

# *BELLA COOLA to FOUR MILE TRAIL*

## **Trail Location & Engineering Design**



Project sponsored by  
Bella Coola General Hospital  
Central Coast Regional District &  
Union of BC Municipalities

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# TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
1.1	Layout & Survey Method	1
1.2	Trail Design Criteria	1
<b>2</b>	<b>TRAIL LAYOUT &amp; DESCRIPTION</b>	<b>1</b>
2.1	Cut and Fill	2
2.2	Partial Fill	2
2.3	Overland Fill	3
2.4	Flush Surfacing	3
2.5	Detailed Description	4
2.6	Tatsquan Creek Crossing Options	5
2.6.1	Option A - Hwy 20 Sidewalk	5
2.6.2	Option A2 – Widened Sidewalk on Hwy Bridge	5
2.6.3	Option B – Parallel Footbridge	6
2.6.4	Option C – Downstream Footbridge	7
<b>3</b>	<b>ENVIRONMENT</b>	<b>8</b>
3.1	Fish	8
3.2	Wildlife	8
<b>4</b>	<b>FIELD REVIEW</b>	<b>9</b>
<b>5</b>	<b>CONSTRUCTION</b>	<b>9</b>
5.1	Trail Components	11
5.1.1	Asphalt	11
5.1.2	Crush Gravel	11
5.1.3	Sub-grade Ballast	11
5.1.4	Foot Bridges	11
5.1.5	Culverts	11
5.1.6	Benches	12
5.1.7	Guards	12
5.1.8	Trail Posts	12
5.2	Next Engineering Steps	12
<b>6</b>	<b>TRAIL MAINTENANCE</b>	<b>12</b>

<b>APPENDIX A – AIRPHOTO MAP OF TRAIL</b>	<b>13</b>
<b>APPENDIX B – SURVEY MAP OF TRAIL</b>	<b>13</b>
<b>APPENDIX C – ENGINEERED PLAN, PROFILE &amp; CROSS SECTIONS</b>	<b>13</b>

### **Acknowledgement**

A number of individuals contributed time and knowledge to this initial stage of locating the proposed trail and Frontier Resource Management Ltd is very grateful for this help. Most importantly, appreciation is extended to Michel Bazille for spearheading the initiative. Thanks are also due to the following people for taking the time to field review the proposed trail location: Archie Pootlass, Frank Webber, Wally Webber, Brad Koroluk, Ken MacKenzie, and Leanna Ilnicki. Abel Hood assisted with the field layout, Ken MacIwain completed the engineering plans and Tom Barratt provided guidance based on experience with similar projects.

# 1 INTRODUCTION

This report summarizes the layout and design of the proposed walking/bicycle path between the Bella Coola town site and the 4 Mile residential area. The trail parallels Hwy 20 and has its end points at the Tatsquan Creek Bridge on the Bella Coola side and the intersection of Tonquin Road at 4 Mile. See the Airphoto Map in Appendix A and Survey Map in Appendix B.

## 1.1 *Layout & Survey Method*

The trail was located and surveyed during wet weather conditions in late October and November when the hydrological conditions were readily apparent and incorporated into the design. A nylon chain, compass (2° increments) and Suunto (% slope) were used to survey the trail route. Monarch Resource Consultants Ltd used Softree's ROADENG program to produce the engineered plans, profiles and cross sections. A Garmin 60CS GPS was used to record location of strategic points of reference and tie points. The trail was marked in orange glow flagging and survey stations were marked with blue/orange flagging and small wood posts marked with blue paint.

## 1.2 *Trail Design Criteria*

The design of the trail was based on the following criteria:

- Trail is to be 'multi-use' for foot, strollers, wheel chair and bicycle traffic
- Trail to be paved: 3-3.5 m wide and 75 mm thick
- Maximum slope is 8% but less than 5% preferred
- 2% trail surface curvature
- 150 mm of crush as base for pavement
- Minimum 0.6 m gravel shoulder (prefer 5 m total gravel base)
- Coarse gravel sub-grade, typically 375 mm deep
- Locate trail to maintain green space between trail and Hwy 20 wherever possible.
- Do not locate trail too far away from highway due to safety concerns regarding possible bear or cougar encounters. Maintain options for emergency access to the highway.

