

team has acknowledged in its presentation that it dropped the recurrence intervals down one notch from the RIC standards:

<u>Recurrence Intervals</u>	<b>Chatwin, Salway, RIC Hazard Class</b>	PRRA <u>Hazard Class</u>
>1:20 years	Very High	High
20 -100 years	High	Moderate
100-500	Moderate	Low
500-2500	Low	Very Low
>2500 years	Very Low	None

While it is indeed possible to compare the PRRA and the PRHA by recurrence intervals, this gives a misleading result as to hazard ratings, and this is not merely a difference of nomenclature. It has real results in the risk matrix and in planning decisions, as in deciding upon additional studies. Even though we knew that the mapping in the Wehr survey was not detailed enough, VWS wanted to correct the downgrading of hazard class in comparison to the RIC standards that occurred because of the "innovative" PRRA methodology. That was the purpose of Dr. Salway's report. Appendix C neatly erases one of the major differences in the methodology of the two reports.

Furthermore, Dr. Salway dropped recurrence intervals altogether from his classification system when releasing the final, bound version of his report (enclosed). Because of extreme time pressure put upon us by the Ministry of Forests and its consultants, VWS released the early version of the report signed and sealed by Dr. Salway on May 12,2000. Dr. Salway was producing an amended version which contained very few changes, most of them minor. One of these was to drop recurrence intervals, stating that they are "largely unsubstantiated." This refers to the fact that *neither the PRRA, Chatwin nor the PRHA had statistical data on which to base claims for recurrence intervals.* This was noted in the VWS Backgrounder which released the earlier version. So Appendix C is based on criteria for which there is no substantiating data. The purpose of the Salway study was to see how well the PRRA reflected the hazard ratings of the only existing field survey. The answer is that the earlier work yields a portrait of extensively higher hazard than does the PRRA.

Addendum 3 to the PRRA does not address many "High" and "Very High" hazard ratings in the PRHA.

#### Changes to Hazard Ratings

All the documents released to the public from the workshop state that the differences in the two reports will be reduced by a new Addendum to the PRRA. For instance, the March 27 letter states:

"The Panel informed Salway that even though many of the hydrologic units with 'moderate risks' were assessed in the PRRA, due to the reviews of other professionals, the Panel would revisit the original report, consider 'moderate risks' as 'significant issues' ~. and, where necessary, make additional 'suggested alternatives' and 'recommendations'".

It is important to note that many "moderate risk" units in the PRRA have High and Very High hazards in the PRHA. However, changes to the hazard ratings in the PRRA were miniscule and most often insignificant. In no case were the PRRA hazard ratings with TCP elevated from "Moderate" to "High", nor did the Panel or Dr. Salway specify that there should be Level A Terrain Mapping for Moderate units. Thus the changes are largely insignificant.

For instance, changing *existing* sediment yield ratings does nothing because logging and road building dramatically alter sediment yield. The workshop did not change the ratings with TCP to reflect the hazard if logging occurs. What's more, the change in existing hazard that the PRRA has adopted is from *Very Low to Low*. This would hardly have brought about the needed changes in hazard with TCP even if the PRRA team had been willing to go that far. Out of 29 units that were rated for sediment yield hazard in both reports, only 3 ratings are the same. All other PRHA ratings for this hazard type are at least one class higher than the PRRA, with many two-class differences and a couple of 3-class differences, and with most of the PRHA ratings being "High". Thus the two reports contain a striking difference in the assessment of hazard to water and stream channels because of sediment yield.

