ENVIRONMENTAL MANAGEMENT PLAN

Keystone Property – Instream Work on Bings Creek Tributary Drainage, Duncan, BC.

for:

Ministry of Forests Lands and Natural Resource Operations – Water Stewardship Division

by:

Trystan Willmott, B.Sc. A.Sc.T.
Madrone Environmental Services Ltd

June 12th, 2015

MADRONE ENVIRONMENTAL SERVICES LTD.
1081 CANADA AVENUE • DUNCAN • BC • V9L 1V2
TEL 250.746.5545 • FAX 250.746.5850 • WWW.MADRONE.CA

DOSSIER: 11.0183

TABLE OF CONTENTS

ENVIRONMENTAL MANAGEMENT PLAN

INSTREAM WORK ON BINGS CREEK TRIBUTARY

1 Background and Introduction

As part of a proposed subdivision located to the west of Keystone Drive, in Duncan, BC, site-related servicing in the form of road construction, stormwater management and sewer line placement requires the completion of instream works. The subject property covers an area of 2.7 ha, and the proposed subdivision would result in the creation of 28 single family lots. As the subdivision is within the Riparian Assessment Area of Bings Creek and a tributary drainage (including headwater wetland), a report (No. 3574) has been submitted under the Riparian Area Regulation (RAR). The measures in the RAR refer to the protection of Streamside Protection and Enhancement Areas (SPEAs) with regard to the proposed subdivision and future construction phase. The purpose of the Environmental Management Plan (EMP) is to provide mitigation that is specific to instream works that affect the tributary drainage.

The EMP has been provided as part of an online Section 9 Notification submission addressing three separate activities within the same general area on the Bings Creek tributary drainage:

- Installation of a culvert to allow the extension of Keystone Drive into the proposed subdivision area;
- Burial of a sewer line underneath the drainage close to the outlet of the installed culvert ; and
- Construction of a stormwater retention area on the drainage in the north eastern corner of the property.

2 Site Location

The proposed subdivision area is located to the immediate west of the current terminus of Keystone Drive, located in the Municipality of North Cowichan, Duncan, BC (Figure 1). A wetland located in the south western corner of the property drains via a poorly defined outlet drainage along the eastern portion of the property to the west of Highland Road and a recently upgraded Cowichan Valley Trail connector. The drainage flows underneath the Cowichan Valley Trail and into Bings Creek. A seasonal drainage with seepage flow, which flows along the base of the Cowichan Valley Trail slope, joins the main tributary drainage immediately upstream of the trail culvert.

The Cowichan Valley Trail separates the subject property from Bings Creek, which flows to the north of the trail. Instream works would be occurring on the tributary drainage in the north eastern corner of the property on the southern side of the Cowichan Valley Trail (Figure 2).

Insert Figure 1 – Overview Location Map.

Insert Figure 2 – Detailed property map

3 Drainage Description and Fish Habitat Characteristics

The subject stream originates in a wetland in the south-western corner of the property. This wetland is seasonally inundated with water and consists of deep organic material, with a dense cover of skunk cabbage (*Lysichiton americanum*). Surface flowing water flows seasonally to the east, with dense skunk cabbage indicating the course of the drainage. There is no defined channel, but water moves over the surface through the wetland during the winter months and flows subsurface during the summer. The watercourse becomes somewhat defined as a "stream" where it flows along the south-central portion of the property. In addition to being fed by the wetland, the stream receives input from a stormwater outflow pipe from neighbouring properties. This discharge enters the stream at the base of a steep slope close to the southern property boundary. Immediately prior to flowing underneath the Cowichan Valley Trail, the watercourse flows through a depression consisting of hydrophytic vegetation (mainly skunk cabbage). This is the proposed area for the stormwater retention pond.

