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ENGINEERING REVIEW AND TIMBER DEVELOPMENT POTENTIAL FOR THE THE CASTLEGAR TO CHRISTINA LAKE CPR RAILLINE

MINISTRY OF FORESTS , NELSON REGIONAL OFFICE

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D.J. Grant Engineering Ltd

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APPENDICES

1.0 EXECUTIVE SUMMARY

An engineering and timber development review of the area developed by the Canadian Pacific Railway's (CPR's) abandoned Castlegar to Christina Lake line was undertaken in the fall of 1999. The objective was to establish if the 72 kilometers of existing rail bed and structures were structurally sound and could be economically converted to a multi-use transportation corridor, or whether it would be more logical to extend the existing forest road network to access this area.

The engineering review indicated that all major structures seem in adequate condition for industrial traffic. However, it is mandatory that an in depth engineering review of the bridges, tunnels, masonry culverts and retaining walls be completed by qualified professionals, prior to commencing use of the route. The detailed review is required to ensure that there are no serious structural concerns, which were beyond the scope of this review.

The timber development review of the route indicated that, after completing the required upgrading, (at a cost of $925,000), the rail bed is the most economic access alternative for the first 25 years (first pass). This route provides $257,000 worth of net direct benefits, after all costs are considered, and develops over 30,000 m^3 in additional first pass timber volume.

In the longer term (approximately 40 years), structures will start to deteriorate and significant liabilities will become apparent. A decision as to what to do with the deteriorating infrastructure will have to be made at that time. Complete deactivation of old bridges and large fills could cost in excess of $2,000,000 (see appendix 3). New replacements of these structures would cost in excess of $10,000,000. Another option is the construction of bypass roads around the large fills, bridges, and tunnels. This would cost in excess of $1,000,000 (see Appendix 4) and would still require the deactivation of the large structures and replacement of retaining walls at a later date.

The cost of total deactivation (in year 40) has been priced into the cost/benefit analysis and even with this included, using the rail grade still shows the benefit to the Crown mentioned above. However, if any of the deactivation work has to be done sooner (10 - 20 years), because the structures deteriorate more quickly than anticipated or because there is a catastrophic failure, then these costs would seriously affect the benefit of using the rail grade alternative.

An alternative to overall deactivation or reconstruction, would be to allow these structures to deteriorate gradually and close sections of the rail line to industrial or public use as they became unsafe. This carries with it the risk of catastrophic failures on both the large bridges and large fills, but this risk could be minimized by setting up a regular inspection schedule for the structures. This option would still require the expenditure of over $2,000,000 in capital, but it would be spread out over a longer time period, as each structure reached the end of its life.

Based on economics alone, it is marginally in the interest of the Province to take over the rail line. If the line is taken over, two options exist for the administration of the rail corridor. One is for the Ministry of Forests to administer the rail line and supervise use by logging companies and other users. The other is for the Ministry of Lands to administer the rail line and allow the Ministry of Forests and Forest Licensees to use the rail line, for hauling logs.

Administration by either government agency would be feasible. If timber extraction is not going to pay for rail bed maintenance, it will require a immediate commitment of $100,000, to maintain the rail bed to a safe trail standard, otherwise significant failures could occur.

2.0 SITE DESCRIPTION

2.1 EXISTING CPR RAILWAY ACCESS

The section of rail line examined for the study starts 7.5 km west of Castlegar, just past the Hugh Keenleyside dam. The route continues for approximately 30 km along the west shore of the Arrow Lakes, before turning west and climbing up the Dog Creek Valley. It then crosses through the height of land at Farron and descends down McCrae creek into Christina Lake. The Castlegar to Christina Lake route is approximately 72 km long and has 4 bridges, 5 tunnels and 28 stone and concrete retaining walls of various shapes and sizes along its length. There are also 25 major fills, ranging from 5 m to 50 m in depth. Some of these are culverted and others have had their drainage patterns altered by the use of flumes. As these structures were constructed between 1898 - 1925, and have not been maintained for 10- 20 years, the vast majority of them are showing signs of minor disrepair. The road grade has adequate width to handle two way logging traffic, as long as, turnout construction and road widening at corners is undertaken.

Slope stability issues are a concern for this road. There are 8 existing slope failures ranging from a significant debris flow at km 5.7 to a partially failed 12m deep fill at km 61.6. These failures indicate a level of risk on the route, which can only be controlled with a high level of maintenance and a constant monitoring of existing structures. If a comprehensive maintenance plan is not developed and implemented, this rail corridor will gradually deteriorate and become unusable.

The estimated cost to upgrade the rail grade to a safe forest road standard is $924,903. It should also be noted that to construct a similar route, with all of its bridges, tunnels, retaining walls and fills would cost over $25,000,000 in today's dollars, and as such this route has significant importance. It could never be reconstructed for the value of the resources it presently develops.

2.2 EXISTING FOREST ROAD NETWORK

The Shields and Bulldog Forest Service roads and Pope & Talbot's, Walker and Dog creek roads will be the prime access routes in the Arrow Forest District. Secondary access will be gained using the Gem Hill, North Ridge and Moberly creek roads.

The use of the Walker creek road and the Paulson Bypass and the Lafferty gravel pit public road will allow minor access in the Boundary District, but the majority of the access will require new construction. The total cost of construction is $870,691, but this is spread out over 25 years

The use of existing road systems will result in adverse haul in the Shields and Pup creek drainages, with the remainder of the drainages having mostly favorable hauls. Haul times in the lower reaches of the Shields and Pup creek drainages will be double that of using the rail grade was used.

There are several areas along the rail corridor, which cannot be accessed by existing roads or extensions of these roads. These areas are km 0.0 – 10.2, km 12.7 – 22.0, km 51.5 - 57.9 and km 62.6 – 71.4. These areas contain approximately 205,000 cubic meters of timber volume. Road access was not considered feasible in these areas because of steep terrain, extensive rock and in some cases private property. The areas from 0.0 - 10.2 km and 12.7 - 22.0 km cannot be accessed by other means (helicopter logging is not deemed feasible for these sections, because

of low timber volumes and the lack of a landings to sort and bundle timber on). Dumping in the lake was not considered feasible, because of losses due to sinkers and lack of facilities to handle unbundled and unsorted wood at the Pope and Talbot's mill. This would result in the loss of a total volume of 123,000 cubic meters. The volume of isolated timber in the McCrae creek and Christina Lake area (82,000 cubic meters), could be helicopter logged if there are no problems with the noise pollution, and an adequately sized landing can be developed on Crown or private land .

3.0 METHODOLOGY

The development corridor was reviewed both in the office and in the field to assess the benefits and liabilities involved in using the abandoned Castlegar to Christina Lake CPR line for a transportation corridor.

The benefits and liabilities of using the CPR rail line were compared against the opportunity of gaining access off of the existing forest road network in the area. For the purposes of this study costs and benefits were compared for the first 25 years only (The present worth of all costs were evaluated at a 6 % rate of return).

The office overview entailed reviewing the following materials; 1:20,000 scale TRIM mapping, 1:20,000 scale Forest Cover mapping, Air photos, Forest Development Plans and the Heritage Inventory - Rail to Trail Conversion - CPR's Castlegar to Midway Line.

All areas and volumes were obtained by from digitized 1:20000 Forest Cover Maps.

All distances on the rail line traverse were based on odometer readings from the field review vehicle (Kawasaki 400 - 4 x 4 ATV). These mileages did not overlay exactly on Trim and Forest Cover maps (approximately 2 - 3 % error), therefore features were located where shown on the maps (tunnels, bridges, creeks) and kilometers distances adjusted in between . This will mean kilometer distances shown on the maps and referred to in the report map are not the same as would be calculated by scaling off the map directly.

The field review was conducted over 2 days, November 30 and December 1,1999. Where possible fills, bridges, tunnels and retaining walls were visually examined for competency. Detailed engineering examinations were not undertaken (i.e. structural bridge inspections, site surveys of retaining walls to establish the extent of movement, or full structural review of masonry culverts in large fills- footing scour, settlement etc.). These detailed inspections will have to be undertaken, if the rail line is to be used as a transportation corridor.

Following the completion of the field review. The study area was broken into 5 sections
Section 1 - km 0.0 - km 10.2 - Hugh Keenlyside Dam to ridge on the east side of Shields Creek
Section 2 - km 10.2 - km 29.2 - Shields creek to and including the Bulldog Tunnel
Section 3 - km 29.2 - km 49.3 - Bulldog Tunnel to Walker creek
Section 4 - km 49.3 - km 71.4 - Walker Creek to Christina Lake
Section 5 - Upper Shields and Moberly creek drainages. Improved access via rail line.

Road costs were estimated using the following information from the Arrow Forest District. Easy road construction (minimal rock , slopes <50%) - estimated cost $25,000/km. Moderate road construction (moderate rock, slopes <60 %) - estimated cost $40,000/km.

Bridge costs were estimated at $3,500/ m installed. Logging costs were based on appraisal averages for the following systems. Helicopter logging - $66/$m^3$, Cable logging - $40/$m^3$, and Skidder logging - $25/ m^3. Hauling costs were based on all timber being appraised to Pope & Talbot mills in either Castlegar or Grand Forks with a $80 /hr truck rental rate and a 33 cubic meter load. Bonus bids on timber were based on $20/$m^3$ average (Arrow District).

Upgrading cost of the existing railline includes costs for bridge redecking and curb and handrail installation. This has been costed for materials; lumber at $1000/mfbm for large timbers (4 x10 and 10 x12) including hardware (nails, bolts etc) and $70/lineal meter for handrails. Initial deck, curb and handrail installation (labour and equipment only) has been costed at $246/lineal meter ($75/ft). Removal and replacement (labour and equipment only) of the deck and curbs in year 12 has been costed out at $410/lineal meter ($125/ft). Removal and replacement of crossties, deck and curbs in yr 24, has been costed out at $820/lineal meter ($250/ft).

A cost of $3,000 /km is estimated for turnout construction (2 per km) and double laning of blind corners. A cost of $200/km/yr was included to cover grading and minor maintenance works required on the rail bed annually. When the road is to be used for industrial haul, grading was increased to three times per year or $600/km.

The cost of concrete guardrails on all of the large retaining walls has also been included. Installed cost is approximately $100/m or about $10,000/ 100 m long retaining wall.

Extending and upgrading the existing road network will require the construction, maintenance and deactivation of the road systems used. Maintenance costs were set at $600/km during periods of active use and a one time charge of $750/km was included to cover off deactivation of the road systems after use. No further long term maintenance charges were included.

Timber harvesting along the rail bed was based on an estimate of 25 % removal over a 25 year period. A road construction and harvesting schedule for both alternatives has been shown in Appendix 2. **This has been completed to help estimate harvesting and haul costs only, and is not a true representation of the proposed harvesting patterns by any of the licensees in the area.**

Timber harvested in the Shields creek area is considered to already be at the 15 % level, therefore only 10% of the total volume of 785,000 cubic meters is considered available for harvesting on the first pass.

4.0 DISCUSSION -DEVELOPMENT USING NEW AND EXISTING LOGGING ROAD ACCESS

4.1 Section 1 - Km 0.0 to km 10.2 - Hugh Keenleyside Dam - Shields Creek

There is no existing access to the first 10.2 km of timber in the 500 m to 1200 m elevation other than the rail line. New road access to this section is not feasible because of the extensive rock and marginal timber values. The present expectation is that all available timber will be helicopter

logged and dropped into Arrow Lake, for booming and transportation to Castlegar. Discussions with Pope & Talbot staff over the logistics of this method, indicate that it may not be feasible. There are extra costs of bucking and limbing in the bush. There are no landings or sort facilities, meaning all timber would enter the lake unbundled and unsorted. This could result in a significant loss of timber to sinkage. As well Pope & Talbot Ltd, Castlegar Division, at this time are not set up to handle unsorted wood on the lake. This would make the unsorted timber unattractive, as purchase wood to the company.

At this point, all timber tributary to the lake (58,202 m^3) has been deemed inaccessible by this route.

Timber from km 0.0 to km 10.2 above the 1200 m elevation is presently accessed by the Gem Hill road and the North Ridge Road and this timber will be developed by these road systems, even if the rail grade becomes a multi-use access corridor.

4.2. Section 2 - Km 10.2 - km 29.2 - Shields creek to and including the Bulldog Tunnel

4.2.1 - Km 10.2 to Km 12.7 - Shields Creek drainage

Timber from km 10.2 to km 12.7 can be developed off of existing access at Shields and Moberly Creek . The Shields creek road can be extended to lake elevation if required and the Moberly creek road (a spur road of the Shields creek road) can be extended to harvest all timber down to the 700 m elevation. Approximately 3.0 km of $25,000/km road and a 10 m ($35,000) bridge are required to parallel the existing tracks and provide equivalent access to this area of timber. Estimated construction cost of the road and bridge is approximately $110,000.

In addition to the construction of the parallel road system, there is the problem of adverse haul affecting the season of harvest for this area using the Shields creek road. This road climbs adverse over a 1550 m elevation pass and back to the highway. This will limit winter hauling of timber in areas where winter harvesting is a requirement of the Silviculture Plan. Haul distances are significantly longer using this route. One way haul distance to Castlegar is 44 km versus 11 km on the rail grade.

4.2.2 - Km 12.7 to Km 22.0 - Lake Face area from Shields creek to Pup creek

Timber can only be developed from the rail grade. Alternate access is not feasible because of extensive rock and steep draws. All timber in this section would have to be helicoptered to the lake, if harvesting was to be undertaken without access to the rail grade. The same difficulties with regards to helicopter logging to the lake exist here, as they did on section 1.

Timber volumes (64,871 m^3) in this section are deemed inaccessible for this route.

4.2.3 - Km 22.0 - Km 29.2. - Pup Creek and Brooklyn creek drainages

Timber can be developed off the existing and proposed extension to the Bulldog/Brooklyn road. The Ministry of Forests is presently developing this road system under the Small Business Program. The construction of a 7 km road parallel to the railgrade, as well as, permission to cross the tracks in several locations would be required in order for this development to work. Road construction costs of approximately $280,000 would be required to parallel the existing rail

network. Constraints for visuals and construction impacts on the rail corridor will also have to be considered in the location of the new road which may increase the costs of constructing a parallel road system

Timber harvesting in this area would be restricted because all of the timber would have to be hauled up over a 1700 m elevation pass and back to the highway on the Bulldog road. This will limit winter hauling of timber in areas where this is a requirement of the Silviculture Plan. Haul distances are significantly longer using this route. One way haul distance to Castlegar is 75 km versus 25 km on the rail grade.

4.3 Section 3 - km 29.2 - km 49.3 - Bulldog Tunnel to Walker Creek

4.3.1 Km 29.2 - 40.8 - Bulldog tunnel to Dog/Walker road

Timber in this section can be developed off an extension to the Dog/Walker creek road. Pope and Talbot has developed a road system from the Paulson bypass public road at km 47.4 which parallels the rail grade to km 40.8. This road system can be extended with the construction of a 9 km of new road (at $25,000/km) and 2 - 8 m bridges ($56,000), which would parallel the railgrade. Access across the tracks in several locations would also be required in order for this development to work. Otherwise timber below the railbed would have to be developed through a secondary road system originating from the lower portions of Dog creek road. This road system parallels the rail bed for 1 km in length before crossing back over Dog creek and continuing on to develop Peter Creek.

Road construction costs of approximately $281,000 would be required to parallel the existing rail network. Constraints for visuals and construction impacts on the rail corridor will also have to be considered in the location of the new road which may increase the costs of constructing a parallel road system

Timber harvesting in this area could be hauled back towards the Paulson pass using the existing Walker creek road.

4.3.2 - Km 40.8 to Km 49.3 - Dog/ Walker road to Paulson bypass road

Timber can be developed by using small spurs from the Walker road or the Paulson bypass road. This would require approximately 3.0 km of spur road ($25,000 /km) and 2 - 8 m bridges ($56,000), for a total cost of $131,000. There is only minimal timber in this section as most of the area is talus slope.

4.4 Section 4 - km 49.3 - km 71.4 - Walker Creek to Christina Lake

4.4.1 - km 49.3 - 51.5 - Walker creek to 1 km past Orion Creek

There is no timber in this section, therefore no access is required.

4.4.1 - km 51.5 - 57.9 - 1 km past Orion Creek to Fill #17

Timber can be developed by extending a spur road from Highway 3 across McCrae Creek and building a parallel road system to the rail line. Timber above the rail line would have be yarded

across the existing rail bed or short landing spurs constructed across the rail line in numerous locations. Cost of the parallel road system would entail the construction of 6.0 km of new road ($25,000/km) and a 15 m bridge ($52,000) across McCrae creek. Estimated cost $202,000. Given the first pass timber volume in this area is only 6,280 m^3 , the volume is considered too small to develop so a 50 % first pass volume has been used to amortize costs. (12,560 m^3)

4.4.1 - km 57.9 - 62.6

Timber can be developed by extending a spur road from the Lafferty gravel pit road at km 61.1 and building a parallel road system to the rail line. Timber below the railline would have be yarded across the existing rail bed or short landing spurs constructed across the rail line in numerous locations. Cost of the parallel road system would entail the construction of 5.0 km of new road ($40,000/km) . Estimated cost $200,000.

4.4.2 - km 62.6 - 71.4

This section has minimal timber, difficult construction because of rock and extensive private property. No development parallel to the rail bed is recommended because of these reasons. Timber extraction for this section may be feasible by using access through various private lots but volumes (57,833 m^3) in this section are deemed accessible by helicopter only for this route. Construction of a 1 km spur for $25,000 is required to provide access to a landing.

4.5 Section 5 - Upper Shields and Moberly creek drainages

There is existing access into the upper Shields and Moberly creek drainages off the Shields creek FSR. No new road construction would be required for this section. Significant adverse hauls and a 33 km highway haul, make this route significantly longer than accessing this area off the rail grade. Over the first pass there are 78,510 m^3 of timber to be transported over this route.

5.0 DISCUSSION – DEVELOPMENT BY UPGRADING EXISTING RAILWAY ACCESS

5.1 Section 1 - Km 0.0 to km 10.2 - Hugh Keenleyside Dam -

The rail grade only provides access to the timber immediately adjacent to the rail bed. The construction of secondary spurs, where feasible, is expensive and minimal vertical elevation can be gained prior to encountering significant amounts of bedrock. The present expectation is that other than the timber immediately adjacent to the rail bed, the remainder of the available timber from the 700 m to 1200 m elevation, will be helicopter logged and dropped into Arrow lake, for booming and transportation to Castlegar. There is only one large landing opportunity, which has sufficient size to handle a helicopter logging operation. This is at km 7.0, where there is an old siding that is 20 m wide x 100 m long. The remainder of the rail grade from 0.0 - 10.2 ranges from being constructed on steep slopes and cut into significant rock faces to being constructed on significant fills and retaining walls, which could be significantly damaged by helicopter logging.

Timber from km 0.0 to km 10.2 above the 1200 m elevation is presently accessed by the Gem Hill road and the North Ridge Road and this timber will be developed by these road systems, even if the rail grade becomes a multi-use access corridor.

In order to use the rail grade, significant amounts of work would have to be completed in this section. Approximately 1.2 km of old track would have to be removed ($20,000). The first 5 km of the route would have to be brushed, graded and graveled, as the present ballast material is large coarse rock not suitable for truck haul.. Inspections would have to be completed on nine retaining walls and the McCormick bridge and the bridge itself would have to be redecked and new guardrails and handrails installed . One major slide at km 5.75 and two minor slides at km 6.7 and 8.6 would have to be repaired. As well turnouts and widenings would have to be constructed for 2 way traffic and no post guard rails would have to be installed at all retaining walls.

5.2. Section 2 - Km 10.2 - km 29.2 - Shields creek to and including the Bulldog Tunnel

5.2.1 - Km 10.2 to Km 12.7 - Shields Creek drainage

Timber immediately adjacent to the rail line from km 10.2 to km 12.7 can be developed directly from the line. Secondary timber volumes can be access by constructing new secondary spurs and by tying into the Shields and Moberly Roads. An inspection of the Shields creek masonry culvert will be required prior to using this section of the road. Timber from Upper Shields and Moberly creek can be transported down to the rail grade to allow for winter harvesting and a shorter appraisal to Castlegar. Haul costs for timber in Shields creek would be considerably reduced by using the rail grade, as it would avoid the adverse grades back up to the highway.

In order to use the rail grade, turnouts and no post guard rails would have to be installed in this section.

5.2.2 - Km 12.7 to Km 22.0 - Lake Face area from Shields creek to Pup creek

Timber can only be developed from the rail grade. Alternate access is not feasible because of extensive rock and steep draws. All timber in this section would have to be cable harvested to the rail grade.

In order to use this section, two bridges, one 100 m long and the other 125 m long would have to be inspected ($20,000). Both would require new running planks, curbs and handrails, installed prior to opening the road up for public use. As well 13 retaining structures and 3 small tunnels would have to be inspected, no post guard rails installed and any remedial work completed. A 30 m long rockfall at km 21.3 would have to be removed and some rock scaling completed to ensure the section is safe .

5.2.3 - Km 22.0 - Km 29.2. - Pup Creek and Brooklyn creek drainages

Timber can be developed off the existing railline and an extensive secondary road system can be used to develop the Pup and Brooklyn creek drainages. Prior to extensive use of this section of the grade, a detailed inspection of the Bulldog tunnel is required. If the tunnel is not usable all timber to the south of the tunnel can be hauled back to Castlegar on the rail grade. Timber to the north of the tunnel can be hauled to the Paulson Bypass public road using the rail grade.

In order to use this section, one large fill would have to be repaired and the Bulldog tunnel inspected. If the tunnel is not usable timber can be hauled north or south on the railline or a bypass could be constructed – 4 km at $40,000/km – to connect the access.

5.3 Section 3 - km 29.2 - km 49.3 - Bulldog Tunnel to Walker Creek

5.3.1 Km 29.2 - 40.8 - Bulldog tunnel to Dog/Walker road

This section of the rail grade is in good condition and will develop all of the timber from Dog creek up to the Bulldog Forest Service road. The main concern in this section is the maintenance of the two large fills at Quinn Creek (30 m deep) and Porcupine creek (48 m deep). The culverts in both fills will have to be inspected in detail at low water, to ensure they are in good working order ($3,000). All timber can be hauled back to Highway 3, using the Paulson Bypass road or if the Bulldog tunnel is deemed safe, timber can also be hauled back to Castlegar.

5.3.2 - Km 40.8 to Km 49.3 - Dog/ Walker road to Paulson bypass road

This section is in good shape and is in adequate condition to haul on. No works are required to upgrade the section. Timber can be developed by using small spurs from the rail grade.

5.4 Section 4 - km 49.3 - km 71.4 - Walker Creek to Christina Lake

5.4.1 - km 49.3 - 51.5 - Walker creek to 1 km past Orion Creek

There is no timber in this section, however several small repairs to the rail grade are still required to maintain access.

5.4.1 - km 51.5 - 57.9 - 1 km past Orion Creek to Fill #17

The timber for 300 m either side of the rail grade is all that will be developed on this section, due to steep slopes and low timber volumes. The area has numerous small gullies and secondary access is not recommended.

There is one large fill at km 57.9, which is failing. The flume in this drainage is in poor condition and is contributing to the failure of the fill. Repair will require the installation of a 600 mm culvert at the base of a 12 m deep fill or the reconstruction of the flume, which presently diverts the water away from the draw.

