil and places it to the left of the hole that was just opened, half a bucket width from the hole so it is half in and half out of the hole. A second hole is then excavated half a bucket width to the right of the first hole. Material from this hole is then placed between the first and second holes. A third hole is now opened half a bucket width to the right of the second hole, with the excavated soil placed between the second and third holes. Care should be taken when excavating the holes to shatter the material between the holes as the hole is dug. The process of making holes and dumping soil is continued until the reasonable operating swing of the excavator is reached. The excavator then backs up the width of a hole and repeats this process, being sure to line up the holes in the new row with the space between the holes (mounds) on the previous row.

Photograph 1 (left) and 2 (right). Rough and loose surface configurations can be made using an excavator on slopes up to 2:1 or 26°. Large areas can be treated for a cost of about $700/ha.

Rough and loose surface treatments can be used in confined areas as well as in large open areas (Photograph 3). These treatments are ideal for recovering hydrologic integrity on resource access roads and where unauthorized access by motor vehicles ("quads" and "dirt bikes") is causing ecological degradation. The rough and loose treatments can be used on coarse textured substrates and can be applied in areas where potentially droughty conditions dictates that planting be conducted on north facing slopes (Photograph 4).

Photograph 3 (left) and 4 (right). Forest access roads and other small areas can be treated using the rough and loose technique (left) as well as areas with coarse substrates (right) such as this old dam site with alluvial boulders, cobbles and gravels.

The rough and loose treatment provides ideal conditions for live staking (Polster 2006) as the soils are loose so the stakes can be planted deeply and roots can grow unencumbered by compaction (Photographs 5 and 6). Live staking can be used to establish pioneering species such as Balsam Poplar and Willow. Two meter long cuttings inserted one meter into the substrate allows substantial root systems to develop and fosters successful establishment of these species.

Photograph 5 (left) and 6 (right). Live staking in the rough and loose soils of this tailings pond is easy and allows the cuttings to grow rapidly (right, start of 2nd year growth for cuttings)

The rough and loose surface treatments provide ideal microsites for seeds to lodge in and for seedlings to grow (Photograph 7, 8 and 9). Where local conditions provide ample seed, a diversity of native species will naturally establish. In general, these species will be appropriate for the sites where they establish so that moisture loving species will establish in the bottoms of the holes while species that favour dry sites will be found on the tops of the mounds. This species diversity enhances ecosystem resilience.

Photograph 7 (left), 8 (centre) and 9 (right). A variety of local forest species have established within a year of treatment on a rough and loose forest road on Salt Spring Island.

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