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## **MILE 122.7 DERAILMENT – COAL RECOVERY PLAN FOR SILVER CREEK, BURNABY LAKE AND BRUNETTE RIVER**

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## 1.0 Introduction

Triton Environmental Consultants Ltd. (Triton) was retained by the Canadian National Railway Company (CN) to provide technical environmental services following a train derailment at Mile 122.7 of the Yale Subdivision in Burnaby, BC. The derailment occurred on January 11th 2014, and caused the partial release of metallurgical coal from three rail cars into and adjacent to Silver Creek. From the derailment site, Silver Creek flows approximately 350 m before entering Burnaby Lake, 200 m upstream of Cariboo Dam (Figure 1-1 and 1-2). From Cariboo Dam Brunette River flows approximately 6 km before entering the Fraser River.

Following the derailment Triton conducted deposition assessments in Silver Creek, Burnaby Lake and Brunette River to assess the feasibility of recovering coal. The coal recovery plan was developed in cooperation with Quantum Murray Remediation Services (Quantum) Canadian National Railway Company (CN), and other environmental consultants retained by CN to provide specialized support for aquatic life salvage.

The total estimated coal deposition in the three waterbodies (Silver Creek, Burnaby Lake and Brunette River) is approximately 82.8 m<sup>3</sup>. Based on in water assessment, habitat characteristics, aquatic use and available recovery techniques, it was determined that of the coal deposited, an estimated 81.4 m<sup>3</sup> is technically feasible to recover without causing substantial habitat impacts.

The Silver Creek deposition assessment identified an estimated 5.5 m<sup>3</sup> of coal, based on measurements at approximately 40 locations in the channel. These coal deposits were classified as:

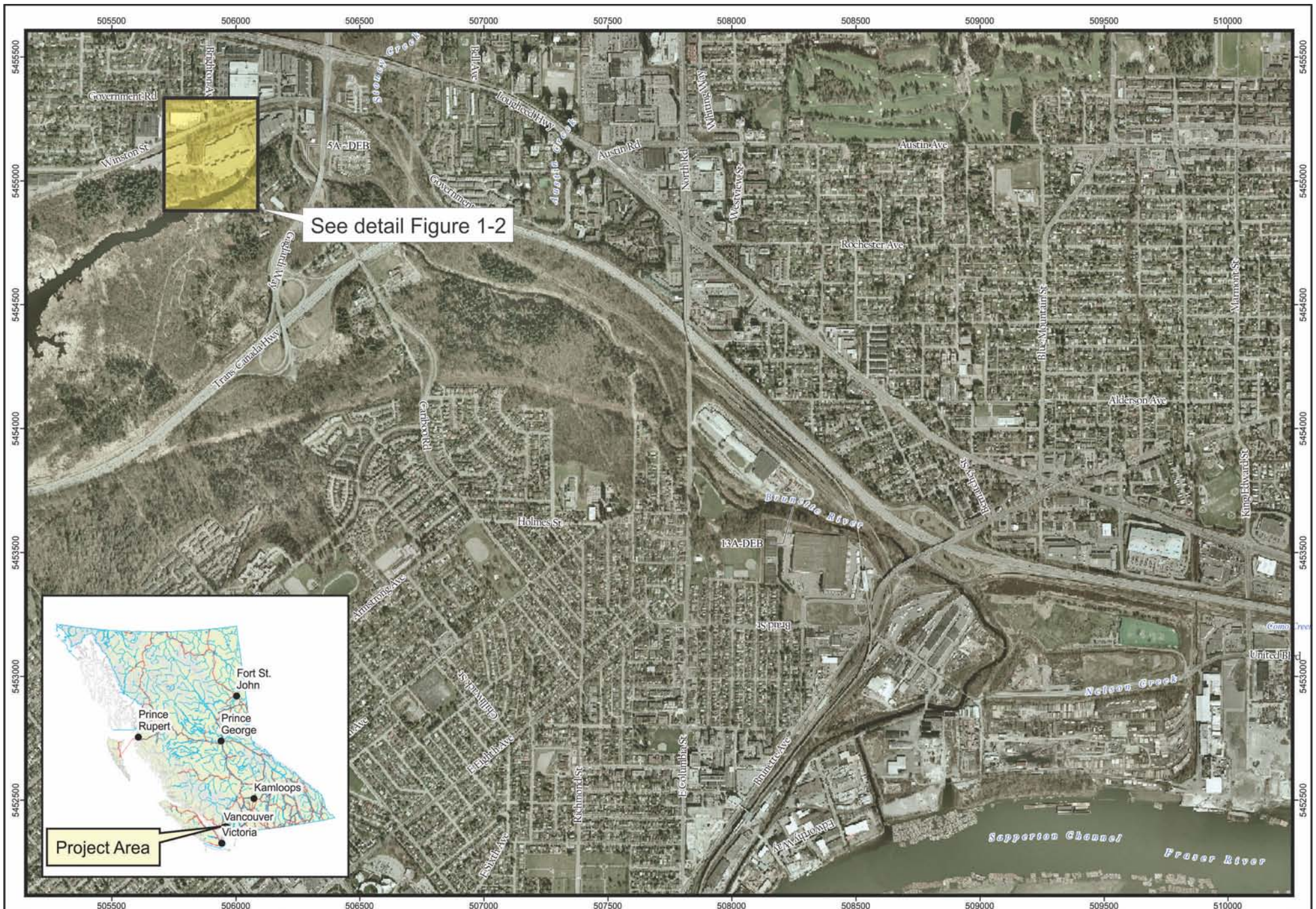
- Dusting deposit of fine particles
- Pocket deposit of small particles (< 10 mm)
- Pocket deposit of large particles (>10 mm)
- Scattering of gravel-size particles

The recommendations for recovery in these areas vary from leaving the material in place (e.g., for light deposits where removal may cause incidental harm), removal by hand (e.g. by crews working with shovels), and removal with equipment (e.g., vac truck or excavator) for larger deposits at easily accessible locations (Triton, 2014a).

The Burnaby Lake deposition assessment identified an estimated 76 m<sup>3</sup> of coal deposited on the alluvial fan of Silver Creek at the confluence with Burnaby Lake. The deposition was characterized by three (3) general categories;

- coarse gravel (5 – 50 mm) with some fines
- fines mixed with small gravel (10 – 20 mm)
- fines (<2 mm)



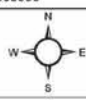


See detail Figure 1-2



CN Environment

Figure 1-1.  
Location of Silver Creek at  
Burnaby Lake confluence

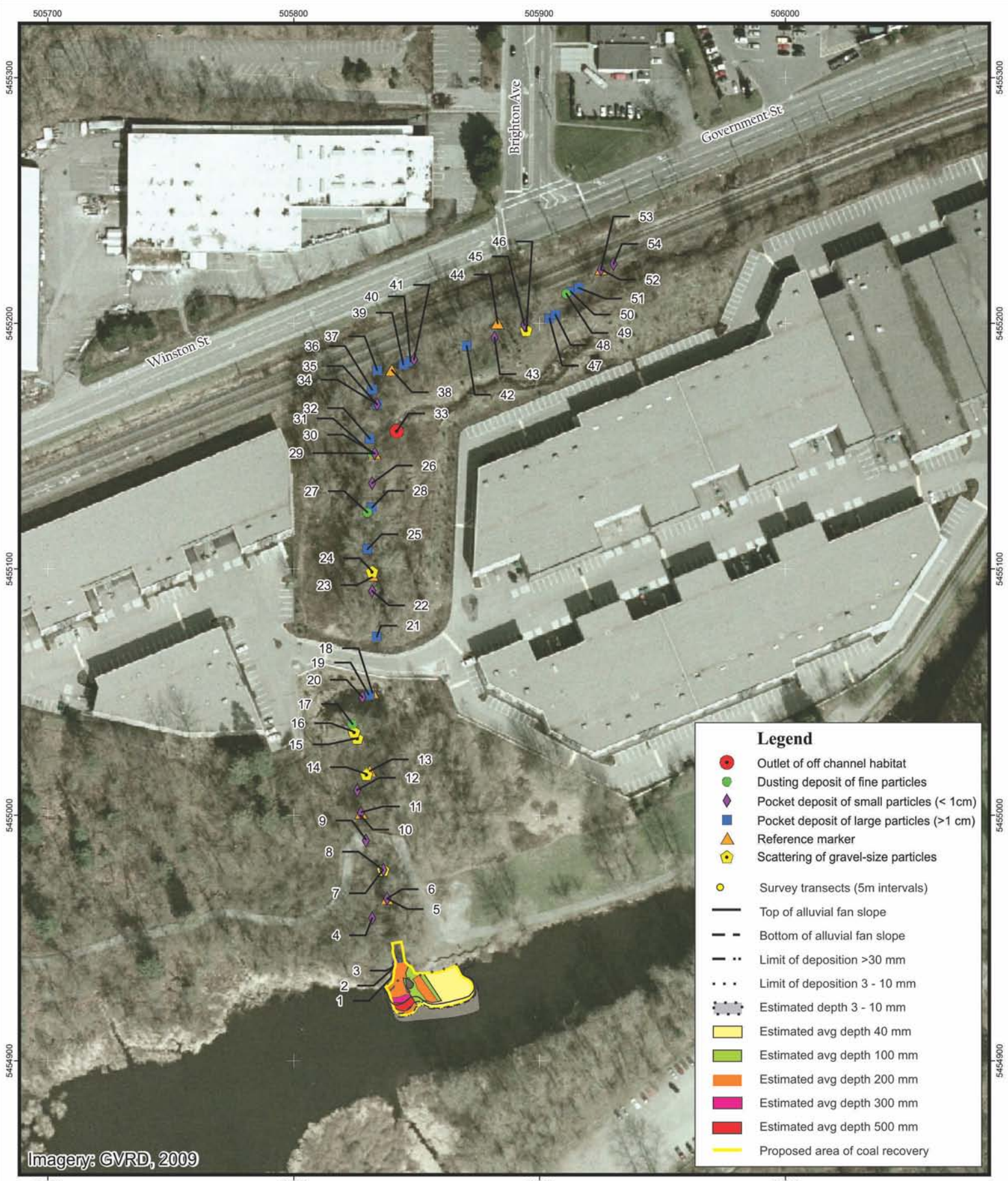


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Imagery: GVRD, 2009

<p><b>CN Environment</b></p>		<p><b>Figure 1-2. Overview of Coal Deposition Areas in Silver Creek and Burnaby Lake</b></p>								
<p>File No: N:\ACTIVE\4435_CN_Environmental_Services\2011\29_Mile122_7Yale SubCaribou Rd\MXD\SilverFieldMap.mxd  M:\Data\Proj#s\4435\080Graphics\Fig1_recovery_areas-PF</p>		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Project No:</td> <td>4435</td> </tr> <tr> <td>Date:</td> <td>February 9, 2014</td> </tr> <tr> <td>Basemap Source:</td> <td>bc_gvrd_east_xc200mm_utm10_2009</td> </tr> <tr> <td>Map Datum:</td> <td>NAD 1983 UTM Zone 10N</td> </tr> </table>	Project No:	4435	Date:	February 9, 2014	Basemap Source:	bc_gvrd_east_xc200mm_utm10_2009	Map Datum:	NAD 1983 UTM Zone 10N
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Coarse gravel size particles were generally confined to the western (upstream) end of the fan where one channel of Silver Creek enters Burnaby Lake on the west side of a vegetated bar. Mixed fines and small gravel were generally confined to the secondary channel on the east side of the vegetated bar, as well as within Silver Creek just upstream of the alluvial fan. The depth of coal deposition varied across the alluvial fan, with the thickest deposits observed at the outer edge of the fan along the flow path of main channel around the vegetated bar. In addition a thin layer of fine deposition (3 – 10 mm deep) was observed off shore from the alluvial fan. A dusting of deposition also extended downstream of the alluvial on the north side Burnaby Lake outlet channel towards Cariboo Dam but was only 1 mm deep (Triton, 2014b; Figure 1-3).