The subject stream displays very limited habitat features necessary for fish life processes. The stream is very poorly defined, there are no alluvial deposits (potential spawning habitat is non-existent, therefore), there is no cover for fish, nor is there any identifiable channel morphology (no pools, riffles or glides). Despite the lack of fish habitat attributes, the watercourse qualifies as a "stream" under the provincial Water Act and connects directly to documented fish habitat (Bings Creek). There is the potential that during high flows in the winter months that fish from Bings Creek could enter the subject stream.

Bings Creek (watershed code 920-257700-05700-66900) represents important fishery resource values, and is known to support populations of coho salmon (*Oncorhynchus kisutch*), chum salmon (*O. keta*), rainbow trout/steelhead (*O.mykiss*), coastal cutthroat trout (*O. clarki clarki*) and brown trout (*Salmo trutta*). Bings Creek flows into Somenos Lake, which is then drained by Somenos Creek. Somenos Creek connects with the Cowichan River approximately 5km below the assessment area. The Cowichan is a heritage river, and represents significant connected downstream fish habitat values.

Where it flows adjacent to the subject property, Bings Creek displays diverse fish habitat attributes. Instream cover is provided by collections of LWD, boulders, deep pools and undercut banks. In addition to pools, riffle and glide habitat types are also well represented. The river bed is comprised of a mix of substrate types, offering spawning potential for salmonids in the form of small to medium-sized cobble and small to medium-sized gravel. The river also flows over scoured bedrock in places. Bings Creek is not subject to any instream works, but it represents the parent stream.

The drainage that occurs along the toe of the Cowichan Valley Trail and joins with the main tributary stream immediately upstream of the culvert under the trail represents a very poorly defined drainage, with seasonal seepage flow over an organic substrate. This watercourse does not represent fish habitat, but connects seasonally by surface flow to the subject stream. The lower segment of the drainage occurs within the depression area proposed to be the footprint of the stormwater retention pond.

At the proposed Keystone Drive and sewer line crossing location, the immediate riparian zone adjacent to the left bank of the subject stream consists of dense shrub and herb growth, with hardhack (*Spiraea douglasii*) and Himalayan blackberry (*Rubus discolor*) – an invasive species - dominating. Reed canary grass (*Phalaris arundinacea*) – an introduced species - occurs in dense concentrations. Beyond the immediate riparian zone, the riparian area consists of grasses and invasive species such as Himalayan blackberry and Scotch broom (*Cytisus scoparius*). The extent of riparian vegetation adjacent to the right bank at the proposed crossing location is limited by a recently upgraded trail extending from the end of Highland Road. Young red alder (*Alnus rubra*), Douglas fir (*Pseudotsuga menziesii*) and western redcedar (*Thuja plicata*) occur between the trail and the edge of the stream.

The proposed location of the stormwater retention area represents a natural depression to the immediate south of the Cowichan Valley Trail and crossing point of the subject stream under the trail. The area consists of dense skunk cabbage, reed canary grass, patchy common horsetail (*Equisetum arvense*), bracken fern (*Pteridium aquilinum*), salmonberry (*Rubus spectabilis*), young red alder and young bigleaf maple.

4 Notification Activities

The activities included as part of the Notification submission are described here:

Culvert installation and sewer line placement:
A 1200mm concrete culvert will be installed to allow the extension of Keystone Drive over the focus stream and into the proposed subdivision area. The culvert will be embedded 0.25m below the invert of the watercourse, to emulate a natural stream bed and allow fish to pass through (assuming by default that the stream is fish bearing on a seasonal basis, despite the lack of habitat attributes).

Concurrently with the culvert placement, a sanitary sewer line will be installed across the focus stream immediately downstream of the culvert outlet. The line is proposed to be a 200mm PVC pipe, and will be buried approximately 1.5m below the watercourse. The pipe will be installed by excavating an open trench approximately 0.6m wide x 1.5m deep, then placing the pipe and backfilling it with compacted granular material, before re-instating the watercourse to its pre-construction conditions. Figure 3 shows a plan view of the proposed location of the culvert and sewer line.