5.4.1 - km 57.9 - 62.6

Development in this section can be tied into the Lafferty gravel pit road. The rail grade can be used as the main haul corridor, but if traffic is to be directed away from the community of Christina Lake, a secondary connector road should be constructed to join the rail grade and the Lafferty Pit road. This can be completed with approximately 1 km of new grade and would allow all of the timber from 49.3 km to 71.4 km to be extracted directly to highway 3 without entering Christina Lake. Use of the rail grade will require either bypassing or inspecting and redecking the Snowslide bridge at km 59.3 and repair of a fill at km 61.6 .

Extensive secondary road systems can be constructed along this section as slopes are moderate and timber volumes adequate.

5.4.2 - km 62.6 - 71.4

This section has minimal timber and extensive private property. Development along the rail grade is a feasible access route, but will require that the fill at km 64.6 be reconstructed, as it partially failed when the bypass flume collapsed and diverted water into the draw. The draw filled with water and eroded sections of the fill away. The flume has temporarily been fixed, but a culvert should be installed in the fill, if the road is to be reactivated .

There are two retaining walls in this section to inspect and a number of other minor repairs.

5.5 Section 5 - Upper Shields and Moberly creek drainages

There is existing access into the upper Shields and Moberly creek drainages off the Shields creek FSR. This road system ties into the rail grade at km 11.9. No new road construction would be required for this section. All timber would be hauled down to the rail grade from this drainage making the average haul distance only 20 km to the mill at Castlegar. Over the first pass there are 78,510 m^3 of timber to be transported over this route.

6. ALTERNATIVE COMPARISON

6.1 Operable timber

The operable timber developed for this study is the timber, which is adjacent to or developed exclusively by an access corridor along the rail line. A total volume of 1,515,008 cubic meters would be developed for harvest with conventional ground skidding and cable logging systems using the rail grade. If the rail corridor was not used, approximately 123,000 cubic meters of this total would be inaccessible and 68,000 cubic meters would have to be helicopter logged.

Included in the total volume are 785,100 m^3 in upper Bulldog and Shields creek . Only 10 % of this volume has been scheduled for harvest in the first 25 years because there has already been extensive harvesting in the drainages. Transportation of this additional timber (78,510 m^3) over the rail corridor would allow for a cheaper haul cost because of the shorter distance to Castlegar. (approximately $80,000 in savings on first pass volumes).

There are other constraints, which could further lower the amount of operable timber available for harvest. There are visual management constraints along the Arrow and Christina Lakes, and visual management and winter range considerations in McCrae creek. The effect of these net downs has not been included in this report, because they will have to be developed on a site specific basis as blocks are engineered for harvesting.

One advantage of the rail system is the potential for increasing the amount of landbase available for winter harvesting, because all grades are favorable down to the rail corridor. The disadvantage of using the rail corridor in the winter is that the tunnels are more susceptible to frost action during this time of year and may have to be bypassed to make the route safe. Surface maintenance during the winter month might be more difficult. The road would be freezing and thawing during most of the winter because of its low elevation, which might lead to rutting concerns and damage to the running surface.

6.2 Other potential costs involved with bringing the rail grade up to a logging road standard.

The short term cost for upgrading the rail bed includes inspecting all structures and completing a site plan for each of the retaining walls (to measure the amount of movement that has occurred during the life of the structures and to give a benchmark to monitor any future movement against). It includes the redecking and construction of handrails on 3 of the bridges and construction of a bypass for the fourth structure. It also includes the reconstruction works required to clean up the rockfalls, rebuild failing fills and install drainage where required. A detailed list of expenditures required to upgrade the rail grade in 2000 is attached in Appendix 1.

Several costs were not included in the original estimate. One is the cost of bypassing the tunnels. If it is determined that the Ministry does not want the liability of maintaining the tunnels, bypass roads will have to be constructed around each of the four small tunnels and the one large tunnel. If bypasses are required, a cost of $30,000 / bypass road can be added to the cost of the improvements. Bypassing of the large Bulldog tunnel will require approximately 3 – 4 km of new road at a cost of $30 - 40,000/km. Total costs of the bypasses would be approximately $250,000.

Another cost not included is the dismantling of the Snowslide bridge at km 59.3. This is a 40 m long, drive through truss, which can be bypassed by the construction of 100 m of new road. The cost of dismantling the old bridge is approximately $40,000 – 50,000, as long as all of the salvageable material is given to the contractor as part of the deactivation contract. Another option is to redeck this bridge and avoid the bypass road. Costs for either the bypass or redecking the new bridge are approximately equal.

6.3) Economic, environmental and social costs, benefits and liabilities of using the upgraded rail grade versus extending the existing road networks.

a) Environmental concerns

The main environmental concern, is the need to build 33 km of additional road if the rail grade is not used. New construction carries with it an inherent risk of instigating mass wasting events. This is because the development of roads involves disturbing surface and subsurface drainage patterns. Once disrupted, drainage patterns can take significant time periods to re-establish themselves.

There is also a significant winter range in the McCrae Creek area which would be disturbed if additional road is constructed in the area. Use of the rail grade would minimize road construction in this area.

The other concern which was raised is the presence of toxins in the rail grade, which may have to be dealt with in the long term. No real information exists on this problem, however discussions with CPR staff indicate that after numerous years, chemical spills and fuel leaks from the cars could have contaminated some of the larger siding areas, where rail cars were stored for extended periods of time.

b) Economic costs and benefits - based on a 25 year time frame.

The option of upgrading the rail grade offers a long term economic advantage of $257,180 over the option of extending the existing forest road network. In order to gain this long term benefit, it will require the expenditure of $924,903 in the first year to two years to maintain and upgrade the rail grade to a safe road standard, versus an expenditure of $98,150 to restore to a trail standard.

Section	Timber developed (m^3)	Present worth Costs -Capital maintenance and deactivation	Present worth Costs - Logging	Present worth Costs - Hauling	Present worth - Timber value	Total cost or benefit
Rail grade development						
Section 1	14,550 m^3	-$443,606	-$517,980	-$15,696	$798,078	-$179,204
Section 2	85,030 m^3	-$697,789	-$2,415,655	-$207,212 *	$3,875,994	$555,338
Section 3	50,250 m^3	-$232,471	-$886,661	-$213,229	$1,834,679	$502,318
Section 4	41,490m^3	-$290,226	-$911,696	-$55,254	$1,466,440	$209,264
Section 5	78,510 m^3	$0	$0	-$107,196*	$991,377	$884,181
Totals	269,830m^3	-$1,664,092	-$4,731,992	-$598,587	$8,966,568	$1,971,897
Existing forest road access						
Section 1	0 m^3	$0	$0	$0	$0	$0
Section 2	68,810 m^3	-$400,688	-$2,152,599	-$498,031	$3,460,760	$409,443
Section 3	50,250 m^3	-$256,333	-$886,661	-$234,723	$1,834,679	$456,962
Section 4	41,490m^3	-$303,600	-$1,064,129	-$55,254	$1,466,440	$43,457
Section 5	78,510 m^3	$0	$0	-$186,521	$991,377	$804,855
Totals	239,060m^3	-$960,621	-$4,103,389	-974,529	$7,753,256	$1,714,717

* If the first section of the rail line from 0.0 to 10.2 is not used, then all haul cost savings for the rail grade option on sections 2 and 5 will be lost, as all timber will have to be hauled over the Shields and Bulldog road.

The rail grade develops an additional 30,770 m^3 first pass timber in sections 1 and 2.2. This timber cannot be developed by extending the existing road network because of extensive rock and steep slopes.

The long term costs involved in using the rail corridor may be substantial. There is about $10,000,000 in infrastructure, which may require replacement . This is made up of 3 bridges at $2,000,000 per structure, 17 retaining structures at $200,000 structure and 5 large fills at $100,000 - $200,000 per fill and does not include any estimate of replacing or upgrading the tunnels, for which a value could not be determined . This estimate does not include the cost of deactivating any of the bridges or fills should they start to fail.

It should be noted that all of the fills and bridges can be bypassed (cost $30 –200,000/bypass) , but that 17 of the retaining walls are built into 10 - 15 m high rock bluffs and would be difficult to bypass and would have to be repaired, if they showed signs of deterioration during use.

c) Social concerns

The existing CPR rail line provides a recreational corridor which has been used for the last 20 years by cyclists, ATV's and the occasional vehicle. Continued structural deterioration of the corridor, would require that bypass trails be constructed around the large fills and bridges.

Even if not used by the logging industry, the route would have to be maintained because of liabilities to residents located downstream of the major culverts. The culverts in the large Quinn and Porcupine creek fills could became plugged during an extreme event. Due to the depth and volume of the pondage created , there could be a risk to the downstream inhabitants at Renata.

d) Deactivation of rail grade

Once past the first 25 years, a decision may be made to permanently deactivate sections of the rail line rather than maintain or repair them. As it is impossible to say when each section will require deactivation, a total estimate of the costs of deactivating the structures (large fills and bridges) has been completed to show the enormity of the cost liabilities to the crown. If the major fills and bridges are to be permanently deactivated the cost to the Crown will be in excess of $2,000,000.

7. RECOMMENDATIONS

Following the preliminary review of rail grade access corridor, several recommendations are offered.

1. If the rail grade is to be taken over by the Provincial Government, it should do so with the understanding that there are significant long term liabilities involved. At some point in the future, these will require a significant expenditure of public funds to maintain or deactivate.

2. If the rail bed is to be taken over by the Province, it should be used as an industrial transportation corridor for the next 25 years or until the structures start to show signs of significant deterioration. At this time, the route should be re-evaluated to see if it should be downgraded to a trail status or whether it is economically viable to maintain industrial use.

3. The Ministry, that administers the rail corridor, should be adequately funded immediately to upgrade the drainage structures and fills to a safe standard. Failure to upgrade and maintain these structures will result in significant liabilities as regards to slope stability and possibly public safety, (due to the large number of cyclists who use the rail bed in the summer). Especially at risk are the steel flumes with wooden supports, which are rapidly deteriorating. If they fail, there is the potential for catastrophic failure of some of the fills, as there is no other drainage structure in the fill to handle creek flow.

APPENDIX 1 – COST BENEFIT SUMMARY
CASTLEGAR TO CHRISTINA LAKE – CPR RAIL LINE

Cost / Benefit - Section 1 - Railway grade access

YEAR	P/W VALUE	Section 1 - construction and Maintenance costs	present worth construction and maintenance costs	Section 1 - harvesting costs	present worth harvesting costs	Section 1 - Hauling costs	present worth hauling costs	Section 1 - revenue	present worth revenue	TOTALS
2000	1	($276,353)	($276,353)	$0	$0	$0	$0	$0	$0	($276,353)
2001	0.9434	($2,040)	($1,925)	$0	$0	$0	$0	$0	$0	($1,925)
2002	0.89	($6,120)	($5,447)	($582,000)	($517,980)	($17,636.36)	($15,696)	$896,717	$798,078	$258,955
2003	0.8396	($6,120)	($5,138)	$0	$0	$0	$0	$0	$0	($5,138)
2004	0.7921	($6,120)	($4,848)	$0	$0	$0	$0	$0	$0	($4,848)
2005	0.7473	($6,120)	($4,573)	$0	$0	$0	$0	$0	$0	($4,573)
2006	0.705	($2,040)	($1,438)	$0	$0	$0	$0	$0	$0	($1,438)
2007	0.6651	($6,120)	($4,070)	$0	$0	$0	$0	$0	$0	($4,070)
2008	0.6274	($6,120)	($3,840)	$0	$0	$0	$0	$0	$0	($3,840)
2009	0.5919	($2,040)	($1,207)	$0	$0	$0	$0	$0	$0	($1,207)
2010	0.5584	($2,040)	($1,139)	$0	$0	$0	$0	$0	$0	($1,139)
2011	0.5268	($95,313)	($50,211)	$0	$0	$0	$0	$0	$0	($50,211)
2012	0.497	($2,040)	($1,014)	$0	$0	$0	$0	$0	$0	($1,014)
2013	0.4688	($2,040)	($956)	$0	$0	$0	$0	$0	$0	($956)
2014	0.4423	($2,040)	($902)	$0	$0	$0	$0	$0	$0	($902)
2015	0.4173	($2,040)	($851)	$0	$0	$0	$0	$0	$0	($851)
2016	0.3936	($2,040)	($803)	$0	$0	$0	$0	$0	$0	($803)
2017	0.3714	($2,040)	($758)	$0	$0	$0	$0	$0	$0	($758)
2018	0.3503	($2,040)	($715)	$0	$0	$0	$0	$0	$0	($715)
2019	0.3305	($2,040)	($674)	$0	$0	$0	$0	$0	$0	($674)
2020	0.3118	($2,040)	($636)	$0	$0	$0	$0	$0	$0	($636)
2021	0.2942	($2,040)	($600)	$0	$0	$0	$0	$0	$0	($600)
2022	0.2775	($2,040)	($566)	$0	$0	$0	$0	$0	$0	($566)
2023	0.2618	($195,617)	($51,213)	$0	$0	$0	$0	$0	$0	($51,213)
2024	0.247	($2,040)	($504)	$0	$0	$0	$0	$0	$0	($504)
Deactivation in 2040	0.0972	($238,938)	($23,225)							($23,225)
Total Cost or benefit	(-=cost , +=benefit)		($443,606)		($517,980)		($15,696)		$798,078	($179,205)
Timber developed m^3		14550								14550

Appendix 1 - Page 1

Cost / Benefit - Section 1 - Railway grade access

Value of timber based on costs (harvesting, construction/maintenance, and hauling plus $20 stumpage.)										

Cost / Benefit - Section 2 - Railway grade access

YEAR	P/W VALUE	Section 2 - construction and Maintenance costs	present worth construction and maintenance costs	Section 2 - harvesting costs	present worth harvesting costs	Section 2 - Hauling costs	present worth hauling costs	Section 2 - revenue	present worth revenue	TOTALS
2000	1	($384,830)	($384,830)	$0	$0	$0	$0	$0	$0	($384,830)
2001	0.9434	($3,800)	($3,585)	$0	$0	$0	$0	$0	$0	($3,585)
2002	0.89	($3,800)	($3,382)	$0	$0	$0	$0	$0	$0	($3,382)
2003	0.8396	($11,400)	($9,571)	($849,200)	($712,988)	($77,200)	($64,817)	$1,362,541	$1,143,990	$356,613
2004	0.7921	($11,400)	($9,030)	($849,200)	($672,651)	($77,200)	($61,150)	$1,362,541	$1,079,269	$336,438
2005	0.7473	($11,400)	($8,519)	($849,200)	($634,607)	($77,200)	($57,692)	$1,362,541	$1,018,227	$317,409
2006	0.705	($3,800)	($2,679)	$0	$0	$0	$0	$0	$0	($2,679)
2007	0.6651	($11,400)	($7,582)	($102,400)	($68,106)	($4,655)	($3,096)	$169,651	$112,835	$34,051
2008	0.6274	($11,400)	($7,152)	($102,400)	($64,246)	($4,655)	($2,920)	$169,651	$106,439	$32,121
2009	0.5919	($3,800)	($2,249)	$0	$0	$0	$0	$0	$0	($2,249)
2010	0.5584	($3,800)	($2,122)	$0	$0	$0	$0	$0	$0	($2,122)
2011	0.5268	($158,808)	($83,660)	$0	$0	$0	$0	$0	$0	($83,660)
2012	0.497	($3,800)	($1,889)	$0	$0	$0	$0	$0	$0	($1,889)
2013	0.4688	($3,800)	($1,781)	$0	$0	$0	$0	$0	$0	($1,781)
2014	0.4423	($3,800)	($1,681)	$0	$0	$0	$0	$0	$0	($1,681)
2015	0.4173	($3,800)	($1,586)	($324,400)	($135,372)	($21,627)	($9,025)	$512,065	$213,685	$67,702
2016	0.3936	($3,800)	($1,496)	($324,400)	($127,684)	($21,627)	($8,512)	$512,065	$201,549	$63,857
2017	0.3714	($3,800)	($1,411)	$0	$0	$0	$0	$0	$0	($1,411)
2018	0.3503	($3,800)	($1,331)	$0	$0	$0	$0	$0	$0	($1,331)
2019	0.3305	($3,800)	($1,256)	$0	$0	$0	$0	$0	$0	($1,256)
2020	0.3118	($3,800)	($1,185)	$0	$0	$0	$0	$0	$0	($1,185)
2021	0.2942	($3,800)	($1,118)	$0	$0	$0	$0	$0	$0	($1,118)
2022	0.2775	($3,800)	($1,055)	$0	$0	$0	$0	$0	$0	($1,055)
2023	0.2618	($340,961)	($89,264)	$0	$0	$0	$0	$0	$0	($89,264)
2024	0.247	($3,800)	($939)	$0	$0	$0	$0	$0	$0	($939)
Deactivation in 2040	0.0972	($693,798)	($67,437)							($67,437)
Total Cost or benefit	(-=cost , +=benefit)		($697,789)		($2,415,655)		($207,212)		$3,875,994	$555,338
Timber developed m^3		85030								85030

Cost / Benefit - Section 2 - Railway grade access

Value of timber based on costs (harvesting, construction/maintenance, and hauling plus $20 stumpage.)										

Cost / Benefit - Section 3 - Railway grade access

YEAR	P/W VALUE	Section 3 - construction and Maintenance costs	present worth construction and maintenance costs	Section 3 - harvesting costs	present worth harvesting costs	Section 3 - Hauling costs	present worth hauling costs	Section 3 - revenue	present worth revenue	TOTALS
2000	1	($74,220)	($74,220)	$0	$0	$0	$0	$0	$0	($74,220)
2001	0.9434	($4,020)	($3,792)	$0	$0	$0	$0	$0	$0	($3,792)
2002	0.89	($4,020)	($3,578)	$0	$0	$0	$0	$0	$0	($3,578)
2003	0.8396	($4,020)	($3,375)	$0	$0	$0	$0	$0	$0	($3,375)
2004	0.7921	($4,020)	($3,184)	$0	$0	$0	$0	$0	$0	($3,184)
2005	0.7473	($12,060)	($9,012)	($418,750)	($312,932)	($100,703)	($75,255)	$866,478	$647,519	$250,319
2006	0.705	($12,060)	($8,502)	($418,750)	($295,219)	($100,703)	($70,996)	$866,478	$610,867	$236,150
2007	0.6651	($12,060)	($8,021)	($418,750)	($278,511)	($100,703)	($66,978)	$866,478	$576,294	$222,785
2008	0.6274	($4,020)	($2,522)	$0	$0	$0	$0	$0	$0	($2,522)
2009	0.5919	($4,020)	($2,379)	$0	$0	$0	$0	$0	$0	($2,379)
2010	0.5584	($4,020)	($2,245)	$0	$0	$0	$0	$0	$0	($2,245)
2011	0.5268	($4,020)	($2,118)	$0	$0	$0	$0	$0	$0	($2,118)
2012	0.497	($4,020)	($1,998)	$0	$0	$0	$0	$0	$0	($1,998)
2013	0.4688	($4,020)	($1,885)	$0	$0	$0	$0	$0	$0	($1,885)
2014	0.4423	($4,020)	($1,778)	$0	$0	$0	$0	$0	$0	($1,778)
2015	0.4173	($4,020)	($1,678)	$0	$0	$0	$0	$0	$0	($1,678)
2016	0.3936	($4,020)	($1,582)	$0	$0	$0	$0	$0	$0	($1,582)
2017	0.3714	($4,020)	($1,493)	$0	$0	$0	$0	$0	$0	($1,493)
2018	0.3503	($4,020)	($1,408)	$0	$0	$0	$0	$0	$0	($1,408)
2019	0.3305	($4,020)	($1,329)	$0	$0	$0	$0	$0	$0	($1,329)
2020	0.3118	($4,020)	($1,253)	$0	$0	$0	$0	$0	$0	($1,253)
2021	0.2942	($4,020)	($1,183)	$0	$0	$0	$0	$0	$0	($1,183)
2022	0.2775	($4,020)	($1,116)	$0	$0	$0	$0	$0	$0	($1,116)
2023	0.2618	($4,020)	($1,052)	$0	$0	$0	$0	$0	$0	($1,052)
2024	0.247	($4,020)	($993)	$0	$0	$0	$0	$0	$0	($993)
Deactivation in 2040	0.0972	($933,891)	($90,774)							($90,774)
Total Cost or benefit	(-=cost , +=benefit)		($232,471)		($886,661)		($213,229)		$1,834,679	$502,319
Timber developed m^3		50250								50250

Appendix 1 - Page 3

Cost / Benefit - Section 3 - Railway grade access

Value of timber based on costs (harvesting, construction/maintenance, and hauling plus $20 stumpage.)									

Cost / Benefit - Section 4 - Railway grade access

YEAR	P/W VALUE	Section 4 - construction and Maintenance costs	present worth construction and maintenance costs	Section 4 - harvesting costs	present worth harvesting costs	Section 4 - Hauling costs	present worth hauling costs	Section 4 - revenue	present worth revenue	TOTALS
2000	1	($185,080)	($185,080)	$0	$0	$0	$0	$0	$0	($185,080)
2001	0.9434	($4,420)	($4,170)	$0	$0	$0	$0	$0	$0	($4,170)
2002	0.89	($4,420)	($3,934)	$0	$0	$0	$0	$0	$0	($3,934)
2003	0.8396	($4,420)	($3,711)	$0	$0	$0	$0	$0	$0	($3,711)
2004	0.7921	($4,420)	($3,501)	$0	$0	$0	$0	$0	$0	($3,501)
2005	0.7473	($13,260)	($9,909)	($289,200)	($216,119)	($17,527)	($13,098)	$464,600	$347,195	$108,069
2006	0.705	($13,260)	($9,348)	($289,200)	($203,886)	($17,527)	($12,357)	$464,600	$327,543	$101,952
2007	0.6651	($4,420)	($2,940)	$0	$0	$0	$0		$0	($2,940)
2008	0.6274	($4,420)	($2,773)	$0	$0	$0	$0	$0	$0	($2,773)
2009	0.5919	($4,420)	($2,616)	$0	$0	$0	$0	$0	$0	($2,616)
2010	0.5584	($4,420)	($2,468)	$0	$0	$0	$0	$0	$0	($2,468)
2011	0.5268	($13,260)	($6,985)	($251,200)	($132,332)	($15,224)	($8,020)	$405,311	$213,518	$66,180
2012	0.497	($13,260)	($6,590)	($251,200)	($124,846)	($15,224)	($7,566)	$405,311	$201,440	$62,437
2013	0.4688	($4,420)	($2,072)	$0	$0	$0	$0	$0	$0	($2,072)
2014	0.4423	($4,420)	($1,955)	$0	$0	$0	$0	$0	$0	($1,955)
2015	0.4173	($13,260)	($5,533)	($289,200)	($120,683)	($17,527)	($7,314)	$464,600	$193,877	$60,347
2016	0.3936	($13,260)	($5,219)	($289,200)	($113,829)	($17,527)	($6,899)	$464,600	$182,866	$56,919
2017	0.3714	($4,420)	($1,642)	$0	$0	$0	$0	$0	$0	($1,642)
2018	0.3503	($4,420)	($1,548)	$0	$0	$0	$0	$0	$0	($1,548)
2019	0.3305	($4,420)	($1,461)	$0	$0	$0	$0	$0	$0	($1,461)
2020	0.3118	($4,420)	($1,378)	$0	$0	$0	$0	$0	$0	($1,378)
2021	0.2942	($4,420)	($1,300)	$0	$0	$0	$0	$0	$0	($1,300)
2022	0.2775	($4,420)	($1,227)	$0	$0	$0	$0	$0	$0	($1,227)
2023	0.2618	($4,420)	($1,157)	$0	$0	$0	$0	$0	$0	($1,157)
2024	0.247	($4,420)	($1,092)	$0	$0	$0	$0	$0	$0	($1,092)
Deactivation in 2040	0.0972	($212,097)	($20,616)							($20,616)
Total Cost or benefit	(-=cost , +=benefit)		($290,226)		($911,696)		($55,254)		$1,466,440	$209,263
Timber developed m^3		41490								41490

Cost / Benefit - Section 4 - Railway grade access

Value of timber based on costs (harvesting, construction/maintenance, and hauling plus $20 stumpage.)										