Recommendations for these deposition areas include leaving the material in place (e.g., for thin off shore layers of deposition), removal by hand near sensitive habitats (e.g., turtle basking platforms) and removal with equipment (e.g., vac truck).

The Brunette River deposition assessment identified an estimated 0.12 m<sup>3</sup> of coal deposited at 23 sites along the surveyed length of the channel from Cariboo Dam to the confluence with Fraser River (Triton 2014c). The deposition was characterized by three (3) general categories;

- Deposition on elevated benches
- Deposition bands on sandy slopes
- Deposition on sandy benches

Considering the estimated volume of material (0.12 m<sup>3</sup>) relative to the wide area of dispersal (i.e. 698 m<sup>2</sup>) coal recovery was not recommended given the disturbance associated with accessing the sites and trying to remove thin layers of coal from wide areas.

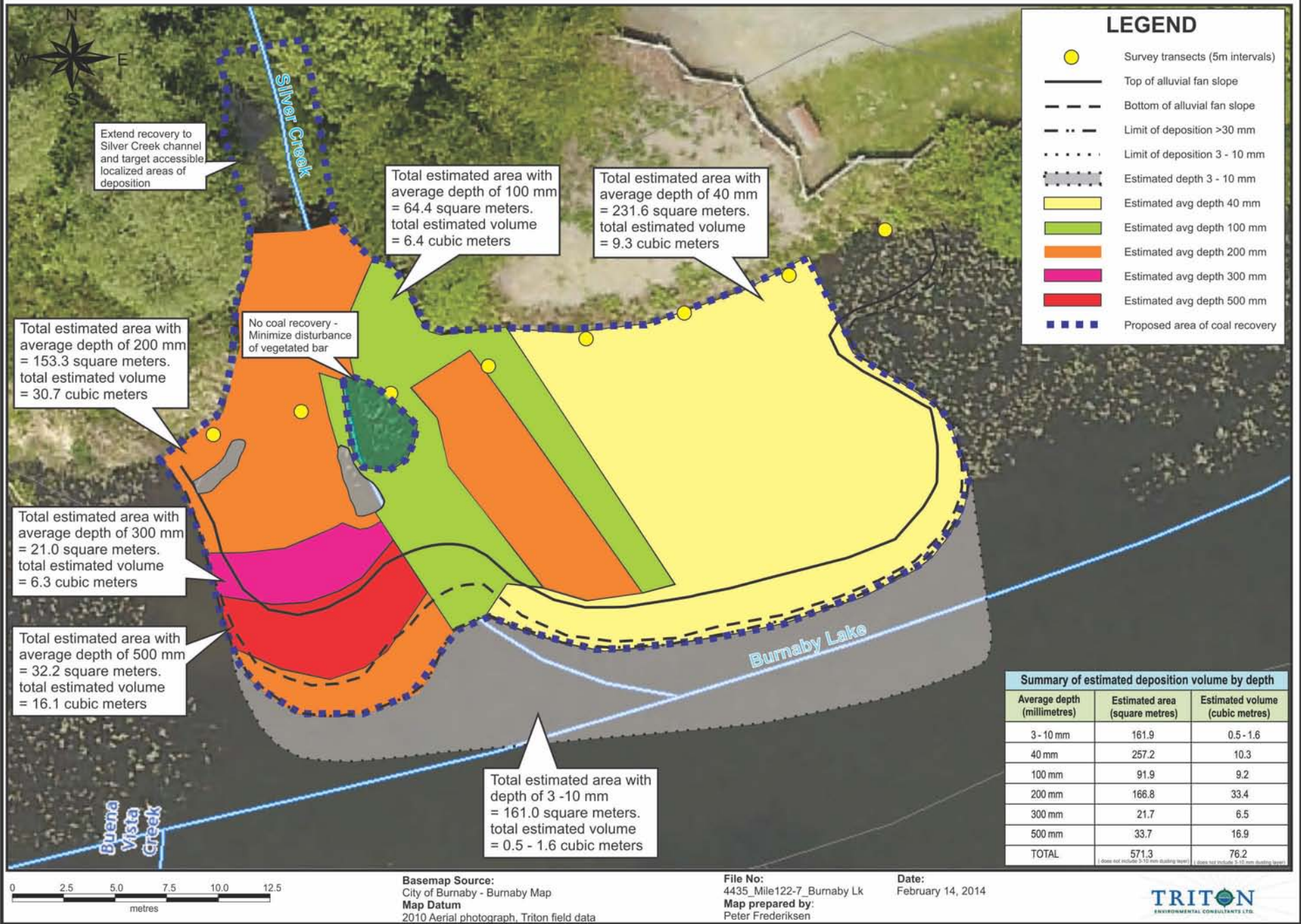
## **1.1 Background**

Coal recovery will be conducted by Quantum Murray LP (Quantum) on the basis of work plans developed in consultation with the Canadian National Railway Company (CN), Triton Environmental Consultants (Triton) and the permitting agencies. Summit Environmental (Summit), EBB Environmental (EBB) and Triton will conduct turtle, amphibian and fish salvages ahead of and during the coal recovery program. Triton will also provide environmental monitoring and site restoration services for the project. The following project-specific information sources were reviewed to develop this EMP:

- Quantum Murray (2014) Coal Recovery Work Plan
- Ministry of Forests, Land and Natural Resource Operations (MFLNRO) (Kym Welstead) (Feb 2014) Response to Burnaby Lake / Silver Creek Coal Deposition Recovery Plan
- Ministry of Environment-South Coast Region (Feb 2014) re: Burnaby Lake Coal Derailment Recovery Plan Review
- CN Environment (Feb 2014) Response to Painted turtle comments raised by Ministry of the Forests, Lands and Natural Resource (Kym Welstead)



Figure 1-3. Proposed area of coal recovery in Burnaby Lake



- Fisheries and Oceans Canada (14-HPAC-00141) (Feb 2014) Subject: Serious harm to fish can be avoided or mitigated (in response to CN's Request for Review of the coal recovery program at and around the confluence of Burnaby Lake and Silver Creek)
- Wildlife Act permit SU14-93104 issued for Painted Turtle (*Chrysemys picta*), Midland Painted Turtle (*Chrysemys picta marginata*) and Red Eared Slider (*Trachemys scripta*) salvage
  - NOTE: Gloria White, Environment Canada (Feb 2014) indicated Section 73 - Species at Risk Act (SARA) permitting would not be required
- Wildlife Act permit SU14-93142 issued for Northern Red legged frog (*Rana aurora*), Western Toad (*Anaxyrus boreas*), Northwestern salamander (*Ambystoma gracile*), and Long Toed Salamander (*Ambystoma macrodactylum*)
- Wildlife Act Permit SU13-85705 issued to Triton Environmental Consultants Ltd. for fish salvage in South Coast Region – all waters
- License Number XR 8 2014 – Scientific License issued to Triton Environmental under section 4 of the Fisheries Act for Brunette River and tributaries including Silver Creek
- City of Burnaby Comments on the 25 January, 2014 Memorandum RE: Mile 122.7 Derailment – Burnaby Lake Coal Deposition Recovery Plan, by Triton Environmental Consultants Ltd.

## 1.2 Schedule

The timeframe for coal recovery was selected on the basis of the following considerations:

- Salmon fry emergence is anticipated on or around March 1 and CN would like to complete the recovery program as near to that date as possible to avoid impacts on salmon
- The nesting bird window is approaching and the coal recovery operation will result in construction noise and an increased number of people in Burnaby Lake Park (the Park), which could negatively impact nesting birds and park users if coal recovery continues into late March
- The seasonal life cycle of the Western Painted turtle described in BC's Coast Region: Species & Ecosystems of Conservation Concern Western Painted Turtle – Pacific Coast Population (*Chrysemys picta* pop.1) Global: G5TNR Provincial S2: COSEWIC: SC E, BC List: Red (Adamah Consultants & Brent Matsuda, 2012) indicates breeding activity between March and July, with nest construction in June and July, followed by a 60 to 80 day incubation period.
- MFLNRO indicated coal recovery and site restoration must be completed before May (identified as the start of the turtle nesting season)

Based on these considerations CN is proposing to complete the coal recovery program in February to avoid potential conflicts with turtle breeding activities, salmon fry emergence the nesting bird window and other park users. Equipment mobilization and staging is expected to take 5 to 7 days, followed by approximately 5 days of coal recovery and 5 to 7 days for demobilization and site restoration. The goal is to be complete instream works by mid March.



## 2.0 Setting

### 2.1 Fish and fish habitat

#### 2.1.1 Silver Creek

Silver Creek is a non-gazetted stream entering the railway right of way (RoW) via three (3) municipal storm water pipes. The watercourse does not appear on National Topographic Survey (NTS) maps, the provincial Terrain Resource Information Management, or the watershed code availability maps. A stream survey from the confluence with Burnaby Lake to Government Street conducted on January 16, 2014 indicated an average channel width of 4.06 m and an average wetted width of 3.22 m. Mean wetted depth at low water ranged from 0.05 to 0.26 m. The majority of the channel was categorized as riffle or glide and there were few pools with residual depths greater than 300 mm. Substrate was dominated by small cobble (SC) and large gravel (LG), with areas of extensive sand deposition along with exposed clay seams. The abundance and quality of spawning habitat over the entire length of channel surveyed was categorized as moderate. Available cover abundance was categorized as low (L) to moderate (M), and was provided mainly by undercut bank (U) and accumulations of large and small woody debris (LWD and SWD), with some overstream vegetation (OV).

There are no records of fish distribution for Silver Creek in the provincial Fisheries Information Summary System (FISS) database. However Coho (*Oncorhynchus kisutch*), Cutthroat Trout (*O. clarkii*) and Lamprey (*Lampetra sp.*) were salvaged in Silver Creek ahead of the January and February Type II Emergency works in the ROW. Triton also reported three spine stickleback (*Gasterosteus aculeatus*) in Silver Creek in 2007 (iMAP, 2014), and we understand Chum Salmon (*O. keta*) were observed spawning in Silver Creek in the Fall of 2013. In addition, anecdotal information from the Stoney Creek Environmental Working Group (Feb 12, 2014 meeting minutes) indicates there were reports Pink Salmon (*O. gorbuscha*) making their way past the Cariboo Dam in 2013, although it is unconfirmed if any of these fish spawned in Silver Creek. Fish species documented in Burnaby Lake, the Brunette River, Still Creek, Eagle Creek, Massey Creek and Beecher Creek upstream of the Cariboo Dam are summarized in Table 2-1(iMAPBC, accessed Feb 2014).