Stormwater Retention Area:

Construction of impermeable surfaces (e.g. rooftops and driveways) generally increases the amount of stormwater leaving a site in comparison to pre-development conditions. Infiltration capacity is reduced, and short-term surface run-off associated with rain events increases. Elevated stormwater run-off can have negative impacts on watercourses, including a potential increase in short-lived peak flow events and a decrease in the long-term supply of water to a system, which can result in lower flows in the summer months.

Increased peak flows can potentially impact fluvial environments by flushing alluvial material from the system (e.g. increased scour), which could have repercussions on the availability of spawning habitat. Stream banks can also become more unstable, which can lead to an increased potential for fine sediment transportation. An increase in the frequency of summer low flow events can lead to a decrease in available wetted habitat for fish.

The goal of stormwater management is to capture storm flow and return it to natural hydrological pathways. Ideally, any development should aim towards a “no net gain” in stormwater leaving the site. It should be noted, however, that depending on specific infiltration rates and permeability of the native ground material, development can lead to increases in stormwater run-off, even if accepted measures are in place.

As part of the development of the subdivision, rock pits will be implemented as an initial measure in addressing stormwater retention from each of the subject lots. The rock pits will likely receive a portion of stormwater from each lot, by allowing for infiltration of water captured from rooftop rain-leaders.

Primary stormwater management for the site would consist of a stormwater retention area located in the north-eastern corner of the property. This would receive water from impermeable surfaces throughout the proposed development. An existing low area to the immediate south of the culvert carrying the subject stream underneath the Cowichan Valley Trail would be “deepened” by constructing sloped berms around the depression. This would be achieved by importing material and building up the slopes with mechanical equipment.

The existing culvert would remain in place underneath the trail, but an additional overflow culvert would be placed above, to allow water to drain during periods when the pond reaches full capacity. The outlet of the culvert would be armoured with coarse rock to avoid any potential for erosion of the bank sloping down from the Cowichan Valley Trail. No work would occur below the high water mark as part of the construction of the stormwater retention area. Figure 3 shows a plan view of the proposed stormwater retention area located in the north-eastern corner of the property.

Figure 3.

5 Potential Construction-Related Impacts

5.1 Deleterious Substances

The operation of heavy machinery introduces the potential for the release of deleterious substances into sensitive areas. Hydrocarbon leakage and spills from machinery (*e.g.* from fuel or hydraulic fluid) are potential occurrences that may result in the introduction of pollutants to receiving fish habitat, if not properly managed.

Activities such as clearing vegetation along the Keystone Drive footprint, excavating the trench for the sewer line crossing and placing material to create the edges of the stormwater retention area will create potential sediment sources, which could become mobilized and transported into watercourses if adequate mitigation measures are not developed.

5.2 Damage to Riparian Vegetation

The construction of Keystone Drive through the riparian zone of the subject stream will result in the loss of vegetation along the footprint of the road. Creating the edges of the stormwater retention area also leads to the potential for damage to riparian vegetation. Construction of the trench for the sewer line through the riparian area represents temporary disturbance of vegetation.

6 Mitigation

6.1 Erosion and Sediment Control

6.1.1 Terrestrial Activities

The Fisheries Act considers sediment as a deleterious substance and its introduction into a watercourse is a reportable federal offence. The use of Best Management Practices (BMPs) for soil erosion and sediment control will be used during each activity.

The most appropriate method to control sediment is to manage potential sediment sources. If potential erosion sources are managed properly, sediment cannot be mobilized. Generally, the impact of rain drops upon an exposed (*i.e.* un-vegetated) surface provides sufficient energy to detach soil particles (depending upon particle size), which then become entrained in surface flowing water. BMPs that are focused on protecting recently exposed soils are extremely useful, therefore, as erosion is curtailed.