Cost / Benefit - Section 5 - Railway grade access

YEAR	P/W VALUE	Section 5 - construction and Maintenance costs	present worth construction and maintenance costs	Section 5 - harvesting costs	present worth harvesting costs	Section 5 - Hauling costs	present worth hauling costs	Section 5 - revenue	present worth revenue	TOTALS
2000	1	$0	$0	$0	$0	$0	$0	$0	$0	$0
2001	0.9434	$0	$0	$0	$0	$0	$0	$0	$0	$0
2002	0.89	$0	$0	$0	$0	($19,033)	($16,939)	$176,019	$156,657	$139,718
2003	0.8396	$0	$0	$0	$0	($19,033)	($15,980)	$176,019	$147,786	$131,806
2004	0.7921	$0	$0	$0	$0	($19,033)	($15,076)	$176,019	$139,425	$124,349
2005	0.7473	$0	$0	$0	$0	($19,033)	($14,223)	$176,019	$131,539	$117,316
2006	0.705	$0	$0	$0	$0	($19,033)	($13,418)	$176,019	$124,094	$110,676
2007	0.6651	$0	$0	$0	$0	$0	$0	$0	$0	$0
2008	0.6274	$0	$0	$0	$0	$0	$0	$0	$0	$0
2009	0.5919	$0	$0	$0	$0	$0	$0	$0	$0	$0
2010	0.5584	$0	$0	$0	$0	$0	$0	$0	$0	$0
2011	0.5268	$0	$0	$0	$0	$0	$0	$0	$0	$0
2012	0.497	$0	$0	$0	$0	$0	$0	$0	$0	$0
2013	0.4688	$0	$0	$0	$0	$0	$0	$0	$0	$0
2014	0.4423	$0	$0	$0	$0	$0	$0	$0	$0	$0
2015	0.4173	$0	$0	$0	$0	$0	$0	$0	$0	$0
2016	0.3936	$0	$0	$0	$0	$0	$0	$0	$0	$0
2017	0.3714	$0	$0	$0	$0	($19,033)	($7,069)	$176,019	$65,374	$58,305
2018	0.3503	$0	$0	$0	$0	($19,033)	($6,667)	$176,019	$61,660	$54,992
2019	0.3305	$0	$0	$0	$0	($19,033)	($6,290)	$176,019	$58,174	$51,884
2020	0.3118	$0	$0	$0	$0	($19,033)	($5,934)	$176,019	$54,883	$48,948
2021	0.2942	$0	$0	$0	$0	($19,033)	($5,599)	$176,019	$51,785	$46,185
2022	0.2775	$0	$0	$0	$0	$0	$0	$0	$0	$0
2023	0.2618	$0	$0	$0	$0	$0	$0	$0	$0	$0
2024	0.247	$0	$0	$0	$0	$0	$0	$0	$0	$0
Deactivation in 2040	0.0972	$0	$0							$0
Total Cost or benefit	(-=cost , +=benefit)		$0		$0		($107,196)		$991,377	$884,180
Timber developed m^3		78510								78510

Appendix 1 - Page 5

Cost / Benefit - Section 5 - Railway grade access

Value of timber/ cubic meter is the haul cost plus $20 cubic meter stumpage										

Cost / Benefit - Section 1 - Existing and upgraded road access

YEAR	P/W VALUE	Section 1 - construction and Maintenance costs	present worth construction and maintenance costs	Section 1 - harvesting costs	present worth harvesting costs	Section 1 - Hauling costs	present worth hauling costs	Section 1 - revenue	present worth revenue	TOTALS
2000	1	$0	$0	$0	$0	$0	$0	$0	$0	$0
2001	0.9434	$0	$0	$0	$0	$0	$0	$0	$0	$0
2002	0.89	$0	$0	$0	$0	$0	$0	$0	$0	$0
2003	0.8396	$0	$0	$0	$0	$0	$0	$0	$0	$0
2004	0.7921	$0	$0	$0	$0	$0	$0	$0	$0	$0
2005	0.7473	$0	$0	$0	$0	$0	$0	$0	$0	$0
2006	0.705	$0	$0	$0	$0	$0	$0	$0	$0	$0
2007	0.6651	$0	$0	$0	$0	$0	$0	$0	$0	$0
2008	0.6274	$0	$0	$0	$0	$0	$0	$0	$0	$0
2009	0.5919	$0	$0	$0	$0	$0	$0	$0	$0	$0
2010	0.5584	$0	$0	$0	$0	$0	$0	$0	$0	$0
2011	0.5268	$0	$0	$0	$0	$0	$0	$0	$0	$0
2012	0.497	$0	$0	$0	$0	$0	$0	$0	$0	$0
2013	0.4688	$0	$0	$0	$0	$0	$0	$0	$0	$0
2014	0.4423	$0	$0	$0	$0	$0	$0	$0	$0	$0
2015	0.4173	$0	$0	$0	$0	$0	$0	$0	$0	$0
2016	0.3936	$0	$0	$0	$0	$0	$0	$0	$0	$0
2017	0.3714	$0	$0	$0	$0	$0	$0	$0	$0	$0
2018	0.3503	$0	$0	$0	$0	$0	$0	$0	$0	$0
2019	0.3305	$0	$0	$0	$0	$0	$0	$0	$0	$0
2020	0.3118	$0	$0	$0	$0	$0	$0	$0	$0	$0
2021	0.2942	$0	$0	$0	$0	$0	$0	$0	$0	$0
2022	0.2775	$0	$0	$0	$0	$0	$0	$0	$0	$0
2023	0.2618	$0	$0	$0	$0	$0	$0	$0	$0	$0
2024	0.247	$0	$0	$0	$0	$0	$0	$0	$0	$0
Deactivation in 2040	0.0972	$0	$0							$0
Total Cost or benefit	(-=cost , +=benefit)		$0		$0		$0		$0	$0
Timber developed m^3		0	No timber can be accessed by extending existing roads because road costs exceed the value of the timber.							0

Cost / Benefit - Section 1 - Existing and upgraded road access

Value of timber/ cubic meter is the same as estimated for the rail access option (section 1)										

Cost / Benefit - Section 2 - Existing and upgraded road access

YEAR	P/W VALUE	Section 2 - construction and Maintenance costs	present worth construction and maintenance costs	Section 2 - harvesting costs	present worth harvesting costs	Section 2 - Hauling costs	present worth hauling costs	Section 2 - revenue	present worth revenue	TOTALS
2000	1	$0	$0	$0	$0	$0	$0	$0	$0	$0
2001	0.9434	($160,000)	($150,944)	$0	$0	$0	$0	$0	$0	($150,944)
2002	0.89	($120,000)	($106,800)	$0	$0	$0	$0	$0	$0	($106,800)
2003	0.8396	($15,600)	($13,098)	($849,200)	($712,988)	($202,264)	($169,821)	$1,362,541	$1,143,990	$248,083
2004	0.7921	($15,600)	($12,357)	($849,200)	($672,651)	($202,264)	($160,213)	$1,362,541	$1,079,269	$234,048
2005	0.7473	($30,600)	($22,867)	($849,200)	($634,607)	($202,264)	($151,152)	$1,362,541	$1,018,227	$209,601
2006	0.705	($110,000)	($77,550)	$0	$0	$0	$0	$0	$0	($77,550)
2007	0.6651	($8,400)	($5,587)	($102,400)	($68,106)	($13,033)	($8,668)	$169,651	$112,835	$30,474
2008	0.6274	($8,400)	($5,270)	($102,400)	($64,246)	($13,033)	($8,177)	$169,651	$106,439	$28,747
2009	0.5919	($10,500)	($6,215)	$0	$0	$0	$0	$0	$0	($6,215)
2010	0.5584	$0	$0	$0	$0	$0	$0	$0	$0	$0
2011	0.5268	$0	$0	$0	$0	$0	$0	$0	$0	$0
2012	0.497	$0	$0	$0	$0	$0	$0	$0	$0	$0
2013	0.4688	$0	$0	$0	$0	$0	$0	$0	$0	$0
2014	0.4423	$0	$0	$0	$0	$0	$0	$0	$0	$0
2015	0.4173	$0	$0	$0	$0	$0	$0	$0	$0	$0
2016	0.3936	$0	$0	$0	$0	$0	$0	$0	$0	$0
2017	0.3714	$0	$0	$0	$0	$0	$0	$0	$0	$0
2018	0.3503	$0	$0	$0	$0	$0	$0	$0	$0	$0
2019	0.3305	$0	$0	$0	$0	$0	$0	$0	$0	$0
2020	0.3118	$0	$0	$0	$0	$0	$0	$0	$0	$0
2021	0.2942	$0	$0	$0	$0	$0	$0	$0	$0	$0
2022	0.2775	$0	$0	$0	$0	$0	$0	$0	$0	$0
2023	0.2618	$0	$0	$0	$0	$0	$0	$0	$0	$0
2024	0.247	$0	$0	$0	$0	$0	$0	$0	$0	$0
Deactivation in 2040	0.0972	$0	$0							$0
Total Cost or benefit	(-=cost , +=benefit)		($400,688)		($2,152,599)		($498,031)		$3,460,760	$409,443
Timber developed m^3		68810	Section 2.2 is inaccessible. Timber volumes from section 2.1 and 2.3 only.							68810

Cost / Benefit - Section 2 - Existing and upgraded road access

Value of timber/ cubic meter is the same as estimated for the rail access option (section 2)										

Cost / Benefit - Section 3 - Existing and Upgraded road access

YEAR	P/W VALUE	Section 3 - construction and Maintenance costs	present worth construction and maintenance costs	Section 3 - harvesting costs	present worth harvesting costs	Section 3 - Hauling costs	present worth hauling costs	Section 3 - revenue	present worth revenue	TOTALS
2000	1	$0	$0	$0	$0	$0	$0	$0	$0	$0
2001	0.9434	$0	$0	$0	$0	$0	$0	$0	$0	$0
2002	0.89	$0	$0	$0	$0	$0	$0	$0	$0	$0
2003	0.8396	($140,000)	($117,544)	$0	$0	$0	$0	$0	$0	($117,544)
2004	0.7921	($141,000)	($111,686)	$0	$0	$0	$0	$0	$0	($111,686)
2005	0.7473	($10,800)	($8,071)	($418,750)	($312,932)	($110,855)	($82,842)	$866,478	$647,519	$243,674
2006	0.705	($10,800)	($7,614)	($418,750)	($295,219)	($110,855)	($78,152)	$866,478	$610,867	$229,881
2007	0.6651	($10,800)	($7,183)	($418,750)	($278,511)	($110,855)	($73,729)	$866,478	$576,294	$216,871
2008	0.6274	($6,750)	($4,235)	$0	$0	$0	$0	$0	$0	($4,235)
2009	0.5919	$0	$0	$0	$0	$0	$0	$0	$0	$0
2010	0.5584	$0	$0	$0	$0	$0	$0	$0	$0	$0
2011	0.5268	$0	$0	$0	$0	$0	$0	$0	$0	$0
2012	0.497	$0	$0	$0	$0	$0	$0	$0	$0	$0
2013	0.4688	$0	$0	$0	$0	$0	$0	$0	$0	$0
2014	0.4423	$0	$0	$0	$0	$0	$0	$0	$0	$0
2015	0.4173	$0	$0	$0	$0	$0	$0	$0	$0	$0
2016	0.3936	$0	$0	$0	$0	$0	$0	$0	$0	$0
2017	0.3714	$0	$0	$0	$0	$0	$0	$0	$0	$0
2018	0.3503	$0	$0	$0	$0	$0	$0	$0	$0	$0
2019	0.3305	$0	$0	$0	$0	$0	$0	$0	$0	$0
2020	0.3118	$0	$0	$0	$0	$0	$0	$0	$0	$0
2021	0.2942	$0	$0	$0	$0	$0	$0	$0	$0	$0
2022	0.2775	$0	$0	$0	$0	$0	$0	$0	$0	$0
2023	0.2618	$0	$0	$0	$0	$0	$0	$0	$0	$0
2024	0.247	$0	$0	$0	$0	$0	$0	$0	$0	$0
Deactivation in 2040	0.0972	$0	$0							$0
Total Cost or benefit	(-=cost , +=benefit)		($256,333)		($886,661)		($234,723)		$1,834,679	$456,962
Timber developed m^3		50250								50250

Cost / Benefit - Section 3 - Existing and Upgraded road access

Value of timber/ cubic meter is the same as estimated for the rail access option (section 3)										

Cost / Benefit - Section 4 - Existing and Upgraded road access

YEAR	P/W VALUE	Section 4 - construction and Maintenance costs	present worth construction and maintenance costs	Section 4 - harvesting costs	present worth harvesting costs	Section 4 - Hauling costs	present worth hauling costs	Section 4 - revenue	present worth revenue	TOTALS
2000	1	$0	$0	$0	$0	$0	$0	$0	$0	$0
2001	0.9434	$0	$0	$0	$0	$0	$0	$0	$0	$0
2002	0.89	$0	$0	$0	$0	$0	$0	$0	$0	$0
2003	0.8396	($100,000)	($83,960)	$0	$0	$0	$0	$0	$0	($83,960)
2004	0.7921	($100,000)	($79,210)	$0	$0	$0	$0	$0	$0	($79,210)
2005	0.7473	($3,000)	($2,242)	($289,200)	($216,119)	($17,527)	($13,098)	$464,600	$347,195	$115,736
2006	0.705	($3,000)	($2,115)	($289,200)	($203,886)	($17,527)	($12,357)	$464,600	$327,543	$109,185
2007	0.6651	($3,750)	($2,494)	$0	$0	$0	$0		$0	($2,494)
2008	0.6274	$0	$0	$0	$0	$0	$0	$0	$0	$0
2009	0.5919	($101,000)	($59,782)	$0	$0	$0	$0	$0	$0	($59,782)
2010	0.5584	($101,000)	($56,398)	$0	$0	$0	$0	$0	$0	($56,398)
2011	0.5268	($3,600)	($1,896)	($251,200)	($132,332)	($15,224)	($8,020)	$405,311	$213,518	$71,269
2012	0.497	($3,600)	($1,789)	($251,200)	($124,846)	($15,224)	($7,566)	$405,311	$201,440	$67,238
2013	0.4688	($4,500)	($2,110)	$0	$0	$0	$0	$0	$0	($2,110)
2014	0.4423	($25,000)	($11,058)	$0	$0	$0	$0	$0	$0	($11,058)
2015	0.4173	($600)	($250)	($477,180)	($199,127)	($17,527)	($7,314)	$464,600	$193,877	($12,814)
2016	0.3936	($750)	($295)	($477,180)	($187,818)	($17,527)	($6,899)	$464,600	$182,866	($12,146)
2017	0.3714	$0	$0	$0	$0	$0	$0	$0	$0	$0
2018	0.3503	$0	$0	$0	$0	$0	$0	$0	$0	$0
2019	0.3305	$0	$0	$0	$0	$0	$0	$0	$0	$0
2020	0.3118	$0	$0	$0	$0	$0	$0	$0	$0	$0
2021	0.2942	$0	$0	$0	$0	$0	$0	$0	$0	$0
2022	0.2775	$0	$0	$0	$0	$0	$0	$0	$0	$0
2023	0.2618	$0	$0	$0	$0	$0	$0	$0	$0	$0
2024	0.247	$0	$0	$0	$0	$0	$0	$0	$0	$0
Deactivation in 2040	0.0972	$0	$0							$0
Total Cost or benefit	(-=cost , +=benefit)		($303,600)		($1,064,129)		($55,254)		$1,466,440	$43,457
Timber developed m^3		41490								41490

Cost / Benefit - Section 4 - Existing and Upgraded road access

Value of timber/ cubic meter is the same as estimated for the rail access option (section 4)										

Cost / Benefit - Section 1 - Existing and upgraded road access

YEAR	P/W VALUE	Section 5 - construction and Maintenance costs	present worth construction and maintenance costs	Section 5 - harvesting costs	present worth harvesting costs	Section 5 - Hauling costs	present worth hauling costs	Section 5 - revenue	present worth revenue	TOTALS
2000	1	$0	$0	$0	$0	$0	$0	$0	$0	$0
2001	0.9434	$0	$0	$0	$0	$0	$0	$0	$0	$0
2002	0.89	$0	$0	$0	$0	($33,117)	($29,474)	$176,019	$156,657	$127,183
2003	0.8396	$0	$0	$0	$0	($33,117)	($27,805)	$176,019	$147,786	$119,981
2004	0.7921	$0	$0	$0	$0	($33,117)	($26,232)	$176,019	$139,425	$113,193
2005	0.7473	$0	$0	$0	$0	($33,117)	($24,748)	$176,019	$131,539	$106,791
2006	0.705	$0	$0	$0	$0	($33,117)	($23,347)	$176,019	$124,094	$100,746
2007	0.6651	$0	$0	$0	$0	$0	$0	$0	$0	$0
2008	0.6274	$0	$0	$0	$0	$0	$0	$0	$0	$0
2009	0.5919	$0	$0	$0	$0	$0	$0	$0	$0	$0
2010	0.5584	$0	$0	$0	$0	$0	$0	$0	$0	$0
2011	0.5268	$0	$0	$0	$0	$0	$0	$0	$0	$0
2012	0.497	$0	$0	$0	$0	$0	$0	$0	$0	$0
2013	0.4688	$0	$0	$0	$0	$0	$0	$0	$0	$0
2014	0.4423	$0	$0	$0	$0	$0	$0	$0	$0	$0
2015	0.4173	$0	$0	$0	$0	$0	$0	$0	$0	$0
2016	0.3936	$0	$0	$0	$0	$0	$0	$0	$0	$0
2017	0.3714	$0	$0	$0	$0	($33,117)	($12,300)	$176,019	$65,374	$53,074
2018	0.3503	$0	$0	$0	$0	($33,117)	($11,601)	$176,019	$61,660	$50,059
2019	0.3305	$0	$0	$0	$0	($33,117)	($10,945)	$176,019	$58,174	$47,229
2020	0.3118	$0	$0	$0	$0	($33,117)	($10,326)	$176,019	$54,883	$44,557
2021	0.2942	$0	$0	$0	$0	($33,117)	($9,743)	$176,019	$51,785	$42,042
2022	0.2775	$0	$0	$0	$0	$0	$0	$0	$0	$0
2023	0.2618	$0	$0	$0	$0	$0	$0	$0	$0	$0
2024	0.247	$0	$0	$0	$0	$0	$0	$0	$0	$0
Deactivation in 2040	0.0972	$0	$0							$0
Total Cost or benefit	(-=cost , +=benefit)		$0		$0		($186,521)		$991,377	$804,855
Timber developed m^3		78,510								78510

Cost / Benefit - Section 1 - Existing and upgraded road access

Value of timber/ cubic meter is the same as estimated for the rail access option (Section 5)								

APPENDIX 2 – RAIL LINE UPGRADE COST SUMMARY

Canadian Pacific Railway - Castlegar to Christina Lake - Upgrade cost summary

Road Section	Feature	Liabilities	Works required -in year 2000 to upgrade railbed for industrial use	Year 2000 costs	Structural maintenance	Forecast replacement	Bypass options	Comments
SECTION #1	**km 0.0 -10.2**							
km 0.00 - 1.20		Remove existing tracks	Remove existing tracks and ties	$20,000				
km 1.15	RW#1	Concrete retaining wall - cracked, dimensions 22 m x 3 m	Grout to protect rebar - geotechnical review and as-built survey. Install no post guard rails	$4,200	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	> 5 m high rock face on cutslope side.
km 0.00 - 5.00		Regravel, construct turnouts and Brush rail bed - $9000/km	Brush and dispose of debris	$45,000				
km 4.6		Partially crushed 600 CMP	Replace culvert	$600				
km 5.00	F#1	9 m deep x 200 m long fill - 750 mm culvert	none	$0		>20 years	bypass feasible if required - $5000 - maintain for long term	
km 5.1	RW#2	Stone retaining wall dimensions 150 m x (3 to 14m) - hole in fill, dimensions .3 m wide x 3 m deep	Geotechnical review and as built survey - install 150 m of no post guard rails	$16,500	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	> 10 m high rock face on cutslope side
km 5.25	RW#3	Concrete retaining wall dimensions 50 m x (3 to 6m)	Geotechnical review and as built survey - install 50 m of no post guard rail	$6,500	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	> 10 m high rock face on cutslope side
km 5.45	F#2	9 m deep x 100 m long fill - 900 mm culvert	None	$0		>20 years	n/a	Fill in good condition
km 5.75	S#1	Debris slide - 50 m long	Install a 1200 mm x 12 m culvert and rock fill. Swale fill at center to handle future debris flows	$20,000				
km 6.12		Fill slope settlement	Pull fill material back and construct road into cut bank	$500				
km 6.7	S#2	Fill slope failure - 20 m long - outside edge only	Construct road into cut bank	$500				

Canadian Pacific Railway - Castlegar to Christina Lake - Upgrade cost summary

Road Section	Feature	Liabilities	Works required -in year 2000 to upgrade railbed for industrial use	Year 2000 costs	Structural maintenance	Forecast replacement	Bypass options	Comments
km 6.85	F#3	10 m deep x 150 m long fill - 600 mm culvert	None	$0		>20 years	bypass feasible if required - $10000-maintain for long term	
km 7.5	RW#4	Stone retaining wall dimensions 100 m x (5 to 10m)	Geotechnical review and as built survey - install 100 m of no post guard rail	$11,500	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	> 10 m high rock face on cutslope side
km 7.6	B#1	McCormick bridge - 125 m span	Redeck, new curbs and handrail for bridge-untreated timber	$74,813	inspect every 3 years - $3000/ inspection	>20 years	bypass possible - $192,000	can bypass with 1000 m of road on 90%slopes and a 12 m bridge
			Initial inspection of structure	$10,000	Inspect every 10 years - $10,000			
km 8.4	RW#5	Stone retaining wall dimensions 100 m x (3 to 14m). 1.0 x 1.5 m concrete culvert	Geotechnical review and as built survey - install 100 m of no post guard rail	$11,500	Inspect every 3 years @ $200/inspection	>10 years	bypass feasible - $15,000-maintain for long term	can bypass with 150 m of road on 90%slopes and a 1600 mm culvert
km 8.5	RW#6	Stone retaining wall dimensions 50 m x 6m. 1.0 x 1.5 m concrete culvert. Small rockfall on grade	Geotechnical review and as built survey - install 50 m of no post guard rail. Remove rock from railbed	$6,700	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	20 m high rock face on cutslope side
km 8.6	S#3	Small fill slope failure - 10 m x 1.5 m	Backfill with rock	$1,500				
km 8.65	RW#7	Stone retaining wall dimensions 100 m x (3 to 14m). 1.0 x 1.5 m concrete culvert	Geotechnical review and as built survey - install 150 m of no post guard rail	$16,500	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	20 m high rock face on cutslope side
km 8.8	RW#8	Stone retaining wall dimensions 150 m x (4 to 12m)	Geotechnical review and as built survey - install 150 m of no post guard rail	$16,500	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	> 10 m high rock face on cutslope side
km 9.0	RW#9	Stone retaining wall dimensions 150 m x (4 to 12m)	Geotechnical review and as built survey - install 150 m of no post guard rail	$16,500	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	> 10 m high rock face on cutslope side
km 10.1	F#4	10 m deep x 150 m long fill - 600 mm culvert	None	$0		>20 years		