Addendum 3 lists only 6 changes of hazard ratings with TCP. Most of these are from Low to Moderate, or from Very Low to Low, which in no way addresses the 30 "Very High" ratings and 59 "High" ratings in the PRHA which are not duplicated in the PRRA. A few examples of units where a change was made will indicate the insignificance of these changes:

Unit 16 Benninger Creek: The hazard rating changed is for "Open slope landslide," from Low to Moderate. In actual fact, the PRHA ratings were one class higher for Peak Flow/Flood, Sediment Yield, and Debris Flow Down Stream, with the PRHA evaluating High or Very High hazard in all these categories. In addition, there is High hazard in the PRHA for Headwaters Avalanche, which is not rated in the PRRA. In Valley-Bottom Landslide, the PRHA rates hazard at High, the PRRA rates is at None. Interception and Diversion is moderate in the PRHA, not rated in the PRRA.

Unit 20 Percy Creek Addendum 3 changes the rating for "Debris Flood/Avulsion along Stream" from Very Low to Low. There are one- and two-class differences between the two reports in hazard ratings for Sediment Yield, Debris Flow Down Stream, Open Slope Landslide, Valley Bottom Landslide and Sinkholes, not to mention the Headwaters ~ Avalanche and Interception & Diversion hazard that the PRRA does not rate.

Only Jerome Creek had significant changes to its hazard and risk ratings, and consequently significant changes to the recommendations.

### PRHA Road Eliminations Ignored

Three very important things need to be kept in mind about roads:

- 1) Allen Isaacson and June Ryder have both pointed out that all it takes is one plugged culvert or some other problem to put water out of place and send a landslide or debris torrent into an area where there are houses, a main access road, and/or the river.
- 2) All consultants for the Perry Ridge water users (Baumann, Isaacson and Ryder) have pointed out that the hazard mapping is insufficiently detailed to show small start zones

for hazardous events. For this purpose the workshop summary recommends Level A Terrain Stability Mapping "for proposed road corridors and proposed cutblocks, and areas downslope where required, in areas with High and Very High risk". However, all three of the water users' consultants have pointed out that the more detailed mapping must be done *before* any planning decision is made, whereas the workshop agreement puts it afterward. In addition, it has been pointed out to us that addressing the Level A TSIL mapping to "Very and Very High" risk areas is inappropriate, since it is impossible to determine what areas are high and very high risk with any accuracy using the original broad brush reconnaissance-level mapping and assessments.

- 3) Further, the only document that addresses "risk" is the PRRA, which has lumped numerous high and very high hazard Wehr/Chatwin polygons into planning units rated only Moderate or Low hazard, and plugged these into the risk matrix. In other words, even if MOF believes the original broad brush reconnaissance-level mapping and assessments are adequate, the PRRA reflects these poorly; they are better reflected in the Salway ratings yet there is no indication that that High and Very High *hazard* areas in the Salway report - most of which are rated Moderate or Low in the PRRA - would be used to determine the location of the new Level A mapping.

With this in mind, consider the failure of the workshop to recommend the road eliminations that Dr. Salway advised. The PRHA recommended the elimination of spur road segments in Hird, Rice, Jerome and Nelly Creeks. Dr. Salway explained to the clients that these recommendations were *absolute* - they *must* be done to avoid high and extreme hazard that could deliver slides and debris torrents into high-risk areas. However, neither the Summary of the Workshop nor Addendum 3 make any new recommendations whatever on the first two units, Hird and Rice.

Hird is one example of a major concern. The main haul road goes through a polygon above Hird Creek rated moderate for open slope landslide by Wehr, high by Chatwin. According to Chatwin, there are 22 High and 2 Extreme hazard polygons in Hird Creek basin. Of those High hazard polygons, 7 of them were originally rated Extreme by Wehr. The PRHA rated hazard for Peak Flow/Flood, Sediment Yield, Debris Slide into Stream, Debris Flow Down Stream, Open Slope Slide, Snow Avalanche (Headwater Streams) and Valley Bottom Landslide as High or Extreme for this watershed.

Although the PRRA eliminated the Very High category from its classification system, it notes in regards to Hird Creek:

"There is an existing high risk to property and water supply from a debris flood/avulsion. The proposed TCP may increase these risks to Very High."