It should be noted that BMPs such as sediment fencing will not be relied upon as the only ESC measure. As discussed, if erosion is controlled at the source, there should be no need for a sediment fence. Sediment fencing can be an effective tool in ESC, but should be viewed as a secondary control measure, with erosion control being the primary focus. Other misconceptions regarding ESC should also be considered; hay bales, for example, are very ineffective at "filtering" turbid water, based on the size of sediment particles, and their ability to pass through the bale without being trapped.

As an initial measure to prevent erosion and sediment movement, all activities will be completed during dry weather and suspended during periods of excessive rainfall (at the discretion of Madrone). Straw will be placed by hand on exposed areas (e.g. verges adjacent to the Keystone Drive footprint) at a minimum thickness of 2.5 cm, using approximately 1 bale per 20-25 m^2. The straw will not only eliminate erosion, but will also retain moisture, reduce the establishment of unwanted weedy vegetation and provide organic material as it breaks down.

To protect any stockpiles of fill or soil from erosion, temporary polyethylene sheeting will be used. Covering the material will prevent it from being displaced by rain drops and/or surface flowing water. This is a short-term erosion control BMP, and would be used in cases where stockpiles of material are to be moved.

Following the placement of the material to create the edges of the stormwater retention area, coir matting will be used to cover the exposed slopes. Straw mulch will be used to cover the exposed footprint of the sewer line trench. Vegetation will be planted through the matting and mulch as per the details in Section 6.3. Once established, the vegetation will provide long-term erosion control.

Where applicable, sediment fencing will be used as a secondary control measure, but it should be noted that erosion control will be the primary focus. Sediment fencing will be installed properly, by backfilling the material with soil and attaching it firmly to stakes located on the downslope side of the fabric (as per Figure 4). Sediment fences will be inspected regularly to check for damage and to remove built up sediment (as necessary).

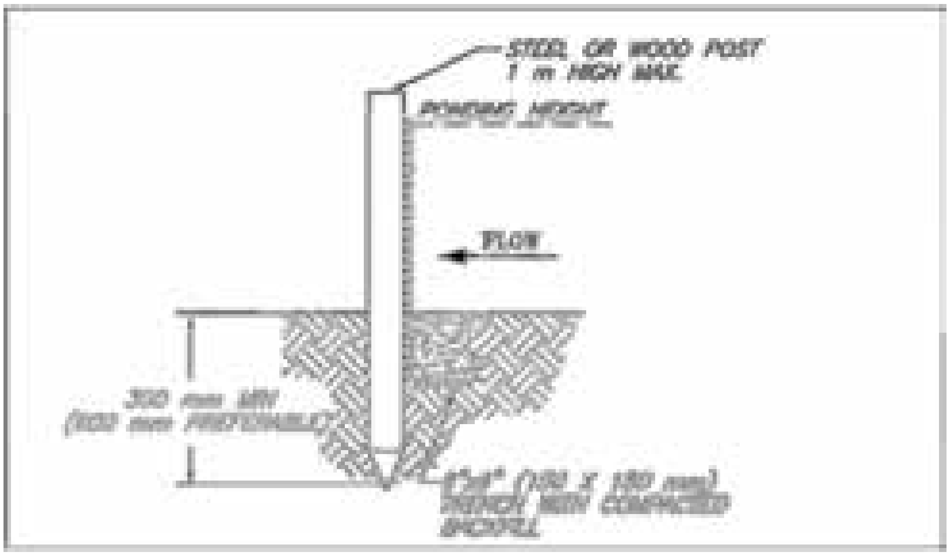

Figure 4. Proper installation of sediment fencing

6.1.2 Instream Activities

To prevent the movement of turbid water downstream during work at the crossing location, activities will be completed in isolation of stream flows. Based on the flow observed in the subject stream at the crossing location during April 2015 (prior to summer drought conditions), it is unlikely that water will be present in the stream during the instream activities associated with burial of the sewer line and placement of the culvert. If water is present at the crossing location, it will likely be in the form of shallow seepage flow.