**Table 2-1. Fish species in Brunette River, Burnaby Lake, Still Creek upstream of Cariboo Dam**

Fish species	Scientific name
Brassy Minnow	<i>Hybognathus hankinsoni</i>
Brown Catfish	<i>Ameiurus nebulosus</i>
Carp	<i>Cyprinus carpio</i>
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>
Coastal Cutthroat Trout	<i>O. clarkii</i>
Coho Salmon	<i>O. kisutch</i>
Lamprey	<i>Lampetra sp.</i>
Northern Pikeminnow	<i>Ptychocheilus oregonensis</i>
Peamouth Chub	<i>Mylocheilus caurinus</i>
Perch	<i>Perca sp.</i>
Prickly Sculpin	<i>Cottus asper</i>
Nooksack dace (1)	<i>Rhinichthys cataractae</i>
Rainbow Trout	<i>O. mykiss</i>
Redside Shiner	<i>Richardsonius balteatus</i>
Sucker	<i>Catostomus sp.</i>
Threespine Stickleback	<i>Gasterosteus aculeatus</i>
Yellow perch	<i>Perca flavescens</i>

(1) Note: record shown for Massey Creek / Robert Burnaby Creek( u/s of Cariboo Dam) in the iMAP dabatase but not shown in the FISS database (searched Feb 2014)

### 2.1.2 Burnaby Lake

Burnaby Lake (WSC 100-020100) has a perimeter of approximately 5.3 km and covers an area of approximately 33.3 hectares with a maximum depth of 3 m (FISS, 2014). The shallow nature of the lake provides a good environment for aquatic vegetation which is abundant around the perimeter of the lake. In the vicinity of the Silver Creek confluence the typical wetted width of the outlet channel is 40 – 50 m. However a review of historical air photos available online (i.e. City of Burnaby (BurnabyMap) and Google Earth) indicates the visible or apparent wetted width of open water in summer is reduced to approximately 10 - 15 m due to the influence of aquatic vegetation along the shoreline. A survey of the area around the confluence conducted during diver and snorkel surveys indicated maximum mid channel depths near the work area to be approximately 1.5 to 1.8 m. The survey also indicated mid channel substrate near the upstream (west) end of the alluvial fan is comprised primarily of coarse gravel, whereas fine organic sediments dominates the surface layer of substrate mid channel near the downstream (eastern) end of the alluvial fan. Water levels in the lake are partially controlled by Cariboo Dam which provides a supplemental hydrologic control for the lake and is operated by Metro Vancouver for

flood control (e.g., to assist in control of storm water run-off), and environmental enhancement purposes (e.g. controlled releases downstream for fish and increased water levels for nesting birds in summer).

Fish species which present in Burnaby Lake are summarized above in Section 2.1.1.

## 2.2 Listed plant and wildlife species

Provincially and / or federally listed species in Burnaby Lake Park (the Park) are shown in Table 2-2 (City of Burnaby, May 2002; Conservation Data Centre, accessed Feb 2014).

**Table 2-2. Listed wildlife species documented in Burnaby Lake park (City of Burnaby, 2002, CDC, 2014)**

Species	Scientific name	Status
red legged Frog	<i>Rana aurora</i>	Blue
Western Painted Turtle	<i>Chrysemys picta bellii</i>	Red
Western Pond Turtle	<i>Actinemys marmorata</i>	Red
Western Grebe	<i>Aechmophorus occidentalis</i>	Red
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	Blue
Great Blue Heron	<i>Ardea herodias</i>	Blue ( <i>fannini</i> )
American Bittern	<i>Botaurus lentiginosus</i>	Blue
Green Heron	<i>Butorides virescens</i>	Blue
Short-billed Dowitcher	<i>Limnodromus griseus</i>	Blue
Peregrine Falcon	<i>Falco peregrinus</i>	Blue ( <i>pealei</i> )
Band-tailed Pigeon	<i>Patagioenas fasciata</i>	Blue
Purple Martin	<i>Progne subis</i>	Blue
Snowshoe Hare	<i>Lepus americanus</i>	Red ( <i>washingtonii</i> )
Long-tailed Weasel	<i>Mustela frenata</i>	Red ( <i>altifrontalis</i> )
Blue dasher	<i>Pachydiplax longipennis</i>	Blue
False Pimpernel	<i>Lindernia dubia</i> var. <i>anagallidea</i>	Blue



Other reptiles and amphibians with some potential to occur in the project area include:

- Red eared slider (*Trachemys scripta elegans*),
- Midland painted turtle (*Chrysemys picta marginata*),
- Bull frog (*Lithobates catesbeianus*),
- Green frog (*Lithobates clamitans*)
- Northwestern salamander (*Ambystoma gracile*).

### **2.3 Western painted turtle overwintering and nesting habitat**

Western painted turtle overwintering habitat is located near the coal recovery area at the Silver Creek and Burnaby Lake confluence. A nesting beach is located upslope of the coal recovery area and will be used on a limited basis for accessing the coal deposit

### **3.0 Silver Creek Coal Recovery**

The Silver Creek coal deposition assessment identified approximately 5.5 m<sup>3</sup> of recoverable coal spread along the surveyed length of the channel.

Some work to recover coal from the Silver Creek channel adjacent to the track near the derailment site has already been completed as part of channel stabilization works being conducted by CN. These works include culvert cleaning, bank protection improvements, and removal of hazard trees. These works were supervised by CN and were designed and constructed with input from Northwest Hydraulic Consults Ltd (NHC), Triton and Sonny's Excavating. Triton provided environmental monitoring services and conducted fish salvages in working areas as required.

Work to recover deposits of coal from downstream of the Burnaby Lake Regional Park footbridge using mechanical assistance is proposed as part of the Burnaby Lake coal recovery plan and is discussed separately in Section 3.0.

Additional works to recover coal from the Silver Creek channel upstream of the footbridge will primarily involve removal of coal by hand. Removal by hand could include but may not be limited to removing coal with shovels, vacuums, or by hand picking. Access to coal removal areas would primarily be through adjacent riparian habitats although some access will be required by walking in the channel. One deposit of fine coal in the off channel area near the Cariboo Business Park driveway (data point #9; 21m x 2m) will be removed by vac truck.

#### **3.1 Project Planning and Permitting**

Works conducted to date for track remediation and maintenance near the derailment site have been reviewed by Fisheries and Oceans Canada, and fish salvage has been completed under existing fish salvage permits held by Triton. DFO project review forms will also be submitted for additional works proposed in the Silver Creek channel to recover coal. The majority of this work will be conducted above the water in the dry and therefore isolation, dewatering and fish salvage will not be required. Where isolation is required (e.g. the off-channel habitat area) Triton has the necessary fish salvage permits to assist contractors conducting the removal. Additional information about project permitting and regulatory framework is also included in Section 1.1 and Appendix 1.

#### **3.2 Silver Creek - Mitigation Measures**

While best efforts should be made to remove the largest practical amount of deposited material, the removal needs to be balanced with mitigation measures or avoidance to minimize impacts to existing habitat. Foot access for recovery work and hand removal of deposits could mobilize fines and causes temporary increases in turbidity or impact riparian vegetation. In addition foot access through the channel or work area isolation and dewatering could impact buried eggs or alevins in the stream substrate.

As noted in the deposition assessment, the majority of the coal deposits in the channel are located above the wetted edge in small concentrated pockets and coal recovery in these areas can be conducted using hand tools. Isolation and dewatering in support of coal recovery is neither practical nor feasible for several reasons (e.g. similar impacts could be associated with these activities and the buried eggs or alevins in the stream could be impacted if work areas are dewatered). However a substantial amount of coal can be recovered now with minimal impact to local water quality and riparian habitat, as well as minimal risk to buried eggs or alevins if suitable mitigation measures are implemented. Proposed mitigation measures include but are not necessarily limited to:

- Coal recovery will take place under low flow conditions and will focus on localized deposits above the water level
- Access through the channel will be minimized to avoid potential disturbance of buried eggs or alevins
- Disturbance of riparian vegetation will be minimized by using a small number of designated access trails
- Vegetation disturbance will be limited to pushing vegetation aside wherever possible, or minimal cutting of vegetation if necessary (e.g. grubbing will not be permitted, except for non-native species)
- The use of vacuums (e.g. industrial shop vac) with extended suction hoses to specifically target coal deposits will be investigated and tested in the field
- Where coal recovery is taking place with shovels or close to the wetted edge, measures to isolate the immediate work area and control the risk from accidental spills will be considered and implemented where required (e.g. temporary placement of geotextiles, plywood, silt fence or poly sheeting to contain spilled coal during shovel recovery)
- Selective removal of large scattered particles will also be conducted using pole mounted strainers or dipnets at select locations where instream conditions are not conducive to spawning and/or where access is available from the bank
- In addition to removing coal, the crew will remove other non-spill related waste products identified during the deposition assessment (e.g., data point#13- remnant snow fence, data point #21, large piece of white plastic) or other non-natural products incidentally observed
- To ensure workers conducting coal removal are aware of the potential impacts from recovery work they will be oriented by a qualified environmental professional (QEP) experienced with conducting instream works in sensitive areas
  - The QEP will advise workers on the size and type of deposits to be removed, methods to minimize disturbance of spawning gravel and riparian vegetation during access, as well as methods to reduce mobilization of fines, (e.g., temporary isolation and avoidance)
  - The QEP will conduct periodic inspections to assess progress of the work, and evaluate the success of the recovery and the methods being used to recover coal



- If necessary the QEP will provide advice if other methods should be considered or if coal recovery should be terminated (i.e. if coal removal is resulting in unacceptable incidental impacts)
- Upon completion of the coal recovery the channel will be re-surveyed to compare remaining deposits to those described during the initial deposition assessment
- If necessary post recovery survey will include recommendations for additional coal recovery during the reduced risk timing window or re-planting of disturbed areas to mitigate disturbance of riparian vegetation

As previously noted, removal of coal from the off channel habitat area near the Cariboo Business Park driveway (data point #9; 21m x 2m) will be conducted by mechanically assisted removal with a vac truck. In addition, the work areas will be isolated and dewatered if necessary to facilitate removal with the vac truck. Furthermore, even though assessment of this area indicates coal deposition was limited to approximately 50 mm with a maximum depth of 200 mm it is recommended the sediment be removed to a depth of at least 0.5 metres to improve the overall function of the off channel area as fish habitat.

In addition, to any applicable BMPs described above for coal recovery work, vac truck removal of coal in the off channel area will be monitored full time by QEP to provide advice on suitable best management practices (BMPs), which may include but might not be limited to methods for isolating the work area, conducting a fish salvage prior to the work, and/or providing advice on methods to dewater the site prior to coal removal. In addition to mitigation measures described above applicable components of the environmental management plan ((EMP; Appendix 1) will also be implemented and/or adhered to.

In summary, recovery of coal from areas that can be conducted in the dry (i.e. above the low water mark) with minimal disturbance will be conducted by hand as soon as practically possible. Some selective hand picking of large scattered pieces of coal at select locations will also be conducted in areas with good bank access. Coal recovery work will be periodically inspected by a QEP to assess progress and provide advice if necessary to modify the work plan. Following the completion of coal recovery the channel will be re-surveyed to assess channel condition and if applicable make recommendations for re-planting of disturbed areas.