Canadian Pacific Railway - Castlegar to Christina Lake - Upgrade cost summary

Road Section	Feature	Liabilities	Works required -in year 2000 to upgrade railbed for industrial use	Year 2000 costs	Structural maintenance	Forecast replacement	Bypass options	Comments
km 5.0 - 10.2		Widen road surface on blind corners and construct 2 turnouts per km @ $3000/km		$15,000				
SUBTOTAL SECTION 1				$274,313	$4800 every 3 years			
SECTION #2	**km 10.2-29.2**							
km 11.5	F#5	Shields creek - 200 m long x 20 m deep fill. Masonary culvert - >4m x 4m dimensions	Structural review and as built survey - presently in good condition	$1,500	Inspect every 3 years @ $200/inspection	>20 years	$71,000	will require 600 m of road and a 10 m bridge
km 12.85	RW#10	Stone retaining wall dimensions 150 m x (4 to 14m)	Geotechnical review and as built survey - install 150 m of no post guard rail	$16,500	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	> 10 m high rock face on cutslope side
km 13.1	T#1	100 m long tunnel - minor rock fall at entrance and inside tunnel	Inspect. Remove rock and store for use at other locations - possible bypass if tunnel roof is not deemed safe.	$2,000	Inspect every 3 years @ $1500/inspection.	>20 years	$ 30,000	will require 200m of road on 90% slopes -rock
km 13.6	RW#11	Stone retaining wall dimensions 20m x 5m	Geotechnical review and as built survey - install 20 m of no post guard rail	$3,500	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	20 m high rock face on cutslope side
km 13.62	RW#12	Stone retaining wall dimensions 70 m x 5m	Geotechnical review and as built survey -install 70 m of no post guard rail	$8,500	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	> 10 m high rock face on cutslope side
km13.7	RW#13	Stone retaining wall dimensions 30 m x 5m	Geotechnical review and as built survey - install 30 m of no post guard rail	$4,500	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	> 10 m high rock face on cutslope side
km 14.1	T#2	100 m long tunnel - minor rock fall at entrance and inside tunnel	Inspect. Remove rock and store for use at other locations - possible bypass if tunnel roof is not deemed safe.	$2,000	Inspect every 3 years @ $1500/inspection.	>20 years	$ 30,000	will require 200m of road on 90% slopes -rock
km 14.2	F#6 and FL#1	100 m long X 9 m deep fill. 40 - 50 m long concrete flume. 600 mm culvert	Clean flume of branches and woody debris	$150	Inspect every 3 years @ $200/inspection	>20 years		

Canadian Pacific Railway - Castlegar to Christina Lake - Upgrade cost summary

Road Section	Feature	Liabilities	Works required -in year 2000 to upgrade railbed for industrial use	Year 2000 costs	Structural maintenance	Forecast replacement	Bypass options	Comments
km 15.3	B#2	Farr creek bridge - 102 m length	Redeck, new curbs and handrail for bridge-untreated timber	$61,767	inspect every 3 years - $3000/ inspection	>20 years	bypass possible - $185,000	can bypass with 1000 m of road on 90%slopes and a 10 m bridge
			Inspect structure	$10,000	Inspect every 10 years - $10,000			
km 15.7	RW#14	Stone retaining wall dimensions 100 m x (4 to 14m)	Geotechnical review and as built survey - install 100 m of no post guard rail	$11,500	Inspect every 3 years @ $200/inspection	>10 years	bypass feasible - $10,000-maintain for long term	Will require 100m of road on 80% slopes -rock
km 16.1	B#3	Cub creek bridge - 125 m span	Redeck, new curbs and handrail for bridge-untreated timber	$74,813	inspect every 3 years - $3000/ inspection	>20 years	bypass possible - $185,000	can bypass with 1000 m of road on 90%slopes and a 10 m bridge
			Inspect structure	$10,000	Inspect every 10 years - $10,000			
km 16.6	RW#15	Stone retaining wall dimensions 100 m x (4 to 14m)	Geotechnical review and as built survey - install 100 m of no post guard rail	$11,500	Inspect every 3 years @ $200/inspection	>10 years	bypass feasible - $10,000-maintain for long term	Will require 100m of road on 80% slopes -rock
km 17.1	RW#16	Stone retaining wall dimensions 100 m x (4 to 14m)	Geotechnical review and as built survey - install 100 m of no post guard rail	$11,500	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	> 6 m high rock face on cutslope side
km 17.3	RW#17	Stone retaining wall dimensions 50 m x (4 to 6m)	Geotechnical review and as built survey - install 50 m of no post guard rail	$6,500	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	> 10 m high rock face on cutslope side
km 17.35	RW#18	Stone retaining wall dimensions 150 m x (4 to 14m)	Geotechnical review and as built survey - install 150 m of no post guard rail	$16,500	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	> 10 m high rock face on cutslope side
km 17.6	RW#19	Stone retaining wall dimensions 30 m x 4m high	Geotechnical review and as built survey - install 30 m of no post guard rail	$4,500	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	> 10 m high rock face on cutslope side
km 18.0	T#3	100 m long tunnel - minor rock fall at entrance and inside tunnel	Inspect. Remove rock and store for use at other locations - possible bypass if tunnel roof is not deemed safe.	$2,000	Inspect every 3 years @ $1500/inspection.	>20 years	$ 30,000	will require 200m of road on 90% slopes -rock

Canadian Pacific Railway - Castlegar to Christina Lake - Upgrade cost summary

Road Section	Feature	Liabilities	Works required -in year 2000 to upgrade railbed for industrial use	Year 2000 costs	Structural maintenance	Forecast replacement	Bypass options	Comments
km 18.6	F#7	Large fill 25 m deep x 200 m long. 1200 mm concrete culvert in good working condition	Structural review and as built survey - presently in good condition	$1,500	Inspect every 3 years @ $200/inspection	>20 years	$40,000	can be bypassed with 800 m of new road and a 1200 mm culvert
km 20.4	RW#20	Stone retaining wall dimensions 70 m x 6-8m high	Geotechnical review and as built survey - install 70 m of no post guard rail	$8,500	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	5-8 m high rock face on cutslope side
km 20.7	RW#21	Stone retaining wall dimensions 80 m x (5 to 14m)	Geotechnical review and as built survey - install 80 m of no post guard rail	$9,500	Inspect every 3 years @ $200/inspection	>10 years	bypass not feasible	5-8 m high rock face on cutslope side
km 21.3	S#4	Large rockfall on road - cracks evident in 20 m high rock face above rail grade	Remove rock and minor rock scaling.	$10,000				
km 21.6	RW#22	Stone retaining wall dimensions 30 m x 4m	Geotechnical review and as built survey - install 30 m of no post guard rail	$4,500	Inspect every 3 years @ $200/inspection	>10 years	bypass feasible - $5,000-maintain for long term	Will require 50m of road on 80% slopes -rock
km 22.0	F#8	Fill - 50 m long x 5-7 m deep. No culvert installed	Install a 600 mm culvert at the bottom of the fill.	$1,500		>20 years		
km 24.7	S#5	Small failure - 10 m long x 3 m deep	Repair using a rock fill.	$1,000				
km 25.0	F#9	Fill - 200 m long and 25 m deep. Culvert inlet partially blocked with debris	Structural review and as built survey. Remove debris from culvert entrance.	$2,000		>20 years	$40,000	can be bypassed with 1000 m of new road and a 1200 mm culvert
km 26.7	F#10 FL#2 S#6	Fill - 50 m long x 6-8 m deep, steel flume on wooden posts directs water to 600 mm culvert. Flume failed and parts of fill have been eroded away	Replace eroded fill and install a 600 mm culvert in base of fill.	$15,000		< 10 years		
km 28.3	T#4	Bulldog tunnel - 900 m . rock has fallen at tunnel entrance.	Inspect. Remove rock and store for use at other locations - possible termination of route if tunnel roof is not deemed safe.	$5,000	Inspect every 3 years @ $1500/inspection.	>20 years	bypass feasible - $160,000	Will require 4 km of new road on 60% slopes
km 10.2 - 29.2		Brushing	Brush approximately 9 km	$6,300				

Canadian Pacific Railway - Castlegar to Christina Lake - Upgrade cost summary

Road Section	Feature	Liabilities	Works required -in year 2000 to upgrade railbed for industrial use	Year 2000 costs	Structural maintenance	Forecast replacement	Bypass options	Comments
km 10.2 - 29.2		Widen road surface on blind corners and construct 2 turnouts per km @ $3000/km		$57,000				
SUBTOTAL SECTION 2				$381,030				
SECTION 3	**km 29.2-49.3**							
km 30.9	F#11	Quinn creek crossing - 30 m deep fill x 200m long. 1600 mm concrete culvert	Structural review and as built survey - presently in good condition	$1,500	Inspect every 3 years @ $200/inspection	>20 years	bypass feasible - $50000	Will require 1 km of new road and a 1600 mm culvert
km 32.5	F#12	Large fill - 15 m deep x 100 m long - 600 mm concrete culvert	none	$0		>20 years	bypass feasible - $10000-maintain for long term	will require 300 m of new road and a 600 mm culvert
km 34.6	F#13	Small fill - 6 m deep x 40 m long - 600 mm cmp.	none	$0		>20 years	no bypass required	
km 34.7	F#14	Small fill - 5 - 8 m deep x 120 m long- 900 mm cmp	Clean debris from outlet	$200		>20 years	no bypass required	
km 36.05	F#15	Porcupine creek crossing - 48 m deep x 250 m long - 2.5 x 3.5 m concrete arch	Structural review and as built survey - presently in good condition	$1,500	Inspect every 3 years @ $200/inspection	>20 years	bypass feasible - $88,000	Will require 1 km of new road in rock and an 8 m bridge
km 29.2-49.3		Brushing	brush approximately 10 km	$7,000				
km 29.2-49.3		Widen road surface on blind corners and construct 2 turnouts per km @ $3000/km		$60,000				
SUBTOTAL SECTION 3				$70,200				
SECTION 4	**km 49.3-71.4**							
km 50.0		Damaged 1200 mm culvert	Replace culvert	$3,000				
km 50.7	RW#23	Small retaining wall - 1.5 x 60 m long upslope of railbed	none-wall on uphill side of rail bed	$1,500	Inspect every 3 years @ $200/inspection	>10 years	no bypass required	small cut slope retaining structure.

Canadian Pacific Railway - Castlegar to Christina Lake - Upgrade cost summary

Road Section	Feature	Liabilities	Works required -in year 2000 to upgrade railbed for industrial use	Year 2000 costs	Structural maintenance	Forecast replacement	Bypass options	Comments
km 51.0	T#5	100 m long tunnel - minor rock fall at entrance and inside tunnel	Inspect. Remove rock and store for use at other locations - possible bypass if tunnel roof is not deemed safe.	$2,000	Inspect every 3 years @ $1500/inspection.	>20 years	$ 30,000	will require 200m of road on 90% slopes -rock
km 52.35	RW#24	Stone retaining wall dimensions 30 m x 12 m high	Geotechnical review and as built survey - install 30 m of no post guard rail	$4,500	Inspect every 3 years @ $200/inspection	>10 years	bypass feasible - $5,000 - maintain for long term	Will require 30m of road on 70% slopes -rock
km 52.65	S#7	Small cutslope failure - 10 - 12 m long	construct a small lockblock retaining wall 1.5 m high.	$4,000				
km 52.7	RW#25	Stone retaining wall dimensions 55 m x 12 m - 900 mm masonary culvert	Geotechnical review and as built survey - install 55 m of no post guard rail	$7,000	Inspect every 3 years @ $200/inspection	>10 years	bypass feasible - $10,000 - maintain for long term	can bypass with 100 m of road on 80%slopes and a 1000 mm culvert
km 54.1	F#16	Coryell creek - 80 m long x 15 m high fill - rock tunnel as water diversion - 3m x 3m wide.	Clean woody debris from entrance.	$500	Inspect every 3 years @ $200/inspection	>20 years	no bypass required	
km 57.5	RW#26	Concrete retaining wall on uphill side dimensions 50 m x 1.2m	none- wall on uphill side of rail bed	$0	Inspect every 3 years @ $200/inspection	>10 years	no bypass required	
km 57.9	F#17 FL#3	Large fill - 80 m x 15 m deep - Steel flume to 600 mm culvert in poor condition - requires replacement or culvert installation at base of fill.	Install a 600 mm culvert part way up the fill or rebuild the flume and maintain. May want to bypass this structure	$18,000	Inspect every 3 years @ $200/inspection	>20 years	bypass feasible - $18,000 - maintain for long term	can bypass with 300 m of road and a 600 mm culvert
km 58.9	F#18 FL#4	Large fill - 80 m x 12 m deep - Concrete flume in good condition - 600 mm culvert in good condition	none	$0	Inspect every 3 years @ $200/inspection	>20 years	no bypass required	maintain
km 59.3	B#4	Snowslide bridge - 41 m long	Bypass or redeck	$13,380		>20 years		
			Inspect bridge	$2,000				
km 60.1	F#19 FL#5	Large fill 100 m x 15 m - concrete flume in good condition - 600 mm culvert in good condition	none	$0	Inspect every 3 years @ $200/inspection	>20 years	no bypass required	maintain

Canadian Pacific Railway - Castlegar to Christina Lake - Upgrade cost summary

Road Section	Feature	Liabilities	Works required -in year 2000 to upgrade railbed for industrial use	Year 2000 costs	Structural maintenance	Forecast replacement	Bypass options	Comments
km 60.6	F#20 FL#6	Small fill 50 m x 6-8 m deep - concrete flume in good condition - 600 mm culvert in good condition	none	$0	Inspect every 3 years @ $200/inspection	>20 years	no bypass required	maintain
km 61.6	F#21 FL#7 S#8	Large fill - 100 m x 12 m deep - steel flume failed - significantly eroded	Presently only usable by ATV's. Install a 900 mm culvert in fill and build up eroded fill to make usable. Can swale grade to reduce fill material.Another option is to bypass the fill with a new road and deactivate the old fill. Costs are approx. equal.	$27,000	Inspect every 3 years @ $200/inspection	<10 years	bypass feasible - $18,000 - maintain for long term	can be bypassed with 300 m of road and a 600 mm culvert
km 64.6	F#22 FL#8	Large fill - 100 m x 12 m deep - steel flume working - 800 mm culvert working	Flume in poor condition (wooden supports rotting). Either replace steel flume or bypass with new road section and deactivate fill.	$27,000	inspect every 3 years @ $200/inspection	>20 years	bypass feasible - $18,000 - maintain for long term	can be bypassed with 300 m of road and an 800 mm culvert
km 65.7	F#23 FL#9	Spaulding creek - 70 m x 3 m fill - 600 mm culvert and small flume	Install a 600 mm culvert in the fill.	$1,200	Inspect every 3 years @ $200/inspection	>20 years	no bypass required	maintain
km 67.0	RW#27	Stone retaining wall dimensions 55 m x 12m	Geotechnical review and as built survey - install 55 m of no post guard rail	$7,000	Inspect every 3 years @ $200/inspection	>10 years	bypass feasible - $3,000 - maintain for long term	Will require 60m of road on 50% slopes -rock
km 67.45	F#24	Large fill - dimensions 100 m x 15m - 800 mm culvert	none	$0		>20 years	bypass feasible- $6000 - maintain for long term	will require 200 m of road on 50% slopes
km 68.4	RW#28	Stone retaining wall dimensions 10 m x 4m high	Install 10 m of no post guard rail	$1,000	Inspect every 3 years @ $200/inspection	>10 years	maintainable	small retaining wall
km 68.75	F#25	Baker creek - 100 m x 12 m deep fill - 1200 mm concrete culvert in good condition	none	$0		>20 years	maintainable	
km 49.3-71.2		Widen road surface on blind corners and construct 2 turnouts per km @ $3000/km		$66,000				
SUBTOTAL SECTION 4				$185,080				

Canadian Pacific Railway - Castlegar to Christina Lake - Upgrade cost summary

Road Section	Feature	Liabilities	Works required -in year 2000 to upgrade railbed for industrial use	Year 2000 costs	Structural maintenance	Forecast replacement	Bypass options	Comments
SECTION 5	SHIELDS CRK			$0				
SUBTOTAL	SECTION 1			$274,313				
SUBTOTAL	SECTION 2			$381,030				
SUBTOTAL	SECTION 3			$70,200				
SUBTOTAL	SECTION 4			$185,080				
SUBTOTAL	SECTION 5			$0				
TOTAL				$910,622				

APPENDIX 3 – RAIL LINE DEACTIVATION COST SUMMARY

Canadian Pacific Railway - Castlegar to Christina Lake - Deactivation cost summary

Railway Grade - Deactivation costs					
Road Section	Feature	Description of Feature	Description of works	Deactivation costs	
SECTION #1	**km 0.0 -10.2**				
km 0.00 - 1.20		Remove existing tracks	deactivation not required	$0	
km 1.15	RW#1	Concrete retaining wall - cracked, dimensions 22 m x 3 m	deactivation not required	$0	
km 4.6		Partially crushed 600 CMP	Remove culvert	$300	
km 5.00	F#1	9 m deep x 200 m long fill - 750 mm culvert	excavate fill and culvert	$5,994	
km 5.1	RW#2	Stone retaining wall dimensions 150 m x (3 to 14m) - hole in fill, dimensions .3 m wide x 3 m deep	deactivation not required	$0	
km 5.25	RW#3	Concrete retaining wall dimensions 50 m x (3 to 6m)	deactivation not required	$0	
km 5.45	F#2	9 m deep x 100 m long fill - 900 mm culvert	excavate fill and culvert	$5,994	
km 5.75	S#1	Debris slide - 50 m long	swale fill and armour with rock	$3,000	
km 6.85	F#3	10 m deep x 150 m long fill - 600 mm culvert	excavate fill and culvert	$8,000	
km 7.5	RW#4	Stone retaining wall dimensions 100 m x (5 to 10m)	deactivation not required	$0	
km 7.6	B#1	McCormick bridge - 125 m span	Remove and disassemble girders.	$200,000	
km 8.4	RW#5	Stone retaining wall dimensions 100 m x (3 to 14m). 1.0 x 1.5 m concrete culvert	deactivation not required	$0	
km 8.5	RW#6	Stone retaining wall dimensions 50 m x 6m. 1.0 x 1.5 m concrete culvert. Small rockfall on grade	deactivation not required	$0	
km 8.65	RW#7	Stone retaining wall dimensions 100 m x (3 to 14m). 1.0 x 1.5 m concrete culvert	deactivation not required	$0	
km 8.8	RW#8	Stone retaining wall dimensions 150 m x (4 to 12m)	deactivation not required	$0	
km 9.0	RW#9	Stone retaining wall dimensions 150 m x (4 to 12m)	deactivation not required	$0	
km 10.1	F#4	10 m deep x 150 m long fill - 600 mm culvert	excavate fill and culvert	$8,000	
km 0.0 - 10.2		remove culverts and waterbar where required	@ $750/km	$7,650	
SUBTOTAL SECTION 1				$238,938	
SECTION #2	**km 10.2-29.2**				

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Canadian Pacific Railway - Castlegar to Christina Lake - Deactivation cost summary

Road Section	Feature	Description of Feature	Description of works	Deactivation costs	
km 11.5	F#5	Shields creek - 200 m long x 20 m deep fill. Masonary culvert - >4m x 4m dimensions	excavate fill and culvert	$56,000	
km 12.85	RW#10	Stone retaining wall dimensions 150 m x (4 to 14m)	deactivation not required	$0	
km 13.1	T#1	100 m long tunnel - minor rock fall at entrance and inside tunnel	deactivation not required	$0	
km 13.6	RW#11	Stone retaining wall dimensions 20m x 5m	deactivation not required	$0	
km 13.62	RW#12	Stone retaining wall dimensions 70 m x 5m	deactivation not required	$0	
km13.7	RW#13	Stone retaining wall dimensions 30 m x 5m	deactivation not required	$0	
km 14.1	T#2	100 m long tunnel - minor rock fall at entrance and inside tunnel	deactivation not required	$0	
km 14.2	F#6 and FL#1	100 m long X 9 m deep fill. 40 - 50 m long concrete flume. 600 mm culvert	excavate fill and culvert	$5,994	
km 15.3	B#2	Farr creek bridge - 102 m length	Remove and disassemble girders.	$200,000	
km 15.7	RW#14	Stone retaining wall dimensions 100 m x (4 to 14m)	deactivation not required	$0	
km 16.1	B#3	Cub creek bridge - 125 m span	Remove and disassemble girders.	$200,000	
km 16.6	RW#15	Stone retaining wall dimensions 100 m x (4 to 14m)	deactivation not required	$0	
km 17.1	RW#16	Stone retaining wall dimensions 100 m x (4 to 14m)	deactivation not required	$0	
km 17.3	RW#17	Stone retaining wall dimensions 50 m x (4 to 6m)	deactivation not required	$0	
km 17.35	RW#18	Stone retaining wall dimensions 150 m x (4 to 14m)	deactivation not required	$0	
km 17.6	RW#19	Stone retaining wall dimensions 30 m x 4m high	deactivation not required	$0	
km 18.0	T#3	100 m long tunnel - minor rock fall at entrance and inside tunnel	deactivation not required	$0	
km 18.6	F#7	Large fill 25 m deep x 200 m long. 1200 mm concrete culvert in good working condition	excavate fill and culvert	$106,250	
km 20.4	RW#20	Stone retaining wall dimensions 70 m x 6-8m high	deactivation not required	$0	
km 20.7	RW#21	Stone retaining wall dimensions 80 m x (5 to 14m)	deactivation not required	$0	
km 21.6	RW#22	Stone retaining wall dimensions 30 m x 4m	deactivation not required	$0	

Canadian Pacific Railway - Castlegar to Christina Lake - Deactivation cost summary

Road Section	Feature	Description of Feature	Description of works	Deactivation costs	
km 22.0	F#8	Fill - 50 m long x 5-7 m deep. No culvert installed	excavate fill and culvert	$2,016	
km 25.0	F#9	Fill - 200 m long and 25 m deep. Culvert inlet partially blocked with debris	excavate fill and culvert	$106,250	
km 26.7	F#10 FL#2 S#6	Fill - 50 m long x 6-8 m deep, steel flume on wooden posts directs water to 600 mm culvert.	excavate fill and culvert	$3,038	
km 28.3	T#4	Bulldog tunnel - 900 m . rock has fallen at tunnel entrance.	deactivation not required	$0	
km 10.2 - 29.2		remove culverts and waterbar where required	@ $750/km	$14,250	
SUBTOTAL SECTION 2				$693,798	
SECTION 3	km 29.2-49.3				
km 30.9	F#11	Quinn creek crossing - 30 m deep fill x 200m long. 1600 mm concrete culvert	excavate fill and culvert	$180,000	
km 32.5	F#12	Large fill - 15 m deep x 100 m long - 600 mm concrete culvert	excavate fill and culvert	$24,750	
km 34.6	F#13	Small fill - 6 m deep x 40 m long - 600 mm cmp.	excavate fill and culvert	$2,016	
km 34.7	F#14	Small fill - 5 - 8 m deep x 120 m long- 900 mm cmp	excavate fill and culvert	$2,493	
km 36.05	F#15	Porcupine creek crossing - 48 m deep x 250 m long - 2.5 x 3.5 m concrete arch	excavate fill and culvert	$709,632	
km 29.2-49.3		remove culverts and waterbar where required	@ $750/km	$15,000	
SUBTOTAL SECTION 3				$933,891	
SECTION 4	km 49.3-71.4				
km 50.0		Damaged 1200 mm culvert	Remove culvert	$300	
km 50.7	RW#23	Small retaining wall - 1.5 x 60 m long upslope of railbed	deactivation not required	$0	
km 51.0	T#5	100 m long tunnel - minor rock fall at entrance and inside tunnel	deactivation not required	$0	
km 52.35	RW#24	Stone retaining wall dimensions 30 m x 12 m high	deactivation not required	$0	
km 52.7	RW#25	Stone retaining wall dimensions 55 m x 12 m - 900 mm masonary culvert	deactivation not required	$0	
km 54.1	F#16	Coryell creek - 80 m long x 15 m high fill - rock tunnel as water diversion - 3m x 3m wide.	excavate fill and culvert	$24,750	
km 57.5	RW#26	Concrete retaining wall on uphill side dimensions 50 m x 1.2m	deactivation not required	$0	

Canadian Pacific Railway - Castlegar to Christina Lake - Deactivation cost summary

Road Section	Feature	Description of Feature	Description of works	Deactivation costs	
km 57.9	F#17 FL#3	Large fill - 80 m x 15 m deep - Steel flume to 600 mm culvert in poor condition	excavate fill and culvert	$24,750	
km 58.9	F#18 FL#4	Large fill - 80 m x 12 m deep - Concrete flume in good condition - 600 mm culvert in good condition	excavate fill and culvert	$13,248	
km 59.3	B#4	Snowslide bridge - 41 m long	Bypass	$40,000	
km 60.1	F#19 FL#5	Large fill 100 m x 15 m - concrete flume in good condition - 600 mm culvert in good condition	excavate fill and culvert	$24,750	
km 60.6	F#20 FL#6	Small fill 50 m x 6-8 m deep - concrete flume in good condition - 600 mm culvert in good condition	excavate fill and culvert	$3,038	
km 61.6	F#21 FL#7 S#8	Large fill - 100 m x 12 m deep - steel flume failed - significantly eroded	excavate fill and culvert	$13,248	
km 64.6	F#22 FL#8	Large fill - 100 m x 12 m deep - steel flume working - 800 mm culvert working	excavate fill and culvert	$13,248	
km 65.7	F#23 FL#9	Spaulding creek - 70 m x 3 m fill - 600 mm culvert and small flume	excavate fill and culvert	$342	
km 67.0	RW#27	Stone retaining wall dimensions 55 m x 12m	deactivation not required	$0	
km 67.45	F#24	Large fill - dimensions 100 m x 15m - 800 mm culvert	excavate fill and culvert	$24,750	
km 68.4	RW#28	Stone retaining wall dimensions 10 m x 4m high	deactivation not required	$0	
km 68.75	F#25	Baker creek - 100 m x 12 m deep fill - 1200 mm concrete culvert in good condition	excavate fill and culvert	$13,248	
km 49.3-71.2		remove culverts and waterbar where required	@ $750/km	$16,425	
SUBTOTAL SECTION 4				$212,097	
SUBTOTAL	SECTION 1			$238,938	
SUBTOTAL	SECTION 2			$693,798	
SUBTOTAL	SECTION 3			$933,891	
SUBTOTAL	SECTION 4			$212,097	
TOTAL				$2,078,724	
NOTE: FILL EXCAVATION AND MOVEMENT HAS BEEN ESTIMATED BASED ON $4.00/ CUBIC METER.					
NOTE: BRIDGE REMOVAL IS BASED ON TAKING APPROXIMATELY 20 DAYS WITH MEN AND EQUIPMENT.					

