Road Failures on Vedder Mountain near Chilliwack

Complaint Investigation 020398

FPB/IRC/90

December 2002

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The Investigation

The Complaint

On December 28, 2001, a small landslide originated in the fill slope of the Vedder Mountain Forest Service Road. Chilliwack Forest District (the district) staff undertook measures to temporarily maintain the road. On January 9, 2002, another landslide occurred at the same site. Both times, fill-slope material deposited into a regenerating cutblock immediately below the road. The road failed in another spot on January 9, 2002, depositing a small amount of material into a stream. On July 3, 2002, the Valhalla Wilderness Society (the complainant) complained to the Forest Practices Board that the district had failed to adequately maintain that forest service road (FSR).

Background

The Board's history with old roads in the Chilliwack Forest District

Two Board audits in 1997 in the Chilliwack Forest District identified that there were a number of old roads that were beginning to cause significant harm to the environment. Although the roads had been approved under a road permit, the Board found that no party had a legal responsibility under the *Forest Practices Code of British Columbia Act* and associated regulations (the Code) to maintain or deactivate roads that were constructed and used for industrial purposes before, but not following, the introduction of the Code. The Board asked the Ministry of Forests (MOF) to identify who was responsible for fixing old roads that are causing significant harm to the environment. MOF responded that the old roads would be dealt with under the watershed restoration program with funding from Forest Renewal British Columbia (FRBC). However, FRBC funding was not sufficient to deal with all the old roads in the district.

The investigation dealt with three sites (see Figure 1):