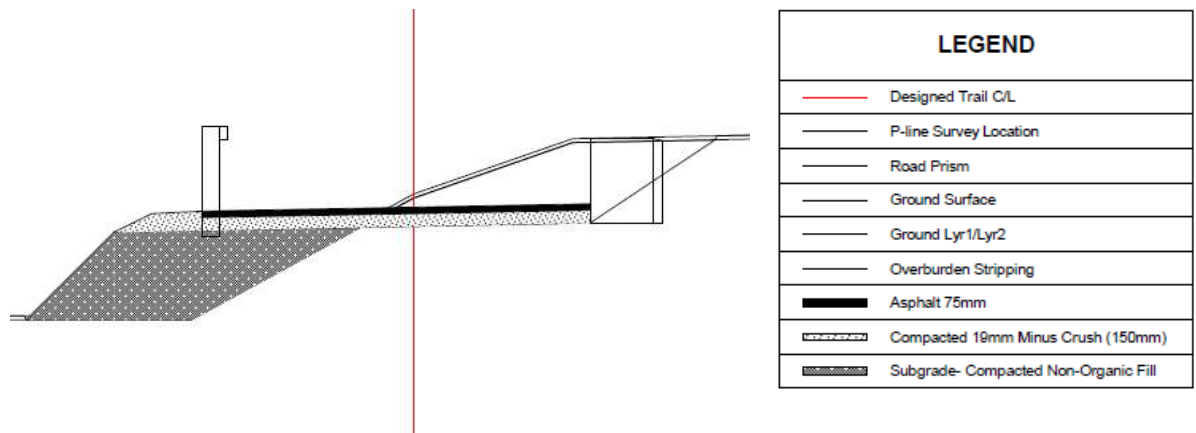
# 2 TRAIL LAYOUT & DESCRIPTION

The trail is situated on the Tatsquan Creek alluvial fan and the Bella Coola River floodplain. The main layout challenges were to locate a route through the

swampy areas associated with the floodplain and maintain slope gradient as low as possible on the Tatsquan fan and where the trail links with the highway shoulder. The fan and highway shoulder are comprised of sand/gravel/cobble material while the floodplain is primarily silt. Given the relatively flat slope, terrain stability is not an issue. Trail construction is classified into four general types: cut & fill, grade fill, overland fill and flush surface.

### 2.1 Cut and Fill

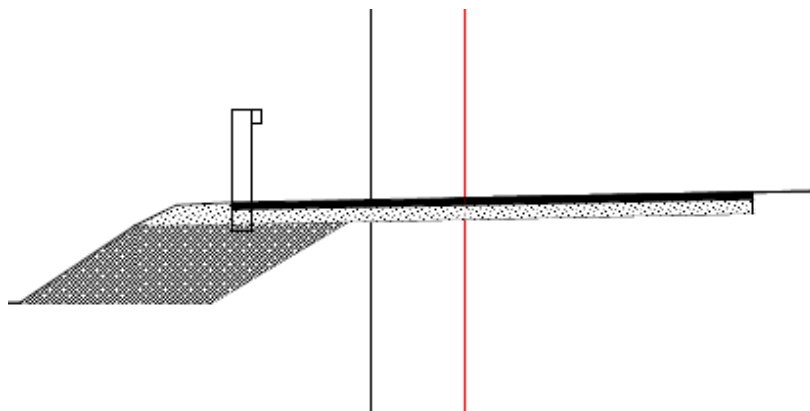
A Cut and fill construction technique is primarily required on stretches where the trail is situated mid-slope along the highway shoulder. In most locations, a retaining wall is proposed to maintain up-slope shoulder stability.



In some locations, a guard rail will be required on the low side and a vehicle barrier may be required on the high side.

### 2.2 Partial Fill

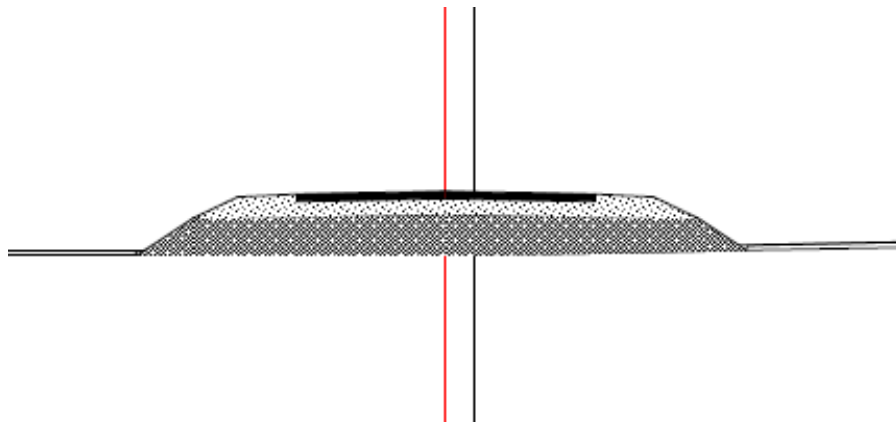
Partial fill technique is primarily required where the trail runs on the highway shoulder, but in order to provide separation from the highway and maintain trail width, it is necessary to fill the outer part of the trail prism.