*However, the Panel declined to recommend against road building in the drainage, and Addendum 3 to the PRRA makes no new recommendations whatsoever for either Hird and Rice Creeks. If the logging and road building ensue, consider that the PRHA identifies*

"At least 3 potential avalanche sites ... that could be created in the lower easterly portion of polygon #385 and the northerly and central portions of #386. If an avalanche occurs in either of the two sites in polygon #386, it could trigger a debris slide/debris flow ... that could travel down the tributary all the way to the main stem ... Such a debris flow, arriving in the mid section of main stem reach

#9 would move rapidly down the channel, at least to reach #5 and most probably would continue down through 4 and onto the fan."

In terms of the PRHA's other road eliminations: For Jerome, the Addendum recommends no development until differences in some reports are resolved.

For Nelly Creek, the Addendum states: "Limit road crossings of Nelly Creek and its tributaries and investigate alternate access of upper drainage," so road crossings are definitely contemplated in spite of the Salway recommendations.

- This is a watershed that contains *eight* High hazard ratings in the PRHA, most of which were rated Moderate or even Low in the PRRA; the PRHA also notes Moderate hazard of interception and diversion of groundwater.
- While Addendum 3 changes the debris slide into stream rating with TCP from Low to Moderate, it remains that the PRRA assigns only 1 High hazard rating, for valley bottom landslide. What is there to activate the Level A TSIL mapping for the middle and upper areas?
- While Addendum 3 recommends a stream channel survey for those reaches not yet covered, it fails to address the fact that Salway has already rated it as High for debris slide into streams and debris flow down stream.

#### Other PRHA "High" and "Very High" Hazard Ratings Inadequately Addressed in Addendum 3

Addendum 3 contains additions to suggested alternatives and recommendations for a number of units having "High" or "Very High" hazards in the Salway report. These advise such generalized palliatives as "recharge areas upslope of all water intakes should be delineated", or "appropriate measures should be adopted to minimize effects of road construction and skidding on the water supply," or "ensure good road drainage" or "road density should be decreased". This is so in the following units:

- Unit 1, West Talbot Creek, where the PRRA itself recognizes that "Approximately 1/3 of unit consists of private land that has already been logged, including a large area directly above a residence." Dr. Salway rates the hazard with TCP as "High" for both Open Slope Landslide and Interception and Diversion of Groundwater.
- Unit 5, Davout/MacFayden Face rated High for sediment yield, open slope landslide, valley bottom landslide and interception and diversion of groundwater in the PRHA.
- Unit 6, MacFayden Creek - Addendum 3 makes no comment at all on this unit, though it was identified by the PRHA as having Very High hazard for debris slides/flows, in contrast to the PRRA, which rated it Moderate in both categories.
- Unit 14, Watson Creek, with 7 categories of High hazard with TCP in the PRHA, plus Moderate hazard of interception and diversion of groundwater.

- Unit 19, Hird/Percy Face, which is the location of the McKean springs complex and is rated as Very High hazard of valley-bottom landslide and Very High hazard of interception and diversion of groundwater.
- Unit 23, RicelRichards Face, which is rated by the PRHA as Very High for valley bottom landslide, H for open slope landslide, and High for interception and diversion of groundwater, as well as Moderate for sediment yield.
- Unit 28, Avis Creek, has 8 High or Very High ratings in the PRHA that are, across the board, rated Moderate or Low in the PRRA. Additionally, it has High hazard of headwaters avalanche and Moderate hazard of interception and diversion of groundwater. Addendum 3 fails to changes its hazard ratings, and states only that Avis should receive a stream channel assessment of the stream reaches not yet assessed. Yet nothing is recommended in view of the fact that Avis is *already* assessed by Salway as having High hazard of debris slide into stream and debris flow downstream based upon the Chatwin and Wehr ratings. Chatwin rated reach #9 as having Class 4 hazard of potential of landslides (equivalent to "High hazard for debris slides into stream) and reaches 10,9,8 and 7 as having High "debris flow transport hazard potential".
- Unit 31, Woodlot Face, is rated High by the PRHA for sediment yield, valley bottom landslide, and sinkholes, with the PRRA ratings being one or two classes lower. In addition there is High hazard of interception and diversion of groundwater.