If there is any potential for fish to be present at the crossing location, an appropriate method will be used to remove fish from the work area. Even during higher flows, the flow of water is too shallow for the effective placement of minnow traps, or effectively allow for electroshocking to take place. A narrow hand-held pole seine represents the most appropriate way of removing fish from the area, if adequate water is present to support fish during the crossing work.

If applicable, a fine-mesh net would first be placed upstream of the work area to prevent any potential movement of fish from upstream areas. The pole-seine would then be moved downstream through the work area (starting at the upstream isolation net), with one person on each side of the stream. Once the pole seine has passed through the work area, it would be anchored in place, creating the downstream isolation net. Any fish in the work area would be located on the downstream side of the net.

If water is present during the instream work, following the completion of the pole-seine pass, a pump would be placed at the upstream isolation net, to pump water through a hose around the work site. Once water is flowing around the site through the hose and maintaining downstream flow, a temporary sand bag/polyethylene dam would be constructed immediately downstream of the pump. A downstream dam would also be constructed at the approximate location of the lower isolation net, but upstream of the hose outlet, in order to isolate the site. When the work area dries, excavations associated with culvert placement and sewer line burial would commence in isolation of stream flow, to prevent the transportation of sediment downstream. A "trash pump" would also be kept on hand to pump out turbid water (e.g. from seepage) from the work site. This water would be pumped to a vegetated area well beyond the stream.

Documented fish habitat occurs immediately downstream in Bings Creek, which emphasizes the requirement to prevent the mobilization and transportation of sediment during the instream activities. Work will proceed in dry weather during the least risk instream work window as a preliminary measure to decrease potential impacts.

To ensure fish passage (assuming the subject stream supports fish, at least on a seasonal basis), the culvert will be embedded with suitable material (i.e. gravel). Based on the magnitude of the stream, it is likely that the material used to embed the culvert would need to consist of a significant proportion of fines, to help prevent water from flowing sub-surface through the gravel placed in the culvert. Following placement of the culvert (including embedded material) and burial of the sewer line, the downstream and upstream dams would be removed (if applicable). The flow of water through the pump/hose diversion would then be cut back, as water begins to flow through the culvert. To ensure that downstream flow is maintained, the pump would not be shut off completely until water flow is continuous through the culvert. Once water is flowing through the culvert, the upstream and downstream isolation nets would be removed.

The implementation of ESC on site is expected to be an adaptive, flexible process. This will allow for appropriate measures to be implemented and/or modified, as required, to ensure optimal results.

6.2 Fuel Handling and Spill Containment

In addition to being clean (*i.e.,* free from leaks and excessive grease/oil on the body) and in good working order, any heavy equipment working on site (e.g. excavator) will contain a small, storable emergency spill containment kit with at least a 30 litre sorbent capacity. In addition, a larger spill containment kit (*e.g.* standard garbage-can size with a minimum 195 litre sorbent capacity) will be placed in a central, easily-accessible location at the work site during all activities (culvert placement, sewer line burial and stormwater retention area construction). Workers on site will make themselves familiar with the contents of the spill kits and will know how to deploy the contents to effectively control spills.

The smaller (30 litre sorbent capacity) spill kits will contain the following:

- 20 absorbent pads (for oil, gas and diesel);
- 2 x 3"x 4' absorbent socks;
- 2 disposal bags; and
- 1 pair of Nitrile gloves.

The larger (195 sorbent capacity) spill kit will contain the following:

- 100 absorbent pads;
- 5 x 18" x 18" oil absorbent pillows;
- 10 x 3" x 4' absorbent socks;
- 1 x 36" x 36" neoprene drain cover;
- 1 1lb. jar of "Plug n Dike" (leak stop);
- 8 disposal bags;
- 2 pairs of Nitrile gloves;
- 1 spill instruction sheet; and
- 1 laminated list of contents.

For all activities, machinery (e.g. excavators) will use environmentally-sensitive hydraulic fluids that are readily or inherently biodegradable. Even if a spill of biodegradable fluid occurs, clean up with a spill kit will still occur, as the oil will persist in the environment until it breaks down naturally. The advantage with using biodegradable oil is that no toxic residue remains. All refueling will occur at least 30 metres from any watercourse.

