

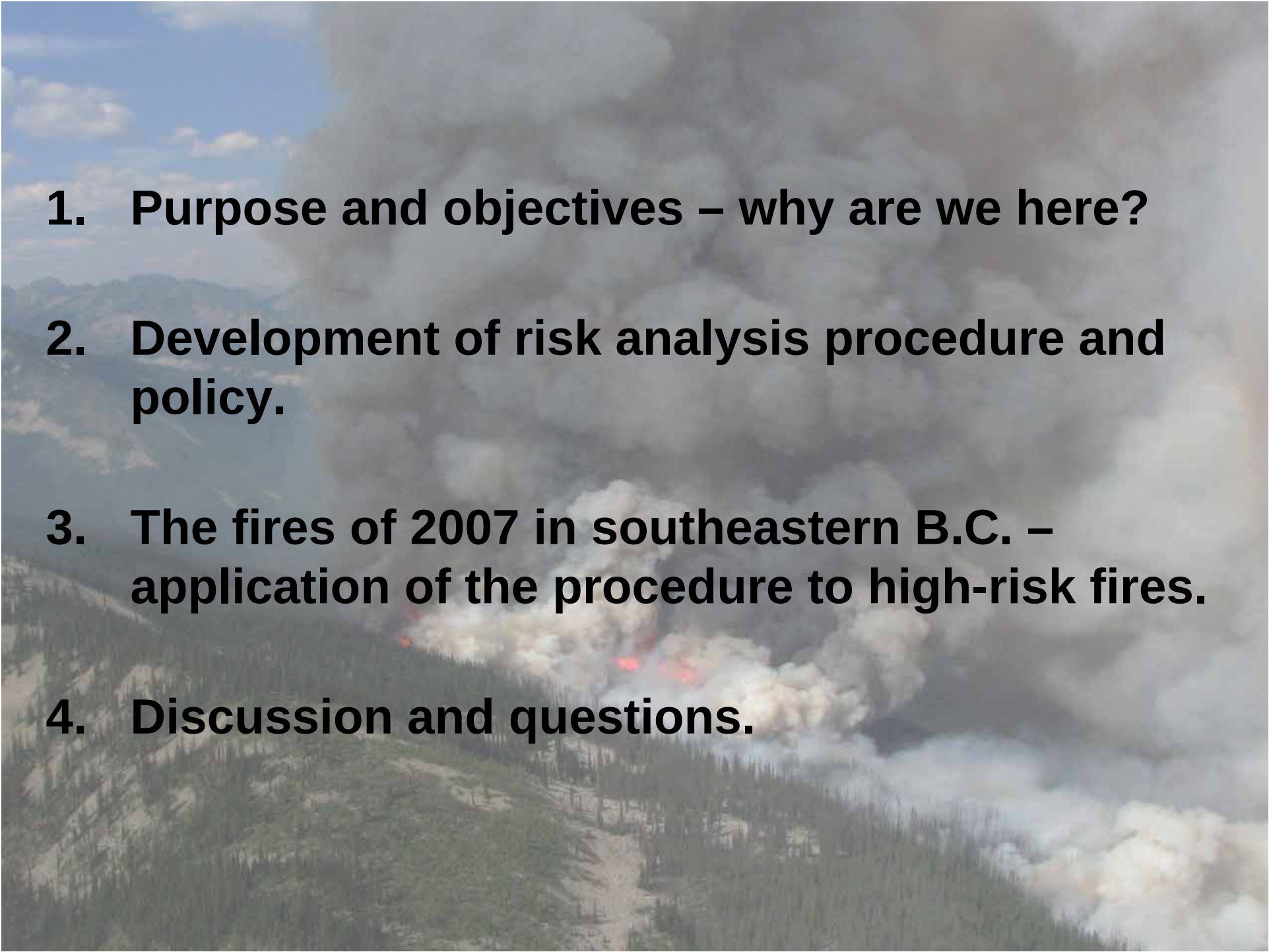
Post-Wildfire Erosion and Flooding, Risk Analysis Procedure and Risk Management

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Incident Management Team meeting 2008, Westbank

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- 1. Purpose and objectives – why are we here?**
 - 2. Development of risk analysis procedure and policy.**
 - 3. The fires of 2007 in southeastern B.C. – application of the procedure to high-risk fires.**
 - 4. Discussion and questions.**

Kuskanook Creek (near Creston, south end of Kootenay Lake) –
Debris flow in August 2004, following the 2003 Kuskanook fire.