- Two blocked culverts
- The spur road junction
- The gully headwall

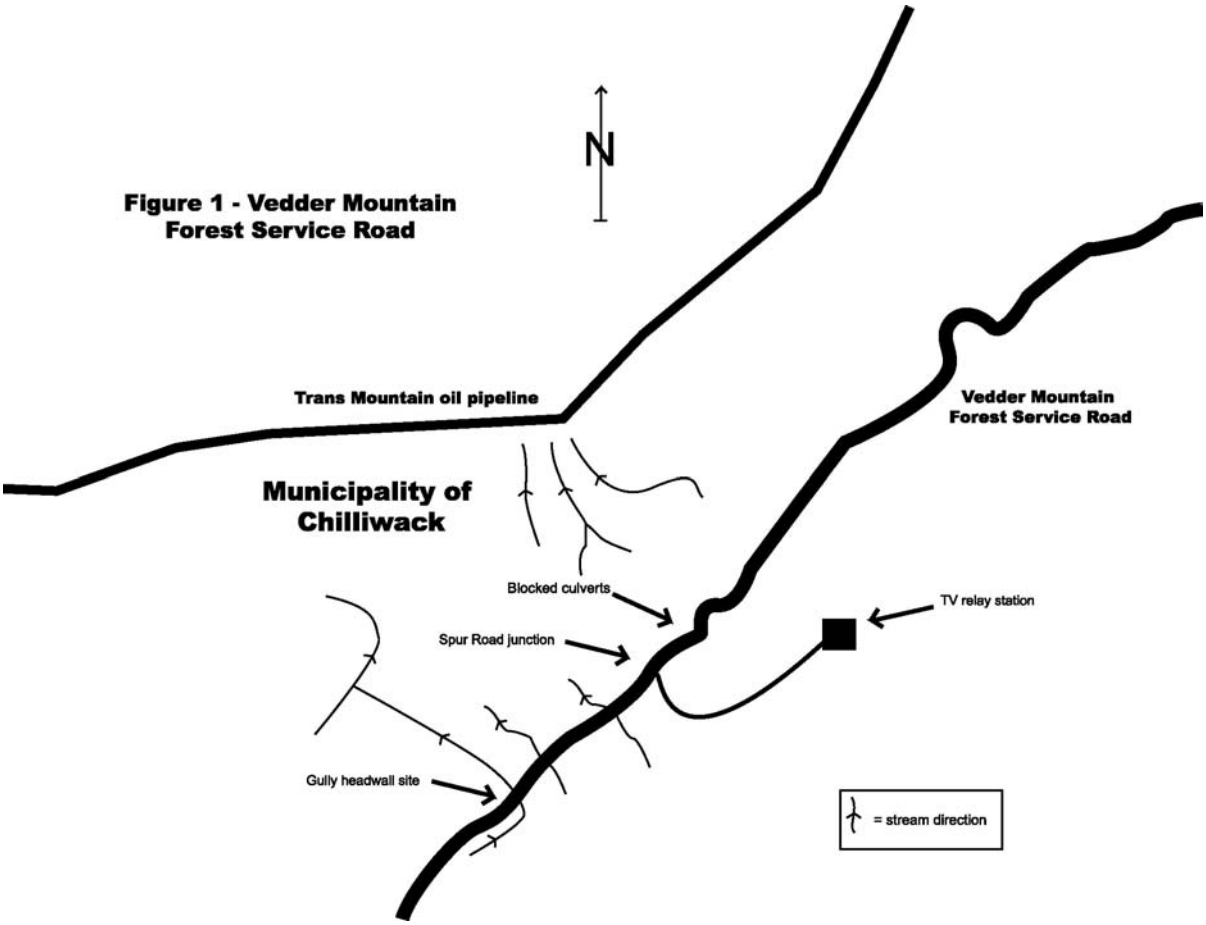


Figure 1 - Vedder Mountain Forest Service Road

Blocked culverts

In addition to identifying the two slides, the complainant identified two blocked culverts on the road, in the Yarrow Community Watershed, that diverted two streams down the road's ditch into a third culvert (see figure 2).

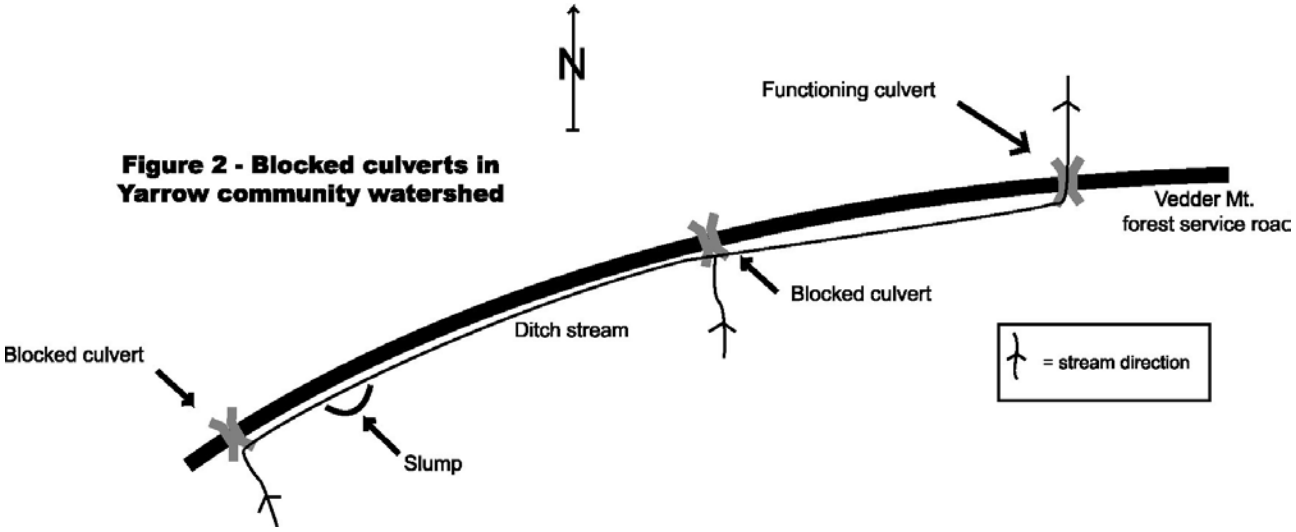


Figure 2 - Blocked culverts in Yarrow community watershed

The complainant also identified a slump on the cut-slope where the diverted water ran down the ditch (see Figure 3).