APPENDIX 4 – RAIL LINE BYPASS COST SUMMARY

Road Section	Feature	Feature description	Bypass cost - Major structures	Bypass options	Comments
SECTION #1	**km 0.0 -10.2**				
km 1.15	RW#1	Concrete retaining wall - cracked, dimensions 22 m x 3 m	$0	bypass not feasible	> 5 m high rock face on cutslope side.
km 4.6		Partially crushed 600 CMP	$0		
km 5.00	F#1	9 m deep x 200 m long fill - 750 mm culvert	$0	bypass feasible if required - $5000 - maintain for long term	
km 5.1	RW#2	Stone retaining wall dimensions 150 m x (3 to 14m) - hole in fill, dimensions .3 m wide x 3 m deep	$0	bypass not feasible	> 10 m high rock face on cutslope side
km 5.25	RW#3	Concrete retaining wall dimensions 50 m x (3 to 6m)	$0	bypass not feasible	> 10 m high rock face on cutslope side
km 5.45	F#2	9 m deep x 100 m long fill - 900 mm culvert	$0	maintain	Fill in good condition
km 5.75	S#1	Debris slide - 50 m long	$0		
km 6.12		Fill slope settlement	$0		
km 6.7	S#2	Fill slope failure - 20 m long - outside edge only	$0		
km 6.85	F#3	10 m deep x 150 m long fill - 600 mm culvert	$0	bypass feasible if required - $10000- maintain for long term	
km 7.5	RW#4	Stone retaining wall dimensions 100 m x (5 to 10m)	$0	bypass not feasible	> 10 m high rock face on cutslope side
km 7.6	B#1	McCormick bridge - 125 m span	$192,000	bypass possible - $192,000	can bypass with 1000 m of road on 90%slopes and a 12 m bridge
km 8.4	RW#5	Stone retaining wall dimensions 100 m x (3 to 14m). 1.0 x 1.5 m concrete culvert	$0	bypass feasible - $15,000-maintain for long term	can bypass with 150 m of road on 90%slopes and a 1600 mm culvert
km 8.5	RW#6	Stone retaining wall dimensions 50 m x 6m. 1.0 x 1.5 m concrete culvert. Small rockfall on grade	$0	bypass not feasible	20 m high rock face on cutslope side
km 8.6	S#3	Small fill slope failure - 10 m x 1.5 m	$0		
km 8.65	RW#7	Stone retaining wall dimensions 100 m x (3 to 14m). 1.0 x 1.5 m concrete culvert	$0	bypass not feasible	20 m high rock face on cutslope side

Road Section	Feature	Feature description	Bypass cost - Major structures	Bypass options	Comments
km 8.8	RW#8	Stone retaining wall dimensions 150 m x (4 to 12m)	$0	bypass not feasible	> 10 m high rock face on cutslope side
km 9.0	RW#9	Stone retaining wall dimensions 150 m x (4 to 12m)	$0	bypass not feasible	> 10 m high rock face on cutslope side
km 10.1	F#4	10 m deep x 150 m long fill - 600 mm culvert	$0	maintain	
SUBTOTAL SECTION 1			$192,000		
SECTION #2	km 10.2-29.2				
km 11.5	F#5	Shields creek - 200 m long x 20 m deep fill. Masonary culvert - >4m x 4m dimensions	$71,000	$71,000	will require 600 m of road and a 10 m bridge
km 12.85	RW#10	Stone retaining wall dimensions 150 m x (4 to 14m)	$0	bypass not feasible	> 10 m high rock face on cutslope side
km 13.1	T#1	100 m long tunnel - minor rock fall at entrance and inside tunnel	$30,000	$ 30,000	will require 200m of road on 90% slopes -rock
km 13.6	RW#11	Stone retaining wall dimensions 20m x 5m	$0	bypass not feasible	20 m high rock face on cutslope side
km 13.62	RW#12	Stone retaining wall dimensions 70 m x 5m	$0	bypass not feasible	> 10 m high rock face on cutslope side
km13.7	RW#13	Stone retaining wall dimensions 30 m x 5m	$0	bypass not feasible	> 10 m high rock face on cutslope side
km 14.1	T#2	100 m long tunnel - minor rock fall at entrance and inside tunnel	$30,000	$ 30,000	will require 200m of road on 90% slopes -rock
km 14.2	F#6 and FL#1	100 m long X 9 m deep fill. 40 - 50 m long concrete flume. 600 mm culvert	$0	maintain	
km 15.3	B#2	Farr creek bridge - 102 m length	$185,000	bypass possible - $185,000	can bypass with 1000 m of road on 90%slopes and a 10 m bridge
km 15.7	RW#14	Stone retaining wall dimensions 100 m x (4 to 14m)	$0	bypass feasible - $10,000-maintain for long term	Will require 100m of road on 80% slopes -rock
km 16.1	B#3	Cub creek bridge - 125 m span	$185,000	bypass possible - $185,000	can bypass with 1000 m of road on 90%slopes and a 10 m bridge

Road Section	Feature	Feature description	Bypass cost - Major structures	Bypass options	Comments
km 16.6	RW#15	Stone retaining wall dimensions 100 m x (4 to 14m)	$0	bypass feasible - $10,000-maintain for long term	Will require 100m of road on 80% slopes -rock
km 17.1	RW#16	Stone retaining wall dimensions 100 m x (4 to 14m)	$0	bypass not feasible	> 6 m high rock face on cutslope side
km 17.3	RW#17	Stone retaining wall dimensions 50 m x (4 to 6m)	$0	bypass not feasible	> 10 m high rock face on cutslope side
km 17.35	RW#18	Stone retaining wall dimensions 150 m x (4 to 14m)	$0	bypass not feasible	> 10 m high rock face on cutslope side
km 17.6	RW#19	Stone retaining wall dimensions 30 m x 4m high	$0	bypass not feasible	> 10 m high rock face on cutslope side
km 18.0	T#3	100 m long tunnel - minor rock fall at entrance and inside tunnel	$30,000	$ 30,000	will require 200m of road on 90% slopes -rock
km 18.6	F#7	Large fill 25 m deep x 200 m long. 1200 mm concrete culvert in good working condition	$40,000	$40,000	can be bypassed with 800 m of new road and a 1200 mm culvert
km 20.4	RW#20	Stone retaining wall dimensions 70 m x 6-8m high	$0	bypass not feasible	5-8 m high rock face on cutslope side
km 20.7	RW#21	Stone retaining wall dimensions 80 m x (5 to 14m)	$0	bypass not feasible	5-8 m high rock face on cutslope side
km 21.3	S#4	Large rockfall on road - cracks evident in 20 m high rock face above rail grade	$0		
km 21.6	RW#22	Stone retaining wall dimensions 30 m x 4m	$0	bypass feasible - $5,000-maintain for long term	Will require 50m of road on 80% slopes -rock
km 22.0	F#8	Fill - 50 m long x 5-7 m deep. No culvert installed	$0	maintain	
km 24.7	S#5	Small failure - 10 m long x 3 m deep	$0		
km 25.0	F#9	Fill - 200 m long and 25 m deep. Culvert inlet partially blocked with debris	$40,000	$40,000	can be bypassed with 1000 m of new road and a 1200 mm culvert
km 26.7	F#10 FL#2 S#6	Fill - 50 m long x 6-8 m deep, steel flume on wooden posts directs water to 600 mm culvert. Flume failed and parts of fill have been eroded away	$0	maintain	
km 28.3	T#4	Bulldog tunnel - 900 m . rock has fallen at tunnel entrance.	$160,000	bypass feasible - $160,000	Will require 4 km of new road on 60% slopes

Road Section	Feature	Feature description	Bypass cost - Major structures	Bypass options	Comments
SUBTOTAL SECTION 2			$771,000		
SECTION 3	km 29.2-49.3				
km 30.9	F#11	Quinn creek crossing - 30 m deep fill x 200m long. 1600 mm concrete culvert	$50,000	bypass feasible - $50000	Will require 1 km of new road and a 1600 mm culvert
km 32.5	F#12	Large fill - 15 m deep x 100 m long - 600 mm concrete culvert	$0	bypass feasible - $10000-maintain for long term	will require 300 m of new road and a 600 mm culvert
km 34.6	F#13	Small fill - 6 m deep x 40 m long - 600 mm cmp.	$0	no bypass required	
km 34.7	F#14	Small fill - 5 - 8 m deep x 120 m long- 900 mm cmp	$0	no bypass required	
km 36.05	F#15	Porcupine creek crossing - 48 m deep x 250 m long - 2.5 x 3.5 m concrete arch	$88,000	bypass feasible - $88,000	Will require 1 km of new road in rock and an 8 m bridge
SUBTOTAL SECTION 3			$138,000		
SECTION 4	km 49.3-71.4				
km 50.0		Damaged 1200 mm culvert	$0	maintainable	
km 50.7	RW#23	Small retaining wall - 1.5 x 60 m long upslope of railbed	$0	no bypass required	small cut slope retaining structure.
km 51.0	T#5	100 m long tunnel - minor rock fall at entrance and inside tunnel	$30,000	$ 30,000	will require 200m of road on 90% slopes -rock
km 52.35	RW#24	Stone retaining wall dimensions 30 m x 12 m high	$0	bypass feasible - $5,000 - maintain for long term	Will require 30m of road on 70% slopes -rock
km 52.65	S#7	Small cutslope failure - 10 - 12 m long	$0		
km 52.7	RW#25	Stone retaining wall dimensions 55 m x 12 m - 900 mm masonary culvert	$0	bypass feasible - $10,000 - maintain for long term	can bypass with 100 m of road on 80%slopes and a 1000 mm culvert
km 54.1	F#16	Coryell creek - 80 m long x 15 m high fill - rock tunnel as water diversion - 3m x 3m wide.	$0	maintainable	
km 57.5	RW#26	Concrete retaining wall on uphill side dimensions 50 m x 1.2m	$0	maintainable	

Road Section	Feature	Feature description	Bypass cost - Major structures	Bypass options	Comments
km 57.9	F#17 FL#3	Large fill - 80 m x 15 m deep - Steel flume to 600 mm culvert in poor condition - requires replacement or culvert installation at base of fill.	$0	bypass feasible - $18,000 - maintain for long term	can bypass with 300 m of road and a 600 mm culvert
km 58.9	F#18 FL#4	Large fill - 80 m x 12 m deep - Concrete flume in good condition - 600 mm culvert in good condition	$0	maintainable	maintain
km 59.3	B#4	Snowslide bridge - 41 m long	$0		
km 60.1	F#19 FL#5	Large fill 100 m x 15 m - concrete flume in good condition - 600 mm culvert in good condition	$0	maintainable	maintain
km 60.6	F#20 FL#6	Small fill 50 m x 6-8 m deep - concrete flume in good condition - 600 mm culvert in good condition	$0	maintainable	maintain
km 61.6	F#21 FL#7 S#8	Large fill - 100 m x 12 m deep - steel flume failed - significantly eroded	$0	bypass feasible - $18,000 - maintain for long term	can be bypassed with 300 m of road and a 600 mm culvert
km 64.6	F#22 FL#8	Large fill - 100 m x 12 m deep - steel flume working - 800 mm culvert working	$0	bypass feasible - $18,000 - maintain for long term	can be bypassed with 300 m of road and an 800 mm culvert
km 65.7	F#23 FL#9	Spaulding creek - 70 m x 3 m fill - 600 mm culvert and small flume	$0	maintainable	maintain
km 67.0	RW#27	Stone retaining wall dimensions 55 m x 12m	$0	bypass feasible - $3,000 - maintain for long term	Will require 60m of road on 50% slopes -rock
km 67.45	F#24	Large fill - dimensions 100 m x 15m - 800 mm culvert	$0	bypass feasible- $6000 - maintain for long term	will require 200 m of road on 50% slopes
km 68.4	RW#28	Stone retaining wall dimensions 10 m x 4m high	$0	maintainable	small retaining wall
km 68.75	F#25	Baker creek - 100 m x 12 m deep fill - 1200 mm concrete culvert in good condition	$0	maintainable	
SUBTOTAL SECTION 4			$30,000		
SECTION 5	SHIELDS CRK		$0		
SUBTOTAL	SECTION 1		$192,000		
SUBTOTAL	SECTION 2		$771,000		
SUBTOTAL	SECTION 3		$138,000		
SUBTOTAL	SECTION 4		$30,000		
SUBTOTAL	SECTION 5		$0		

Canadian Pacific Railway - Castlegar to Christina Lake - Bypass cost summary

Road Section	Feature	Feature description	Bypass cost - Major structures	Bypass options	Comments
TOTAL			$1,131,000		

APPENDIX 5 – PRESENT WORTH - CONSTRUCTION AND MAINTENANCE COSTS

Construction and Maintenance schedule using existing road access

YEAR	SECTION 1 km 0.0-10.2	SECTION 2 km 10.2-29.2	SECTION 3 km 29.2-49.3	SECTION 4 km 49.3-71.4
2000	no works req'd	construct access to Sect 2.3	no works req'd	no works req'd
2001	no works req'd	construct access to Sect 2.3	no works req'd	no works req'd
2002	no works req'd	maintain access to Sect 2.3	no works req'd	no works req'd
2003	no works req'd	maintain access to Sect 2.3	construct access to Sect 3.1	construct access to Sect 4.3
2004	no works req'd	maintain access to Sect 2.3	construct access to Sect 3.1	construct access to Sect 4.3
2005	no works req'd	deact access to Sect 2.3	maintain access to Sect 3.1	maintain access to Sect 4.3
2006	no works req'd	construct access to Sect 2.1	maintain access to Sect 3.1	maintain access to Sect 4.3
2007	no works req'd	maintain access to Sect 2.1	maintain access to Sect 3.1	deact access to Sect 4.3
2008	no works req'd	maintain access to Sect 2.1	deact access to Sect 3.1	no works req'd
2009	no works req'd	deact access to Sect 2.1	no works req'd	construct access to Sect 4.2
2010	no works req'd	no works req'd	no works req'd	construct access to Sect 4.2
2011	no works req'd	no works req'd	no works req'd	maintain access to Sect 4.2
2012	no works req'd	no works req'd	no works req'd	maintain access to Sect 4.2
2013	no works req'd	no works req'd	no works req'd	deact access to Sect 4.2
2014	no works req'd	no works req'd	no works req'd	construct access to Sect 4.4
2015	no works req'd	no works req'd	no works req'd	maintain access to Sect 4.4
2016	no works req'd	no works req'd	no works req'd	deact access to Sect 4.4
2017	no works req'd	no works req'd	no works req'd	no works req'd
2018	no works req'd	no works req'd	no works req'd	no works req'd
2019	no works req'd	no works req'd	no works req'd	no works req'd
2020	no works req'd	no works req'd	no works req'd	no works req'd
2021	no works req'd	no works req'd	no works req'd	no works req'd
2022	no works req'd	no works req'd	no works req'd	no works req'd
2023	no works req'd	no works req'd	no works req'd	no works req'd
2024	no works req'd	no works req'd	no works req'd	no works req'd
TIMBER DEVELOPED	0	68805	50250	41490

Construction and Maintenance costs using existing road access

YEAR	P/W VALUE	SECTION 1 km 0.0-10.2	SECTION 2 km 10.2-29.2	SECTION 3 km 29.2-49.3	SECTION 4 km 49.3-71.4	TOTALS
2000	1	$0	$160,000	$0	$0	$160,000
2001	0.9434	$0	$120,000	$0	$0	$113,208
2002	0.89	$0	$15,600	$0	$0	$13,884
2003	0.8396	$0	$15,600	$140,000	$100,000	$214,602
2004	0.7921	$0	$15,600	$141,000	$100,000	$203,253
2005	0.7473	$0	$15,000	$10,800	$3,000	$21,522
2006	0.705	$0	$110,000	$10,800	$3,000	$87,279
2007	0.6651	$0	$8,400	$10,800	$3,750	$15,264
2008	0.6274	$0	$8,400	$6,750	$0	$9,505
2009	0.5919	$0	$10,500	$0	$101,000	$65,997
2010	0.5584	$0	$0	$0	$101,000	$56,398
2011	0.5268	$0	$0	$0	$3,600	$1,896
2012	0.497	$0	$0	$0	$3,600	$1,789
2013	0.4688	$0	$0	$0	$4,500	$2,110
2014	0.4423	$0	$0	$0	$25,000	$11,058
2015	0.4173	$0	$0	$0	$600	$250
2016	0.3936	$0	$0	$0	$750	$295
2017	0.3714	$0	$0	$0	$0	$0
2018	0.3503	$0	$0	$0	$0	$0
2019	0.3305	$0	$0	$0	$0	$0
2020	0.3118	$0	$0	$0	$0	$0
2021	0.2942	$0	$0	$0	$0	$0
2022	0.2775	$0	$0	$0	$0	$0
2023	0.2618	$0	$0	$0	$0	$0
2024	0.247	$0	$0	$0	$0	$0
						$978,311
TIMBER DEVELOPED	cubic meters	0	68805	50250	41490	160545

Construction and Maintenance schedule using existing rail grade

YEAR	SECTION 1 km 0.0-10.2	SECTION 2 km 10.2-29.2	SECTION 3 km 29.2-49.3	SECTION 4 km 49.3-71.4
2000	Upgrade rail line	Upgrade rail line	Upgrade rail line	Upgrade rail line
2001	Annual maintenance	Annual maintenance	Annual maintenance	Annual maintenance
2002	Operational Maintenance for section 1	Annual maintenance	Annual maintenance	Annual maintenance
2003	Operational maintenance - for section 2.3	Operational maintenance - Section 2.3	Annual maintenance	Annual maintenance
2004	Operational maintenance - for section 2.3	Operational maintenance - Section 2.3	Annual maintenance	Annual maintenance
2005	Operational Maintenance for section 2.3	Operational maintenance - Section 2.3	Operational maintenance - section 3.1& 3.2	Operational maintenance - section 4.3
2006	Annual maintenance	Annual maintenance	Operational maintenance - section 3.1& 3.2	Operational maintenance - section 4.3
2007	Operational maintenance for section 2.1	Operational maintenance - Section 2.1	Operational maintenance - section 3.1& 3.2	Operational maintenance - section 4.3
2008	Annual maintenance	Annual maintenance	Annual maintenance	Annual maintenance
2009	Annual maintenance	Annual maintenance	Annual maintenance	Annual maintenance
2010	Annual maintenance	Annual maintenance	Annual maintenance	Annual maintenance
2011	Replace bridge deck- 1 bridge	Replace bridge decks - 2 bridges	Annual maintenance	Operational maintenance - section 4.2
2012	Annual maintenance	Annual maintenance	Annual maintenance	Operational maintenance - section 4.2
2013	Annual maintenance	Annual maintenance	Annual maintenance	Operational maintenance
2014	Annual maintenance	Annual maintenance	Annual maintenance	Annual maintenance
2015	Operational maintenance - for section 2.2	Operational maintenance - for section 2.2	Annual maintenance	Operational maintenance - section 4.4
2016	Operational maintenance - for section 2.2	Operational maintenance - for section 2.2	Annual maintenance	Operational maintenance - section 4.4
2017	Annual maintenance	Annual maintenance	Annual maintenance	Annual maintenance
2018	Annual maintenance	Annual maintenance	Annual maintenance	Annual maintenance
2019	Annual maintenance	Annual maintenance	Annual maintenance	Annual maintenance
2020	Annual maintenance	Annual maintenance	Annual maintenance	Annual maintenance
2021	Annual maintenance	Annual maintenance	Annual maintenance	Annual maintenance
2022	Annual maintenance	Annual maintenance	Annual maintenance	Annual maintenance
2023	Replace bridge crossties and running planks	Replace bridge crossties and running planks	Annual maintenance	Annual maintenance
2024	Annual maintenance	Annual maintenance	Annual maintenance	Annual maintenance
Timber developed m^3	14550	85030	50250	41490