This event made us realize that severe erosion and mass movement can occur after wildfires, and can create risks to public safety and infrastructure.

Risk Analysis Procedure for Post-wildfire Natural Hazards

- In 2005 and 2006, SIFR specialists in earth sciences and natural hazards developed a risk analysis procedure.
- The procedure consists of: (a brief summary)
 - screening all wildfires in potentially high-risk locations;
 - flyover or ground reconnaissance for fires of concern;
 - investigation of soil, stream channel, or landslide hazards and consequences (risk analysis);
 - determine and report risks to stakeholders;
 - warn PEP where there is imminent threat to stakeholders;
 - on Crown land, assess risk and recommend reduction or mitigation strategies.
- We typically include all interface fires, and fires >100 ha near highways, in community watersheds, etc.

2007 season in Southeast Fire Centre:

- We did risk analyses on 6 fires simultaneously in August and September.
- Most of our field work was done while the fires were still burning (but had been mostly contained).
- 4 fire camps, crews from all over BC.
- There was a need to coordinate with fire centre and camps: aircraft availability, safety, ground access, crew labour.
- At the same time, we worked with rehab specialists on each fire.
- Mitigation treatments were done on 2 fires.



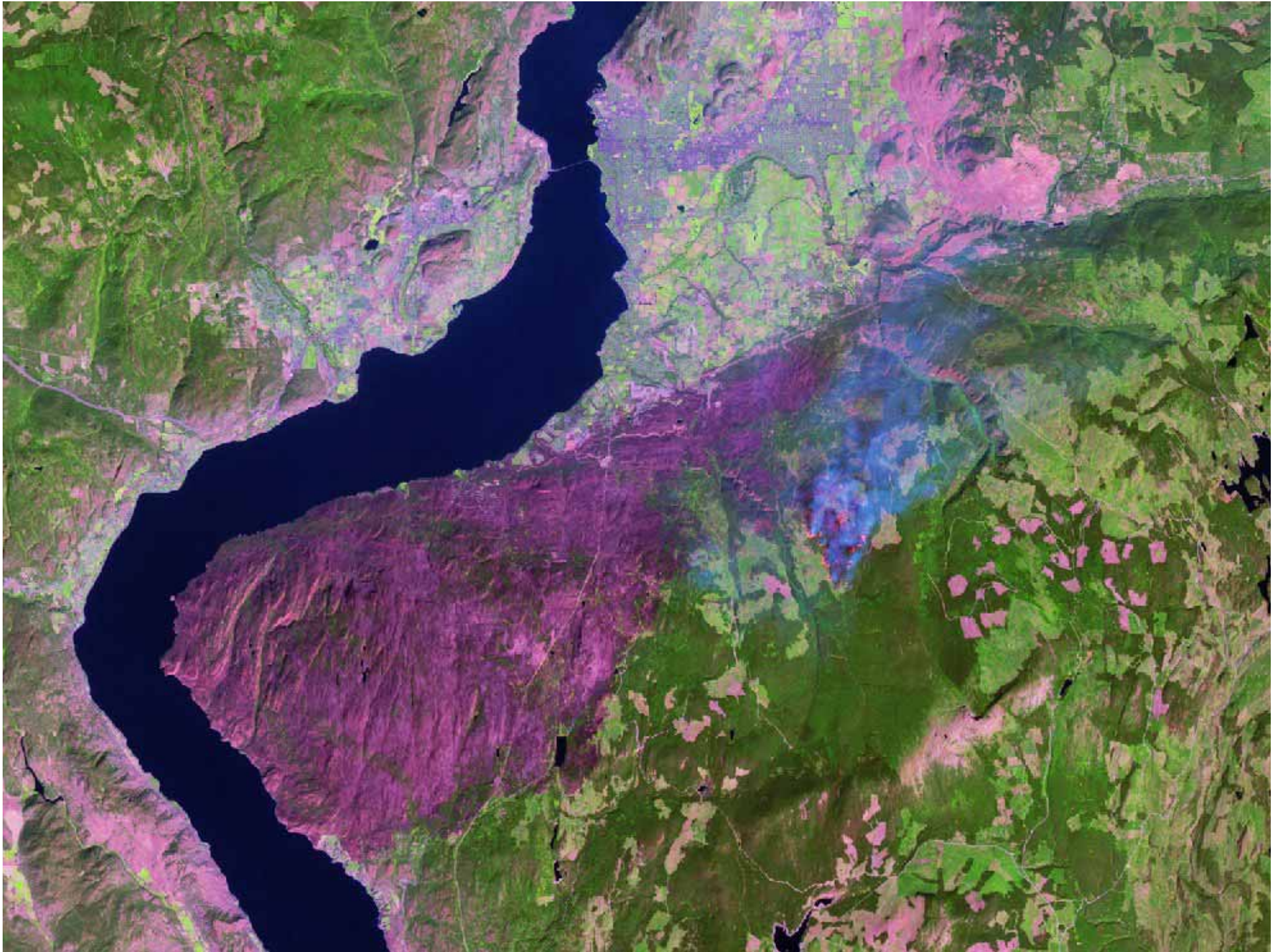
Lessons learned:

- Incident Management Teams need to know who we are and what we do.
- We need to learn more about how Fire Centres and Incident Management Teams are structured.
- We plan on using Incident Command Structure in the future for our program.
- Our staff need some basic training before working in active fires (fire behaviour, danger trees, aircraft safety, communications).
- We tried to do too much with too few people.
- The really high-risk fires (with respect to post-wildfire hazards) are obvious quite early – we should work more closely with IMT's on rehab issues, fire guard locations, stream crossings etc, to help minimize post-wildfire problems.

Landslide / erosion / flood events following 2003 fires

- Okanagan Mtn. Park Fire - 2003
- Cedar Hills - 2004
- Strawberry Hills - 2004
- Kuskanook - 2004
- Lamb Creek - 2004
- Vaseux - 2004
- Hellroar Creek - 2005
- McLure Fire - 2005
- McGillivray Fire - 2005
- Mt Ingersoll Fire - 2005





KELOWNA: Erosion event following 2003 Okanagan Mountain Park fire



Photos courtesy of Dobson
Engineering Ltd.

Cedar Hills Fire, 2003



Unconfined
overland flow



Loss of confinement
on fan

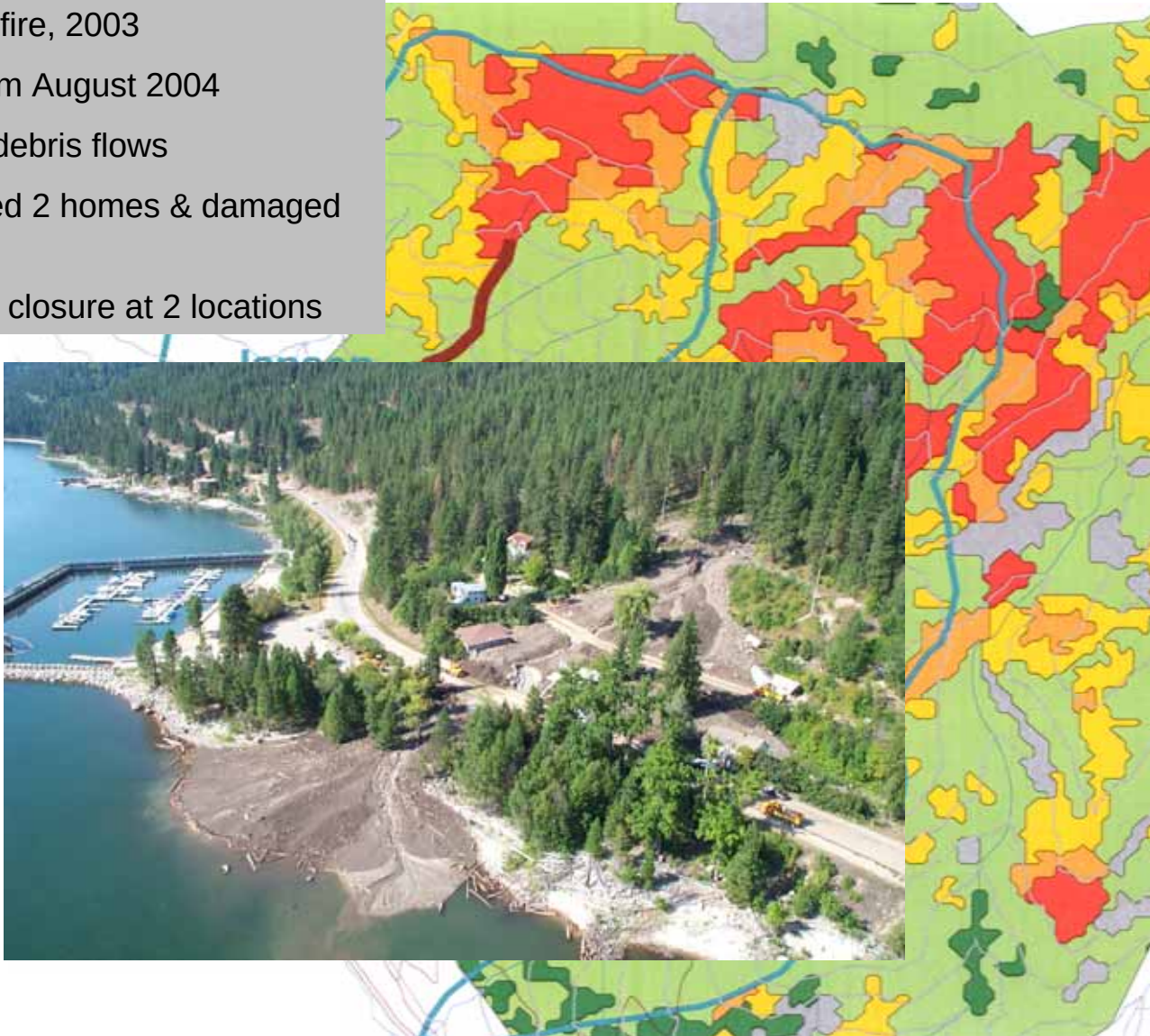


Flow confinement
in gullies

Photos courtesy of
Grainger Associates
Consulting Ltd.

Kuskanook Fire, 2003

- 4839 ha fire, 2003
- Rainstorm August 2004
- 2 major debris flows
- Destroyed 2 homes & damaged others
- Highway closure at 2 locations



Overland Flow Leading to Soil Erosion

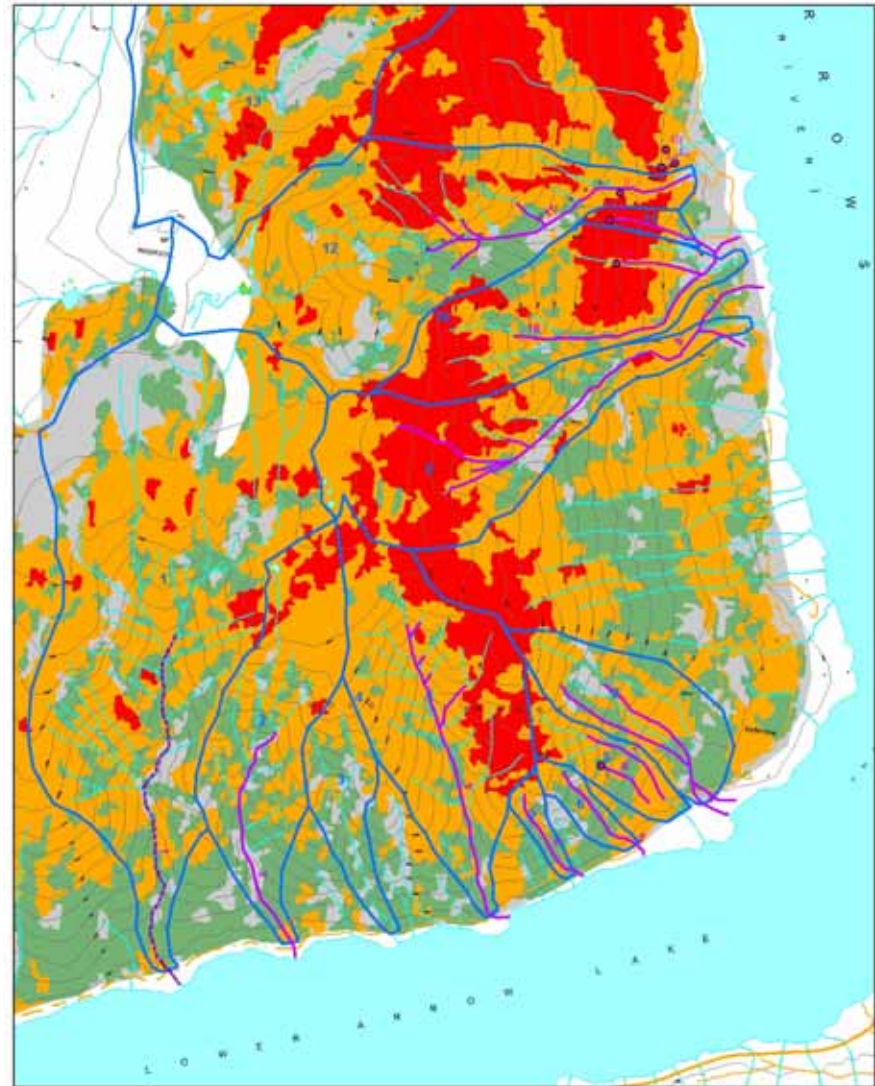
- Water repellent soils occur at 0 to 5 cm, and creates a **“tin-roof”** effect.
- Surface erosion from overland flow causes **sediment bulking** in gullies/channels, which can lead to debris flows.
- Summer thunderstorm with intensity of 10mm/hr for 30 minutes can cause debris flows or flooding.