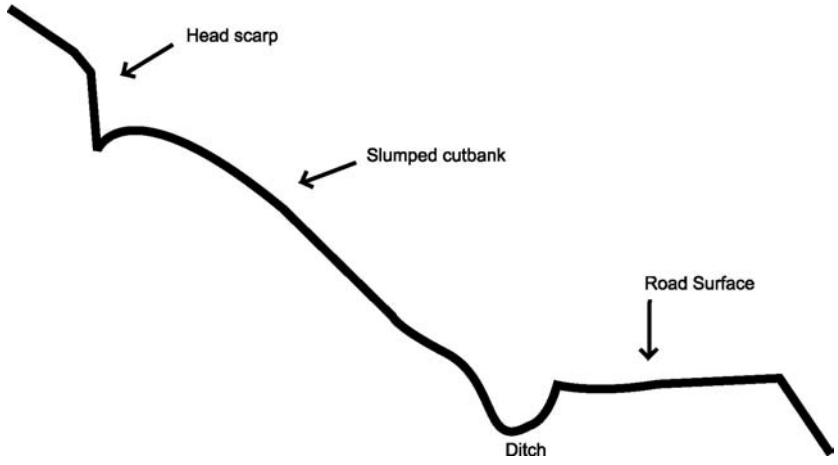


Figure 3 - Slump Cross Section

The complainant thinks that the stream in the road's ditch may have caused the slump. The slump did not divert the water from the road's ditch and the third culvert carried the combined water flow.

Spur road junction

The Vedder Mountain FSR was built long before the Code came into force. It had originally been constructed as a logging railroad in the early 1900s. The road is not currently used for industrial purposes. MOF maintains the Vedder Mountain FSR, however no party is responsible for maintenance of a spur road that joins the FSR. That spur road was constructed in 1969. At that time, MOF issued a special use permit to authorize a television relay transmitter site on Vedder Mountain, but the special use permit did not include that spur road. The complainant is concerned that no party has responsibility to maintain this old road, however the Code does not require that the government take on or assign responsibility to maintain old roads such as this.

Before the Code came into force, loggers in the Small Business Forest Enterprise Program (SBFEP) used the junction of the spur road and the FSR as a roadside landing to log a cutblock immediately below the FSR. The loggers piled the landing debris on the road fill slope and MOF burned the landing pile.

On December 28, 2001, after a prolonged period of precipitation, the roadside landing fill slope failed. Water channelled down the spur road surface to the FSR because the spur road had no drainage structures. The FSR was in-sloped, so its ditch water would cross the spur road junction to stay in the ditch of the FSR. Sediment was deposited on the spur road and blocked the in-sloped drainage structure so that drain water caught by the spur road and ditch water from the FSR pooled on the surface of the roadside landing. The water gradually saturated the roadside landing, adding weight to, and weakening, the fill slope.
(See Figure 4.)