## 4.0 Burnaby Lake Coal Recovery

The Burnaby Lake coal deposition assessment identified approximately 76 m<sup>3</sup> of recoverable coal at the alluvial fan near the confluence of Silver Creek.

Work to remove coal deposits in this area downstream of the Burnaby Lake Park footbridge over Silver Creek will be undertaken using primarily mechanical removal (i.e. vac truck suction dredging), but will be supported by hand recovery. Extensive plans have been developed to isolate the work area, and salvage aquatic organisms. The work area will be isolated with a silt curtain to contain disturbance in the water column. A 6" electric pump will be installed near the footbridge to divert at least a portion of flow from Silver Creek around the work area, and multiple techniques of aquatic life salvages will be used to remove fish, amphibians and turtles from the work area. Other measures to further partition the work area, and to contain or isolate daily work areas will also be considered and implemented when feasible (e.g silt fencing or geotextile barriers)

Coal recovery will be undertaken by Quantum Murray LP (Quantum). Coal will be recovered by a vac truck powered suction dredging system supported by a 20 metric tonne long reach excavator capable of reaching 18 m. The excavator will maneuver the suction hose within the work area, and, with manual assistance, will be used to direct the end of the suction hose to target areas of coal recovery. The suction hose will be fitted with a screening device(s) to prevent the unwanted entry of adult turtles (e.g. 7 - 10 cm openings). The vac truck excavation/suction system will discharge coal and water into a series of modified bins for dewatering. The dewatering bins will have a combination of metal screens and non-woven geotextile cloth for straining coal and other debris from the water. In general water will be discharged continuously to one screening container until the container is partially full of coal and sediment, at which time water will be discharged to a second container while the previous container is removed for off-site holding and assessment at Quantum until final disposal has been determined.

The strained water will be removed from the bins by pumping and will be pushed through a pH adjustment system, which if required can adjust pH to address either acidic or alkaline conditions outside of water quality guidelines (6.5 to 9.0). From there the water will flow through tubes housing chitosan flocculent belts. Flocculent treated water will then be allowed to settle through a series of tanks before being processed by mechanical filtration. The mechanical filtration system will include an automated sand filter to remove particulates larger than 20 microns. The sand filter will be followed by bag filters that remove particulates down to 5 microns. Finally the water will be polished using carbon vessels in series, parallel format.

Sampling ports between each set of carbon vessels and after the final vessel allow for monitoring of discharge water quality, and flow through the system flow will be measured with a flow meter at the discharge location. The system discharge location will be determined in consultation with Quantum and Metro Vancouver. The pipe will be surrounded by a silt curtain in the water, and wood forms and filter fabric will be used to dissipate the energy of the discharge to limit disturbance of sediment in the lake bottom.

An Environmental Monitor (EM) from Triton will periodically measure in situ water quality parameters (e.g., turbidity, pH, and dissolved oxygen) from the downstream end of the water treatment system and near the discharge point back to Burnaby Lake to ensure water quality is similar to background conditions and/or compliant with applicable water quality guidelines (e.g. MOE, 2013, and CCME 2014). The frequency of monitoring will vary depending on the status of the coal recovery efforts and the duration the system has been operating (e.g. monitoring will be more frequent during early stages of the treatment program and may decrease over time once system effectiveness has been established). Responsibilities of the EM are described in more detail in Appendix 1.

At a minimum the EM will endeavour to collect hourly measurements from the water treatment system discharge and near the discharge point back to Burnaby Lake. These measurements will be compared to background measurements upstream of the work area in Silver Creek. If water quality objectives are not being achieved, the EM will coordinate with the Quantum representative to identify and implement possible modifications and collect additional water quality measurements to assess effectiveness. If modifications fail to achieve the desired water quality objectives, water discharge will be stopped and alternative processing and/or discharge alternatives will be considered and implemented. Since the entire system is modular extra components can be mobilized to site to allow for additional treatment as necessary.

#### **4.1 Project Planning and Permitting**

According to typical emergency response and spill remediation procedures followed by CN, the draft coal deposition assessment and work plans for coal recovery was submitted to the Ministry of Forest Lands and Natural Resource Operations (MFLNRO) emergency response officer for review (Triton 2014b). MFLNRO subsequently circulated the draft documents to other interested parties for review and comment. This work plan incorporates comments received to date from interested parties (e.g. provincial and municipal, authorities). In addition CN is in discussions with the landowner (Metro Vancouver) regarding property access for the proposed coal recovery work. Additional information about project permitting and regulatory framework is also included in Section 1.1 and Appendix 1.

#### **4.2 Mitigation Measures**

The recovery program has the potential to impact fish and other aquatic life (e.g. turtles or amphibians) from physical removal or exposure to turbid water conditions. Foot access for recovery work and removal of deposits could mobilize fines and cause temporary increases in turbidity or impact riparian vegetation (through trampling). In addition, foot access and coal removal could impact buried eggs or alevins in the stream substrate, as well as hibernating turtles if present in the bottom sediments of Burnaby Lake, and neonate turtles which may be present in the turtle nesting beach. Therefore while best efforts should be made to remove the largest practical amount of deposited material, coal removal needs to be balanced with mitigation measures or avoidance to minimize impacts to existing habitat (e.g. underlying organic layers) and aquatic life.



Coal deposits near the alluvial fan of Silver Creek are located below the water level, although the depth of deposition and particle size of the deposits varies by location. Considering the volume of coal to be removed, work area isolation will be required to contain turbid water disturbed during coal recovery. An aquatic life salvage will also need to be conducted to capture and remove animals from the work area to minimize their exposure to turbid water or risk of removal during suction dredging. The working area will likely need to be salvaged daily during recovery. In addition, since the long reach excavator proposed to assist in mechanical removal of coal will need to park on the turtle nesting beach to access the work area, the beach will need to be checked for remaining neonate turtles.

The following section summarizes proposed mitigation measures focusing on aquatic life salvage. A construction environmental management plan (EMP) for the coal recovery program has also been prepared to provide additional information about other mitigation measures such as waste management and construction monitoring (Appendix 1). Proposed aquatic life mitigation measures include but are not necessarily limited to:

- The turtle nesting beach will be carefully raked/screened to a depth of 20 cm (8”) to look for neonate/ hatchling turtles prior to equipment traversing out on the beach. (Although turtle nesting was monitored by personnel from MFLNRO and eggs and neonate turtles were removed from the nesting beach, some nest sites may have been missed (Welstead pers. comm., 2014))
- The nesting beach will be covered with geotextile to minimize the potential for inadvertent contamination of the nesting substrate with organic material
- Swamp mats will be placed on the nesting beach to distribute the weight of the excavator and minimize compaction
- To limit disturbance the work area will be isolated with a double-walled silt curtain to contain sediments mobilized during the recovery. If necessary the silt curtain(s) will be supported by sand bags other temporary barriers (e.g. silt fence) along the shoreline
  - Attachment of the silt curtain will be determined onsite and may include a number of measures depending on flow, current, depth, etc.
  - Temporary barriers (e.g., silt fence) will also be installed where feasible to isolate daily coal recovery areas within the larger work zone
- To reduce the potential for sediment dispersal by water flowing through the work area, flow from Silver Creek will be diverted around the work area with a 6” submersible pump installed inside a suitable fish screen near the Silver Creek footbridge.
- A fyke net with 3 mm mesh netting will also be installed in Silver Creek near the footbridge to isolate the work area and prevent fish from migrating into the work zone from Silver Creek
- Once the work area isolation(s) has been installed a salvage will be conducted to capture and remove fish and other aquatic life from the work area
- Aquatic life salvages will be conducted by QEPs experienced in capturing and handling aquatic life, and salvage crews will follow the Best Management Practices for

Amphibians and Reptiles in Urban and Rural Environments in British Columbia (Biolinx and Wind, 2004).

- Ms Nicole Basaraba of Summit Environmental has been retained by CN and will be the lead biologist for the turtle salvage program. Ms. Basaraba will be assisted by Mr. Darcy Schiller of Triton and other personnel with turtle salvage experience from EBB Consulting
- The fish salvage will be led by Triton with support from EBB Consulting who will lead the amphibian salvage portion of the project
- All Western painted turtles will be held and transferred to Kym Welstead (MFLNRO) for confirmation of identification
- All fish and native amphibians will be temporarily held in buckets of well aerated water before being enumerated and relocated at least 100 m west of the work zone or above the isolation net in Silver Creek
- The initial aquatic life salvage will endeavour to encompass the entire work area, and subsequent daily salvages will target specific areas where work is proposed for the day
- The aquatic life salvage and protection measures will include but not necessarily be limited to:
  - A dive survey will be conducted along the outer edge of the alluvial fan to the inside edge of the silt curtains to look and feel for turtles that may be hibernating in the soft sediments at the edge of the alluvial fan
  - Sediment and vegetation within two (2) metres of the two (2) basking platforms will be hand salvaged and screened to look and feel for turtles that may be hibernating in the sediment
  - Sediment and vegetation (including riparian vegetation) within two (2) metres of the shoreline will be hand salvaged to look and feel for turtles that may be hibernating in the sediment or among vegetation
  - Aquatic life on the vegetated bar will be protected by installing an isolation fence consisting of 8 mm hardware cloth or similar around the bar to contain aquatic organisms on the bar and minimize disturbance of vegetation during coal recovery
  - The salvage will focus on daily work areas as well as in-shore areas at the mouth of Silver Creek where vegetation and LWD provide cover for fish and better conditions for capture
  - Aquatic life capture methods will include (but not necessarily be limited to) minnow traps, hoop traps, beach seining, pole seining, dipnetting, fyke nets and hand salvage.
  - The final phase of the salvage will be completed by electrofishing through the work area in order to capture/ remove as many organisms as possible

Other mitigation measures to minimize impacts from the coal removal work include but will not necessarily be limited to:

- Discharge water and coal will be screened through an upland containment treatment system to remove suspended solids
- Discharge should be monitored through periodic measurements of water quality to ensure compliance with applicable water quality guidelines. (Additional information about water quality monitoring and applicable guidelines is included in Appendix 1)
- In-water work should be monitored full time by an Environmental Monitor (EM) experienced in work area isolation and water quality monitoring. A description of EM responsibilities more details about water quality monitoring is included in Appendix 1.

### **4.3 Site Restoration**

The proposed methods to recover coal from the alluvial fan will require access for heavy equipment and trucks as well as other disturbance to install and operate a water treatment system. Prior to conducting any work, the work area will be photo documented to show the condition of existing habitat and park infrastructure (e.g. fencing trails, footbridge). Upon completion of the coal recovery the alluvial fan will be re-surveyed to compare the characteristics of the fan to those described during the initial deposition assessment. Restoration plans to rehabilitate disturbed areas will be prepared based on the results of the survey and in cooperation and consultation with Metro Vancouver and the Ministry of Forest Lands and Natural Resource Operations (MFLNRO).