In most locations, a guard rail will be required on the low side and a vehicle barrier may be required on the high side.

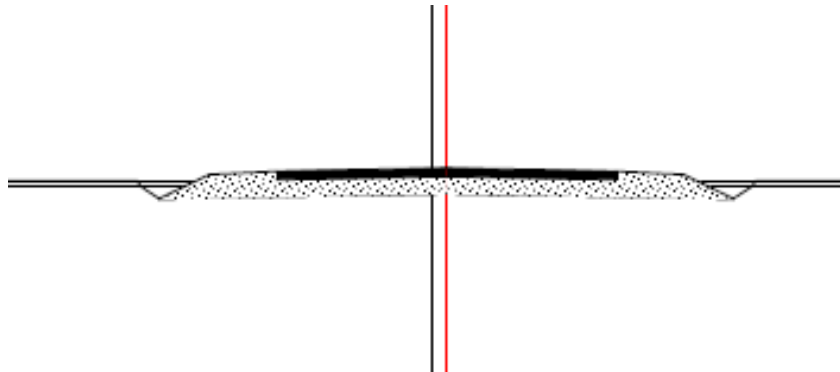
### **2.3 Overland Fill**

Overland fill is the most common construction technique as much of the trail is situated on silty, wet soils. On these stretches, the trail is elevated so that the surface will likely be 60 cm above the natural ground level. By elevating the trail, it will remain free of water during times when the water table is high. To reduce potential settling of these softer soils, geotextiles can be layed down as a base for the sub-grade ballast.



### **2.4 Flush Surfacing**

Flush surfacing is used where minimal sub-grade ballast is required and trail surface is nearly even with natural ground level. This is the least common construction type.



## 2.5 Detailed Description

Table 1 provides a brief description of the site conditions and construction technique to be applied between layout stations.

Table 1 – Detailed Trail Description

Station	Distance m	Description
AH0-AH3	110	Trail starts at north east side of Tatsquan bridge, parallels highway, descending at 5% to switchback. Cut and fill construction needed to angle trail away from highway down to old road. Retaining wall and guard rails. Switchback and curve also provides variety.
AH3-AH6	57	Trail follows old road grade. Firm subsurface soil, so anticipate minimal settling. Primarily flush surface/partial fill construction. Opportunity for interpretive sign at Ulkatcho camp. Alternative options for crossing Tatsquan creek tie in at AH3 and AH4. Forest cover consists of large spruce and hemlock.
AH6-AH11	91	Trail pushed towards highway due to Tatsquan creek cutbank. No green-space between hwy and trail from station AH9 to AH11. Forest cover consists of second growth conifers.
AH11-AH19	162	Trail winds through mixed second growth forest including alder patches. Trail crosses ATV trail between AH17 & AH18. Sub-surface soil consists of coarse rubble from Tatsquan creek fan. Mixed age forest.
AH19-AH24	98	Sub-surface soil changes to silt matrix thus requiring more sub-grade ballasting material.
AH24-AH25	46	Trail on edge of hwy shoulder. Fill dry 'ditch' with material from berm north of road.
AH25-AH38	326	Floodplain flats. Overland fill construction. Thick brush with intermittent large Sitka spruce.
AH38-AH54	317	Floodplain brush flats. Deep overland fill construction. Series of small wet depression require culverting to maintain drainage. Trail access to hwy possible at a number of places along this stretch.
AH54-AH61	126	Floodplain brush flats with wet swamp between trail and hwy. Scattered large trees amongst brush. Deep overland fill construction.
AH61-AH62	11	11 m long footbridge spanning swamp wetland.
AH62-AH65	128	Trail located along hwy shoulder below telephone/power poles. Cut and fill construction with retaining wall and guard rail. Nice view of wetland. Trail by the hwy due to wetlands.
AH65-AH70	182	Trail on hwy shoulder above telephone/powerpoles. Minor work needed to move powerpole guywire. Short footbridges needed to span hwy culvert outflows. Partial fill construction. Trail by the highway due to wetlands.
AH70-AH78	183	Trail leaves hwy and goes through young alder stand that regenerated over the old garbage dump. Site has recovered well and only very minor work needed to clean up evidence of old dump site. Thin overland fill construction.
AH78-AH81	222	Trail on hwy shoulder above telephone/power poles. Partial fill construction. Require guard rails both sides. Nice view of wetland.
AH81-AH94	262	Trail traverses through brush flats and lush, mature timber stand.