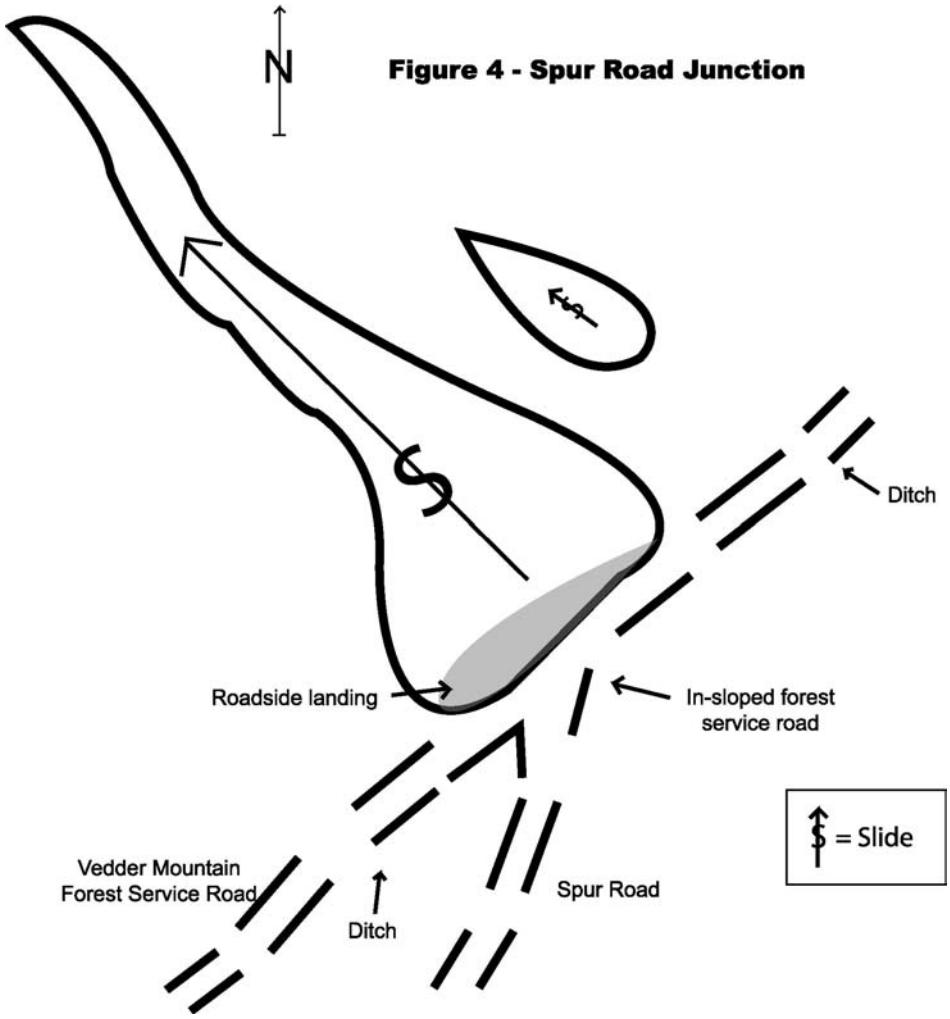


Figure 4 - Spur Road Junction

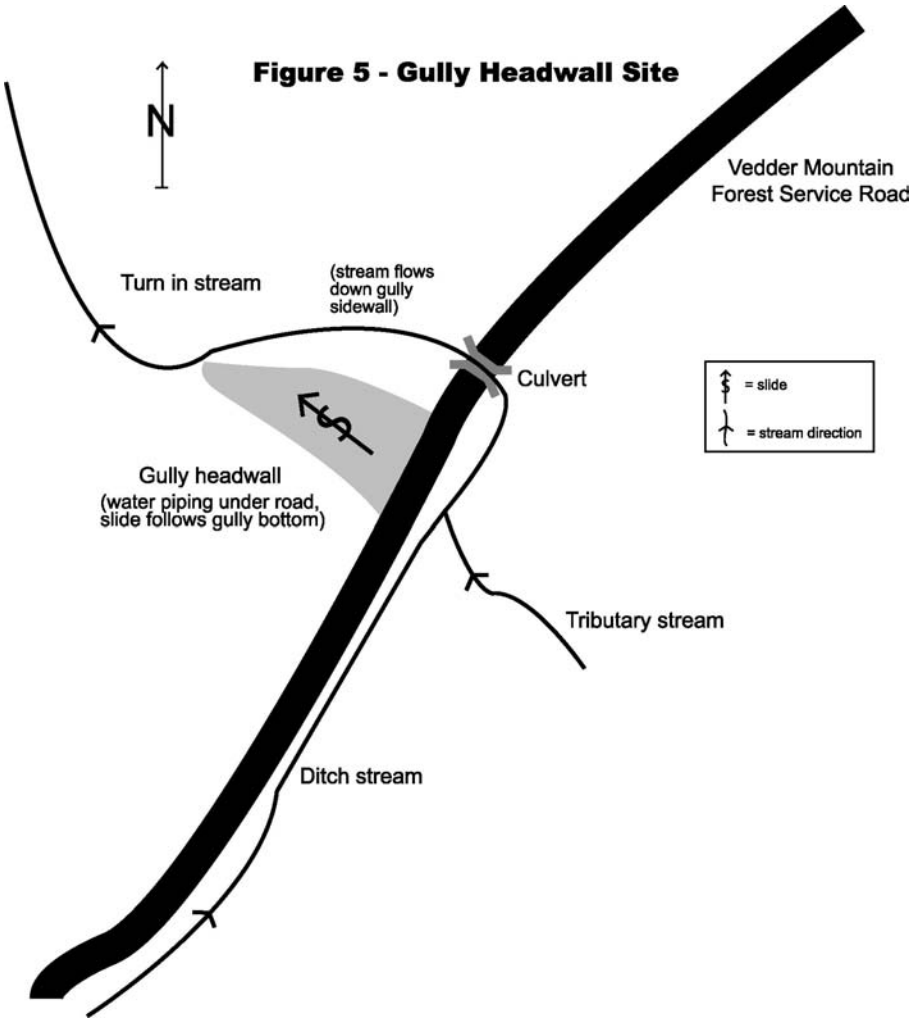
On the day of the failure, the district inspected the FSR and prescribed measures to repair the road. On January 4, 2002, the district completed temporary repair of the road. Final repair work was to be completed when conditions were drier. The wet weather continued and, despite the interim measures, on January 9, 2002, this site failed again.