PRHA ratings on hazard types not assessed in the PRRA were whitewashed by the workshop agreements.

### Avalanches

The Summary of the Workshop states that:

"The PRHA split the PRRA "Snow Avalanche" event type into two components - 'Headwater' and 'Valley Bottom'".

The PRRA only found avalanche hazard in MacFayden, Draw and Newcommen Creeks. Twenty-five other units were rated "None". Of these, the PRWUA found High or Moderate hazard of either valley bottom or headwaters avalanche potential in 18 units, and most of that is rated High. So where did all the High hazard that Salway identified go in the PRRA?

The March 27 letter from the PRRA team to MOF adds:

"At the workshop, the Panel and Salway *resolved the differences* in the manner that "Snow Avalanche" hazard ratings were assessed in the PRRA and the PRHA. It was agreed that the PRRA addressed many of the PRHA's 'Snow Avalanche' concerns in the hazard ratings for other event types, specifically 'Debris flow downstream' and "Debris flood/avulsion along stream." (Emphasis added)

Why is there an Avalanche category in the PRRA, if this hazard is just as well reflected in other hazard types? Isn't it terribly misleading if hazard that should be registered under "Avalanche" does not appear because the hazard is rated "None", however, we're expected to be satisfied because the hazard shows up in some other category - a category which does not reveal that avalanches can be *caused* if the watershed is logged?

It is true that some of the instances where the PRHA identified headwaters avalanche hazard are rated by the PRRA report as High hazard for debris slide into stream and debris slide downstream. However, the PRHA identifies a new possible *trigger* to the debris flow hazard, in addition to hydrological triggers. Identifying the possible triggers is important to demonstrate the *cumulative* effect of different kinds of hazards, i.e., what happens when high hazard of avalanche caused by logging sits on top of an already high natural hazard of landslides and debris flows, or an elevated hazard due to logging and road building.

For the record, there are significant instances where High ratings for hazard type #8 are NOT reflected in High ratings for debris flows in the PRRA: Avis and Nelly Creeks. However, the PRHA rated these watersheds High hazard for debris flows. These ratings are well substantiated in the Chatwin Stream Channel Survey.

The PRHA report cites the Ranch Ridge and Frog Peak slides as examples of avalanches created by logging. In the case of Ranch Ridge, only one of the two slides was a debris flow. The other came down to the main highway as a *pure snow avalanche*. This is also not addressed in the PRRA in its debris flow ratings.

The workshop participants made the following recommendation about avalanches:

"Potential snow avalanche start zones should be addressed as a component of Terrain Stability Field Assessments and Forest Development Plans should be reviewed by snow avalanche specialists."

However, the whole context of the workshop agreements indicates that such additional studies would occur after a strategic level decision has been made. It appears you are preparing to decide where and how logging can take place without the benefit of this information.

#### Interception and diversion of groundwater

The workshop summary states:

"It was agreed that for most hydrologic units, the PRRA addressed 'Interception and Diversion' event type in a different manner than the PRHA, but that the Panel's existing and proposed 'suggested alternatives' and 'recommendations' should satisfy Salway's intention of identifying 'Interception and Diversion' as a separate event type."

As far as we know, Dr. Salway had only his 1986 springs report for evaluating this hazard, but springs are surface water, not groundwater, and the PRRA didn't even use that. There are no groundwater studies or water balance data for Perry Ridge.