Ingersoll Fire, 2003

- 7310 ha fire, 2003
- Rainstorm Oct 2005
- 15 channel failures
- 7 hillslope failures



Ingersoll Fire, 2003



Post-Wildfire Natural Hazards / Risk Management

Policy and procedures completed, or under development:

- Protection Branch and Southern Interior Forest Region developed a policy background document (latest draft, April 4, 2008).
- MFR and Provincial Emergency Program (PEP) drafted MOU defining roles and responsibilities of the two agencies - received **approval in principle** from the Policy Secretariat (March 2008).
- Southern Interior Forest Region (SIFR) developed a Standard Operating Procedure (draft dated February 28, 2008), which outlines scope of analysis and communications protocol.
- MFR specialists drafted and tested a Risk Analysis Procedure – outlines what we do when we identify a fire that presents possible risks of post-wildfire natural hazards.
- Entire process subject to Enterprise Risk Management review by Ministry of Finance (pending).
- Flowchart illustrates process and roles.

Outline of the risk management process (based on CSA standards)

- What is risk?
Risk = Hazard X Consequence
(e.g. probability of a hazardous event occurring X probability of the event impacting the element at risk)
- Communication with stakeholders about risks is important at all stages.
- MFR risk analysis procedure only deals with the first 3 steps.
- Steps 4 – 6 include evaluating whether or not risks are tolerable, developing strategies to control or mitigate risks, and acting on these strategies.