Some of the disturbances and associated restoration efforts that may be required include but are not necessarily limited to:

- Placement of gravel to provide or expand laydown and staging areas for the water treatment system and improve access for heavy equipment, as well as construction of a temporary pedestrian trail to divert park users around the work area
  - laydown and staging areas will be restored based on discussions and requirements expressed by Metro Vancouver (property owner)
  - gravel will be removed and disturbed areas will restored and/ or re-seeded
  - pedestrian trails will be restored to pre-construction condition
  - Vehicle access to the work area will be limited to operational vehicles only (e.g. vehicles with tools or other equipment required for coal recovery or aquatic life salvage), all other worker vehicles will be required to use the public parking area on Avalon Ave
- Walking the excavator, needed to support the coal recovery operations, out on the turtle nesting beach may cause compaction of the nesting substrate, and will require temporary removal of the pedestrian exclusion fence
  - Once the work is complete the protection measures will be removed and the nesting beach will be inspected by the turtle biologist(s) and if necessary will be raked to reduce compaction

- If the nesting substrate is deemed to be unsuitable for turtles (e.g., due to inadvertent mixing of organic material from coal recovery operations or raking), the substrate will be replaced with a suitable mixture of sand and other material as specified by MFLNRO
- Pedestrian exclusion fencing will be re-constructed to pre-existing condition and any damaged signage will be replaced
- As part of coal recovery program the two (2) turtle basking platforms will need to be removed from the project area to facilitate turtle salvage and removal of coal from under the platforms.
- Prior to being repositioned the basking platforms will be pressure washed to remove residual coal and any staining

If necessary re-planting of disturbed areas to mitigate disturbance of riparian vegetation, and other potential restoration options. Riparian habitats disturbed through site access or other activities will be replanted with native shrub and tree species consistent with Metro Vancouver Park standards and at densities of  $\geq 1$  plant / m<sup>2</sup> depending on the level of disturbance and species selected for restoration

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## **APPENDIX 1**

### **ENVIRONMENTAL MANAGEMENT PLAN – SILVER CREEK AND BURNABY LAKE COAL RECOVERY PROGRAM**

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# ENVIRONMENTAL MANAGEMENT PLAN – SILVER CREEK AND BURNABY LAKE COAL RECOVERY PROGRAM

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Figure 4-1. Overview of coal recovery area and preliminary water quality monitoring stations



## 1.0 Introduction

This Environmental Management Plan (EMP) has been prepared in support of the coal recovery program in Silver Creek and Burnaby Lake in Burnaby, BC. Coal recovery was conducted opportunistically in Silver Creek in January and February 2014 during post-spill Type II Emergency Works<sup>1</sup> in the railway Right of Way (ROW). This coal was removed by excavator, shovels and shop-vac and was taken to a Quantum Murray (LP) facility in Delta, BC for disposal consistent with the *Environmental Management Act*. Additional works to recover coal from the Silver Creek channel upstream of the footbridge will primarily involve removal of coal by hand. Removal by hand could include but may not be limited to removing coal with shovels, vacuums, or by hand picking. Work to recover deposits of coal from downstream of the Burnaby Lake Regional Park footbridge using mechanical assistance is proposed as part of the Burnaby Lake coal recovery plan. Coal recovery in Burnaby Lake at and around the confluence with Silver Creek will be conducted by Quantum Murray LP (Quantum) on the basis of work plans developed in consultation with the Canadian National Railway Company (CN), Triton Environmental Consultants (Triton) and the permitting agencies. Summit Environmental (Summit), EBB Environmental (EBB) and Triton will conduct turtle, amphibian and fish salvages ahead of and during the coal recovery program. Triton will also provide environmental monitoring and site restoration services for the project.

The following project-specific information sources were reviewed to develop this EMP:

- Ministry of Forests, Land and Natural Resource Operations (MFLNRO) (Kym Welstead) (Feb 2014) Response to Burnaby Lake / Silver Creek Coal Deposition Recovery Plan
- Ministry of Environment-South Coast Region (Feb 2014) re: Burnaby Lake Coal Derailment Recovery Plan Review
- CN Environment (Feb 2014) Response to Painted turtle comments raised by Ministry of the Forests, Lands and Natural Resource (Kym Welstead)
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<sup>1</sup> Type II Emergency Works require attention before the next high flow event in a given system. These works included cleaning out the CN culverts, removing accumulated fine sands / silts / clays from the two outfall pools (at the storm sewer outfall and the CN crossing culvert outlets) and bank armouring downstream of the CN culverts, and at the sharp channel bend where Silver Creek flows south and heads south toward Burnaby Lake Park

- Fisheries and Oceans Canada (14-HPAC-00141) (Feb 2014) Subject: Serious harm to fish can be avoided or mitigated (in response to CN's Request for Review of the coal recovery program at and around the confluence of Burnaby Lake and Silver Creek)
- Wildlife Act permit SU-1493104 issued for Painted Turtle (*Chrysemys picta*), Midland Painted Turtle (*Chrysemys picta marginata*) and Red Eared Slider (*Trachemys scripta*) salvage
  - NOTE: Gloria White, Environment Canada (Feb 2014)<sup>2</sup> indicated Section 73 - Species at Risk Act (SARA) permitting would not be required
- Wildlife Act permit SU-1493104 issued for Northern Red legged frog (*Rana aurora*), Western Toad (*Anaxyrus boreas*), Northwestern salamander (*Ambystoma gracile*), and Long Toed Salamander (*Ambystoma macrodactylum*)
- Wildlife Act Permit SU13-85705 issued to Triton Environmental Consultants Ltd. for fish salvage in South Coast Region – all waters
- License Number XR 8 2014 – Scientific License issued to Triton Environmental under section 4 of the Fisheries Act for Brunette River and tributaries including Silver Creek
- City of Burnaby Comments on the 25 January, 2014 Memorandum RE: Mile 122.7 Derailment – Burnaby Lake Coal Deposition Recovery Plan, by Triton Environmental Consultants Ltd.

## 1.1 Project overview

Triton (2014 a and b) estimated 76 m<sup>3</sup> of coal was deposited at the Silver Creel alluvial fan (at the confluence with Silver Creek and Burnaby Lake) and roughly 5 m<sup>3</sup> in Silver Creek, with 0.94 m<sup>3</sup> occurring in Lower Silver Creek. CN will begin coal recovery in February 2014 and hopes to complete the program by March 15, 2014, to manage reduced risk timing windows for various aquatic organism and balance them with ability to mitigate. Equipment mobilization and staging is expected to take 5 to 7 days, followed by approximately 5 days of coal recovery and 5 to 7 days for demobilization and site restoration.

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<sup>2</sup> Email communications, February 6 and 7, 2014

This timeframe has been selected on the basis of the following considerations:

- Salmon fry emergence is anticipated on or around March 1 and CN would like to complete the recovery program as near to that date as possible to avoid impacts on salmon
- The nesting bird window is approaching and the coal recovery operation will result in construction noise and an increased number of people in Burnaby Lake Park (the Park), which could negatively impact nesting birds and park users if coal recovery continues into late March
- The seasonal life cycle of the Western Painted turtle described in *BC's Coast Region: Species & Ecosystems of Conservation Concern Western Painted Turtle – Pacific Coast Population (Chrysemys picta pop.1)* (Adamah Consultants & Brent Matsuda, 2012) indicates breeding activity between March and July, with nest construction in June and July, followed by a 60 to 80 day incubation period.
  - MFLRO indicated coal recovery and site restoration must be completed before May (identified as the start of the nesting season)

Based on these considerations CN is proposing to complete the coal recovery program in February to avoid potential conflicts with turtle breeding activities, salmonid fry emergence the nesting bird window and other park users.

## 2.0 Description of recovery methods

### 2.1 Silver Creek

Coal recovery in Silver Creek channel upstream of the footbridge will emphasize removal of coal by hand. This could include but may not be limited to removing coal with shovels, vacuums, or by hand picking. Access to coal removal areas would primarily be through adjacent riparian habitats. One deposit of fine coal in the off channel area near the Cariboo Business Park driveway (data point #9; 21m x 2m) will be removed by vac truck.

### 2.2 Burnaby Lake

Coal at and around the confluence of Burnaby Lake and Silver Creek will be recovered with a vac-truck powered suction system supported by a long reach excavator. The excavator and onsite personnel will maneuver the suction hose within the work area to targeted areas for coal

recovery. This will be conducted behind a double walled silt curtain to contain sediment and help keep aquatic life out of the working area. The recovery (and water treatment) equipment proposed for use onsite includes but may not be limited to the following:

- 20 mt long reach excavator capable of reaching 60'
- 12 mt excavator
- Hydro excavating vacuum truck
- 25 kw generator
- 2 x 5 kw light plants
- 3 x 20 yd bins modified to dewater coal
- 7 x 20,000L tanks
- pH adjustment (as needed)
- Flocc tubes using chitosan flocc belts
- 3 pod automated sand filter
- 6 bag - bag filter housing
- 4 x 2,000 lb carbon vessels in series parallel
- Heated and powered site trailer
- Tool crib with various small hand tools
- Skid steer with bucket and sweeper attachment

### 2.2.1 Waste water collection and treatment

Recovered coal and sediment will be discharged to settling tanks for initial screening and settling of large particles (achieved with a combination of metal screens and non-woven filter cloth to strain out debris and coal). Flow levels will be variable; however the electric pumps discharging from the dewatering bins will be capable of pumping 1,500 L / min. The proposed treatment system is modular and can be sized accordingly to meet changing discharge volume and / or performance criteria. Redundant tanks will be available for excess onsite storage as needed during system maintenance.

Flow from the first set of tanks will be pushed through a chitosan flocculant belt. This water is allowed to settle through several tanks before being processed by mechanical filtration. The mechanical filtration consists of an automated sand filter that removes particulate > 20 microns. The sand filter system is followed by a bag filter system that can drop particulates down to 5 microns. Finally the water will be polished using multiple carbon vessels in series, parallel format.

The on-site water treatment will be fitted with sampling ports at multiple locations to accommodate frequent water quality sampling. The system discharge location will be determined in consultation with Quantum and Metro Vancouver. The discharge pipe will be inside a silt curtain and onto plywood and / anchored poly to avoid erosion at the point of discharge. Recovered coal will be taken offsite for disposal by Quantum.

## 3.0 Project area

### 3.1 Fish and fish habitat

Silver Creek is a non-gazetted stream entering the railway ROW via three (3) municipal storm water pipes (Photo 1). Field surveys conducted in January 2014 indicated an average channel width of 4.06 m and an average wetted width of 3.22 m. Mean water depth at the time of survey ranged from 0.05 m to 0.26 m. Riffle and glide habitat units were common and the survey crew noted few pools with residual depths >0.3 m. The substrate was dominated by small cobble (SC) and large gravel (LG), with areas of extensive sand deposition along with exposed clay seams. Available cover was categorized as low (L) to moderate (M), and was provided mainly by undercut bank (U) and accumulations of large and small woody debris (LWD and SWD), with some overstream vegetation (OV) (Photo 2).

Coho Salmon (*Oncorhynchus kisutch*), Cutthroat Trout (*O. clarkii*) and Lamprey (*Lampetra sp.*) were salvaged in Silver Creek ahead of the January and February Type II Emergency works in the ROW. Triton also reported three spine stickleback (*Gasterosteus aculeatus*) in Silver Creek in 2007 (iMAP, 2014). We understand Chum Salmon (*O. keta*) were observed spawning in Silver Creek in the Fall of 2013, and information from the Stoney Creek Environmental Working Group (Feb 12, 2014 meeting minutes) indicates there were reports of Pink Salmon (*O. gorbuscha*) making their way past the Cariboo Dam in 2013, although it is unconfirmed if any of these fish spawned in Silver Creek.