YEAR	P/W VALUE	SECTION 1 km 0.0-10.2	SECTION 2 km 10.2-29.2	SECTION 3 km 29.2-49.3	SECTION 4 km 49.3-71.4	TOTALS
2000	1	$276,353	$384,830	$74,220	$189,500	$924,903
2001	0.9434	$2,040	$3,800	$4,020	$4,420	$13,472
2002	0.89	$6,120	$3,800	$4,020	$4,420	$16,340
2003	0.8396	$6,120	$11,400	$4,020	$4,420	$21,796
2004	0.7921	$6,120	$11,400	$4,020	$4,420	$20,563
2005	0.7473	$6,120	$11,400	$12,060	$13,260	$32,014
2006	0.705	$2,040	$3,800	$12,060	$13,260	$21,968
2007	0.6651	$6,120	$11,400	$12,060	$4,420	$22,613
2008	0.6274	$6,120	$11,400	$4,020	$4,420	$16,287
2009	0.5919	$2,040	$3,800	$4,020	$4,420	$8,452
2010	0.5584	$2,040	$3,800	$4,020	$4,420	$7,974
2011	0.5268	$95,313	$158,808	$4,020	$13,260	$142,974
2012	0.497	$2,040	$3,800	$4,020	$13,260	$11,491
2013	0.4688	$2,040	$3,800	$4,020	$4,420	$6,694
2014	0.4423	$2,040	$3,800	$4,020	$4,420	$6,316
2015	0.4173	$2,040	$3,800	$4,020	$13,260	$9,648
2016	0.3936	$2,040	$3,800	$4,020	$13,260	$9,100
2017	0.3714	$2,040	$3,800	$4,020	$4,420	$5,304
2018	0.3503	$2,040	$3,800	$4,020	$4,420	$5,002
2019	0.3305	$2,040	$3,800	$4,020	$4,420	$4,720
2020	0.3118	$2,040	$3,800	$4,020	$4,420	$4,453
2021	0.2942	$2,040	$3,800	$4,020	$4,420	$4,201
2022	0.2775	$2,040	$3,800	$4,020	$4,420	$3,963
2023	0.2618	$195,617	$340,961	$4,020	$4,420	$142,686
2024	0.247	$2,040	$3,800	$4,020	$4,420	$3,527
Total						$1,466,461
Yr 2023 -Replacement of deck/crossties/curbs based on an install cost (no materials) of $300/ft or $984/m						
Yr 2011 -Replacement of planks/curbs based on install costs (no materials) of $125						$2,932,921
Timber developed m^3		14550	85020	50250	41490	191310

APPENDIX 6 – PRESENT WORTH - LOGGING COST SUMMARY

Harvesting Cost to existing and extended Forest road network

YEAR	P/W VALUE	SECTION 1 km 0.0-10.2	SECTION 2 km 10.2-29.2	SECTION 3 km 29.2-49.3	SECTION 4 km 49.3-71.4	TOTALS
2000	1	$0	$0	$0	$0	$0
2001	0.9434	$0	$0	$0	$0	$0
2002	0.89	$0	$849,200	$0	$0	$755,788
2003	0.8396	$0	$849,200	$0	$0	$712,988
2004	0.7921	$0	$849,200	$0	$0	$672,651
2005	0.7473	$0	$0	$418,750	$289,200	$529,051
2006	0.705	$0	$0	$418,750	$289,200	$499,105
2007	0.6651	$0	$102,400	$418,750	$0	$346,617
2008	0.6274	$0	$102,400	$0	$0	$64,246
2009	0.5919	$0	$0	$0	$0	$0
2010	0.5584	$0	$0	$0	$0	$0
2011	0.5268	$0	$0	$0	$251,200	$132,332
2012	0.497	$0	$0	$0	$251,200	$124,846
2013	0.4688	$0	$0	$0	$0	$0
2014	0.4423	$0	$0	$0	$0	$0
2015	0.4173	$0	$0	$0	$477,180	$199,127
2016	0.3936	$0	$0	$0	$477,180	$187,818
2017	0.3714	$0	$0	$0	$0	$0
2018	0.3503	$0	$0	$0	$0	$0
2019	0.3305	$0	$0	$0	$0	$0
2020	0.3118	$0	$0	$0	$0	$0
2021	0.2942	$0	$0	$0	$0	$0
2022	0.2775	$0	$0	$0	$0	$0
2023	0.2618	$0	$0	$0	$0	$0
2024	0.247	$0	$0	$0	$0	$0
						$4,224,570
TIMBER DEVELOPED	TIMBER DEVELOPED	0	68810	50250	41480	160540

YEAR	P/W VALUE	SECTION 1 km 0.0-10.2	SECTION 2 km 10.2-29.2	SECTION 3 km 29.2-49.3	SECTION 4 km 49.3-71.4	TOTALS
2000	1	$0	$0	$0	$0	$0
2001	0.9434	$0	$0	$0	$0	$0
2002	0.89	$582,000	$0	$0	$0	$517,980
2003	0.8396	$0	$849,200	$0	$0	$712,988
2004	0.7921	$0	$849,200	$0	$0	$672,651
2005	0.7473	$0	$849,200	$418,750	$289,200	$1,163,658
2006	0.705	$0	$0	$418,750	$289,200	$499,105
2007	0.6651	$0	$102,400	$418,750	$0	$346,617
2008	0.6274	$0	$102,400	$0	$0	$64,246
2009	0.5919	$0	$0	$0	$0	$0
2010	0.5584	$0	$0	$0	$0	$0
2011	0.5268	$0	$0	$0	$251,200	$132,332
2012	0.497	$0	$0	$0	$251,200	$124,846
2013	0.4688	$0	$0	$0	$0	$0
2014	0.4423	$0	$0	$0	$0	$0
2015	0.4173	$0	$324,400	$0	$289,200	$256,055
2016	0.3936	$0	$324,400	$0	$289,200	$241,513
2017	0.3714	$0	$0	$0	$0	$0
2018	0.3503	$0	$0	$0	$0	$0
2019	0.3305	$0	$0	$0	$0	$0
2020	0.3118	$0	$0	$0	$0	$0
2021	0.2942	$0	$0	$0	$0	$0
2022	0.2775	$0	$0	$0	$0	$0
2023	0.2618	$0	$0	$0	$0	$0
2024	0.247	$0	$0	$0	$0	$0
						$4,731,992
Timber developed		14550	85030	50250	41490	191320
Cost/ cubic meter		$40	$40	$25	$40	

APPENDIX 7 - PRESENT WORTH - HAUL COST SUMMARY

Hauling costs using existing and extended Forest road network

YEAR	P/W VALUE	SECTION 1 km 0.0-10.2	SECTION 2 km 10.2-29.2	SECTION 3 km 29.2-49.3	SECTION 4 km 49.3-71.4	Section 5 - Shields creek	TOTALS
2000	1	$0	$0	$0	$0	$0	$0
2001	0.9434	$0	$0	$0	$0	$0	$0
2002	0.89	$0	$202,264	$0	$0	$33,117	$209,489
2003	0.8396	$0	$202,264	$0	$0	$33,117	$197,626
2004	0.7921	$0	$202,264	$0	$0	$33,117	$186,445
2005	0.7473	$0	$0	$110,855	$17,527	$33,117	$120,688
2006	0.705	$0	$0	$110,855	$17,527	$33,117	$113,857
2007	0.6651	$0	$13,033	$110,855	$0	$0	$82,397
2008	0.6274	$0	$13,033	$0	$0	$0	$8,177
2009	0.5919	$0	$0	$0	$0	$0	$0
2010	0.5584	$0	$0	$0	$0	$0	$0
2011	0.5268	$0	$0	$0	$15,224	$0	$8,020
2012	0.497	$0	$0	$0	$15,224	$0	$7,566
2013	0.4688	$0	$0	$0	$0	$0	$0
2014	0.4423	$0	$0	$0	$0	$0	$0
2015	0.4173	$0	$0	$0	$17,527	$0	$7,314
2016	0.3936	$0	$0	$0	$17,527	$0	$6,899
2017	0.3714	$0	$0	$0	$0	$33,117	$12,300
2018	0.3503	$0	$0	$0	$0	$33,117	$11,601
2019	0.3305	$0	$0	$0	$0	$33,117	$10,945
2020	0.3118	$0	$0	$0	$0	$33,117	$10,326
2021	0.2942	$0	$0	$0	$0	$33,117	$9,743
2022	0.2775	$0	$0	$0	$0	$0	$0
2023	0.2618	$0	$0	$0	$0	$0	$0
2024	0.247	$0	$0	$0	$0	$0	$0
	TOTALS						$1,003,393
TIMBER DEVELOPED	First pass volumes	0	68810 m^3	50250 m^3	41480 m^3	78510 m^3	239,050 m^3

Section 1 - No haul costs, this area is inaccessible if the rail grade is not used

Section 2.1 - Haul is based on a 12 km one way bush haul. Avg speed 25 kmh and a 33 km one way hwy haul.

Avg Speed 60 kmh - Cycle time 2.1 hr

Section 2.2 -No haul costs, this area is inaccessible if the rail grade is not used

Section 2.3 - Haul is based on a 25 km one way bush haul. Avg speed 20 kmh and a 43 km one way hwy haul.

Avg Speed 60 kmh - Cycle time 3.93 hr

Section 3- Haul is based on a 15 km one way bush haul. Avg speed 30 km. and a 52 km one way hwy haul.

Avg Speed 60 kmh - Cycle time 2.73 hr

Section 4 -Haul cost is based on a 30 km one way haul. Average haul speed - 60 kmh - Cycle time 1 hr.

Section 5 - Haul cost is based on an 8 km one way bush haul. Avg spd 25 kmh and a 33 km one way hwy haul.

Avg Speed 60 kmh - Cycle time 1.74 hr

Cycles times for 2 are based on delivery to P&T' s mill in Castlegar, via the Shields and Bulldog FSR.

Cycle times for Section 3 are based on delivery to P&T's mill in either Castlegar or Grand Forks via the Walker creek road

Cycle times for Section 4 are based on delivery to P&T's mill in Grand Forks via the Lafferty road and highway.

Hauling costs using existing and extended Forest road network

YEAR	P/W VALUE	SECTION 1 km 0.0-10.2	SECTION 2 km 10.2-29.2	SECTION 3 km 29.2-49.3	SECTION 4 km 49.3-71.4	Section 5 - Shields creek	TOTALS
2000	1	$0	$0	$0	$0	$0	$0
2001	0.9434	$0	$0	$0	$0	$0	$0
2002	0.89	$0	$202,264	$0	$0	$33,117	$209,489
2003	0.8396	$0	$202,264	$0	$0	$33,117	$197,626
2004	0.7921	$0	$202,264	$0	$0	$33,117	$186,445
2005	0.7473	$0	$0	$110,855	$17,527	$33,117	$120,688
2006	0.705	$0	$0	$110,855	$17,527	$33,117	$113,857
2007	0.6651	$0	$13,033	$110,855	$0	$0	$82,397
2008	0.6274	$0	$13,033	$0	$0	$0	$8,177
2009	0.5919	$0	$0	$0	$0	$0	$0
2010	0.5584	$0	$0	$0	$0	$0	$0
2011	0.5268	$0	$0	$0	$15,224	$0	$8,020
2012	0.497	$0	$0	$0	$15,224	$0	$7,566
2013	0.4688	$0	$0	$0	$0	$0	$0
2014	0.4423	$0	$0	$0	$0	$0	$0
2015	0.4173	$0	$0	$0	$17,527	$0	$7,314
2016	0.3936	$0	$0	$0	$17,527	$0	$6,899
2017	0.3714	$0	$0	$0	$0	$33,117	$12,300
2018	0.3503	$0	$0	$0	$0	$33,117	$11,601
2019	0.3305	$0	$0	$0	$0	$33,117	$10,945
2020	0.3118	$0	$0	$0	$0	$33,117	$10,326
2021	0.2942	$0	$0	$0	$0	$33,117	$9,743
2022	0.2775	$0	$0	$0	$0	$0	$0
2023	0.2618	$0	$0	$0	$0	$0	$0
2024	0.247	$0	$0	$0	$0	$0	$0
	TOTALS						$1,003,393
TIMBER DEVELOPED	First pass volumes	0	68810 m^3	50250 m^3	41480 m^3	78510 m^3	239,050 m^3

Section 1 - No haul costs, this area is inaccessible if the rail grade is not used

Section 2.1 - Haul is based on a 12 km one way bush haul. Avg speed 25 kmh and a 33 km one way hwy haul.

Avg Speed 60 kmh - Cycle time 2.1 hr

Section 2.2 -No haul costs, this area is inaccessible if the rail grade is not used

Section 2.3 - Haul is based on a 25 km one way bush haul. Avg speed 20 kmh and a 43 km one way hwy haul.

Avg Speed 60 kmh - Cycle time 3.93 hr

Section 3- Haul is based on a 15 km one way bush haul. Avg speed 30 km. and a 52 km one way hwy haul.

Avg Speed 60 kmh - Cycle time 2.73 hr

Section 4 -Haul cost is based on a 30 km one way haul. Average haul speed - 60 kmh - Cycle time 1 hr.

Section 5 - Haul cost is based on an 8 km one way bush haul. Avg spd 25 kmh and a 33 km one way hwy haul.

Avg Speed 60 kmh - Cycle time 1.74 hr

Cycles times for 2 are based on delivery to P&T' s mill in Castlegar, via the Shields and Bulldog FSR.

Cycle times for Section 3 are based on delivery to P&T's mill in either Castlegar or Grand Forks via the Walker creek road

Cycle times for Section 4 are based on delivery to P&T's mill in Grand Forks via the Lafferty road and highway.

YEAR	P/W VALUE	SECTION 1 km 0.0-10.2	SECTION 2 km 10.2-29.2	SECTION 3 km 29.2-49.3	SECTION 4 km 49.3-71.4	Section 5 - Shields creek	TOTALS
2000	1	$0	$0	$0	$0	$0	$0
2001	0.9434	$0	$0	$0	$0	$0	$0
2002	0.89	$17,636	$0	$0	$0	$19,033	$15,696
2003	0.8396	$0	$77,200	$0	$0	$19,033	$64,817
2004	0.7921	$0	$77,200	$0	$0	$19,033	$61,150
2005	0.7473	$0	$77,200	$100,703	$17,527	$19,033	$146,045
2006	0.705	$0	$0	$100,703	$17,527	$19,033	$83,352
2007	0.6651	$0	$4,655	$100,703	$0	$0	$70,073
2008	0.6274	$0	$4,655	$0	$0	$0	$2,920
2009	0.5919	$0	$0	$0	$0	$0	$0
2010	0.5584	$0	$0	$0	$0	$0	$0
2011	0.5268	$0	$0	$0	$15,224	$0	$8,020
2012	0.497	$0	$0	$0	$15,224	$0	$7,566
2013	0.4688	$0	$0	$0	$0	$0	$0
2014	0.4423	$0	$0	$0	$0	$0	$0
2015	0.4173	$0	$21,627	$0	$17,527	$0	$16,339
2016	0.3936	$0	$21,627	$0	$17,527	$0	$15,411
2017	0.3714	$0	$0	$0	$0	$19,033	$0
2018	0.3503	$0	$0	$0	$0	$19,033	$0
2019	0.3305	$0	$0	$0	$0	$19,033	$0
2020	0.3118	$0	$0	$0	$0	$19,033	$0
2021	0.2942	$0	$0	$0	$0	$19,033	$0
2022	0.2775	$0	$0	$0	$0	$0	$0
2023	0.2618	$0	$0	$0	$0	$0	$0
2024	0.247	$0	$0	$0	$0	$0	$0
Totals							$491,391
TIMBER DEVELOPED	First pass volumes	0	68810 m^3	50250 m^3	41480 m^3		239,050 m^3

Section 1 - Haul cost is based on a 10 km one way haul. Average speed - 40 kmh - Cycle time 0.5 hr.
Section 2.1 - Haul cost is based on a 15 km one way haul. Average speed - 40 kmh - Cycle time 0.75 hr.
Section 2.2 -Haul cost is based on a 22 km one way haul. Average speed - 40 kmh - Cycle time 1.1 hr.
Section 2.3 -Haul cost is based on a 30 km one way haul. Average haul speed - 40 kmh - Cycle time 1.5 hr.
Section 3- Haul is based on a 15 km one way bush haul. Avg speed 40 km. and a 52 km one way hwy haul
Avg Speed 60 kmh - Cycle time 2.48 hr
Section 4 -Haul cost is based on a 30 km one way haul. Average haul speed - 60 kmh - Cycle time 1 hr.
Section 5 - Haul cost is based on 20 km one way haul - Avg speed 40 kmh - Cycle time - 1 hr
Cycles times for Section 1,2 and 5 are based on delivery to P&T' s mill in Castlegar, via the rail grade.
Cycle times for Section 3 are based on delivery to P&T's mill in either Castlegar or Grand Forks via
the rail grade and highway
Cycle times for Section 4 are based on delivery to P&T's mill in Grand Forks via the rail grade and highway

APPENDIX 8 - EXISTING CPR ROUTE INFRASTRUCTURE

The following is a summary of the route infrastructure, including all large fills, bridges, tunnels and retaining walls. A more detailed description of these structures is attached in appendix 1 and locations of the structures in shown on Map 1. For the purpose of this study km 0.0 is the gated entrance to the rail bed just west of the Hugh Keenleyside dam, 7.5 km west of Castlegar.

8.1 BRIDGES

McCormack Creek	- km 7.6 - 125 m long truss bridge - 5 spans
Farr Creek	- km 15.3 - 102 m long truss and plate girder bridge - 5 spans
Cub Creek	- km 16.1 - 125 m long truss and plate girder bridge - 5 spans
Snowslide	- km 59.3 - 41 m long through truss - 1 span

8.2 TUNNELS

Tunnel #1	- km 13.1 - 100 m long tunnel
Tunnel #2	- km 14.1 - 100 m long tunnel
Tunnel #3	- km 18.0 - 100 m long tunnel
Tunnel #4	- km 28.3 - 900 m long Bulldog tunnel
Tunnel #5	- km 51.0 - 100 m long tunnel

8.3 RETAINING WALLS

Retaining wall #1	- km 1.15 - 22 m long x 3 m high concrete retaining wall
Retaining wall #2	- km 5.1 - 150 m long and 5 - 14 m high cut stone retaining wall
Retaining wall #3	- km 5.25 - 50 m long and 3 - 6 m high concrete retaining wall
Retaining wall #4	- km 7.5 - 100 m long and 5 - 10 m high cut stone retaining wall
Retaining wall #5	- km 8.4 - 100 m long and 3 - 14 m high cut stone retaining wall
Retaining wall #6	- km 8.5 - 50 m long and 6 m high cut stone retaining wall
Retaining wall #7	- km 8.6 - 150 m long and 8 - 14 m high cut stone retaining wall
Retaining wall #8	- km 8.8 - 150 m long and 4 - 12 m high cut stone retaining wall
Retaining wall #9	- km 9.0 - 150 m long and 4 - 12 m high cut stone retaining wall
Retaining wall #10	- km 12.85 - 150 m long and 4 - 14 m high cut stone retaining wall
Retaining wall #11	- km 13.6 - 20 m long and 5 m high cut stone retaining wall
Retaining wall #12	- km 13.62 - 70 m long and 5 m high cut stone retaining wall
Retaining wall #13	- km 13.7 - 30 m long and 5 m high cut stone retaining wall
Retaining wall #14	- km 15.7 - 100 m long and 5 - 14 m high cut stone retaining wall
Retaining wall #15	- km 16.6 - 100 m long and 4 - 14 m high cut stone retaining wall
Retaining wall #16	- km 17.1 - 100 m long and 4 - 14 m high cut stone retaining wall
Retaining wall #17	- km 17.3 - 50 m long and 4 - 6 m high cut stone retaining wall
Retaining wall #18	- km 17.35 - 150 m long and 4 - 14 m high cut stone retaining wall
Retaining wall #19	- km 17.6 - 30 m long and 4 m high cut stone retaining wall
Retaining wall #20	- km 20.4 - 70 m long and 6 - 8 m high cut stone retaining wall
Retaining wall #21	- km 20.7 - 80 m long and 5 - 14 m high cut stone retaining wall
Retaining wall #22	- km 21.4 - 30 m long and 4 m high cut stone retaining wall
Retaining wall #23	- km 50.7 - 60 m long and 1.5 m high cut stone retaining wall-U/S
Retaining wall #24	- km 52.35 - 30 m long and 12 m high cut stone retaining wall
Retaining wall #25	- km 52.7 - 55 m long and 12 m high cut stone retaining wall
Retaining wall #26	- km 57.55 - 50 m long and 1.5 m high cut stone retaining wall-U/S

Retaining wall #27 - km 67.0 - 55 m long and 12 m high cut stone retaining wall
Retaining wall #28 - km 68.4 - 10 m long and 4 m high cut stone retaining wall

U/S = Retaining wall located on the Upslope or cutbank side of rail grade - all other structures are on the fill side of the rail grade.

8.4 FILLS AND CULVERTS

Fill #1 - km 4.8 - 200 m long x 9 m deep fill - 750 mm concrete culvert
Fill #2 - km 5.35- 100 m long x 9 m deep fill - 900 mm concrete culvert
Fill #3 - km 6.85- 150 m long x 10 m deep fill - 600 mm concrete culvert
Fill #4 - km 10.1- 100 m long x 8 m deep fill - 600 mm concrete culvert
Fill #5 -Shields creek - km 11.5- 200 m long x 20 m deep fill - 4m x 4m masonry culvert
Fill #6 - km 14.2- 100 m long x 9 m deep fill - no culvert
Fill #7 -Grass creek - km 18.6- 200 m long x 20 m deep fill - 1200 mm concrete culvert
Fill #8 - km 22.0- 50 m long x 6 m deep fill - no culvert
Fill #9 - Pup creek - km 25.0- 200 m long x 25 m deep fill - 1200 mm concrete culvert
Fill #10 - km 26.7- 100 m long x 7 m deep fill - no culvert
Fill #11 - Quinn creek - km 30.9- 200 m long x 30 m deep fill - 1600 mm concrete culvert
Fill #12 - km 32.5- 100 m long x 15 m deep fill - 600 mm concrete culvert
Fill #13 - km 34.6 - 40 m long x 6 m deep fill - 600 mm steel culvert
Fill #14 - km 34.7 - 120 m long x 7 m deep fill - 900 mm steel culvert
Fill #15-Porcupine crk - km 36.05-250 m long x 48 m deep fill - 2.5 x 3.5 masonry arch
Fill #16-Coryell creek - km 54.1- 80 m long x 15 m deep fill - 600 mm concrete culvert
Fill #17 - km 57.9- 80 m long x 15 m deep fill - no culvert
Fill #18 - km 58.9- 80 m long x 12 m deep fill - no culvert
Fill #19 - km 60.1- 100 m long x 15 m deep fill - no culvert
Fill #20 - km 60.6- 80 m long x 7 m deep fill - no culvert
Fill #21 - km 61.6- 80 m long x 7 m deep fill - no culvert
Fill #22 - km 64.6- 100 m long x 12 m deep fill - no culvert
Fill #23-Spaulding crk - km 65.7 - 50 m long x 3 m deep fill - no culvert
Fill #24 - km 67.45- 100 m long x 15 m deep fill - 800 mm concrete culvert
Fill #25 - km 68.75 - 100 m long x 12 m deep fill-1200 mm concrete culvert

8.5 FLUMES

Flume #1 - km 14.2- 50 m long concrete flume - 600 mm concrete culvert
Flume #2 - failed - km 26.7 - 50 m long steel flume - 600 mm concrete culvert
Flume #3 - km 57.9 - 50 m long steel flume - 600 mm concrete culvert
Flume #4 - km 58.9 - 50 m long concrete flume - 600 mm concrete culvert
Flume #5 - km 60.1 - 50 m long concrete flume - 600 mm concrete culvert
Flume #6 - km 60.6 - 50 m long concrete flume - 600 mm concrete culvert
Flume #7 - failed - km 61.6 - 50 m long steel flume - 600 mm concrete culvert
Flume #8 - km 64.6 - 50 m long steel flume - 800 mm concrete culvert
Flume #9 - km 65.7 - 30 m long concrete flume - 600 mm concrete culvert

APPENDIX 9 - OFFICE INFORMATION

The office overview entailed reviewing the following materials

i). 1:20000 scale TRIM mapping - 82F032, 82F031,82E040, 82E030, 82E020, 82E019, & 82E009

ii). 1:20000 scale Forest Cover mapping - 82F032, 82F031,82E040, 82E030, 82E020, 82E019, & 82E009

iii). Air photos

Arrow Dist. - 30BCC98057 No's 110 - 118
- 30BCC98042 No's 71-81 and 85 - 90
- 30BCC98035 No's 22 - 26, 52 - 65, 68 - 75, 80 - 86, 94 - 100, 112 - 116, and 127 - 131

Boundary Dist.- 30BCC93092 No's 266 -268 and No's 271 - 272
- 30BCC93091 No's 235 - 237
- 30BCC93060 No's 29 - 32, 39 - 42, 78 - 81, and 87 - 89
- 30BCC93019 No's 49 - 51, 99-101, 123, and 169 - 175
- 30BCC93018 No's 147 - 149

iv). Forest Development Plans- Ministry of Forests - SBFEP, Arrow District,
- Atco Lumber Ltd.
- Pope & Talbot Ltd.

v). Heritage Inventory - Rail to Trail Conversion - CPR's Castlegar to Midway Line , completed for Boundary Rails to Trails Society and the BC Heritage Trust - January 1993 by Grant Copeland & Associates.