Both the complainant and district agree on the sequence of events: water draining from the spur road pooled on the road surface, saturated the roadside landing, and caused the fill slope to fail.

Since the failures, the district has constructed water bars on the spur road to stop water from channelling onto the FSR. The Vedder Mountain FSR has been further in-sloped to better control drainage and prevent pooling at that point. MOF has removed some of the fill-slope material at the failure site to reduce the risk of further failures.

Gully headwall

The other section of the road that failed on January 9, 2002, after the prolonged wet weather, goes across the slope break on a gentle sloping bench. The road is on the headwall of a gully that extends from the slope break, down a steeper slope to the base of the mountain (see Figure 5).



In this area there is no cut slope—the old railway grade is constructed entirely on fill. The fill is approximately five feet high on the uphill side of the road. Therefore, the road disrupts the natural drainage pattern, causing the road ditch to be a permanent streambed. This ditch was overgrown with woody brush. A culvert passed the ditch stream under the road approximately 50 metres downstream from the road failure site. After the failure, district staff observed the water piping under the road prism at the point of failure. In an attempt to stop the water flow through the road prism, the district cleaned the ditch to increase the stream velocity where the water was piping under the road. However, cleaning the ditch did not stop the piping action.

The complainant inspected the road approximately one week after the failure of the fill slope and observed sediment obstructing one-third of the culvert. The complainant suspects that this condition, together with the overgrown ditch, caused water to pool upstream from the culvert and to saturate the road. The complainant asserts the water pressure increased, causing water to pipe under the road, which in turn weakened the fill slope, causing it to fail. Further, it asserts that this fill-slope failure moved down the gully and caused a debris dam on the creek. The complainant maintains that the dam subsequently broke and caused a debris torrent that scoured the stream draw, resulting in a large sediment deposit in a subdivision at the base of the mountain.

MOF agrees that water piping across the road fill contributed to the fill-slope failure. Although some material from the slide entered the stream channel, MOF feels it was an insignificant amount. The district asserts that the cause of the debris torrent occurred 40 metres downslope. Once across the road, the ditch stream heads down the gully sidewall. Approximately 40 metres down the gully from the road failure site, the stream reaches the bottom of the gully, turns and follows the gully to the base of the mountain. District staff believe the debris torrent started at the point the stream turns, and resulted from erosion of the natural slope. They believe the combination of the turn in the stream channel and volume of water in the extremely wet weather eroded the natural slope that supported the road. They claim this erosion of the natural slope initiated the debris torrent and contributed to the failure of the road fill slope.

When Board staff visited the site, a crew was repairing the road fill slope. There was no evidence that the ditch or culvert failed, allowing water to cross the road prism on the surface of the road. Despite the clean ditch and water flowing freely in the ditch stream, water was piping under the road into the gully. The Board did not explore if water would have been piping under the road if the ditch had been clean before the slide occurred, as that would involve speculation.

Issues

1. Was the frequency of the road inspection appropriate?

2. Was inspection and repair of the road adequate?

Discussion

The complainant and district disagree on where the debris torrent at the gully headwall site was initiated. However, both parties agree that water piping across the road prism contributed to the failure of the road fill slope. The Board did not determine the location of the initiation zone of the debris torrent because the precise location was not relevant to the requirements of the Code. The investigation of this issue examined whether or not inadequate road inspection and maintenance contributed to the water piping under the road.

The spur road to the television repeater station is not a FSR, and no road permit, special use permit, cutting permit or timber sale licence applied to the spur road. The Code does not regulate old roads that are not under such tenures. Therefore, there is no Code requirement to maintain the spur road.

Section 63(6) of the *Forest Practices Code of British Columbia Act* (the Act) requires the government to maintain FSRs in accordance with the requirements of any forest development plan (FDP) and the requirements of Code regulations. No FDP listed requirements for the Vedder Mountain FSR because the road was not being used for timber harvesting. However, the *Forest Road Regulation* (FRR) specifies inspection requirements that do apply to the road.

Was the frequency of the road inspection appropriate?

Section 18(2) of the FRR requires maintenance inspections to be carried out at a frequency that takes into account risk to fish streams and to road users.

The road failure at the spur road junction is not adjacent to a stream, and the stream reach below the gully headwall is not a fish-bearing stream. Fish streams, classified by slope gradient, are adjacent to the road in other areas, but the district has not assessed the risk of sediment transfer to those streams on this road.

