Restoring Trenches in Permafrost

The oilfields in far north Arctic Alaska present unique environmental and logistical challenges for responsible development and for rehabilitating the land. A portion of my work as a consulting soil scientist and restoration ecologist involves rehabilitation of trenching sites in permafrost. Trenches are created for a number of reasons, including burying gas pipelines and communications cables, but most often, the trenches are created to bury overhead powerlines across roads to allow for access by drilling rigs.

In the permafrost region, heavy equipment can only cross the tundra when the ground is frozen in order to avoid damaging the ground. A trencher, which is like a giant chain saw, opens a trench approximately 18 inches wide. During excavation, the soil is ejected to the sides of the trench. When the trench is complete, the side-cast soil is pushed back, as much as possible without damaging the underlying vegetation. Keep in mind that in the Arctic winter, the sun does not rise, temperatures are often well below 0°F, and a near-constant wind blows snow across the mostly flat landscape. Snow blown into the open trench is covered with frozen chunks of soil during backfilling. The snow and soil leave air pockets in the trench. When summer arrives, water moving through the active layer (the portion of surface soil that thaws each summer) fills the trench. The entrained snow melts and the backfilled soil thaws in contact with water, causing the centerline of the trench to slump.

In the past, the trenches have been backfilled with additional soil, but this tends to propagate thaw into the surrounding permafrost, making the problem worse. In recent years, we have been experimenting with placing pre-vegetated sedge mats in the trench line. We theorize that vegetation mats provide a physical barrier to surface water when the trench intersects a pond, lowers the albedo of the ground surface, and provides cooling through evapotranspiration.
Currently, there are some large-scale trenching projects proposed in Alaska’s Arctic, including a gas pipeline from Prudhoe Bay to southern Alaska. In order to make sure the latest ecological techniques are employed in trench installation, state agencies need to require a soil scientist or restoration ecologist be included in the planning process. Currently, some agencies haven’t employed experienced environmental professionals and, unfortunately, permitted a communications cable installation that may not be able to be restored.

Consulting soil scientists provide an important service for industry and government. We are able apply the findings of researchers for the benefit of the planet.