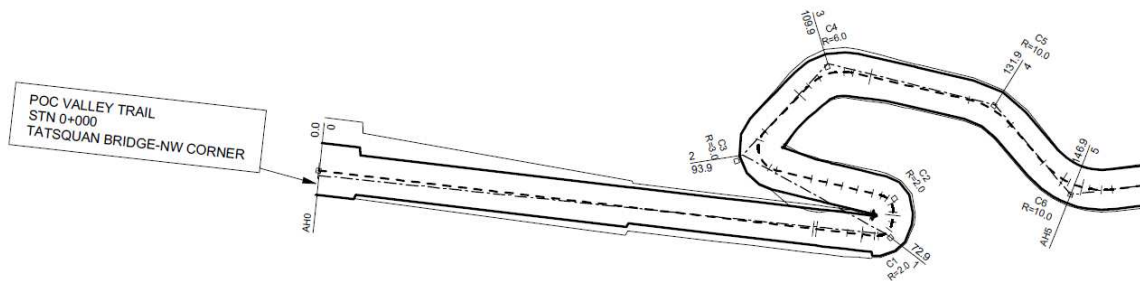
Station	Distance m	Description
		Brush flats require deep overland fill construction. Crosses ATV access trail. Good location for rest bench.
AH94-AH98	253	Trail on hwy shoulder above telephone/power poles. Partial fill construction with guard rail and vehicle guard. Trail along hwy to maintain flat grade (adjacent forest land is significantly lower) and to avoid stream overflow complex.
AH98-AH123	504	Trail meanders through dense mature forest and crosses a series of streams, including a coho spawning stream. Good location for rest bench and interpretive sign. Trail enters hwy across from Tonquin Road. Mostly overland fill with some partial fill.

## 2.6 Tatsquan Creek Crossing Options

The trail has been located to tie in with the sidewalk at the northeast corner of the Tatsquan Creek Hwy bridge. In addition, three alternative crossings Tatsquan Creek are presented, each requiring a long footbridge. These crossing options would be quite expensive, but a separate bridge would also be an enticing 'gateway' attraction to use the trail.

### 2.6.1 Option A - Hwy 20 Sidewalk

This is the original option that ties into the sidewalk on the Tatsquan bridge. The sidewalk on the bridge is only about 1.5 m wide, so there would be an abrupt transition from trail to sidewalk. This could be ameliorated by gradually narrowing the trail as it approaches the bridge.



### 2.6.2 Option A2 – Widened Sidewalk on Hwy Bridge

This option is a slight variation to the bridge sidewalk option whereby the sidewalk is widened. The bridge abutments are significantly wider than the existing bridge (see photo 1) and there appears to be room to widen the sidewalk by extending out from the existing structure or adding a stringer to support foot traffic.

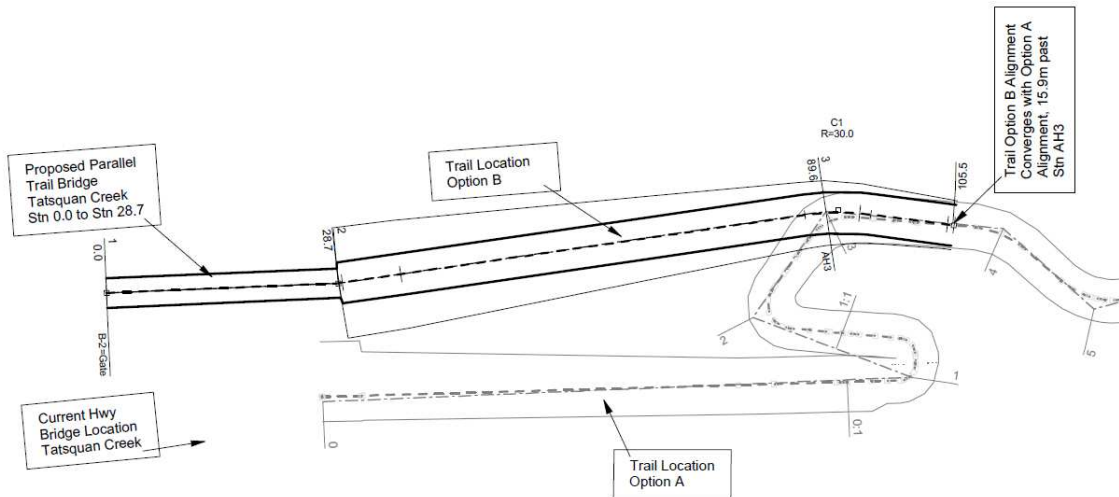
Photo 1 – Note that the cement abutments extend beyond the bridge, thus creating possibility of widening the sidewalk.