Burnaby Lake has an approximate perimeter of 5.3 km, occupies an approximate area of 33.3 hectares and has a maximum depth of roughly 3 m. The results of diver and snorkel surveys conducted in Burnaby Lake at and around the confluence with Silver Creek indicated depths up to 1.8 m. The surveys also indicated substrates near the upstream (west) end of the alluvial fan were dominated by coarse gravel, with fine sediments dominating the surface layer near the downstream (eastern) end of the fan. Water levels in the lake are partially controlled by Metro Vancouver's Cariboo Dam. Fish species documented in Burnaby Lake, the Brunette River, Still Creek, Eagle Creek, Massey Creek and Beecher Creek upstream of the Cariboo Dam are summarized in Table 1(iMAPBC, accessed Feb 2014).



**Table 1. Fish species in Brunette River, Burnaby Lake, Still Creek upstream of the Cariboo Dam**

Fish species	Scientific name
Brassy Minnow	<i>Hybognathus hankinsoni</i>
Brown Catfish	<i>Ameiurus nebulosus</i>
Carp	<i>Cyprinus carpio</i>
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>
Coastal Cutthroat Trout	<i>O. clarkii</i>
Coho Salmon	<i>O. kisutch</i>
Lamprey	<i>Lampetra sp.</i>
Northern Pikeminnow	<i>Ptychocheilus oregonensis</i>
Peamouth Chub	<i>Mylocheilus caurinus</i>
Perch	<i>Perca sp.</i>
Prickly Sculpin	<i>Cottus asper</i>
Nooksack dace (1)	<i>Rhinichthys cataractae</i>
Rainbow Trout	<i>O. mykiss</i>
Redside Shiner	<i>Richardsonius balteatus</i>
Sucker	<i>Catostomus sp.</i>
Threespine Stickleback	<i>Gasterosteus aculeatus</i>
Yellow perch	<i>Perca flavescens</i>

(1) Note: record shown for Massey Creek / Robert Burnaby Creek( u/s of Cariboo Dam) in the iMAP dabatase but not shown in the FISS database (searched Feb 2014)

### 3.2 Listed plant and wildlife species

Provincially and / or federally listed species in the Park are shown in Table 2 (City of Burnaby, May 2002; Conservation Data Centre, accessed Feb 2014).

**Table 2. Listed wildlife species documented in Burnaby Lake Park City of Burnaby, 2002; CDC, 2014)**

Species	Scientific name	Status
red legged Frog	<i>Rana aurora</i>	Blue
Western Painted Turtle	<i>Chrysemys picta bellii</i>	Red
Western Pond Turtle	<i>Actinemys marmorata</i>	Red

**Table 2. Listed wildlife species documented in Burnaby Lake Park City of Burnaby, 2002; CDC, 2014)**

Species	Scientific name	Status
Western Grebe	<i>Aechmophorus occidentalis</i>	Red
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	Blue
Great Blue Heron	<i>Ardea herodias</i>	Blue ( <i>fannini</i> )
American Bittern	<i>Botaurus lentiginosus</i>	Blue
Green Heron	<i>Butorides virescens</i>	Blue
Short-billed Dowitcher	<i>Limnodromus griseus</i>	Blue
Peregrine Falcon	<i>Falco peregrinus</i>	Blue ( <i>pealei</i> )
Band-tailed Pigeon	<i>Patagioenas fasciata</i>	Blue
Purple Martin	<i>Progne subis</i>	Blue
Snowshoe Hare	<i>Lepus americanus</i>	Red ( <i>washingtonii</i> )
Long-tailed Weasel	<i>Mustela frenata</i>	Red ( <i>altifrontalis</i> )
Blue dasher	<i>Pachydiplax longipennis</i>	Blue
False Pimpernel	<i>Lindernia dubia</i> var. <i>anagallidea</i>	Blue

Other reptiles and amphibians with some potential to occur in the project area include: red eared slider (*Trachemys scripta elegans*), Midland painted turtle (*Chrysemys picta marginata*), bull frog (*Lithobates catesbeianus*), green frog (*Lithobates clamitans*) and Northwestern salamander (*Ambystoma gracile*).

### 3.3 Western painted turtle overwintering and nesting habitat

Western painted turtle overwintering habitat is located near the coal recovery area at the Silver Creek and Burnaby Lake confluence. A nesting beach is located upslope of the coal recovery area and will be used on a limited basis for accessing the coal deposit (Photos 3 and 4).

### 3.0 Regulatory Framework

CN has obtained federal and provincial salvage permits in support of the project, and has received feedback on the coal recovery program from Fisheries and Oceans Canada (DFO) through the Request for Review process. Each permit and DFO's response to CN's Request for Review provides conditions. Additionally, there are federal and provincial Acts, as well as a variety of Best Management Practices documents that are applicable to the coal recovery program. Examples are provided below in Table 3.

**Table 3. Examples of relevant legislation and BMPs**

Federal and BC Provincial Acts	Relevant Sections
Fisheries Act (Canada)	Section (32) Destruction of Fish, Section (34) Deposition of a Deleterious Substance, Section (35) Harmful Alteration, Disruption or Destruction of Fish Habitat (HADD).
Migratory Birds Convention Act (Canada)	Migratory Birds Regulations: Section (35) Pollution, Deposition of oil, oil wastes or any other substance harmful to migratory birds in any waters or any area frequented by migratory birds
Species at Risk Act (SARA) (Canada)	Conformance with: General Prohibitions (Sections 32, 33), Protection of Critical Habitat (Section 58, 61)
Environmental Management Act (BC)	Contaminated Sites Regulation, Spill Reporting Regulation, Hazardous Waste Regulation
Wildlife Act (BC)	Section 34 - Birds, nests and eggs Feeding dangerous wildlife (waste disposal) Section 27 - Prohibitions against harassing wildlife
A Field Guide to Fuel Handling, Transportation & Storage	Small containers = 230L – Canisters, Jerry Cans, Pails, Drums; Small TDG tanks < 454L – Truck-Box Fuel Tanks, Secondary containment & collision protection & spill response
Best Management Practices for Amphibians and Reptiles in Urban and Rural Environments in British Columbia	Introduced species management and controlling spread of wildlife diseases, Construction Phase, Regional BMPs
Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO)	Information Requirements for Evaluation of Intake Screens, Design, Installation, & Maintenance of Freshwater Intake End-of-Pipe Fish Screens
Standards and Best Practices for Instream Works (MWLAP)	Erosion and sediment control, Habitat enhancement and restoration, stream crossings, monitoring and reporting requirements, vegetation management, Spill management, Fish and Aquatic Life Salvage, Concrete Materials and Use, Site Restoration

**Table 3. Examples of relevant legislation and BMPs**

Federal and BC Provincial Acts	Relevant Sections
BC Approved Water Quality Guidelines and the Compendium of Working Water Quality Guidelines (BC)	Water & sediment quality guidelines for the protection of aquatic life
CCME Environmental Quality Guidelines (Soil, Water, Sediment) and CCME Ambient Air Quality Objectives (Canada)	Water, soil and sediment quality guidelines for a variety of uses; air quality objectives for human health

## 4.0 Environmental protection strategies

A combination of site-specific mitigation measures and standard BMPs will be implemented during the coal recovery program. These will address the following:

- Air Quality Management
- Construction Waste Management
- Environmental Monitoring Strategies
- Water Quality Protection and Monitoring
- Hazardous Waste Management
- Noise Management
- Wildlife Protection
- Pedestrian and Personnel Management

### 4.1 Air Quality Management

Given the time of year (winter) dust and combustion emissions from diesel and / or gas powered vehicles and stationary equipment would be of limited concern. In addition the recovered coal will be wet, eliminating coal dust generation. The project will take place in a public park, and consideration will be given to selected mitigation measures to prevent air quality impacts. These may include the following:

- On-road low sulphur diesel fuel should be used in all equipment capable of using such fuel
- Diesel particulate filters should be used on all construction equipment capable of supporting their use

Site-specific worker education programs should be developed to address:

- Idling reduction (automatic anti-idling shut-off where feasible)
  - Operation of equipment at optimum rated loads
  - Routine equipment inspection and maintenance
  - Daily inspections to identify dust and equipment exhaust issues
- Ongoing assessments of the potential for combustion emissions. Steps will be taken to minimize combustion emissions as needed
  - Locating combustion emissions sources (machinery) and staging areas for vehicles away from sensitive receptors (e.g. near businesses, employee break areas, and public walkways)

## 4.2 Solid Waste Management

Solid waste management strategies focus on non-hazardous wastes such as untreated wood, food waste, packing materials, and other non-hazardous wastes common to construction. Solid waste is generally managed through a combination of provincial laws and regional district prohibitions. The CCA has also developed guidelines for the reduction, re-use and recycling of selected construction materials. Construction waste strategies for the coal recovery program will emphasize effective waste containment and disposal measures to:

- Ensure hazardous materials do not enter the landfill disposal stream
- Limit potential effects on scavenging wildlife
- Encourage re-use and recycling where feasible

Contractors will implement the following measures to control solid wastes in working areas:

- Select suitable locations for disposal bins, which should be near active construction areas and convenient use for use
  - Secured bins will be used to prevent wildlife access
- Provide information on sorting and storage requirements of specific wastes or materials that can be reused or recycled. Bins should be properly labeled and located in easily accessible areas to encourage reuse and recycling, and to ensure materials destined for landfill disposal are properly stored
- Conduct daily site cleaning and routine inspections of waste disposal and storage areas



- Provide employees and subcontractor training on site-specific waste management strategies. In particular, employees and subcontractors should be made aware of materials that are banned from landfill disposal

### 4.3 Environmental monitoring

The Environmental Monitor (EM) will be onsite throughout the coal recovery program, from mobilization to site restoration. At a minimum, the EM will be responsible for monitoring the following tasks and activities:

- Mobilization of the coal collection and water treatment systems (by Quantum)
- Access into and out of the work area, particularly in the vicinity of the turtle nesting beach (machines that must access the recovery area via the nesting beach will be positioned on swamp pads)
- Silt curtain installation (and maintenance) as well as the installation and maintenance of any other sediment control measures onsite
- Coal recovery and deposition into temporary holding tanks prior to discharge into the water treatment system
- Solid waste and hazardous materials management strategies, including spill preparedness
- Site restoration in upland, riparian and wetted areas, in consultation with the permitting agencies and emphasizing the restoration of Western Painted Turtle Habitat and park infrastructure

The Environmental Monitor will also be responsible for the following:

- Coordinating with Summit and EBB on the turtle and amphibian salvage ahead of and during coal recovery
  - All turtles and non-native amphibians will be held for Kym Welstead for identification and subsequent relocation or other management
  - Fish and native amphibians will be temporarily held in buckets of well aerated water before being enumerated and relocated at least 100 m west of the work zone

- Supervising and participating in the fish salvage, which will include installing (and monitoring) a fyke net with 3 mm mesh netting in Silver Creek near the footbridge to isolate the work area and prevent fish from migrating into the work zone
- Collecting in situ and analytical water quality measurements upstream and downstream of the working areas, as well from the treated discharge water leaving the site for (See Section 4.4.2)
- Compiling daily information on recovered coal volumes and treated discharge volumes from the program
- Preparing a summary report on the program including (but not necessarily limited to the following)
  - Tabular list of activities and concurrent weather conditions
  - Onsite meetings and discussions
  - Notes on condition of mitigation measures and advice provided
  - Environmental incidents (if any) during the reporting period
  - Summary of water quality and aquatic life salvage data
  - Photo documentation