An assessment of the risk to road users must take into account the frequency and type of road use, and the amount of precipitation. The road has a high recreational use, but there is no industrial use of the road. The *Forest Road Engineering Guidebook* (the guidebook), applicable at the time of the inspections, points out that the Mission-Hope area should be given special recognition because it has a high frequency of intense rainstorms. The Vedder Mountain FSR is in the Mission-Hope area and, therefore, is subject to higher levels of precipitation than many other roads in the district.

In addition to requirements in the FRR, the guidebook recommends considering other downstream values, such as human life or property values, when risk-rating roads. There are residential properties below the road.

In 1998, the district developed an access management plan for FSRs not covered under FDPs. That plan rated the road as a high risk. The guidebook made the same recommendation for high- or very high-risk roads: they should be scheduled for yearly inspections and inspections following significant precipitation events. The district scheduled the inspections accordingly. Therefore, it is the Board's opinion that the schedule for inspections on the Vedder Mountain FSR was appropriate.

District engineering staff performed detailed field inspections and completed detailed written road-inspection reports for the FSR in February 1997, November 1997, June 1998, September 2000, and April 3, 2001. District staff responsible for inspections made seven site

visits to the road in 1999, but did not fill out an inspection report. The inspector indicated that he would have filled out a report if he thought the road needed repair.

The district also inspected the road after the prolonged periods of precipitation in December 2001 and January 2002.

It is the Board's opinion that the frequency of the road inspections was appropriate.

Was inspection and repair of the road adequate?

Section 18 of the FRR requires inspection and repair of the road to ensure that:

a) the structural integrity of the road prism and clearing width are protected;

b) the drainage systems of the road are functional;

c) the transport of sediment from the road prism, and its effects on other forest resources, are minimized;

d) safe passage for fish is provided at all fish-stream crossings constructed or modified after June 15, 1995; and

e) the road can safely be used for timber harvesting or other industrial purposes.

The road was constructed before June 15, 1995, and the road was not active, so neither criterion d) or e) apply to this investigation.

Neither the legislation nor the guidebook describes how inspections should be done. For road inspections, MOF standard operating procedures only include a road-inspection report checklist. It includes 10 maintenance items for inspectors to look at while inspecting roads and 10 associated actions to prescribe repairs for the road. Other than that, MOF has no documentation on how to do an inspection. MOF, in conjunction with the British Columbia Institute of Technology, have developed courses on road maintenance. Inspection of roads is covered in such courses; however, there is no requirement for inspectors to take courses.

Notes on the inspection reports show that the inspections included checking for dangerous trees, sight distance, culvert function, culvert capacity, surface condition, ditch condition, and road prism integrity. Inspection reports noted where culverts and culvert inlets were becoming filled with sediment. Minor repairs were done during the inspections. Other repairs were noted and marked in the field for repair by contractors.

Blocked culverts

The area of the stream diversion is within the Yarrow Community Watershed. The complainant believes that blocking the two culverts is a forest practice and, therefore, contravened section 45(3) of the Act. Section 45(3) prohibits a forest practice if it could

foreseeably cause slumping or sliding of land in inclement weather. The culverts were blocked before the Code came into force, and neither the government nor a licensee blocked the culverts. Therefore, section 45(3) does not apply. However, section 18 of the FRR requires the party responsible for maintenance of the road to keep the drainage systems functional.

District staff knew that members of the Yarrow Community Watershed had diverted the streams to increase the flow into their reservoir. Inspections of the road identified the blocked culverts, but they were not repaired because the community wanted the water for the reservoir, the diversion was not considered an environmental risk, the ditch had not failed, and the last culvert was sufficient in size to carry all the water. Although the culverts are blocked, the road drainage system in the Yarrow Community Watershed continues to function. Therefore, the Board considers that inspection and maintenance concerning the blocked culverts was adequate. However, the Ministry of Water, Land and Air Protection, the district, and representatives of the Yarrow Community Watershed are currently trying to resolve the ongoing water supply issue.

