MERG Report 2004-3

Reconnaissance Survey of Erosion Site

At Gold Run Creek

By Laberge Environmental Services

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EXECUTIVE SUMMARY

Disturbance of frozen ground, through placer mining activities, may lead to slope failure. A stockpile of frozen overburden has recently begun eroding from the formation of a runoff channel. A large cut, approximately 300 metres long and up to 50 metres deep has been created adjacent to Gold Run Creek, a heavily mined area southeast of Dawson City.

This stockpiled overburden has been in place for several years and has revegetated with several species of mature willows (age dated to 15 years). Either due to heavy rainfall or climate change, melting has commenced in the stockpile resulting in the formation of a runoff channel. This has increased in size and slope failure continues to enlarge the cut.

Laberge Environmental Services conducted a reconnaissance survey of the site in July 2003, to assess the site with the purpose of exploring ways of halting the slope failure and stabilizing the disturbed section of overburden. Several bioengineering techniques have been suggested to assist in controlling the erosion.

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1.0 INTRODUCTION

Placer mining has been an important industry in the Yukon for over one hundred years with this activity typically taking place in the Klondike Region near Dawson City. To access gold-bearing gravels, the removal of extensive quantities of overburden is usually required. The majority of placer mining has taken place in the zone of discontinuous permafrost where vegetated valley flats and north-facing slopes are generally underlain with permafrost. When the overburden is removed, which has acted as an insulating cover, the thermal equilibrium of permafrost is disrupted and thawing occurs. The stability of soils and vegetation is affected and slope failure may occur. As melting progresses, the potential for mass movement of soil increases.

Laberge Environmental Services investigated such a site adjacent to Gold Run Creek near Dawson City, Yukon, on July 14th, 2003. Slope failure has occurred on the southwest-facing incline of an overburden stockpile, and a runoff channel has subsequently eroded through the overburden, increasing the sediment loading of the creek during snowmelt and rainfall events.

The 2003 survey was carried out with the purpose of exploring ways of halting the slope failure and stabilizing the disturbed section of overburden. It was anticipated that the use of bioengineering techniques could provide at least part of the solution to this problem.

1.1 History of the Site

A large volume of frozen overburden had been stockpiled to the left of the Gold Run Road and has since revegetated. The current owners and operators of these claims have not added to or altered the stockpile. It is not clear exactly when the slope failure first occurred, however melting permafrost has created a runoff channel which is eroding through the overburden and increasing the sediment loading in Gold Run Creek. Initially, the current owners installed a gravel plug at the base of the erosion channel to inhibit the flow and slope failure. This was unsuccessful and they have built settling ponds to decrease the amount of sediment reaching the creek.

Attempts to contact previous owners to ascertain the time frame and the volumes of overburden stacked here have been unsuccessful. An examination of air photos shows that stockpiling of the overburden had been underway, but not completed, in 1989.

2.0 STUDY AREA

The study site is located approximately 52 kilometres southeast of Dawson City. The site is on the left bank of Gold Run Creek, about seven kilometres upstream from its confluence with Dominion Creek. It is located at UTM and can be sited on the NTS Map 115-O/10.

3.0 RESULTS OF RECONNAISSANCE SURVEY

It is unclear just when the slope failure first occurred. By July 2003, soil had slumped back to a point about 300 metres from the creek bank (see Figure 1). The width of the slumped-in area ranged from about 4 metres at its apex to about 60 metres at its centre. The maximum depth was estimated to be about 50 metres. The walls of the gully were nearly vertical in places.

Vertical cracks in the soil about one metre deep had formed up to 20 metres back from the sidewalls at various locations, indicating the instability of the thawed overburden. The depth to frost in mid-July ranged from 20 cm near the apex of the slope failure to about one metre at the top of the overburden stockpile. Water was discharging from the base of the erosion cut at a rate of about 0.1 litres / second. Photographs of the site are presented in Appendix A.

The overburden stockpile has overgrown with a dense stand of willows (mostly *Salix arbusculoides* and *S. planifolia*). These willows were aged to be about 15 years.