APPENDIX 10 - TIMBER VOLUMES BY SECTION

Road Section	Total timber developed by rail grade	Timber Developed by Rail Grade- first pass - 25 years	Timber Developed by existing and extended road Grade- first pass - 25 years
Section 1	**km 0.0 - 10.2**		
Km 0.0 - 10.2 Section 1	Crwn-58,202 m^3 Priv – 9,305m^3	Crown - 14,550 m^3	Crown - 0 m^3
Subtotal	**Crown = 58,202m^3**	**Crown - 14,550 m^3**	**Crown - 0 m^3**
Section 2	**km 10.2 - 29.2**		
Km 10.2 - 12.7 Section 2.1	Crwn-10,236 m^3 Priv – 17,363m^3	Crown - 5,120 m^3	Crown - 5,120 m^3
Km 12.7 - 22.0 Section 2.2	Crwn-64,871 m^3 Priv –25,186m^3	Crown - 16,220 m^3	Crown - 0 m^3
Km 22.0 - 29.2 Section 2.3	Crn-254,748 m^3 Priv – 22,775m^3	Crown - 63,690 m^3	Crown - 63,690 m^3
Subtotal	**Crown – 329,855 m3**	**Crown - 85,030 m^3**	**Crown - 68,810 m^3**
Section 3	**km 29.2 - 49.3**	**km 29.2 - 49.3**	**km 29.2 - 49.3**
Km 29.2 - 40.8 Section 3.1	Crn-170,439m^3 Priv – 997m^3	Crown - 42,610 m^3	Crown - 42,610 m^3
Km 40.8 - 49.3 Section 3.2	Crn-30,571 m^3 Priv – 2392m^3	Crown - 7,640 m^3	Crown - 7,640 m^3
Subtotal	**Crown – 201,010m^3**	**Crown - 50,250 m^3**	**Crown - 50,250 m^3**
Section 4	**km 49.3 - 71.4**	**km 49.3 - 71.4**	**km 49.3 - 71.4**
Km 49.3 - 51.5 Section 4.1	0 m^3	0 m^3	0 m^3
Km 51.5 - 57.9 Section 4.2	Crown-25,131m^3 Private - 0 m^3	Crown - 12,560 m^3	Crown - 12,560 m^3
Km 57.9 - 62.6 Section 4.3	Crwn-57,877m^3 Private - 0 m^3	Crown - 14,470 m^3	Crown - 14,470 m^3
Km 62.6 - 71.4 Section 4.4	Crown-57,833m^3 Private – 747m^3	Crown - 14,460 m^3	Crown - 14,460 m^3
Subtotal	**Crown- 140,841 m^3**	**Crown - 41,490**	**Crown - 41,490**
Section 5	**Shields and Moberly creeks**	**Shields and Moberly creeks**	**Shields and Moberly creeks**
Shields and Moberly creek to the height of land	Crown - 785,100	Crown - 78,510	Crown - 78,510
Total Crown	**1,515,008 m^3**	**269,730 m^3**	**238,960 m^3**

APPENDIX 11 – COSTS TO UPGRADE TO A TRAIL STANDARD

Road Section	Feature	Liabilities	Works required to maintain railgrade to a safe standard	Year 2000 costs
SECTION #1	**km 0.0 -10.2**			
km 4.6		Partially crushed 600 CMP	Replace culvert	$600
km 6.12		Fill slope settlement	Pull fill material back and construct road into cut bank	$500
km 6.7	S#2	Fill slope failure - 20 m long - outside edge only	Construct road into cut bank	$500
km 8.6	S#3	Small fill slope failure - 10 m x 1.5 m	Backfill with rock	$1,500
km 5.0 - 10.2		Widen road surface on blind corners and construct 2 turnouts per km @ $3000/km		$0
SUBTOTAL SECTION 1				$3,100
SECTION #2	**km 10.2-29.2**			
km 14.2	F#6 and FL#1	100 m long X 9 m deep fill. 40 - 50 m long concrete flume. 600 mm culvert	Clean flume of branches and woody debris	$150
km 22.0	F#8	Fill - 50 m long x 5-7 m deep. No culvert installed	Install a 600 mm culvert at the bottom of the fill.	$1,500
km 24.7	S#5	Small failure - 10 m long x 3 m deep	Repair using a rock fill.	$1,000
km 25.0	F#9	Fill - 200 m long and 25 m deep. Culvert inlet partially blocked with debris	Structural review and as built survey. Remove debris from culvert entrance.	$500
km 26.7	F#10 FL#2 S#6	Fill - 50 m long x 6-8 m deep, steel flume on wooden posts directs water to 600 mm culvert. Flume failed and parts of fill have been eroded away	Replace eroded fill and install a 600 mm culvert in base of fill.	$15,000
SUBTOTAL SECTION 2				$18,150
SECTION 3	**km 29.2-49.3**			
km 34.7	F#14	Small fill - 5 - 8 m deep x 120 m long- 900 mm cmp	Clean debris from outlet	$200
SUBTOTAL SECTION 3				$200
SECTION 4	**km 49.3-71.4**			
km 50.0		Damaged 1200 mm culvert	Replace culvert	$3,000
km 50.7	RW#23	Small retaining wall - 1.5 x 60 m long upslope of railbed	none	$0

Road Section	Feature	Liabilities	Works required to maintain railgrade to a safe standard	Year 2000 costs
km 54.1	F#16	Coryell creek - 80 m long x 15 m high fill - rock tunnel as water diversion - 3m x 3m wide.	Clean woody debris from entrance.	$500
km 57.9	F#17 FL#3	Large fill - 80 m x 15 m deep - Steel flume to 600 mm culvert in poor condition - requires replacement or culvert installation at base of fill.	Install a 600 mm culvert part way up the fill or rebuild the flume and maintain. May want to bypass this structure	$18,000
km 61.6	F#21 FL#7 S#8	Large fill - 100 m x 12 m deep - steel flume failed - significantly eroded	Presently only usable by ATV's. Install a 900 mm culvert in fill and build up eroded fill to make usable. Can swale grade to reduce fill material.Another option is to bypass the fill with a new road and deactivate the old fill. Costs are approx. equal.	$27,000
km 64.6	F#22 FL#8	Large fill - 100 m x 12 m deep - steel flume working - 800 mm culvert working	Flume in poor condition (wooden supports rotting). Either replace steel flume or bypass with new road section and deactivate fill.	$27,000
km 65.7	F#23 FL#9	Spaulding creek - 70 m x 3 m fill - 600 mm culvert and small flume	Install a 600 mm culvert in the fill.	$1,200
SUBTOTAL SECTION 4				$76,700
SECTION 5	SHIELDS CRK			$0
SUBTOTAL	SECTION 1			$3,100
SUBTOTAL	SECTION 2			$18,150
SUBTOTAL	SECTION 3			$200
SUBTOTAL	SECTION 4			$76,700
SUBTOTAL	SECTION 5			$0
TOTAL				$98,150

APPENDIX 12– SUMMARY OF FIELD NOTES

Canadian Pacific Railway - Field notes - Castlegar to Christina Lake

Km from	Km to	Logging Opportunity		Sideslopes		Terrain	Road width	Secondary road opportunity		Railway Features	Comments	R.W.=Retaining wall	
		Uphill	Downhill	Up	Down			Uphill	Downhill		R= Existing road	B= Bridge	
											T= Tunnel	F=Fill	
0.00	= gated entrance at Castlegar end of route (km 50.5 Grant Copeland report)										FL= Flume	S= Slide	
SECTION 1 - KM 0.00 - 10.20													
0.00	1.20	10% of this section has 200 m uphill logging potential	None - on lake no timber below road	150%	50-100%	Rock	4-5 m wide, 2- 3 m wide ditch	short spur at 1km. 200 - 300m long	None	Tracks still in rail bed, one concrete retaining wall at km 1.15 (22 m wide x 3 m high)	Find out who is responsible to remove existing tracks and ties. There is a long crack in the retaining wall, which is not yet structurally significant. Monitor for degradation of rebar. Adequate room to widen for turnouts, some brushing required.	R.W.#1	Equiv. km on Rail to trail report
1.20	2.40	100 - 300 m	None - too close to lake (<40 m)	50-80%	50-80 %	granular soils with sections of rock	4-5 m wide, 2- 3 m wide ditch	short spurs are feasible for most of this section. 200 - 300 m long	None	No tracks - large rail siding at km 1.5 - 80m x 15m	Adequate room for turnouts, brushing required. Timber volumes are scattered		
2.40	3.10	None	None - too close to lake (<40 m)	400%	80%	Rock	4-5 m wide, 2 m wide ditch	None	None	Large rock through cut from 2.65-2.75km. 20m deep	Brushing required, turnouts can be built but will be widely spaced > 300m		
3.10	3.40	200-300m	None - too close to lake (<40 m)	50%	50%	granular soils with sections of rock	4-5 m wide, 2- 3 m wide ditch	short spurs are feasible for most of this section. 200 - 300 m long	None	None	Adequate room for turnouts, brushing required. Timber volumes are scattered		
3.40	4.40	minimal -200 m	50 - 75 m	100-400%	80%	Rock/ talus	4-5 m wide, 2- 3 m wide ditch	None	None	Several small rock through cuts < 6 m deep	Adequate room for turnouts, brushing required. Timber volumes are scattered		
4.40	4.80	300 m	75 - 100 m	60%	60%	talus/ granular	4-5 m wide, 2- 3 m wide ditch	short spurs are feasible for most of this section. 100 m long	None	km 4.6- 600 mm CMP crushed at center.	Replace 600 mm culvert. Adequate room for turnouts, brushing required. Timber volumes are scattered		
4.80	5.00	300 m	75 - 100 m	60%	60%	talus/ granular	4 - 5 m wide, large fill	None	None	km 5.0- 750 mm concrete culvert in good condition. Large fill 9 m deep in good condition	Large fill bypass possible by rerouting road into side hill if required. (fill is for rail alignment)	F #1	
5.00	5.10	None	None	400%	100%	rock	4-5 m wide, 1m ditch	None	None	Large rock cut	Adequate width for road, no turnout		

Canadian Pacific Railway - Field notes - Castlegar to Christina Lake

Km from	Km to	Logging Opportunity		Sideslopes		Terrain	Road width	Secondary road opportunity		Railway Features	Comments	R.W.=Retaining wall
		Uphill	Downhill	Up	Down			Uphill	Downhill		R= Existing road	B= Bridge
											T= Tunnel	F=Fill
0.00	= gated entrance at Castlegar end of route (km 50.5 Grant Copeland report)										FL= Flume	S= Slide
5.10	5.25	None	None	400%	400%	rock	4-5 m wide, 1m ditch	None	None	Retaining wall - cut stone 5 - 14m in height x 150 m length	There is a 3.0 m deep by 0.3 m wide hole in the retained fill at km 5.1. Possible exposed tieback. Geotech review required. Bypass of this section not possible without significant rock blasting.	R.W#2
5.25	5.35	None	None	400%	400%	rock	4-5 m wide, 1m ditch	None	None	Retaining wall - concrete 3 - 6m in height x 50 m in length	Retaining wall in good condition. Bypass of this section would not be possible without significant rock blasting	R.W. #3
5.35	5.55	300 m	100 - 150 m	60%	60%	granular/ talus	4-5 m wide, 2- 3 m wide ditch	short spurs are feasible for most of this section. 200 - 300 m long	None	Large fill from 5.35 - 5.45km - (100 m long x 9m deep). 900 mm concrete culvert in good condition. Slight bow at center.	Fill in good condition. Replacement not required.	F#2
5.55	5.70	50-75 m	100 m	400%	80%	rock	4-5 m wide, 1m ditch	None	None	None	Adequate width for road, no turnout	
5.70	5.80	None - existing debris flow	None - existing debris flow	70%	70%	granular	2 m	None	None	Debris flow from above has destroyed the rail grade from 5.75 km to 5.8 km.	Will require reconstruction. Construct new road into hillside. Use rock fills. Install a 1200 mm culvert. construct a swale above culvert to control water if further debris flows are initiated above.	S#1
5.80	6.10	300 m	300 - 400 m	70%	70%	granular	4-5 m wide, 2- 3 m wide ditch	short spurs are feasible for most of this section. 100 m long	None	Small fill slope failure km 6.0 - 6.02 . Flume from 6.08 km is carrying water back to km 6.02 and has partially collapsed. Has been temporarily fixed.	Wil require the installation of a 600 mm culvert and rock fill at km 6.08. 5 m deep fill.	
6.10	6.70	300 - 500 m	100-150 m	70%	70%	granular	4-5 m wide, 2- 3 m wide ditch	short spurs are feasible for most of this section. 100 m long	None	Small fill slope settlement at km 6.12. Fill slope failure at km 6.7.	Pull back fill a.s.a.p and rebuild by cutting road into cut bank from km 6.1 - 6.14 and km 6.7. **Fill pullback at km 6.1 should be completed in 2000.**	S#2
6.70	6.85	300 m	100-150 m	150%	70%	rock	4-5 m wide, 1m ditch	None	None	None	Adequate width for road, no turnout	

Canadian Pacific Railway - Field notes - Castlegar to Christina Lake

Km from	Km to	Logging Opportunity		Sideslopes		Terrain	Road width	Secondary road opportunity		Railway Features	Comments	R.W.=Retaining wall	
		Uphill	Downhill	Up	Down			Uphill	Downhill		R= Existing road	B= Bridge	
											T= Tunnel	F=Fill	
0.00	= gated entrance at Castlegar end of route (km 50.5 Grant Copeland report)										FL= Flume	S= Slide	
6.85	7.00	300 m	100-150 m	50%	70%	granular	4-5 m wide, 2- 3 m wide ditch	short spurs are feasible for most of this section. 100 m long	None	Large fill - 10 m deep x 150 m long. 600 mm concrete culvert - cannot see through it but it is passing water from one side of the fill to the other	Fill can be bypassed by constructing a road into the cut slope for 200 m and installing a 600 mm cmp	F#3	
7.00	7.50	300 m	100-150 m	40%	60%	silts and fine sands	4-5 m wide, 2- 3 m wide ditch	secondary roads feasible	None	large turnout at km 7.0	Potential for secondary development		
7.50	7.60	100 m	none	60%	400%	Rock	4-5 m wide, 1m ditch	None	None	Retaining wall - cut stone 5 - 10m in height x 100 m length	Retaining wall in good condition. Geotech to review. Will require extensive rock work to bypass.	R.W. #4	
7.60	7.725	none	none	n/a	n/a	McCormack Creek	4.0 m deck width	None	None	McCormack creek bridge - 125 m span.	Will require running planks and tip out curbs to be usable for hauling. Is shown at km 58.1 on Grant Copeland report.	B#1	km 58.1
7.725	8.00	100-200 m	200 m	60%	60%	granular	4-5 m wide, 2- 3 m wide ditch	short spurs are feasible for most of this section. 100 m long	None	None	None		
8.00	8.40	0 - 50 m	200 m	100-400%	80%	Rock - 10 - 20 m high cutbanks	4-5 m wide, 1m ditch	None	None	None	None		
8.40	8.50	none	none	90%	400%	rock	4-5 m wide, 1m ditch	None	None	Carved rock retaining wall - 100 m long x 3-14 m high. 1.0x1.5 m concrete culvert	In good condition. Can be bypassed with 150 of road in rock. Full bench on 90% slopes and 1600 mm culvert	RW#5	
8.50	8.60	none	none	90%	400%	rock	4-5 m wide, 1m ditch	None	None	Carved rock retaining wall - 50 m long x 6 m high. Small rock fall on grade.	Remove rock on grade. In good condition. Cannot be bypassed. 20 m high rock face on uphill side of road.	RW#6	

Canadian Pacific Railway - Field notes - Castlegar to Christina Lake

Km from	Km to	Logging Opportunity		Sideslopes		Terrain	Road width	Secondary road opportunity		Railway Features	Comments	R.W.=Retaining wall
		Uphill	Downhill	Up	Down			Uphill	Downhill		R= Existing road	B= Bridge
											T= Tunnel	F=Fill
0.00	= gated entrance at Castlegar end of route (km 50.5 Grant Copeland report)										FL= Flume	S= Slide
8.60	8.80	none	none	90%	400%	rock	4-5 m wide, 1m ditch	None	None	Carved rock retaining wall - 150 m long x 8-14 m high. Small fill slope failure just before start of rock wall.	Fill slope failure can be replaced with rock fill. Cannot bypass this section, 20 m high rock face on uphill side. Minor settlement noted at center of fill/retaining wall.	RW#7 S#3
8.80	9.00	none	none	90%	400%	rock	4-5 m wide, 1m ditch	None	None	Carved rock retaining wall - 150 m long x 4-12 m high.	Cannot bypass this section, 10-20 m high rock face on uphill side.	RW#8
9.00	9.15	none	none	90%	400%	rock	4-5 m wide, 1m ditch	None	None	Carved rock retaining wall - 150 m long x 4-12 m high.	Cannot bypass this section, 10-20 m high rock face on uphill side.	RW#9
9.15	10.10	none	200-300 m	70%	70%	rock and talus	4-5 m wide, 1m ditch	None	None	None	Minimal timber above road. Scattered volumes below road	
10.10	10.20	none	none	70%	70%	granular fill	6 m wide, major fill	None	None	Large fill - 100 m x 8 m high- 600 mm concrete culvert, in good condition, slight bow at center.	Can be rerouted with 150m of new road in and out of creek draw. Will require a 1000 mm new culvert	F#4
10.20	= end of section 1											
SECTION 2 - KM 10.2 - 29.2												
10.20	11.50	200 - 300 m	200 - 300 m	30-50%	30-80%	granular soils with sections of rock	6 m wide,2- 3 m wide ditch	secondary roads feasible	200 m spurs possible	none	Possible development of major secondary road system on the uphill side of rail grade,by tying into existing road system which extends from Shields creek road. (located 600 m upslope)	

Canadian Pacific Railway - Field notes - Castlegar to Christina Lake

Km from	Km to	Logging Opportunity		Sideslopes		Terrain	Road width	Secondary road opportunity		Railway Features	Comments	R.W.=Retaining wall	
		Uphill	Downhill	Up	Down			Uphill	Downhill		R= Existing road	B= Bridge	
											T= Tunnel	F=Fill	
0.00	= gated entrance at Castlegar end of route (km 50.5 Grant Copeland report)										FL= Flume	S= Slide	
11.50	11.70	none	none	70%	70%	granular fill	6m wide	none	none	Shields creek masonary culvert (dimensions not taken because of water levels) >4m across and >4 m high . Fill is >20 m deep.	Can be bypassed with 600 m of road and 10 m bridge. Deactivation of this structure (if bypassed) would require the removal of approximately 2-3000 cubic meters of fill and removal of existing stone arch culvert.	F#5	
11.70	12.70	300 - 400 m	300 m	30-50%	40-70%	granular soils with sections of rock	4.5 - 6 m wide	secondary roads feasible	secondary roads feasible	none	The Shields creek road crosses the tracks at km 11.85. Development above and below the tracks is possible off this road system. This area can also be developed using the Shields creek road as an extraction point.	R#1	
12.70	12.85	100 m	200 m	50%	80%	rock	4-5 m with 1 m ditch	none	none	none	none		
12.85	13.00	none	none	400%	400%	rock	4-5 m with 1 m ditch	none	none	Stone retaining wall. 4-14 m high	Wall in good condition. Bypass not feasible - 20 -30 m high rock face on uphill side of rail grade.	RW#10	
13.00	13.10	none	none	400%	100%	rock	4-5 m with 1 m ditch	none	none	none	none		
13.10	13.20	none	none	n/a	n/a	rock	5.5 m wide x 6.0 high	none	none	100 m long tunnel.	Minor rock fall evident from roof. Will have to monitor on a continuous basis for safety concerns. Possible concreting of structure if public safety cannot be guaranteed.	T#1	64 km
13.20	13.60	none	none	150%	150%	rock	4-5 m with 1 m ditch	none	none	none	none		
13.60	13.62	none	none	150%	400%	rock	4-5 m with 1 m ditch	none	none	Stone retaining wall. 5 m high x 20 m	In good shape. Bypass not possible because of rock	RW#11	
13.62	13.70	none	none	150%	400%	rock	4-5 m with 1 m ditch	none	none	Stone retaining wall. 5 m high x 70 m	In good shape. Bypass not possible because of rock	RW#12	
13.70	13.75	none	none	150%	400%	rock	4-5 m with 1 m ditch	none	none	Stone retaining wall. 5 m high x 30 m	In good shape. Bypass not possible because of rock	RW#13	
13.75	14.10	100 m	200 m	400%	100%	rock	4-5 m with 1 m ditch	none	none	none	none		

Canadian Pacific Railway - Field notes - Castlegar to Christina Lake

Km from	Km to	Logging Opportunity		Sideslopes		Terrain	Road width	Secondary road opportunity		Railway Features	Comments	R.W.=Retaining wall	
		Uphill	Downhill	Up	Down			Uphill	Downhill		R= Existing road	B= Bridge	
											T= Tunnel	F=Fill	
0.00	= gated entrance at Castlegar end of route (km 50.5 Grant Copeland report)										FL= Flume	S= Slide	
14.10	14.20	none	none	n/a	n/a	rock	5.5 m wide x 6.0 high	none	none	100 m long tunnel.	Minor rock fall evident at north end of tunnel. Will have to monitor on a continuous basis for safety concerns. Possible concreting of structure if public safety cannot be guaranteed.	T#2	65 km
14.20	14.30	none	none	60%	100%	rock fill	6 m	none	none	100 m long x 9 m deep fill . 40 -50 long concrete flume to carry water out of creek to 600 mm culvert at north end of fill.	There is no culvert in base of fill, water is flumed along slope to a short 600 mm culvert at north end of fill. There is a risk of the flume plugging and water filling upside of fill. Will have to maintain flume.	F #6 and FL#1	
14.30	15.30	100 m	200 m	60 - 100%	100%	rock	4-5 m with 1 m ditch	none	none	none	Minor timber development. Poor quality timber.		
15.30	15.40	none	none	n/a	n/a	Fire (Farr) creek bridge	4 m deck width	none	none	Farr creek bridge - 102 m length	Will require new deck and guard rails. Bypass is difficult as slopes are 60-90% and rock. Would require about 500 m of new road.	B#2	km 66.1
15.40	15.70	600 m	300 m	60%	60%	granular soils with sections of rock	4-5 m wide, 2- 3 m wide ditch	A short 100 m spur is feasible in this section.	None	None	None		
15.70	15.80	300 m	none	80%	400%	rock	4-5 m with 1 m ditch	none	none	Rock retaining wall. 5 - 14 m high x 100 m long	In good condition. Can be bypassed. Will require 100 m of full bench road in rock on 80 % slopes.	RW#14	
15.80	16.10	600 m	300 m	80%	80%	rock	4-5 m with 1 m ditch	none	none	none	none		
16.10	16.225	none	none	n/a	n/a	Bear (Cub) creek bridge	4 m deck width	none	none	Bear (Cub) creek bridge	Will require new deck and guard rails. Bypass is difficult as slopes are70 - 80% and rock. Would require about 400 m of new road.	B#3	km 67.1
16.225	16.60	300 - 600 m	300 m	80%	80%	rock	4-5 m with 1 m ditch	none	none	none	Marginal timber		
16.60	16.70	300-600 m	none	80%	400%	rock	4-5 m with 1 m ditch	none	none	Rock retaining wall 4-14 m high x 100 m long	In good condition . Can be bypassed with 100 m of full bench constructed road in rock.	RW #15	