#### **4.4 Water quality protection and monitoring**

##### **4.4.1 Mitigation measures to protect water quality**

Mitigation measures to protect water quality in the Burnaby Lake and Silver Creek recovery areas will include but not be limited to the following:

- Conducting the work during low water to the extent possible based on weather conditions
- Use of a double walled silt curtain in Burnaby Lake to contain mobilized sediments. Attachment of the curtain will be determined onsite and may include a number of measures depending on flow, current, depth, etc.
- Partial or full isolation as appropriate based on local habitat conditions in Lower Silver Creek

- Onsite treatment system for wastewater generated during coal recovery in both Burnaby Lake and Silver Creek
- Prohibiting grubbing in upland / riparian working areas, which will reduce the potential for exposed soils and subsequent rain splash erosion
- Restricting personnel access into wetted areas, and using tools such as dip nets or strainers to collect coal particles to extent practical
- Ensuring silt fence, straw bales, poly -sheeting , tarps are available onsite to address erosion issues that may come up

#### 4.4.2 Water quality monitoring

The EM will collect hourly *in situ* water quality data (e.g., turbidity, pH, conductivity, temperature, salinity, ORP and dissolved oxygen) as follows for the Burnaby Lake and Silver Creek coal recovery program (Figure 4-1):

- Upstream of the recovery area (background site)
- Treatment system discharge
- Downstream of the system discharge (but upstream of Cariboo Dam)

These data will be used to determine if the treated discharge water is consistent with background conditions and / or the BC Approved and Working Water Quality Guidelines. If the *in situ* data indicate treatment objectives are not being met, the EM will coordinate with the Quantum representative to identify and implement system modifications. If these modifications fail to achieve the water quality objectives the discharge will be stopped and alternative processing and/or discharge alternatives will be evaluated and implemented. Analytical data collection will also be undertaken and will focus on:

- Total suspended solids
- pH
- Chloride
- Sulphate
- Sulphide
- Hardness
- Alkalinity
- Total and dissolved metals

- Nutrients (Ammonia, Nitrate, Nitrite, Phosphorus, Carbon)
- Light and Heavy Extractable Petroleum Hydrocarbons
- Polycyclic aromatic hydrocarbons

These analyses will be conducted at project start up and at least once weekly thereafter. More frequent analyses of selected parameters shown above may be conducted based on the *in situ* sampling results, such as an upward fluctuation in conductivity. All water quality sampling locations will be photographed and geo-referenced.

## 4.5 Hazardous Materials Management

The Hazardous Materials Management focuses on managing potentially hazardous materials to avoid impacts on aquatic and terrestrial habitats. This includes compounds used during operations, and wastes generated as a result of the work. Spills of hazardous materials have the potential to effect soil, water and sediment quality. Hazardous wastes are prohibited from routine landfill disposal. Examples of hazardous materials that are most likely to be associated with the project include: gasoline and diesel fuel, hydraulic fluids, and waste oils.

### 4.5.1 Hazardous materials management strategies

Effective hazardous materials management strategies include:

- Preparing inventories of compounds that will be used, or have the potential to be used onsite. Inventories should include anticipated volumes, types of compounds and the associated Material Safety Data Sheets (MSDS)
- Providing appropriate storage and general guidelines for use of hazardous materials
- Conducting an overview assessment of risks associated with spills of known hazardous materials used in working areas. This requires the contractor to evaluate the potential hazards of working with specific compounds, in association with a particular task, in particular areas
  - This will be completed with the EM in the field
- Developing and posting spill prevention plans. Such plans would include guidelines for daily use and overnight fuel storage, as well as designated waste storage areas for oils, and other potentially hazardous products. These plans also include guidelines for managing suspect or known contaminated materials

- Developing and posting spill preparedness and response plans for compounds in use onsite. These plans should include, at a minimum, information on appropriate spill response equipment, communications and response plans

#### 4.5.2 Storage and use of hazardous materials

Where feasible and applicable, Contractors should follow these general guidelines for storage and use of hazardous materials in construction areas (Gibb *et al.*, 1999):

- Storage areas and containers will be regularly inspected for leaks, poor condition, inadequate seals and other problems that may result in the spill or release of a hazardous substance
- Personnel will read and follow the directions for all products, and have easy access to MSDS for all hazardous material onsite
- Products will be stored in their original containers and their labels maintained in good condition; labels should be protected with transparent tape as necessary
- As needed and where safe to do so, a correctly sized funnel will be used to transfer hazardous materials from one container to another

#### 4.5.3 Spill prevention

Spill prevention strategies for the project will include the following:

- Daily inspections of machinery for leaks, cracked hoses and other conditions that may result in spills. Contractors will ensure external equipment surfaces are free of oil, diesel and other potential contaminants prior to use
- Routine inspections of storage areas and containers for leaks, poor condition, improper seals and other problems that may result in the release of a hazardous substance
- Storage of daily use fuels, lubricants and other compounds over impermeable areas and / or in lined, leak proof containers. Temporary covers will be used as needed to prevent rainfall from pooling in daily use storage containers
- Daily use compounds will be stored onsite in a locked container or will be taken offsite at the end of each workday

- Fuelling and equipment maintenance will be undertaken  $\geq 30$  m away from all drainages to the extent feasible
- Written procedures for the proper use and storage of compounds will be provided as needed, depending on the potential risks associated with each compounds, anticipated frequency of use and any special handling requirements.

#### 4.5.4 Spill preparedness

Written spill response procedures and communications protocols will be posted at conspicuous locations onsite. Personnel should know the locations of the spill kits in each working area and be trained in their use prior to construction. Spill kits will be appropriate to the types of hazardous materials and anticipated spills onsite (e.g. smaller hydrocarbon spills). Contractors will be expected to develop and post a list of contacts and emergency numbers for managing and responding to spills. Machine operators will generally have onboard spill kits. However, one larger spill kit should also be also available at each working area. At a minimum we recommend larger spill kits contain the following (or similar):

- (50) absorbent pads
- (4) booms
- bag granular absorbent
- (4) disposal bags
- stop leak plug
- personal protective equipment
- roll duct tape
- flagging and tarps
- up to 80 empty sand bags
- instructions and list of contents

#### 4.5.5 Spill response

Contractors will develop and post spill response plans prior to construction. These plans will include but not be limited to the following procedures:

- Confirm the safety of all personnel and secure the area (as needed)
- Eliminate ignition sources

- Identify spilled product, associated hazards and clean up requirements (refer to MSDS if uncertain)
- Determine if the spill can be contained and cleaned up by onsite staff. Spills that cannot be managed by onsite personnel should be directed to the District and other agencies as required
- Stop the flow of spilled materials if safe to do so
- Contain spilled materials if safe to do so
- Clean up and dispose of spilled product and used response materials consistent with the *Environmental Management Act*
- Notify CN of the incident who will report the spill to the Provincial Emergency Program (PEP) in the event of a reportable spill, as defined by the Spill Reporting Regulation of the Environmental Management Act
- Investigate causes of the spill and identify required changes to hazardous materials management strategies and spill response plans
- Complete spill reporting forms ensuring the following information is provided:
  - Name of the person(s) reporting the spill
  - Witnesses of the spill
  - Date, time and location of the spill
  - Source of spill
  - Type and estimated volume of product
  - Nature of the receiving environment (soil, water)
  - Spill response measures
  - Estimated volume recovered
  - Impact of the spill on terrestrial and / or aquatic resources
  - Required remediation (if any)
  - Measures taken to prevent similar spills in future
  - Agencies made aware of the spill (as needed)



Note: Environmentally sensitive hydraulic fluids will be used in onsite equipment

## 4.6 Lighting plans

Night time work is not expected. However, the site will be manned 24 hours a day for security reasons so some level of lighting will be required, and therefore mitigation measures will be implemented to avoid potential impacts on wildlife. Lighting should be selected, installed and operated with consideration of the following mitigation measures to the extent possible:

- Minimizing night-time activity
- Using light on an 'as and when needed' basis
  - Directing light toward the ground on working areas
  - Reducing the height of lighting to the extent possible
  - Minimizing the number of lights required through strategic spacing
- Eliminating upward directed lighting
- Shutting off lights when they are not needed

## 4.7 Noise Management Plan

Night work is not expected as part of the coal recovery program. However, there are operating businesses immediately next door and the Park will remain open to patrons during the recovery program. Therefore a noise management plan has been developed to ensure operations are consistent with the City of Burnaby's noise bylaw (NOISE OR SOUND ABATEMENT BYLAW 1979 BYLAW NO. 7332). Noise mitigation measures will therefore be implemented during the recovery program and will include:

- Construction noise awareness training program for all personnel addressing site specific and generic construction noise issues, potentially sensitive noise receptors, relevant noise bylaws and performance criteria
- Selecting less noisy machinery, vehicles and equipment for use onsite wherever possible. Newer equipment, and/or equipment with noise suppression features like exhaust silencers on air tools should be evaluated for use onsite

- Equipment should be kept in good order, emphasizing lubrication, replacement of worn parts and the condition of exhaust systems
- Diesel and gas powered equipment should be routinely inspected and equipped with higher quality mufflers where possible
- Locating noisy equipment (e.g. portable generators) away from sensitive noise receptors
- Muffling back up beepers where safe and feasible to do so
- Shutting off equipment that is not in use and operating equipment at the minimum speeds permitting effective operation, with hoods and shields closed
- Enforcing speed limits to reduce vehicle noise
- Efforts will be made to comply with the bylaw, however due to the necessity of completing the work as soon as possible, construction may occur slightly earlier and on days other than suggested in the bylaw

#### **4.8 Wildlife protection plan**

The coal recovery program will be restricted to Silver Creek, Burnaby Lake, and a grassy upland area on the north side of pedestrian trail for equipment staging. Potential effects on wildlife in the project area as a result of the project include but may not be limited to the following:

- Disturbance of turtle overwintering and nesting habitat, as well as amphibian habitat
- Construction noise and personnel activity disturbances to wildlife
- Possible exposure to solid and hazardous materials (e.g. spills)
- Disturbance to riparian habitats from site access

General mitigation measures to protect wildlife will include but may not be limited to the following:

- Installing temporary fencing around upland working areas to prevent access and storage of equipment and materials in sensitive vegetated areas
- Minimizing disturbance to riparian vegetation by using a small number of designated access trails

- Pushing vegetation aside wherever possible, or minimal cutting of vegetation if necessary (e.g. grubbing will not be permitted, except for non-native species)
- Checking coarse woody debris cover and boulder cover near stream banks and / or in smaller terrestrial construction areas for amphibians (adjacent to main working areas)

The initial aquatic life salvage will endeavour to encompass the entire work area, and subsequent daily salvages will target specific areas where work is proposed for the day. The aquatic life salvage and protection measures will include but not necessarily be limited to:

- A dive survey will be conducted along the outer edge of the alluvial fan to the inside edge of the silt curtains to look and feel for turtles that may be hibernating in the soft sediments at the edge of the alluvial fan
- Sediment and vegetation within two (2) metres of the two (2) basking platforms will be hand salvaged and screened to look and feel for turtles that may be hibernating in the sediment
- Sediment and vegetation (including riparian vegetation) within two (2) metres of the shoreline will be hand salvaged to look and feel for turtles that may be hibernating in the sediment or among vegetation
- Aquatic life on the vegetated bar will be protected by installing an isolation fence consisting of 8 mm hardware cloth or similar around the bar to contain aquatic organisms on the bar and minimize disturbance of vegetation during coal recovery
- The salvage will focus on daily work areas as well as in-shore areas at the mouth of Silver Creek where vegetation and LWD provide cover for fish and better conditions for capture
- Aquatic life capture methods will include (but not necessarily be limited to) minnow traps, hoop traps, beach seining, pole seining, dipnetting, fyke nets and hand salvage.
- The final phase of the salvage will be completed by electrofishing through the work area in order to capture/ remove as many organisms as possible

#### 4.8.1 Coal recovery in turtle habitat

As requested by MFLNRO, coal recovery conducted in sediment and vegetation within 2 m of the basking platforms, in riparian vegetation within 2 m of the shoreline, will be conducted after the areas have been screened by hand to look for turtles. In addition a dive survey will be

conducted in deeper offshore areas to look for hibernating turtles. Coal recovery on the vegetated island will be undertaken to the extent possible – given the thin layer present. Finally, the basking logs will either be washed or replaced, whichever is ultimately preferable to MFLNRO.