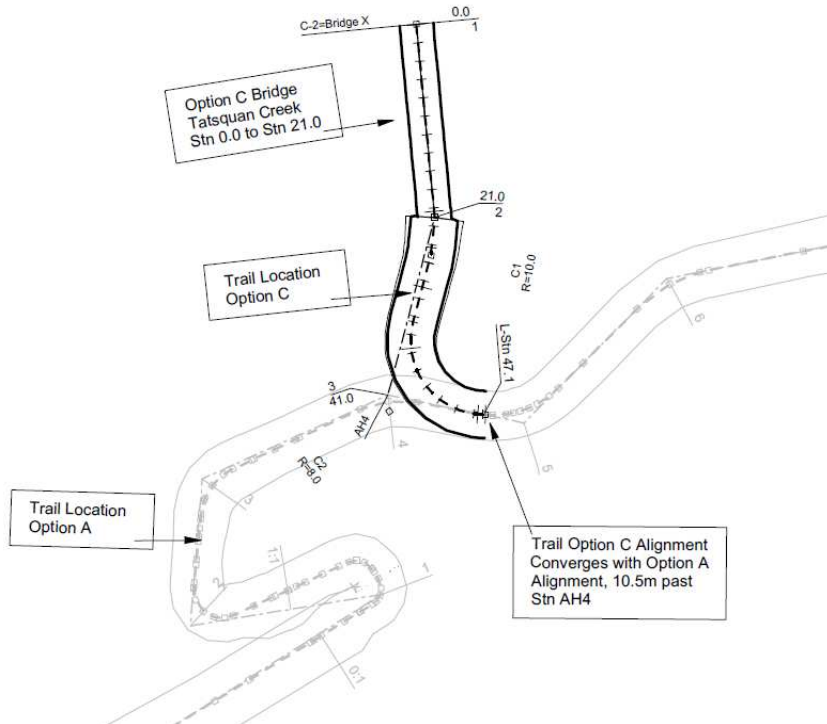
### **2.6.3 Option B – Parallel Footbridge**

Under this option, a separate foot bridge would be built approximately 15 m downstream from the highway bridge (left edge on photo 1). The vision is to build a bridge similar in style to the long-gone Bella Coola River bridge as this would be an interesting heritage attraction.

A 29 m span would be required to cross the creek and due to the height of the bridge, a long ramp or fill slope would be required in order to not exceed a 5% grade. Another challenge with this option is that this site is used for machine access to the creek, should there need to be any future bedload removal under the highway bridge.



### 2.6.4 Option C – Downstream Footbridge



### **3 ENVIRONMENT**

The proposed trail traverses a series of dynamic ecosystems that provide a varied and pleasant walking experience while also providing interesting educational opportunities. The Bella Coola Valley is situated in the dry sub-maritime variant of the Coastal Western Hemlock biogeoclimatic zone and the trail itself is situated on a combination of high and medium bench floodplain sites comprised of Sitka spruce–Salmonberry and Cottonwood-Red-osier dogwood site series. In addition, the trail skirts alongside a number of wetlands including marshes and forested swamps. Tree cover ranges from immature alder groves to second growth hemlock and Sitka spruce stands to pockets of old growth Sitka spruce and hemlock. There are also stretches of dense, open grown Salmonberry, interspersed with impressive old Sitka spruce individuals.

#### **3.1 Fish**

Given the close proximity to the Bella Coola River, all of the streams are assumed to be fish bearing at certain times of the year, primarily as salmon fry rearing habitat. However, stream at station AH 110 is a productive coho spawning stream. All stream crossings will be designed to maintain and protect the fishery values.