Based on the fact that the retention area would continue to connect with Bings Creek, management of stormwater quality will be a component of the subdivision. Throughout the subdivided area, catchment basins will consist of sumps, where the majority of any sediment entrained from surface water will be captured. In addition, the retention area will consist of two separate "cells", with the aim being to provide an initial settlement area, where any remaining particulates can fall out of suspension and primary "filtering" from planted and naturally occurring hydrophytic vegetation can occur. Water would then spill over a berm (constructed from clean angular rock) prior to entering a second settlement area. Water from the second cell would flow out of the overflow culvert and into Bings Creek during significant storm events.

To help maintain the quality of water entering the stormwater retention area, the catch basin sumps throughout the subdivided area will be cleaned out on a regular basis, especially after the winter months. The developer of the subdivision will also be employing a simple, but effective way to help improve stormwater management for the site (specifically related to water quality). A solid yellow salmonid fish, painted using a wooden or cardboard template will be painted next to each catch basin to provide a visual reminder to residents that stormwater ultimately connects to fish habitat:

6.3 Vegetation Management

6.3.1 Culvert and Sewer Line Installation

The removal of vegetation from the Keystone Drive footprint is an unavoidable aspect of the culvert installation process. Generally, the riparian vegetation at the crossing location adjacent to the right bank is constricted by a footpath and consists of young red alder and young coniferous trees, with dense pockets of Himalayan blackberry adjacent to the left bank. Vegetation disturbance will also occur as a result of constructing the trench for the sewer line, but this disturbance will be temporary and the footprint will be replanted.

During construction of the road and trench through the riparian area, care will be taken to avoid inadvertent damage to tree stems and limbs from working machinery. Damage to tree bark and/or limbs from excavator buckets, for example, can lead to long-lasting negative impacts that can adversely affect the health of trees. Machinery will not be parked over the rooting zones of trees, as roots can become damaged from compaction and the drainage regime around trees can become altered (e.g. infiltration can decrease).

Excavations will be kept to an absolute minimum and the road and sewer line crossing footprints along the approaches to the stream will be field fit, wherever possible, to avoid damage to trees (including the rooting zones of trees to be retained).Where roots are encountered during any excavations, clean cuts will be made as opposed to leaving fragmented cuts. When applying the road base material, or stockpiling fill, tree stems will not be buried.

6.3.2 Stormwater Retention Area

The retention area will likely be dry during the summer months, and the levels would fluctuate during the wetter months of the year. The lower sloped edges of the pond will be planted with native species adapted to seasonal inundation and the upper slopes will be planted with species that require drier conditions. The objective is that the retention area will emulate a natural seasonally-inundated wetland, which will provide habitat for native amphibians and also a functioning riparian area, which will be of value to wildlife (e.g. nesting/foraging habitat for birds).

The placement of fill material around the edges of the natural depression to create an area where stormwater can collect in the north eastern corner of the subject property will lead to impacts to riparian vegetation. Generally, riparian vegetation in this area consists of dense shrub vegetation (salmonberry, Himalayan blackberry and willows). Young red alder and bigleaf maple also occur.

6.3.3 Replanting Plan

Planting native vegetation on the slopes of the stormwater retention area and over the temporary footprint of the sewer line trench will occur later in the year when conditions are more suitable for the survival of planted vegetation. Planting prior to the end of October 2015 will allow vegetation to become established over the winter months. The vegetation will be planted through the coir matting (stormwater retention area) or straw mulch (sewer line trench).