Canadian Pacific Railway - Field notes - Castlegar to Christina Lake

Km from	Km to	Logging Opportunity		Sideslopes		Terrain	Road width	Secondary road opportunity		Railway Features	Comments	R.W.=Retaining wall	
		Uphill	Downhill	Up	Down			Uphill	Downhill		R= Existing road	B= Bridge	
											T= Tunnel	F=Fill	
0.00	= gated entrance at Castlegar end of route (km 50.5 Grant Copeland report)										FL= Flume	S= Slide	
16.70	16.90	300 - 600 m	300 m	60%	70%	granular with rock sections	4-5 m wide, 2- 3 m wide ditch	A short 100 m spur is feasible in this section.	None	None	None		
16.90	17.10	none	none	100%	100%	rock	4-5 m with 1 m ditch	none	none	none	none		
17.10	17.20	none	none	400%	400%	rock	4-5 m with 1 m ditch	none	none	Rock retaining wall 4-14 m high x 100 m long	In good condition . 6 m high rock face on uphill side with 40 % slopes above. difficult to bypass.	RW # 16	
17.20	17.30	300 m	300 m	50%	80%	granular with rock sections	4-5 m wide, 2- 3 m wide ditch	Potential short spur - possible length 100 m.	none	none	none		
17.30	17.35	none	none	400%	400%	rock	4-5 m with 1 m ditch	none	none	Rock retaining wall 4-6 m high x 50 m long	In good condition . 10 - 15 m high rock face on uphill side. Bypass not possible.	RW # 17	
17.35	17.60	none	none	400%	400%	rock	4-5 m with 1 m ditch	none	none	Rock retaining wall 4-14 m high x 150 m long	In good condition . 10 - 15 m high rock face on uphill side. Bypass not possible. Remainder of section full bench rock cut.	RW # 18	
17.60	17.90	300 - 600 m	300 m	400%	400%	rock	4-5 m with 1 m ditch	none	none	Rock retaining wall 4 m high x 30 m long	In good condition . 10 - 15 m high rock face on uphill side. Bypass not possible. Remainder of section full bench rock cut.	RW # 19	
17.90	18.00	300-600m	300 m	60%	60%	rock	4-5 m with 1 m ditch	none	none	none	none		
18.00	18.10	300 - 600 m	300 m	n/a	n/a	rock	5.5 m wide x 6.0 high	none	none	100 m long tunnel, poor visibility from southern approach	Minor rock fall evident from roof. Will have to monitor on a continuous basis for safety concerns. Possible concreting of structure if public safety cannot be guaranteed.	T#3	km 69.0
18.10	18.60	600 - 900 m	300 m	50%	70%	granular material with sections of rock	4-5 m wide, 2- 3 m wide ditch	Potential secondary spur - possible length greater than 500 m.	none	none	none		

Canadian Pacific Railway - Field notes - Castlegar to Christina Lake

Km from	Km to	Logging Opportunity		Sideslopes		Terrain	Road width	Secondary road opportunity		Railway Features	Comments	R.W.=Retaining wall
		Uphill	Downhill	Up	Down			Uphill	Downhill		R= Existing road	B= Bridge
											T= Tunnel	F=Fill
0.00	= gated entrance at Castlegar end of route (km 50.5 Grant Copeland report)										FL= Flume	S= Slide
18.60	18.80	none	none	70%	70%	Granular fill material	6 m wide	none	none	Large fill - 25 m deep, 1200 mm concrete culvert in good condition	Can be bypassed with 800 m of road and 1200 mm culvert. Deactivation of this structure (if bypassed) would require the removal of approximately 2000 cubic meters of fill and removal of existing concrete culvert.	F#7
18.80	19.70	300 - 600 m	300-600 m	30-50%	30-70%	granular material with sections of rock	4-5 m wide, 2- 3 m wide ditch	Potential secondary spur - possible length greater than 500 m.	Potential secondary spur - possible length greater than 500 m.	none	none	
19.70	20.40	0-100 m	300-500 m	100-400%	100%	rock	4-5 m with 1 m ditch	none	none	none	potential for occasional turnouts, adequate for road safety	
20.40	20.50	none	none	400%	400%	rock	4-5 m with 1 m ditch	none	none	Rock retaining wall 6-8 m high x70 m long	Retaining wall in good condition. Bypass not possible. 5 - 8 m high rock face on uphill side	RW #20
20.50	20.70	100 m	none	100%	100%	rock	4-5 m with 1 m ditch	none	none	none	Intermittent patches of timber - 3- 5 m high rock face on uphill side of railbed.	
20.70	20.80	none	none	400%	400%	rock	4-5 m with 1 m ditch	none	none	Rock retaining wall 5-14 m high x80 m long	Retaining wall in good condition. Bypass not possible. 5 - 8 m high rock face on uphill side	RW #21
20.80	21.30	100 m	none	100%	100%	rock	4-5 m with 1 m ditch	none	none	none	Intermittent patches of timber - 3- 5 m high rock face on uphill side of railbed.	
21.30	21.40	none	none	400%	100%	rock	4-5 m wide, 2- 3 m wide ditch	none	none	none	Large rockfall on road. Can easily be cleaned up in 1 - 2 days with an excavator. Large crack in existing rock face, will require scaling prior to use.	S#4
21.40	21.60	100 -200 m	100 m	70%	70%	rock and talus	4-5 m with 1 m ditch	none	none	Rock retaining wall at km 21.6 - 4 m high x 30 m long	Retaining wall in good condition. Can be bypassed. Full bench road in rock for 50 m	RW #22
21.60	22.00	300 m	300-500 m	70%	70%	rock and talus	4-5 m with 1 m ditch	none	none	none	none	

Km from	Km to	Logging Opportunity		Sideslopes		Terrain	Road width	Secondary road opportunity		Railway Features	Comments	R.W.=Retaining wall	
		Uphill	Downhill	Up	Down			Uphill	Downhill		R= Existing road	B= Bridge	
											T= Tunnel	F=Fill	
											FL= Flume	S= Slide	
0.00	= gated entrance at Castlegar end of route (km 50.5 Grant Copeland report)												
22.00	22.05	300 m	none	30-60%	30-60%	granular with rock sections	4-5 m wide, 2- 3 m wide ditch	Secondary road system possible > 500 m uphill	Secondary road system possible >300 m downhill	km 22- 22.05, Granular fill 5-7 m deep x 50 m long. No culvert installed.	Install a 600 mm culvert in fill at km 22.0.	F#8	
22.05	24.70	>900 m	>600 m	30-60%	30-60%	granular with rock sections	4-5 m wide, 2- 3 m wide ditch	Secondary road system possible > 500 m uphill	Secondary road system possible >300 m downhill	none	none		
24.70	25.00	>900 m	>600 m	30-60%	30-60%	granular with rock sections	4-5 m wide, 2- 3 m wide ditch	Secondary road system possible > 500 m uphill	Secondary road system possible >300 m downhill	none	There is a small failure at km 24.7 (10 m long) which can be repaired using a rock fill.	S#5	
25.00	25.20	none	none	70%	70%	Granular fill	6 m wide	none	none	Large fill - 25 m deep, 1200 mm concrete culvert inlet partially plugged, but can see all the way through, no water at this time.	**Clean inlet asap.**Can be bypassed with 1000 m of road and 1200 mm culvert. Deactivation of this structure (if bypassed) would require the removal of approximately 2500 cubic meters of fill and removal of existing concrete culvert.	F#9	
25.20	26.70	>900 m	>600 m	30-60 %	30-60 %	granular with rock sections	4-5 m wide, 2- 3 m wide ditch	Secondary road system possible > 500 m uphill	Secondary road system possible >300 m downhill	none	none		
26.70	26.80	none	none	70%	70%	granular	3 m	none	none	Fill 6- 8 m deep.Flume to 600 mm culvert.	Flume failed earlier this year. Creek flooded and overtopped fill, causing significant erosion. Flume has been temporarily rebuilt but rail grade is not usable except by ATV's and bicycles.	F#10 FL#2 S#6	
26.80	28.30	300 - 900 m	>600 m	30-50%	30-50%	granular with rock sections	4-5 m wide, 2- 3 m wide ditch	Secondary road system possible > 500 m uphill	Secondary road system possible >300 m downhill	none	none		
28.30	29.20	none	none	n/a	n/a	rock	5.5 m wide x 6.0 high	none	none	Bulldog Tunnel, 900 m long tunnel, poor visibility from southern approach	Minor rock fall evident from roof. Will have to monitor on a continuous basis for safety concerns. Possible concreting of structure if public safety cannot be guaranteed.	T#4	km 79.8
29.20	End Section 2												
SECTION 3 - KM 29.2 - 49.3													

Canadian Pacific Railway - Field notes - Castlegar to Christina Lake

Km from	Km to	Logging Opportunity		Sideslopes		Terrain	Road width	Secondary road opportunity		Railway Features	Comments	R.W.=Retaining wall
		Uphill	Downhill	Up	Down			Uphill	Downhill		R= Existing road	B= Bridge
											T= Tunnel	F=Fill
0.00	= gated entrance at Castlegar end of route (km 50.5 Grant Copeland report)										FL= Flume	S= Slide
29.20	30.90	300 m	300 m	30-60%	30-70%	granular with rock sections	4-5 m wide, 2- 3 m wide ditch	Secondary road system possible > 500 m uphill	Spur roads only. Creek located 600 m below road bed.	none	none	
30.90	31.10	none	none	70%	70%	Granular fill	6 m wide	none	none	Quinn creek - Large fill - 30 m deep, 1600 mm concrete culvert, can see all the way through, flowing with no problems at this time	Can be bypassed with 1000 m of road and 1600 mm culvert. Deactivation of this structure (if bypassed) would require the removal of approximately 4000 cubic meters of fill and removal of existing concrete culvert.	F#11
31.10	32.50	300 -600 m	300-400 m	30-60%	60%	granular with rock sections	4-5 m wide, 2- 3 m wide ditch	Secondary road system possible > 500 m uphill	Spur roads only. Creek located 600 m below road bed.	none	none	
32.50	32.60	none	none	70%	70%	Granular fill	6 m wide	none	none	Large fill - 15 m deep, 600 mm concrete culvert, cannot see all the way through, but is flowing with no problems at this time	Can be bypassed with 200 m of road on 30 -50 % slopes (O.M.)and 600 mm culvert. Deactivation of this structure (if bypassed) would require the removal of approximately 1000 cubic meters of fill and removal of existing concrete culvert.	F#12
32.60	34.60	300-900 m	300-600 m	30-50%	30-50%	granular with rock sections	4-5 m wide, 2- 3 m wide ditch	Secondary road system possible > 500 m uphill	Spur roads only. Creek located 600 m below road bed.	none	none	
34.60	34.70	none	none	70%	70%	Granular fill	6 m wide	none	none	Small fill - 6 m deep x 40 m long, 600 mm steel culvert, no water, seems to be working okay	Can be bypassed with 100 m of road on 30 -50 % slopes (O.M.)and 600 mm culvert or this structure can be left in place. No major liabilities with this structure.	F#13
34.70	34.82	none	none	70%	70%	Granular fill	6 m wide	none	none	Small fill - 5-8 m deep x 120 m long, 900 mm steel culvert.	Can be bypassed with 150 m of road on 30 -50 % slopes (O.M.)and 900 mm culvert or this structure can be left in place. **Clean outlet as it is partially blocked.**	F#14

Canadian Pacific Railway - Field notes - Castlegar to Christina Lake

Km from	Km to	Logging Opportunity		Sideslopes		Terrain	Road width	Secondary road opportunity		Railway Features	Comments	R.W.=Retaining wall
		Uphill	Downhill	Up	Down			Uphill	Downhill		R= Existing road	B= Bridge
											T= Tunnel	F=Fill
0.00	= gated entrance at Castlegar end of route (km 50.5 Grant Copeland report)										FL= Flume	S= Slide
34.82	36.05	>900m	300-600 m	30-50%	30-50%	granular with rock sections	4-5 m wide, 2- 3 m wide ditch	Secondary road system possible > 500 m uphill	Spur roads only. Creek located 600 m below road bed.	none	none	
36.05	36.30	none	none	70%	70%	Granular fill	8 m wide	none	none	Porcupine creek - Large fill - 48 m deep, 2.5m x 3.5 m masonary arch, can see all the way through, flowing with no problems at this time	Can be bypassed with 1000 m of road and 8 m bridge. Deactivation of this structure (if bypassed) would require the removal of approximately 8000 - 9000 cubic meters of fill and removal of existing concrete culvert.	F#15
36.30	40.80	300 - 400 m	300 m	30-50%	30-50%	granular with rock sections	4-5 m wide, 2- 3 m wide ditch	Secondary road system possible > 500 m uphill	Spur roads only. Creek located 600 m below road bed.	none	none	
40.80	47.40	100 m	100 -300 m	30-50%	30-50%	granular with rock sections	4-5 m wide, 2- 3 m wide ditch	Secondary road system possible > 500 m uphill	Spur roads only. Creek located 300 m below road bed.	km 40.8 - Junct of Dog creek road. km 41.3 - hgt of land at Farron- 1220 m. Km 47.4 Junct of Paulson Bypass rd.	Road bed in good condition	R#2 R#3
47.40	49.30	50 - 300 m	50 - 75m	60%	20%	granular with rock sections	4-5 m wide, 2- 3 m wide ditch	Secondary road system possible once past km 48.1	Creek just below road	km 49.1 - Walker creek - 2 x900mm culverts handle major creek. Fill depth only 1 m above top of culvert.	Walker creek has low gradient. culverts provide adequate fish passage and seem to be hydrologically adequate.	
Section 4 - km 49.3 - 71.4												

Canadian Pacific Railway - Field notes - Castlegar to Christina Lake

Km from	Km to	Logging Opportunity		Sideslopes		Terrain	Road width	Secondary road opportunity		Railway Features	Comments	R.W.=Retaining wall	
		Uphill	Downhill	Up	Down			Uphill	Downhill		R= Existing road	B= Bridge	
											T= Tunnel	F=Fill	
											FL= Flume	S= Slide	
0.00	= gated entrance at Castlegar end of route (km 50.5 Grant Copeland report)												
49.30	51.00	none	none	100 - 400 %	60-90%	rock	4-5 m with 1 m ditch	none	none	Orion crk-km 50.0 - 1200 mm culvert (1 m fill) with damaged entrance. km 50.5 - pass under Paulson bridge. km 50 .7 - Retaining wall upslope of road 1.5 m high x 60 m long	Monitor culvert - may have to repair if it does not handle flows - Retaining wall upslope in good conditon. Base of old snow shed.	RW#23	
51.00	51.10	none	none	n/a	n/a	rock	5.5 m wide x 6.0 high	none	none	100 m long tunnel	Minor rock fall evident from roof. Will have to monitor on a continuous basis for safety concerns. Possible concreting of structure if public safety cannot be guaranteed.	T#5	km 106
51.10	51.50	none	none	100 - 400 %	60-90%	rock	4-5 m with 1 m ditch	none	none	none	Minor rock fall which can be cleared easily with an excavator.		
51.50	52.10	100 - 300 m	200 m to creek	55-75%	65%	talus, rock and some granular material	4-5 m with 2 m ditch	Short spurs	short spurs	small slumps on outer edge of fill	Can be backsloped with an excavator for stability.		
52.10	52.70	300 m	0 - 200 m	80 - 400%	60-80%	talus and rock	4-5 m with 2 m ditch	None	none	km 52.35 - cut stone retaining wall in good condition - 30 m long by 12 m high km 52.7 - cut stone retaining wall in good condition - 55 m long by 12 m high - 900 mm masonary culvert	**Km 52.35** - Section can be bypassed by constructing 30 m of road in 70 % rock slopes. **km 52.65** - small cutslope failure- excavate and use lockblocks to support cutslope. **km 52.7** -can be bypassed with 100 m of road on 80 % slopes and a 1000 mm culvert.	RW#24 S#7 RW#25	
52.70	54.10	200 -250 m	100 - 300 m	40-60%	60%	granular material with numerous 3-5 m deep gullies	4-5 m with 2 m ditch	Potential for spurs > 500 m in length	Potential for short spurs - 200 m	none	Km - 53.8 - rail bed crosses two gullies - the first draw has no culvert and the second draw has a 600 mm culvert - **install a 600 mm culvert in the first draw as well.**		

Canadian Pacific Railway - Field notes - Castlegar to Christina Lake

Km from	Km to	Logging Opportunity		Sideslopes		Terrain	Road width	Secondary road opportunity		Railway Features	Comments	R.W.=Retaining wall	
		Uphill	Downhill	Up	Down			Uphill	Downhill		R= Existing road	B= Bridge	
											T= Tunnel	F=Fill	
0.00	= gated entrance at Castlegar end of route (km 50.5 Grant Copeland report)										FL= Flume	S= Slide	
54.10	55.60	0 -300 m	100 - 300 m	65%	65%	talus and granular material	4-5 m with 2 m wide ditch	none	none	Coryell crk - km 54.1- 80 m long x 15 m deep fill - creek has been diverted by a concrete structure through a rock tunnel on the west end of the the draw.	Fill , concrete works and tunnel for water passage in good condition except for debris at tunnel entrance. **Clean debris from tunnel entrance. Minimal timber on this section - very scattered volumes - heavily gullied**	F#16	
55.60	56.80	0 - 200 m	0 - 100 m	65%	65%	tallus and granular material	4-5 m with 2 m wide ditch	none	none	none	none		
56.80	59.10	300 - 600 m	100 - 200 m	65%	65%	talus and rock	4-5 m with 2 m wide ditch	short spur 200 - 300 m lengths	none	km 57.5 - 50 m retaining wall on uphill side. km 57.9 - 80 m x 15m deep fill.Steel Flume in poor condition.km 58.9 - 80 m x12 m deep fill - concrete flume in good condition	Marginal timber < 200 m3/ha. will require extensive work to install a 600 mm culvert at km 57.9. Retaining wall in good condtion	RW #26 F#17, F#18 FL#3, FL#4	
59.10	59.40	300-900 m	300 m	50-65%	50-65%	granular soils, talus	4-5 m with 2 m wide ditch	spur road and secondary road development	Short spurs 200 - 300 m length	km 59.3 - Snowslide bridge - 41 m long	Bridge in good condition, but can be bypassed with 150 m of road in granular soils - 50 % slopes. Original bridge was installed to avoid snowslides.	B#4	km 111.5
59.40	60.65	300-900 m	200 - 300 m	50-65%	50-65%	granular soils, talus	4-5 m with 2 m wide ditch	spur road and secondary road development	Short spurs 200 - 300 m length	**km 60.1** - creek draw with 15 m deep fill - concrete flume diverts water. km 60.6 - 6-8 m deep fill - concrete flume diverts water	Both flumes are in good condition and if maintained can be used for the long term.	F#19 F#20 FL#5 FL#6	

Canadian Pacific Railway - Field notes - Castlegar to Christina Lake

Km from	Km to	Logging Opportunity		Sideslopes		Terrain	Road width	Secondary road opportunity		Railway Features	Comments	R.W.=Retaining wall
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											T= Tunnel	F=Fill
0.00	= gated entrance at Castlegar end of route (km 50.5 Grant Copeland report)										FL= Flume	S= Slide
60.65	62.60	600-1200 m	300 m	50-65%	50-65%	granular soils, talus	4-5 m with 2 m wide ditch	spur road and secondary road development	Short spurs 200 - 300 m length	km 61.1 - Lafferty - old railway siding and gravel pit. **Access to highway possible on old road from this point.** km 61.6 - badly washed out fill - metal flume	**At km 61.1** it is possible to direct traffic onto the highway and bypass Christina Lake. **km 61.6 -** Timber supports for metal flume had failed, fill then saturated and was washed out. Fill can be bypassed with 150 m of road and 900 mm culvert.	F#21 FL#7 S#8
62.60	64.50	50 - 200 m	200 m	100%	65-85%	rock	4-5 m with 1 m wide ditch	none	none	none	none	
64.50	65.50	200 - 300 m	100 - 150 m	65%	65%	Granular soils, talus and rock	4-5 m with 2 m wide ditch	Short spurs 200 - 300 m length	Short spurs 200 - 300 m length	km 64.6 - 12 m deep fill. Steel flume on wooden posts to an 800 mm culvert	Steel flume still functioning- Cannot see through culvert but it is flowing - Monitor annually . Can be bypassed with 100 m of road in 50 -70 % slopes and a 900 mm culvert.	F#22 FL #8
65.50	66.80	>900 m	<200 m private property below railbed	30%	30%	Granular soils	4-5 m with 2 m wide ditch	Secondary development > 1000 m road lengths	Secondary development > 1000 m road lengths	km 65.7 - Spaulding creek - 3 m deep fill with small flume and 600 mm culvert	Scattered volumes only, large open areas. Replace flume with a 600 mm culvert installed in the fill	F#23 FL #9
66.80	68.50	0 - 50 m	100 m	30-60 %	30-60 %	Granular and with short sections of rock	4-5 m with 2 m wide ditch	none	none	**km 67.0 -** 55m x 12 m high cut stone retaining wall. **km 67.45 -** 100 m x 15 m fill - 800 mm culvert. **km 68.4 -** 10 m x 4 m stone retaining wall	All in good condition - Can bypass km 67 with 60 m of full bench road in rock - 50 % slopes. Can bypass km 67.45 with 150 m of road in talus 50% slopes. Can maintain wall at km 68.4. Minimal timber this entire section.	RW#27 RW#28 F#24
68.50	69.90	300 m	0 - private property	30-50%	30-50%	Granular soils, talus and rock	4-5 m with 2 m wide ditch	Secondary development > 1000 m road lengths	Secondary development > 1000 m road lengths	km 68.75 - 100 m x 12 m deep fill with 1200 mm concrete culvert	Baker creek fill in good condition - can be bypassed with 150 m of road on 30 % slopes and a 1200 mm culvert. There is existing access 600 m upslope.	F#25
69.90	70.70	0 - private property	0 - private property	50-80%	50-80%	rock	4-5 m with 2 m wide ditch	none	none	None	Minimal to no timber	
70.70	71.40	0 - private property	0 - private property	30%	30%	Granular material	4-5 m with 2 m wide ditch	none	none	none	Private property - houses and buildings adjacent to railgrade.	

Canadian Pacific Railway - Field notes - Castlegar to Christina Lake

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											T= Tunnel	F=Fill	
0.00	= gated entrance at Castlegar end of route (km 50.5 Grant Copeland report)										FL= Flume	S= Slide	
71.4	End of review - junction with public road												