The marsh complexes are also assumed to contain fish, particularly during flood conditions. However, it is not believed that habitat quality in the marshes near the trail is very good and it is proposed that the edges of these marshes, running next to the trail (stations AH61 to AH65 and AH79-AH80) be filled-in with ~1-3 m of clean gravel/cobble ballast to support the trail shoulder.

#### **3.2 Wildlife**

Wildlife viewing is another attraction of the trail. The ecology surrounding the trail is very productive and all types of coastal wildlife can be expected to utilize the area. Numerous bird species were seen during the layout, including bald eagles, dippers, wrens, woodpeckers and various water fowl. Squirrels were also very active. Otter footprints were also observed along the shore of the oxbow pond (pond is not on the proposed trail but accessible from it).

The potential for bear (grizzly and black) or cougar encounters is of concern and therefore the trail has been located near Hwy 20, as it is anticipated that these large animals will tend to stay away from the busy roadway. By maintaining close proximity to the hwy, there are also ample opportunities to leave the trail and reach the road in emergency situations.

## 4 FIELD REVIEW

Following the initial layout, a number of field trips were conducted with Nuxalk Nation representatives and government agencies in order to receive input on trail location and construction issues. These field trips entailed a guided review of the ribboned trail location as could be seen from Hwy 20. All of the participants were pleased with the trail location and were very much in favour of its construction as any detrimental effects were seen as minor in relation to the many benefits. However, this does not constitute approval by the various organizations and agencies. Formal proposals will need to be submitted although it may be possible to get 'support in principle' to help with fundraising.

Field tours have been conducted with the following people:

- **BC Hydro** – Ken MacKenzie
- **Nuxalk Nation, Fisheries** – Wally Webber.
- **Ministry of Transportation & Highways** – Leanna Ilnicki
- **Department of Fisheries & Oceans** – Brad Koroluk
- **Nuxalk Nation, Capital Works** – Archie Pootlass, Frank Webber
- **Bella Coola General Hospital** – Michelle Bazille.

## 5 CONSTRUCTION

Construction of the envisioned trail will be a major undertaking. The estimated amounts of sub-grade ballast, rock crush and asphalt that will be required to build the trail are summarized in table 2.

The trail has been located to minimize tree cutting, so only minor right-of-way falling will be required. A small excavator (100 size range) is recommended to do the main trail clearing, followed by dump trucks depositing sub-grade which would then be leveled using a small size bulldozer. Dump trucks would deliver crush gravel which would require leveling and compaction in preparation for the final asphalt surfacing.

During construction, a number of temporary highway access points will be used by the dump trucks to deliver the base material and surfacing in the most efficient manner.

Table 2 Trail Specifications and Estimated Material Requirements

Item	Units
<b>Trail length</b>	3,133 M
<b>Asphalt</b> – surface width	3.0 m
- thickness	75 mm

- volume of material - truck loads <sup>1</sup>	861 m <sup>3</sup> 144
<b>Crush gravel</b> ( 19 mm minus) - width - Thickness - volume of material - truck loads	4.2 m 150 mm 2665 m <sup>3</sup> 444
<b>Sub-grade ballast</b> – thickness - volume of material (net cut/fill) - truck loads	Variable 8,487 m <sup>3</sup> 1,415
<b>Foot bridges</b> – Stn AH 61 - Stn AH 70 - Stn AH 91 - Stn AH 101 - Stn AH 105 - Stn AH 110	11 m 3 m 3 m 10 m 5 m 4 m
<b>Culverts</b> – 800 mm diameter, 7 m long - 600 mm diameter, 7 m long - 500 mm, 7 m long - 500 mm, 8 m long - 200 mm, 7 m long	2 1 3 1 5
<b>Rest Benches</b> -	5
<b>Guards</b> – Pedestrian Rail Guards AH0-AH1 AH62-AH65 AH78-81 AH94-98  - Vehicular Traffic Guards AH0-AH1 AH62-AH70 AH78-AH81 AH94-AH98	70 m 128 m 222 m 253 m  50 m 310 m 222 m 253 m
<b>Trail Posts</b> – Start/finish, ATV access trail crossings, hwy access points.	8-12

<sup>1</sup> Assuming 6 m<sup>3</sup> per truck load

## **5.1 Trail Components**

### **5.1.1 Asphalt**

There is no local source of asphalt and so this material and application equipment would have to be brought in to the valley specifically for this purpose. From time to time, there are other paving projects in the valley and ideally this project would 'piggy-back' on other jobs to minimize cost.