During the coal recovery program, the nesting beach will be covered with geotextile to minimize the potential for inadvertent contamination of the nesting substrate with organic material. Swamp mats will be placed on the nesting beach to distribute the weight of the excavator and minimize compaction.

#### 4.8.2 Turtle salvage

Turtle salvage will be completed consistent with CN's Wildlife Act Permit SU-1493104. The salvage will be completed by a three (3) person crew led by a turtle biologist (Nicole Basaraba, Summit Environmental) and additional personnel from EBB and Triton with experience salvaging turtles. The salvage will emphasize raking the nesting beach, sifting sediments in the recovery area, (prior to coal being removed), as well diver survey(s) and the use of dip nets, seine nets and traps in deeper areas.

Handling will be consistent with the following documents:

- Inventory Methods for Pond Breeding Amphibians and Painted Turtles (1998)
- Live Animal Capture and Handling Guidelines for Wild Birds, Mammals, Amphibians and Reptiles (1998)
- Canadian Council on Animal Care (2003 & 2004)
- Standard Operating Procedures: Hygiene Protocols for Amphibian Fieldwork (2008)
  - All equipment (including personal gear) will be scrubbed and disinfected with bleach
  - All equipment will be stored in disinfected waterproof bins when not in use
  - All salvage personnel will wear Nitrile gloves, and gloves will be changed between handling individual specimens

All salvaged Western painted turtles will be held in Rubbermaid containers for daily pick up by Kym, Welstead of MFLNRO.

## 5.0 Pedestrian and personnel management

### 5.1 Pedestrian traffic

Pedestrian access to walking paths on both side of the work area must be maintained during the project. Park users are also expected to be interested in the project and attempt to access the work area. Finally, the project will require the use of heavy equipment and trucks for equipment staging and operations, which could interfere with pedestrians. We anticipate the following pedestrian traffic management strategies (at a minimum):

- A temporary perimeter fence will be installed to isolate the construction zone and divert pedestrians around the equipment working area
- Information signs will be prepared and erected on the perimeter fence to provide park users with information about the derailment, assessments and restoration works completed to date, and coal recovery activities
- A boom with signage will be placed across Burnaby Lake immediately upstream from the work area to act as a barrier to watercraft entering the work zone. The boom will be securely fixed to large trees or similar on either side of the lake in the general location of Metro Vancouver's existing no boat traffic area (due to the proximity of the Cariboo Dam)
- Flaggers will be used to escort vehicles and equipment into and out of the working areas
- Standard signage will be installed at the Cariboo Dam (and other pedestrian entrances as necessary) informing park users of construction
- The speed limit for all vehicles travelling to the work area on Metro Vancouver dam access road will be restricted to 15 km per hour
- Vehicle access to the work area will be limited to operational vehicles only (e.g. vehicles with tools or other equipment required for coal recovery or aquatic life salvage), all other worker vehicles will be required to use the public parking area on Avalon Ave

## 5.2 Personnel management

Mobilization, staging, and operations will require multiple workers, accessing the site at various times, for different periods of time. Up to  $\leq 15$  workers may onsite during parts of the program. Quantum will provide on-site facilities (e.g. portable toilets, drinking water, shelter) as well as meeting areas, first aid and tool storage facilities. Parking for onsite personnel is not expected to be an issue.

## 6.0 Site Restoration

Site restoration plans will be prepared on the basis of post construction conditions in wetted, riparian and upland areas and the need to secure the turtle nesting area. Prior to conducting any work the project area will be photo documented to show the condition of existing habitat and park infrastructure (e.g. fencing trails, footbridge). At a minimum we anticipate the following restoration strategies:

- With the possible exception of selected erosion control measures, construction mitigation measures (e.g. geotextile on turtle beach, snow fencing) will be removed once the coal recovery program is complete
- Wetted habitats disturbed through coal recovery will be restored consistent with pre-construction conditions to the extent practical and beneficial for aquatic life. This could include, for example, importing gravel and cobble into Lower Silver Creek in riffles disturbed through coal recovery, or importing new substrate for the turtle nesting beach if considered necessary by the turtle specialist(s)
- Riparian habitats disturbed through site access or other activities will be replanted with native shrub and tree species consistent with Metro Vancouver Park standards and at densities of  $\geq 1$  plant / m<sup>2</sup> depending on the level of disturbance and species selected for restoration
- Coarse woody debris cover that must be removed in support of site access or other activities will be replaced
- Grassy upland areas used for equipment storage will be restored consistent with Metro Vancouver Park standards for grading and seed mixes
  - Impacted trails will also be restored consistent with Metro Vancouver trail construction standards
- Fencing will be reinstated around the turtle nesting area and the sands comprising the beach will be raked to a loose condition under the supervision of the EM and in consultation with Nicole Basaraba (turtle specialist)



Site restoration will begin immediately following coal recovery and demobilization by Quantum Murray. We anticipate a post recovery meeting with Kym Welstead and Metro Vancouver Parks staff to finalize site restoration plans.

## 7.0 Emergency Contact Information

In the event of a medical, security, or fire emergency the contractor will immediately contact the appropriate emergency response services by calling 911.

Other emergency contact numbers include but are not necessarily limited to:

- Metro Vancouver (MV), Cariboo Dam operations
  - During working hours contact: Gerry Gentile 604-202-9117 or Steve Benton 604-220-9469
  - After hours Monday to Friday (15:30 - 07:00) contact: 604-451-6610 (MV corporate security) and ask for the Urban Drainage duty officer contact number
- Metro Vancouver 24 hour emergency contact number 604-432-9483
- City of Burnaby 24 hour emergency contact number 604-294-7200
- CN 24 hour emergency contact number 1-800-465-9239

## 8.0 References

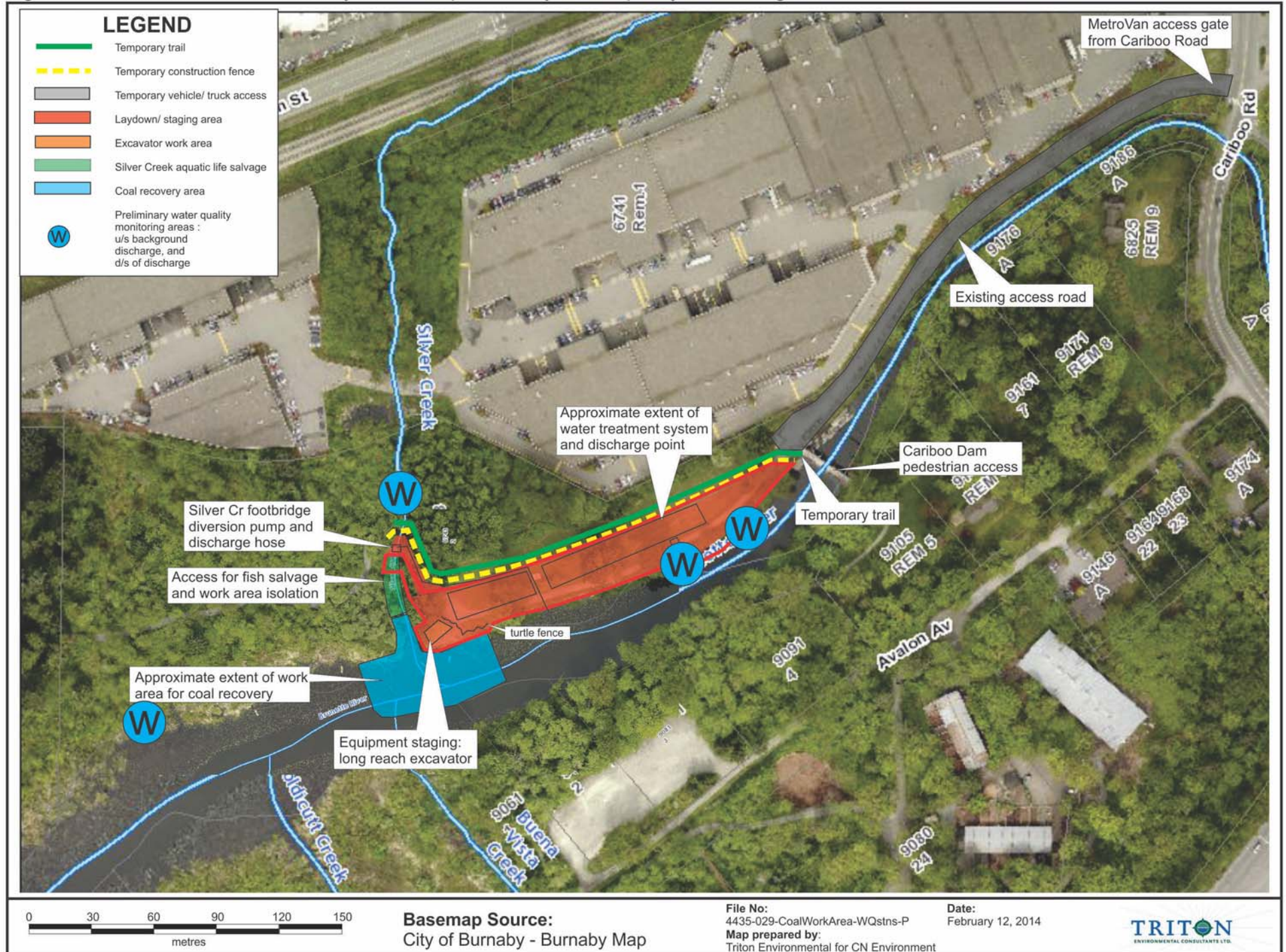
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Conservation Data Centre (accessed 2014) CDC Internet Mapping Service

<http://www.env.gov.bc.ca/cdc/>

iMAP BC (accessed Feb 2014)

Figure 4-1 Overview of coal recovery area and preliminary water quality monitoring stations







**Photo 1. City of Burnaby storm sewer outfall upstream of the railway ROW**



**Photo 2. Silver Creek downstream view**





Photo 3: Turtle nesting beach and immediately adjacent offshore habitat



Photo 4: Turtle nesting beach and immediately adjacent offshore habitat