More importantly, three outstanding professionals in hydrology, engineering and terrain hazard mapping have told the government that water linkages on the Perry Ridge slopes have not been identified, and that this must be done before the risk to the residents of any development can be assessed. Allen Isaacson states:

"I have walked the entire top and down into the headwaters on many of the breaks into the individual watersheds (on Perry Ridge). There is a very high water table on much of this area and many seeps and springs. Also in the spring there are fairly large flows of intermittent streams that do not show up as moving that much water later in the season. If water quality and good drinking water is to be preserved for the water box intakes for human use, then the headwaters need to be protected.

"The protection in the VanDine report is the 20 percent ECA. When you look at a watershed and think about the area of the headwater as an area of "x" in size, the middle third of the watershed would be about "4-6 x" and the lower third of the watershed would be "8-10x" in area. The 20 percent ECA is figured for the area of the whole watershed down to the mouth or to the private property. This means that the whole headwater in a watershed could be cut in one pass and still be within the 20 percent ECA or even the 15 percent that was described as being sufficient for protection. That is not true and would result in a dense cutting pattern in the headwater area. It is possible there may be some ridge areas that could be harvested but the road system would probably have to cross some unstable terrain to reach those sites."

"The whole (pRRA and PRHA) analyses are based on mapping units for terrain stability. Mapping units are an important part of the analysis, but they are not the main part. The main ingredient of risk for mass failures in mountainous terrain is the water and how it reacts with the terrain.

"The key to managing terrain like Perry Ridge is in the managing of the water. The water is hardly mentioned in these reports ... The VanDine and Salway approaches are probably much better at identifying existing hazard than the danger from a road or a cut block, because this is impossible to know without knowing what the activity will do to the water. How much water is there to *begin* with? What is the precipitation, what is the snowfall? What is the melt rate, and how will that be changed with management. These all have to be answered, and then an analysis of how much change from the natural will occur with a road or a cut block.

In this terrain there are areas in the headwaters with many seeps and springs, these are not mapped with the level that is presently used. There is no clue as to what will happen if a road is put on one of these slopes. The major impact here is water intercepted by roads in its natural travel path through the soil and rock above solid bedrock. When this slope water is intercepted and brought to the surface it has to be taken care of and not dumped on a slope that can not handle the weight and flotation mechanism of additional water. A small amount of additional water will start mass failures. We have seen this with the number of slides that Craig Pettitt has looked at over the last few years. Many have started on slopes that would map out as stable or intermediate and yet have resulted

in some large slides. Why, because the water was not handled adequately. If you do not know how much is there to begin with, how do you know when there is too much?

The VanDine report uses 20% ECA. Twenty percent of what? Impliedly, 20% of the area in that watershed can be cut over without damage. This is not true. These steep slopes have many fragile sites that a very small amount of intercepted water put into a ditch, then into a culvert, and then dumped off on a slope that is already saturated and you have a mass failure. The ECA has nothing to do with it unless a cut block is upslope of the road and then statistically, the probability of a mass failure greatly increases. There are models of statistical analysis available to come up with the probability of a mass failure from different types of management, but not one has been used in the Perry Ridge analysis.

Well aware of Isaacson's views, the workshop professionals signed an agreement that:

"It was agreed that detailed hydrological mapping of small streams, springs, seepage areas, standing water (lakes and ponds), swamps and sloughs on the upper slope, as suggested by AI Isaacson, does not need to be carried out as a separate study, because such mapping should be part of Silviculture Prescriptions or Terrain Stability Field Assessments."

And further:

"It was agreed that regional groundwater studies, as suggested by June Ryder, are not required at the strategic planning level and that detailed groundwater studies are more suited to valley bottom development than to forest development on Crown land."

This is a most shocking example of professional disregard of the well-known fact that the impacts of forest development on *Crown* land on Perry Ridge would, in many cases, be delivered straight to the valley-bottom by steep stream channels and slopes, where the lives and homes of many residents would be in danger.