### **5.1.2 Crush Gravel**

There is a local crush gravel producer (Don Nygaard and Son Ltd) and their pit is located next to the Thorsen Creek garbage dump which is in relatively close proximity to the trail site. The estimated turnaround travel time for a dump truck from the pit to the trail is 10-15 minutes.

### **5.1.3 Sub-grade Ballast**

Sub-grade ballast, comprised of sand/gravel/cobble mix, can be sourced from the following gravel pits – Nuxalk 4 Mile Reserve, Thorsen garbage dump and Nygaard's pit mentioned above. The turnaround time from each of these pits is similar (10-15 min), although the Nuxalk pit is closest.

Another potential source of sub-grade ballast material is to utilize the bed load material that is removed from to time from Thorsen and Snootli Creeks in order to protect the highway bridges over these creeks. This would be the ideal option as it is often a challenge to find a suitable spoil site location for this material. It would also save on costs in terms of loading and delivery. Coordinating the two projects would be a challenge, however.

### **5.1.4 Foot Bridges**

A total of 6 foot bridges are recommended ranging in size from 3 m to 11 m. These foot bridges would require engineering design in order to hold a pick-up maintenance vehicle. The smaller 3 m bridges are for spanning existing Hwy 20 culverts, as opposed to extending the culvert and using fill material to support the trail.

### **5.1.5 Culverts**

A total of twelve (12) culverts are recommended ranging in size from 200 mm to 800 mm diameter. These could be corrugated metal or plastic. The smaller culverts are primarily to enable slow moving surface water to drain during wet periods while the larger culverts are for seepages and wet depressions.

### **5.1.6 Benches**

A total of five rest benches are proposed and recommended locations have been chosen for their aesthetic appeal and spacing between rest stops. For one of these benches, a piling supported platform extending out over the swamp is proposed. Interpretive signs could also be installed by these benches.

### **5.1.7 Guards**

#### **Pedestrian Rail Guards**

Approximately 673 m of pedestrian guard rails are recommended for stretches where the trail shoulder slopes steeply off the edge.

#### **Vehicle Guards**

Approximately 835 m of vehicle guard rails are proposed for stretches where the trail runs along the highway edge. Design in accordance with Ministry of Transportation & Highways requirements.

### **5.1.8 Trail Posts**

Trail posts are used to block ATV or vehicles from entering the trail. The trail crosses three existing ATV trails and the posts would be installed at these locations while still allowing ATV's to cross the paved trail. It would also be necessary to place logs or other obstacles to block ATV's from going around the posts and enter the paved trail. Additional posts may be required at hwy access points.

## **5.2 Next Engineering Steps**

There are a number of elements that require more detailed design and/or engineering prior to construction. These are:

- 6 Foot bridges – capable of handling a pick-up truck for maintenance work.
- Tatsquan Creek crossing
- One rest bench platform supported by pilings (in vicinity of stn AH64)
- Retaining walls
- Pedestrian and vehicular guard rails.
- Flashing cross walk light over Hwy 20 at Tonquin Road.

## **6 TRAIL MAINTENANCE**

It is one thing to construct the trail and another to maintain it. So, construction plans also need to incorporate the long term maintenance strategy and who will be responsible to make sure it gets done. The trail has been designed so that

ATV's or small pick-up trucks can access the length of it. Anticipated yearly maintenance activities include:

- Debris removal – branches, wind-throw and litter fall will require removal on an ongoing basis.
- Brushing – brush encroachment will be a constant issue and will require cutting back on a yearly basis, some sections may require more than one treatment per year.
- Snow removal – ATV and pick-up mounted plows can be expected to handle the brunt of required snow plowing, the main challenge will likely be snow deposition on some sections of the trail resulting from snow removal off highway 20.