A strip of land, 15 to 20 metres wide, running parallel to the creek and behind the overburden pile, had also been cleared at some point. A pure stand of water horsetail (*Equisetum fluviatile*) covers a small wet, level area at the apex of the slope failure. The cleared zone has revegetated with willows (*Salix planifolia*), dwarf birch (*Betula glandulosa*) and other shrub species along with forbs, sedges and grasses. A list of plant species observed in this area is shown in Appendix B. The area behind this cleared strip is undisturbed black spruce forest.

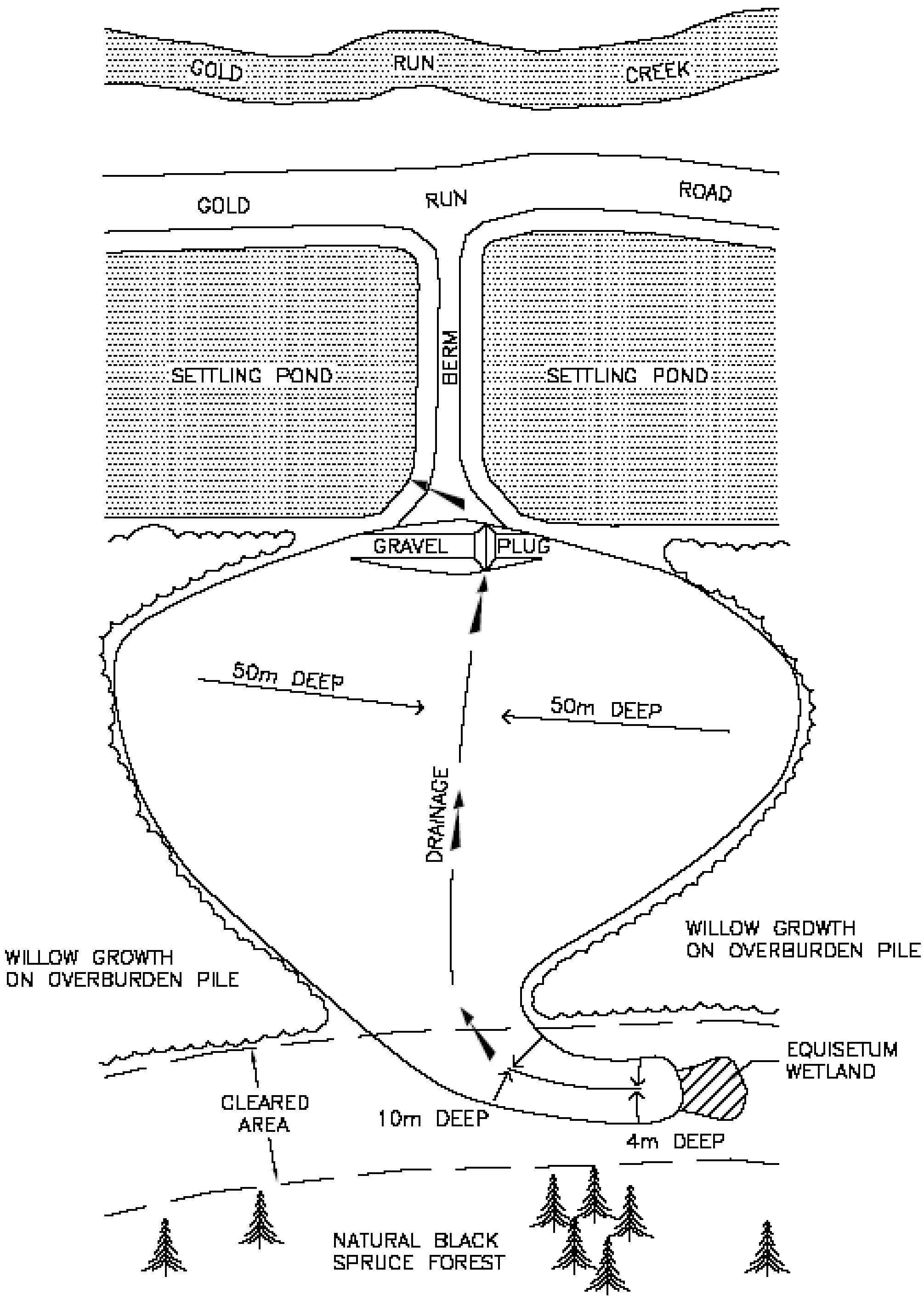

Figure 1 – Slope Failure Near Gold Run Creek
(Not To Scale)

4.0 POSSIBLE BIOENGINEERING SOLUTIONS

The side-slopes of this cut are very steep and should be recontoured prior to the installation of any bank stabilization systems. This could either be done by hand labour or with the use of heavy equipment. Late summer/early fall, when the ground has thawed to its maximum depth, would be the best time of year for doing this work.