6.3.3.1 Stormwater Retention Area

The slopes of the stormwater retention area will be divided into planting zones, depending on the expected degree of inundation during the winter months. The lower slopes, where inundation is expected to occur for the majority of the winter months, will be planted with the following species: red-osier dogwood (*Cornus stolinifera*), sitka willow (*Salix sitchensis*), hardhack (*Spiraea douglasii*), slough sedge (*Carex obnupta*) and common rush (*Juncus effusus*). The middle zone, where inundation is expected to be less frequent, will be planted with the following species: Pacific ninebark (*Physocarpus capitatus*), salmonberry, black twinberry (*Lonicera involucrata*) and red elderberry (*Sambucus racemosa*). The upper zone, which includes the tops of the slopes and on the slopes leading from the crest away from the retention area will be planted with the following species: thimbleberry (*Rubus parviflorum*), flowering currant (*Ribes sanguineum*), Oregon grape (*Mahonia nervosa*), oceanspray (*Holodiscus discolor*) and Indian plum (*Oemleria cerasiformis*). The planting methodology will consist of one-gallon pots spaced at 1 m intervals.

Red-osier dogwood and sitka willow are pioneer woody species that area capable of establishing from cuttings. As such, live stakes of these species will be planted in the lower zone, at a relatively high density (less than 50cm between cuttings), with hardhack, slough sedge and common rush interspersed throughout. These species are accustomed to seasonal inundation, and will be suited, therefore, to the growing conditions on the lower slopes.

Live stakes will be at least 2 m long with a diameter of at least 2.5 cm, and all sucker growth will be removed at time of harvest (Figure 5) from a suitable donor site. Stakes will be bundled and soaked in running (oxygenated) water for at least 24 hours prior to being planted. Stakes will be inserted into the ground through the coir matting to a depth of at least 1 m. To help achieve this depth requirement, a hole will be prepared using a heavy metal bar, into which the stake is inserted. It is of paramount importance that adequate planting depths are achieved, to ensure that the plants become established.

To achieve successful growth, the stakes should ideally be harvested prior to the donor plant breaking dormancy in the spring. Stakes can also be harvested in the fall, after the majority of the leaves have dropped. Based on the timing of the activities, it is not possible to gather donor plants during the optimal spring-time window. Harvesting and live staking the stormwater retention area slopes is, therefore, recommended for the fall of 2015 (prior to the end of October).

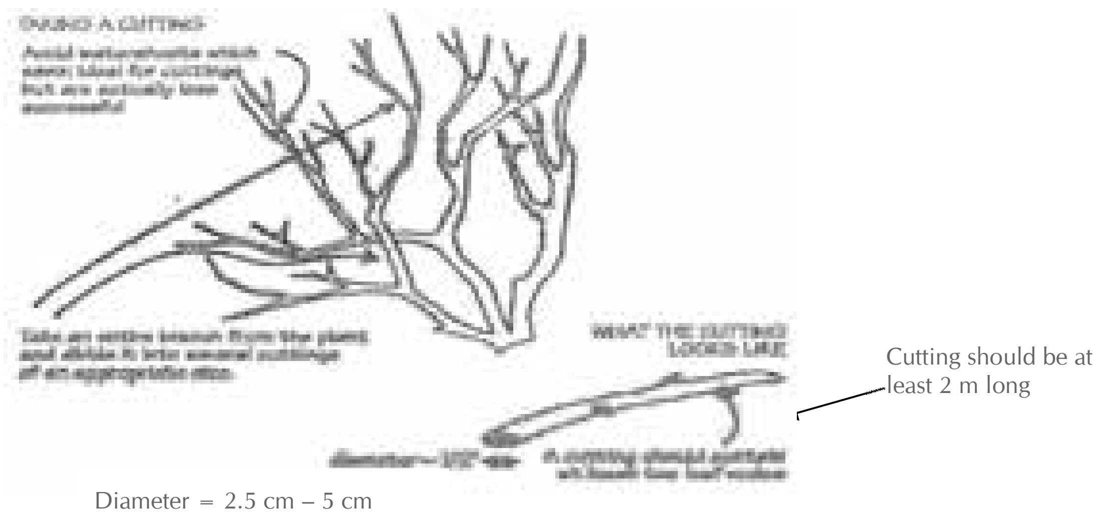

Figure 5. Procedure for taking live stake cuttings from donor plant. (Figure modified from Streamkeepers Handbook, 1995).

