

Peatland Restoration by Burying: An Effective Option

CONTEXT

To build long-term in-situ infrastructure in peatland settings, the ground must be stabilized to prevent flooding or sinking of equipment. Thick layers of foreign fill material, such as borrowed subsoil or wood chips, are introduced to elevate the surface and provide support. These materials are usually placed directly on top of the original peat, altering the final surface chemistry and moisture.

This impacts future regeneration potential as the thick, saturated, organic substrates (>40cm) that characterize peatlands directly influence the surface vegetation composition. Therefore, one approach to reclaim peatland in-situ disturbances is to recreate a saturated peat surface vegetated with desirable species. In simple scenarios the foreign material can be removed to its origin, such as a borrow pit, revealing the underlying peat. However, in more complex cases, fill disposal sites are lacking, or, the buried peat is severely compromised by the fill weight, which once removed results in a deep depression of standing water.

In response, NAIT's Centre for Boreal Research has successfully used burial-in-place under peat to recreate saturated peat surfaces while reducing offsite transportation and disposal costs. Depending on the compressed peat's integrity and the area's hydrological setting, some or all of the foreign material (mineral subsoil or wood chips) can be buried below the underlying peat.

At the Canadian Natural Resources Limited (CNRL) Peace River Complex, a wood chip road through a wet, moderate rich fen was reclaimed using complete burial of the wood chips. In a nearby dry, poor fen, strips of a well-pad were reclaimed using partial removal and burial of remaining clay where the underlying peat was too compromised to fluff to the target elevation. Both sites now support peatland vegetation communities.



Clay pad removed, and mineral fill backfilled into excavated hole in the underlying peat, awaiting final replacement of peat on top.

HOW TO USE BURIAL UNDER PEAT FOR PEATLAND RESTORATION

- Burial under peat can be used for organic (wood chip) or inorganic (mineral soil) fill materials.** Aim to create an upper peat surface at least 40cm thick to reduce the buried fill's influence on the surface vegetation.
- A portion of the fill material may still need to be removed offsite.** The volume of fill appropriate to bury will depend on the type of underlying peat (fibric versus humic), amount of compression, and thickness of the fill above the surface of the surrounding area.
- The **final peat surface elevation** regardless of volume of fill material buried beneath **should match** that of the **target reference elevation**.
- Use microform elevation in the nearby wetlands**, rather than solely water table position, **to determine the appropriate target surface elevation** for the reclamation site. This will usually be similar to the average elevation of the low points.
- Buried fill material like clay can affect **sub-surface water flow**, particularly on linear features (i.e. access road). **Deep trenches and flow channels can be created** to facilitate cross flow.



KEY FINDINGS

- Final surface elevation was critical to ensuring appropriate soil moisture. Carefully monitor how much fill is buried to prevent over-elevating the surface.
- Peat soils derived from sedges and brown mosses experienced greater compression and loss of integrity than those of Sphagnum mosses.
- The buried wood chips did not impact vertical or horizontal subsurface water movement, or available surface moisture.
- The buried clay did alter vertical and horizontal subsoil water movement but has not had a significant negative impact on the reclaimed site or surrounding area.
- Buried clay (under 40cm of peat) in a poor fen setting did not significantly shift the vegetation composition compared to reclaimed areas without buried clay (peat only).

COST ANALYSIS

Cost is highly variable depending on disposal site availability, distance to disposal site, volume of fill to bury on-site versus remove.

Ideally, complete fill removal with peat fluffing is less time-consuming and complex than partial fill removal and burial under peat to ensure the proper final elevation. But, additional costs to transport fill offsite should also be considered.

PRACTICAL RECOMMENDATIONS

DETERMINING VOLUME TO BURY

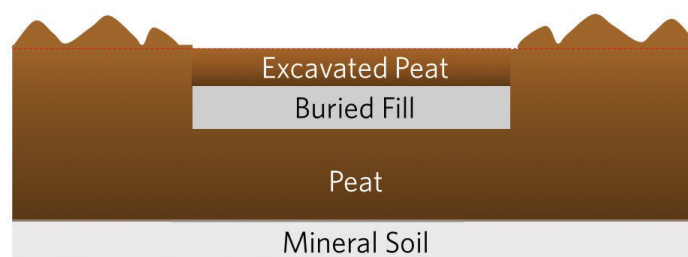
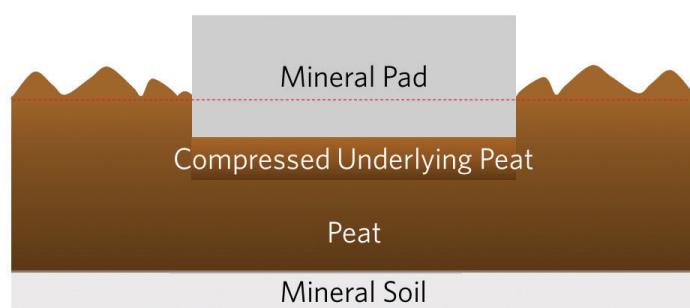
- Determine the target peat surface elevation by surveying the low points of the adjacent wetland. Target 0 to 10cm lower than the low point average.
- Determine the final fill surface elevation. Account for the peat placed on top and settling, aiming for about 30-40cm lower than the final peat surface elevation.

BURYING FILL MATERIAL

- Remove excess fill material to the disposal site.
- Working backwards in strips, remove remaining fill to one side. Excavate out enough buried peat for the peat surface.
- Replace the fill material back in the hole to the target elevation and tap out air pockets. Replace the excavated peat on top of fill material. Smooth the peat surface to remove air pockets and achieve final surface elevation.
- If the surface does not settle as much as anticipated, track pack or reprofile the following year.

LOGISTICAL CONSIDERATIONS

- Expect greater surface settling for sites with more porous fill material (wood chips versus sand versus clay).
- Peat decomposition stage (fibric versus humic) will also affect surface settling.
- Small variations in final surface elevation (up to 30cm) are acceptable, as long as the site average moisture is saturated, but without flooding for the entire growing season.



CENTRE FOR BOREAL RESEARCH

TECHNICAL NOTE #37

PEATLAND RESTORATION - SYNTHESIS OF TECHNIQUE - DECEMBER 2020



Clay burial: backfilled clay fill being buried under excavated peat to create final peat surface.



Clay burial: clay fill, completely buried under 40cm of peat substrate.



Clay burial: final peat surface at a similar elevation to the low points in the natural areas, awaiting revegetation.



Wood chip burial: wood chip layer removed to side, with underlying peat being excavated to create a hole to bury the wood chips in.



Wood chip burial: wood chip layer piled on right, with underlying peat substrate piled on left. Once the wood chips are placed in the hole, the excavated peat will be placed on top.



Wood chip burial: final peat surface after wood chip burial, awaiting elevation adjustment by trackpacking. Final surface elevation must be similar to that of the adjacent natural area to ensure proper moisture.

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