## **Appendix A – Airphoto Map of Trail**

## **Appendix B – Survey Map of Trail**

## **Appendix C – Engineered Plan, Profile & Cross Sections**

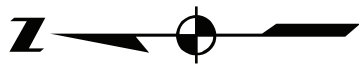
# Appendix A - Bella Coola - 4 Mile Trail Airphoto Map



## Legend

- Designed Trail
- Option B Crossing
- Option C Crossing
- - - ATV Trail
- Rivers & Creeks
- == Roads

Trail length:  
3,133 m



1:7,000

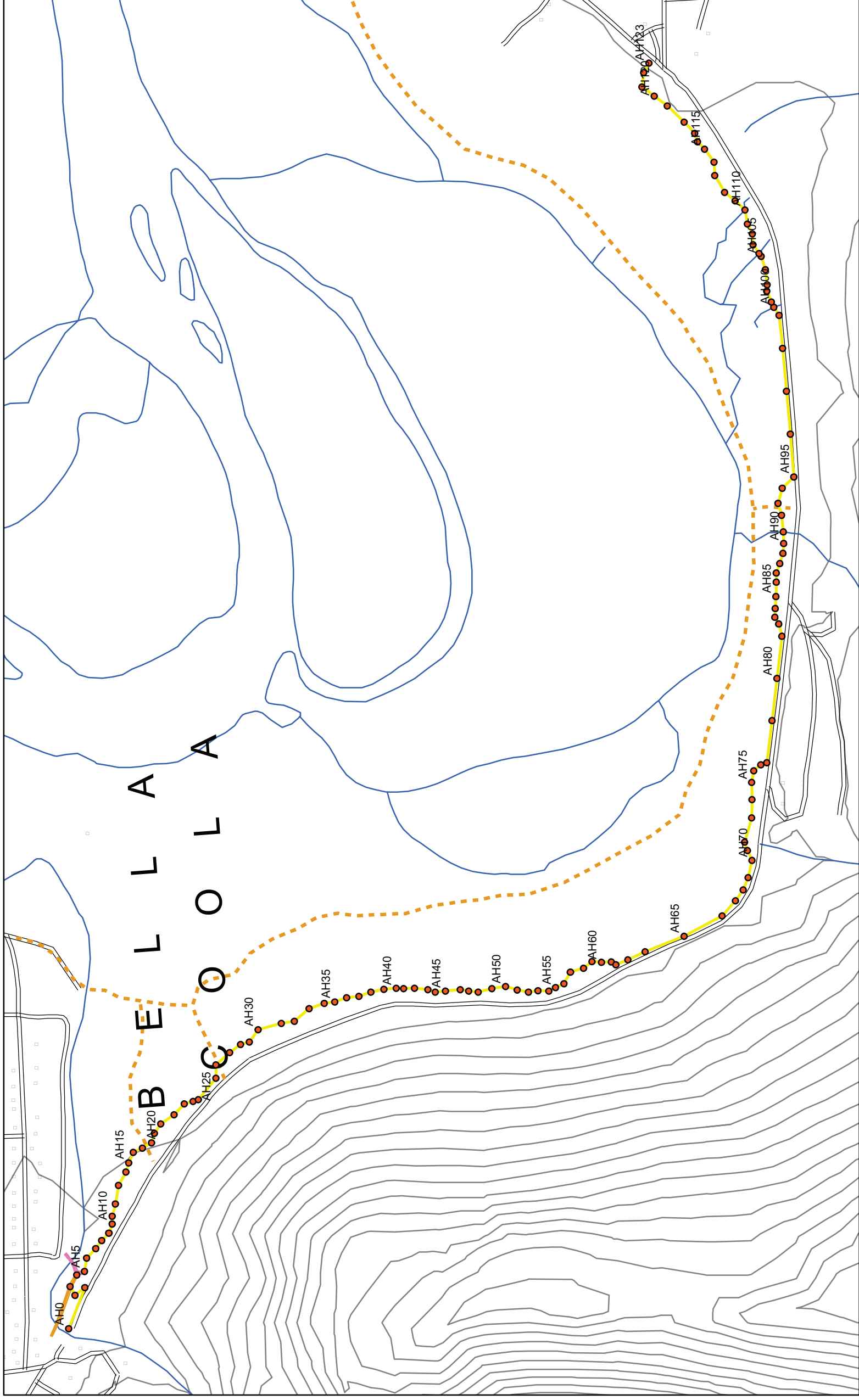
Base Map: 93D 037



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December 10, 2009

# Appendix B - Bella Coola - 4 Mile Trail Survey Station Map



## Legend

- BC-4Mile Trail
- Option B Crossing
- Option C Crossing
- Survey stations
- - - ATV Trail
- Rivers & Creeks
- = Roads
- 20 m contour

Trail length:  
3,133 m



1:7,000

Base Map: 93D 037



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