6.3.3.2 Sewer Line Trench

The following mix of species will be used to restore areas impacted by the sewer line trench: Indian plum, oceanspray, red huckleberry (*Vaccinium parvifolium),* black twinberry, common snowberry (*Symphoricarpos albus*) and Nootka rose (*Rosa nutkana*), planted approximately 1 m apart using one gallon pots. Douglas-fir and western redcedar will be interspersed throughout. Planting will occur during the early fall months (before the end of October 2015), prior to which the exposed footprint will be covered with mulch to prevent erosion and inhibit the growth of unwanted weedy species.

6.3.3.3 Survival of Vegetation in Restored Areas

Based on the current trend towards hotter, longer, drier summers, watering will likely be required (at least during the first summer). The specific frequency of watering would be weather-dependent, but watering will likely be required at least twice per week during hot, dry weather. Following the establishment of the planted vegetation, watering would likely not be required during the second summer. It should be noted, however, that even established vegetation appears to be showing signs of drought stress earlier in the season with each passing summer. Watering may be required, therefore, after the first summer, depending on weather conditions.

To help ensure that the vegetation survives, an inventory will be made at the time of planting, and each plant will be made readily identifiable by flagging tape. At the end of the first year after planting, a 90% survival threshold will be used as a measure of replanting success. Plants will be replaced, as necessary, to achieve the 90% survival threshold.

7 Environmental Monitoring

All activities will be monitored to ensure compliance to the mitigation measures detailed in this EMP. The key roles of the environmental monitor will be to monitor, recommend, and report on all aspects of the EMP. The responsibilities of the environmental monitor are listed here:

- liaison with regulatory government agencies as required, and communicating any events which contravene approvals and permits;
- delivering environmental awareness information to construction staff;
- providing technical assistance on environmental matters to construction staff and government habitat protection officers;
- documenting construction activities through field notes and photographs, particularly in sensitive areas;
- ensuring the proper use of spill kits in the event of a spill;
- ensuring that the replanting is carried out properly and that the specified survival threshold is achieved; and
- preparing reports to summarize the activities and actions taken.

The environmental monitor will act independently from construction management and will have the authority to suspend construction activities where impacts to biological resources could occur. This will prevent further environmental degradation until an appropriate solution can be established, and will minimize the potential for subsequent liability.

If you have any questions regarding the EMP or environmental monitoring of this project, please do not hesitate in contacting the undersigned.

Prepared by:

Trystan Willmott, B.Sc., A.Sc.T.

APPENDIX 1 - PHOTOS

Outflow of the subject watercourse on the northern side of the Cowichan Valley Trail. This existing crossing would remain in place, but an overflow culvert would be placed through the trail at a higher elevation than the existing culvert to serve as an overflow when the stormwater retention area is at maximum capacity.

Inflow of the subject stream culvert prior to going underneath the Cowichan Valley Trail.

Looking south-west over the moist depression proposed to be modified into a stormwater retention area (view is from the Cowichan Valley Trail).

Looking west along a poorly defined drainage with seepage at the base of the Cowichan valley Trail slope, which joins with the moist depression pictured above.

Typical channel characteristics of the subject stream at the proposed culvert and sewer line crossing location.

Looking north east over the dense Himalayan blackberry growth in the riparian zone beyond the immediate treed fringe along the left bank of the subject stream.

Dense reed canary grass growth typical along the course of the subject stream.

Looking west from the end of Keystone Drive (located to the east of the subject property), which is to be extended to provide access to the subject property. View is over the riparian vegetation adjacent to the stream along the proposed route of Keystone Drive. Note recently upgraded trail, which passes to the immediate east of the right bank of the subject stream – the trail will continue to connect to the Trans Canada Trail by means of a crossing over the extended Keystone Drive.