A combination of standard bioengineering techniques could be used for restoring slope stability at this site. These could include well-tried methods such as contour wattling, brush layering and live staking. A good supply of plant material is available. The overburden stockpile, with its dense growth of willows, would be a handy donor site. The existing slumping soils should be a good growth medium. A light seeding of locally occurring grasses and forbs would also be beneficial.

Contour wattling are retaining walls built out of living cuttings that are continuous and follow the contour of the slope. They reduce the effective slope angle and allow vegetation to become established.

Brush layering is the use of rows of live cuttings buried into the cut slope. Brush layers are constructed by digging a trench across the slope (an excavator can be of great assistance in this regard) and laying in the cuttings. The brush layers can be modified to increase the stablility by supporting the brush layer on a small log or board. The small terrace that is created can serve to catch rolling material. The brush layers are built from bottom of the slope and up, as the next trench excavation can be used to backfill the previous one.

Live staking is simply the use of living cuttings, in this case willows, to stabilize slumping materials. They can provide effective erosion control at times when normal seeding would be ineffective. The cuttings can be placed into the slope diagonally.

Early/mid September would be the optimum time for carrying out this bioengineering work. The amount of time that would be required depends on the available work force.

5.0 ACKNOWLEDGMENTS

Laberge Environmental Services would like to thank the Mining Environmental Research Group for providing the funding for this project. We also appreciate the assistance of Lorraine Millar, Client Services Officer, Energy Mines and Resources, YTG, who guided us to the site and introduced us to the current owners. We also thank Dan and Peggy Cuevas for allowing us access to the site, which is located on their property.

APPENDIX A

PHOTOGRAPHS

Aerial view of slope failure at Gold Run Creek photographed by Dawson Client Services, September 13, 2002.

View of the slope failure from Gold Run Road. Note the gravel plug. July 14, 2003.

The small stand of water horsetail (*Equisetum fluviatile*) located at the apex of the slope failure, July 14, 2003.

The cleared area looking north from the wetland. The re-vegetated overburden pile is on the left, the undisturbed black spruce forest is on the right. July 14, 2003.

The actively eroding north-west facing wall of the slope failure, July 14, 2003.

Drainage (melting permafrost) flows to Gold Run Creek via settling ponds from the base of the cut, July 14, 2003.

APPENDIX B

PLANT SPECIES OBSERVED AT GOLD RUN CREEK EROSION SITE

Appendix B: Plant Species Observed at Gold Run Creek Erosion Site

Trees and Shrubs

Arctostaphylos rubra	bearberry
Betula glandulosa	dwarf birch
Betula papyrifera	paper birch
Ledum groenlandicum	Labrador tea
Picea mariana	black spruce
Populus tremuloides	trembling aspen
Potentilla fruticosa	shrubby cinquefoil
Salix arbusculoides	little-tree willow
Salix planifolia	diamond-leaf willow
Vaccinium uliginosum	bog blueberry
Vaccinium vitus-idaea	lingonberry

Graminoids

Beckmannia syzigachne	slough grass
Calamagrostis canadensis	blue-joint
Carex spp.	sedge
Festuca altaica	rough fescue
Luzula parviflora	wood rush

Mosses

Sphagnum sp.	sphagnum

Forbs

Aconitum delphinifolium	monkshood
Chrysoplenium tetrandrum	golden saxifrage
Epilobium angustifolium	fireweed
Epilobium palustre	willow-herb
Equisetum arvense	common horsetail
Equisetum fluviatile	water horsetail
Erigeron acris	fleabane
Geum macrophyllum	avens
Mertensia paniculata	lungwort
Pedicularis verticillata	lousewort
Petasites frigidus	coltsfoot
Polemonium acutiflorum	tall Jacobs ladder
Rubus chamaemorus	cloudberry
Saussurea angustifolia	saussurea
Senecio lugens	black-tipped groundsel
Stellaria sp.	chickweed
Valeriana capitata	valerian