Gully headwall site

Road inspections normally include driving and walking segments of the road surface to inspect the road condition. On much of the Vedder Mountain FSR, both cut and fill slopes are visible. However, at the gully headwall site, anything off the running surface of the road was not visible because brush had encroached on the fill slopes and ditch. An inspector could not tell that the road crossed the top of the gully without walking the overgrown fill slope. As well, if there were indicators that water was piping under the road there, they would have only been detected if inspectors had walked that brushed-in area. Inspections do not normally involve walking the entire clearing width of roads. The brush on the fill slope was live vegetation. Live vegetation aids slope stability. The railway bed the road was built on had been established for almost 100 years without a failure at this site. There were no apparent indications to an inspector that walking the brushed-in area was required. It is the Board's opinion that inspections of the road at the gully headwall site were adequate.

Spur road junction

Although no problems were noted in inspections at the site of the spur road failure, the district road permit file contained photos taken after the landing was burned in 1997 at the spur road junction. District SBFEP staff did a post-harvest inspection to examine the landing. Hand-written notes on the photos mention wood perched on the fill slope, indicate that the fill slope was settling, and identify that stress cracks had formed. Although not documented during the post-harvest inspection, the inspector remembers that the stress cracks and debris were in the landing fill but not the road fill. He did not think the problem was serious enough to prescribe repairs. The 1999 SBFEP business plan did not budget for repair of the landing. Since there were no corrective measures prescribed for this site, none were done.

There is no record that road inspectors monitored this site again until the 2001 failure. In the Board's view, reviewing files before doing an inspection is a good practice. If a file review had been done before subsequent inspections, the inspectors could have checked the spur road junction, noted if there were any changes to the indicators and, if so, prescribed corrective measures. Regardless of the photos on file, since the yearly inspections were detailed, were done more or less to schedule, and followed normal inspection procedures, it is the Board's opinion that the inspections were adequate.

During the investigation, MOF branch staff suggested that one way of improving the chances of collecting file information prior to a scheduled inspection would be to add a section to the inspection form that requires a summary of chronic problems by location, or a list of pre-existing conditions found on the road file. They also suggested that, even though MOF was not responsible for maintaining the spur road, it would make sense for inspectors to travel the spur road as part of the FSR inspection. They explained that a quick traverse of these upper roads could identify potential future problems for the road below.

District staff inspected the spur road junction after the failure occurred on December 28, 2001. That day, staff hand-cleared the sediment deposited in the in-sloped drainage structure, allowing the water to drain from the road surface. The district did additional interim repairs on the site on January 4, 2002. However, as stated above, the wet weather continued and the site failed again on January 9.

District and regional staff inspected both sites on January 10, 2002, the day after the next two slides occurred. Those inspectors recommended immediate maintenance at both sites. Further, the inspector at the gully headwall site recommended that a professional geotechnical engineer design measures to repair the road at the gully headwall site. An MOF geotechnical engineer did so on January 14, 2002. The prescribing engineer also supervised the repair at this site. The Board concludes that, after the failures, the district inspections were adequate.

The FRR requires that the person responsible for repairing a road must do so at the earliest of:

- a time specified in an inspection record,
- a time determined by the district manager, or
- a reasonable time taking into account the risk to the road, its users, and the environment.

The district contracted out the maintenance identified in regular inspections of the Vedder Mountain FSR that took place on February 1997, August 1998 and February 2000. Other than hand repair in 2001, the district did not do any work on the road in 1999 and 2001. The district did not document the exact nature of the repairs. However, the inspections showed only normal deterioration-type defects, such as loss of sightline due to brush, silt build-up in

ditches and at culvert openings, and damaged culverts. Those defects were either not apparent or did not get worse in future inspections. Deficiencies noted in the 2001 inspection report were minor in nature and neither the report nor the district manager required work to be done immediately. Therefore, the Board concludes that, even though no repairs were contracted for 2001, the preventive road repairs were adequate to maintain the road.

Works to repair the roadside landing and road fill-slope failures were completed on January 4, 2002, February 23, 2002, and July 15, 2002. The Board concludes that remedial repairs to the road were adequate at the failure sites.

Commentary

MOF's only documented procedure for road inspections is the road inspection report form. The Board suggests that MOF supplement that form with best management practices to guide road inspections. For example, roads could be risk-rated by road segment, with more detailed inspection required on higher-risk sections.

Conclusions

The frequency of road inspections for the Vedder Mountain FSR was appropriate.

Overall, the inspections of the road were adequate; however, an office review of the road file would have reminded the inspector to check the landing at the spur road junction for indicators of slope instability.

Repairs done as a result of inspections and repairs done to correct failures were adequate