Dr. Ryder, engineer Frank Baumann and hydrologist Allen Isaacson are interested in saving *lives and homes* and we hope the MOF will reach around the political agreements from the workshop to take the recommendations of these other professionals seriously.

PRRA and PRHA ratings on Valley Bottom Landslide remain widely disparate.

In the March 21 summary we learn that:

"It was agreed that the PRRA and PRHA assessed ... "Valley Bottom Landslides" differently, however, the PRRA had considered many of these differences as parts of other event types."

The March 29 document states:

"At the workshop, the Panel and Salway resolved the differences in the manner that "Valley Bottom Landslide" hazard ratings were assessed in the PRRA and

PRHA. It was agreed that the PRRA addressed some of the PRHA's valley bottom landslide concerns in hazard ratings for other event types, specifically 'Debris slide into stream' and 'Open slope landslide'."

Please note that "Debris slide into stream" would not seem to categorize the movements on the Greengrass and Benedict property. "Open slope landslide" would quite often refer to Crown land, whereas much "Valley bottom landslide" might refer to private property, but at any rate, "Open slope landslide" does not infer proximity to residences the way "Valley bottom landslide" does. So if the PRRA team put "Valley bottom landslide" in other categories, we must question why they have listed an event type which would seem to infer that the potential for valley-bottom landslide was *specifically* assessed.

Under Valley bottom landslide, the VWS table shows the Salway ratings are higher as follows: 6 units have a 4-class difference - High in the PRHA but None in the PRRA; 2 units have a 3-class difference; 3 units have 2-class difference, and 8 units have 1-class difference.

#### Summary

The cover letter sent out by Pat Field, distributing the workshop material to the LRUP table, indicates that MOF is now prepared to make a strategic level decision on logging Perry Ridge. All workshop material indicates that the PRRA is an *overview* study. According to Dr. Ryder, P. Geo, Frank Bauman, PEng, and Allen Isaacson, hydrologist, the overview nature of the PRRA makes it unsuitable as a basis for strategic level planning. We strongly dispute the assertion in the workshop material that an admittedly *overview* report equates with a "strategic level study", as we have found no basis for this in any information we've reviewed on risk assessment in high risk areas.

The Salway report demonstrates beyond a shadow of a doubt that many planning units rated Moderate in the PRRA for a particular hazard actually contain *multiple* polygons rated High or Very High for that same hazard on Perry Ridge's only existing hazard maps. There are instances where development is proposed in the Ministry of Forests' Total Chance Plan in or above such polygons or stream reaches.

We believe that MOF will be making an irresponsible decision if it chooses to finalize strategic level planning without the additional studies advised by Ryder, Isaacson and Baumann. Such a decision could result in irreparable damage that would endanger people's lives every year on into the future,

Sincerely,



Anne Sherrod  
Chairperson

# PERRY RIDGE BENEFIT/COST ANALYSIS

**Trevor Jones, P. Eng.**

September 16, 2000

## SUMMARY

- The Forest Service estimated the revenues from logging of Perry Ridge would exceed operational costs by \$884,679 after 10 years. This critique, however, projects a financial loss of over \$21/4million. Consideration of other costs would result in substantially greater economic loss.
- The main causes of the Forest Service's overestimate of benefits are unrealistic stumpage rate projections and omission of interest charges on up-front expenditures.
- Deferral of logging on Perry Ridge would result in no reduction in allowable annual cut in Arrow district over the 10-year period of the benefitcost analysis.

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## INTRODUCTION

On August 2, 2000 the Arrow Forest District released the Perry Ridge Benefit/Cost Analysis[1], an estimate of the benefits from timber harvesting of Perry Ridge. The analysis was limited to direct revenues and direct operational costs.

It was concluded that by year 7 (2007) the operation would show a net benefit, with projected benefit of \$884,679 after 10 years.

A critique of the benefitcost analysis follows.

[1] Arrow Forest District Perry Ridge Benefit/Cost Analysis. August 2, 2000