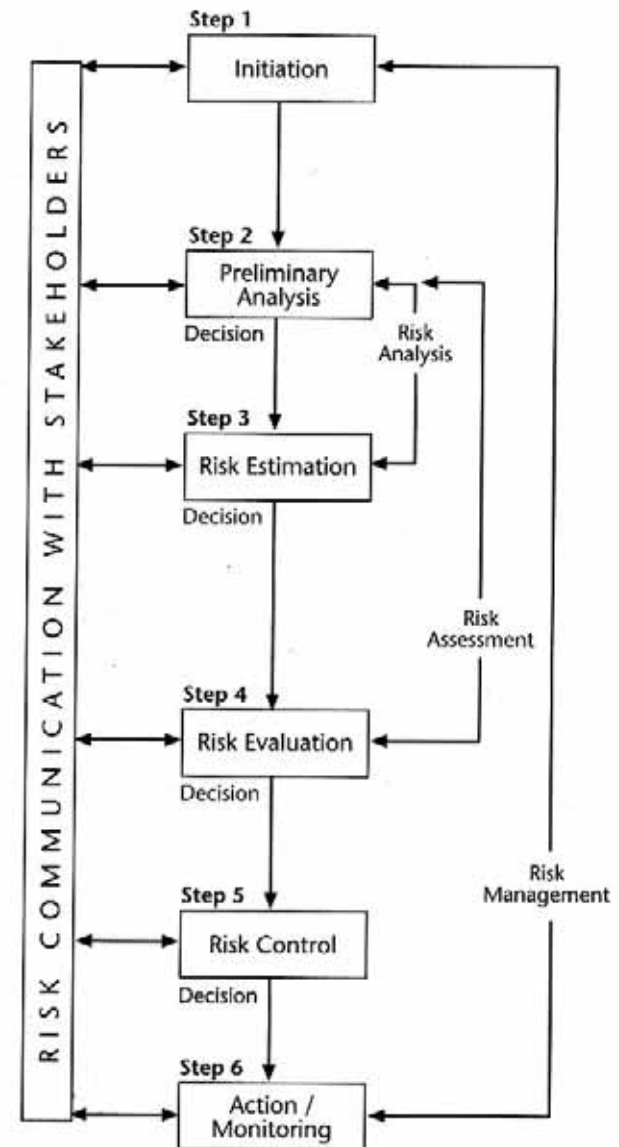


FIGURE 2 Six steps in the decision-making framework for risk management (adapted from CSA 1997).

Background – how did we get here?

- 2003 Fire Storm – large and severe interface fires in the Kamloops and Southeast Fire Centres.
- SIFR specialists were involved with Protection fireguard rehabilitation operations.
- Increased awareness of post-wildfire natural hazards and threat to the public.
- There appeared to be no legal / regulatory mandate to deal with potential hazards.
- Recognition of professional obligations.
- After the 2003 fires, MFR sent information about potential risks to various agencies, local governments, etc. – response was mixed.

THE FILMON REPORT

- *“The provincial government, in partnership with local governments, should examine watershed restoration as soon as possible, to identify areas of severe watershed destruction and develop a plan for protection and rehabilitation of these areas.”*

FPB REPORT

- Forest Practices Board released a report on post-fire site rehabilitation (FPB/SIR/12) (February 2005).
- It mentioned the lack of defined responsibilities in managing the increased risk from natural hazards.

NATURAL HAZARDS MITIGATION FUND

- In 2005-06, the Natural Hazard Mitigation Fund provided support for engineering and planning projects.
- Ministry of Forests & Range received funding from the Natural Hazard Mitigation Fund for development of a risk analysis procedure.

Steps in the procedure:

What MFR Forest Sciences / Engineering specialists
will do each fire season

- Screen Protection Branch's database for wildfires (>100 ha) that pose a potential risk to settlements, highway or industrial corridors, community watersheds:
 - public safety
 - occupied private property
 - public or critical infrastructure
 - community water supply infrastructure (not water quality)
 - other social-economic or environmental values identified by RED.
- Following screening:
 - may involve field or aerial review to confirm
 - identify immediately if there is imminent threat and notify PEP
 - If risk confirmed, proceed with natural hazards / risk analysis.

Steps in the procedure:

What MFR Forest Sciences / Engineering specialists
will do each fire season

- **For fires of concern:**
 - map burn severity based on helicopter aerial photographs;
 - field work on the ground: test soils to determine burn severity;
 - identify areas of high landslide, erosion or flood hazard;
 - inspect elements at risk (e.g. fans, highway culverts, towers, etc.).
 - where warranted, prepare satellite-based burn severity maps, and do more detailed ground investigations;
 - report results to stakeholders
 - where permitted under policy on Crown land, make recommendations on defensive works or treatments.
- **For areas with imminent threat risk fires:**
 - inform PEP who contacts affected stakeholders;
- Work is done by MFR forest science and engineering staff; consultants will be used when resources are overwhelmed.

Summary of MFR Role and Responsibility

- Screen wildfires and conduct risk analyses.
- For fires with imminent threat:
 - inform PEP who contacts affected stakeholders
 - Local governments enact emergency response legislation.
- Provide report to potential stakeholders.
- For Crown land, where it meets with policy, evaluate risk and make recommendations on defensive works or treatments.
 - we consider mitigative works on Crown forest within the burn perimeter
 - may undertake mitigative works if likely to be of benefit to reduce risks to public safety or infrastructure.
- **Our mandate is limited to Crown forest, but we will provide information on risks affecting other areas.**

Protection's Role:

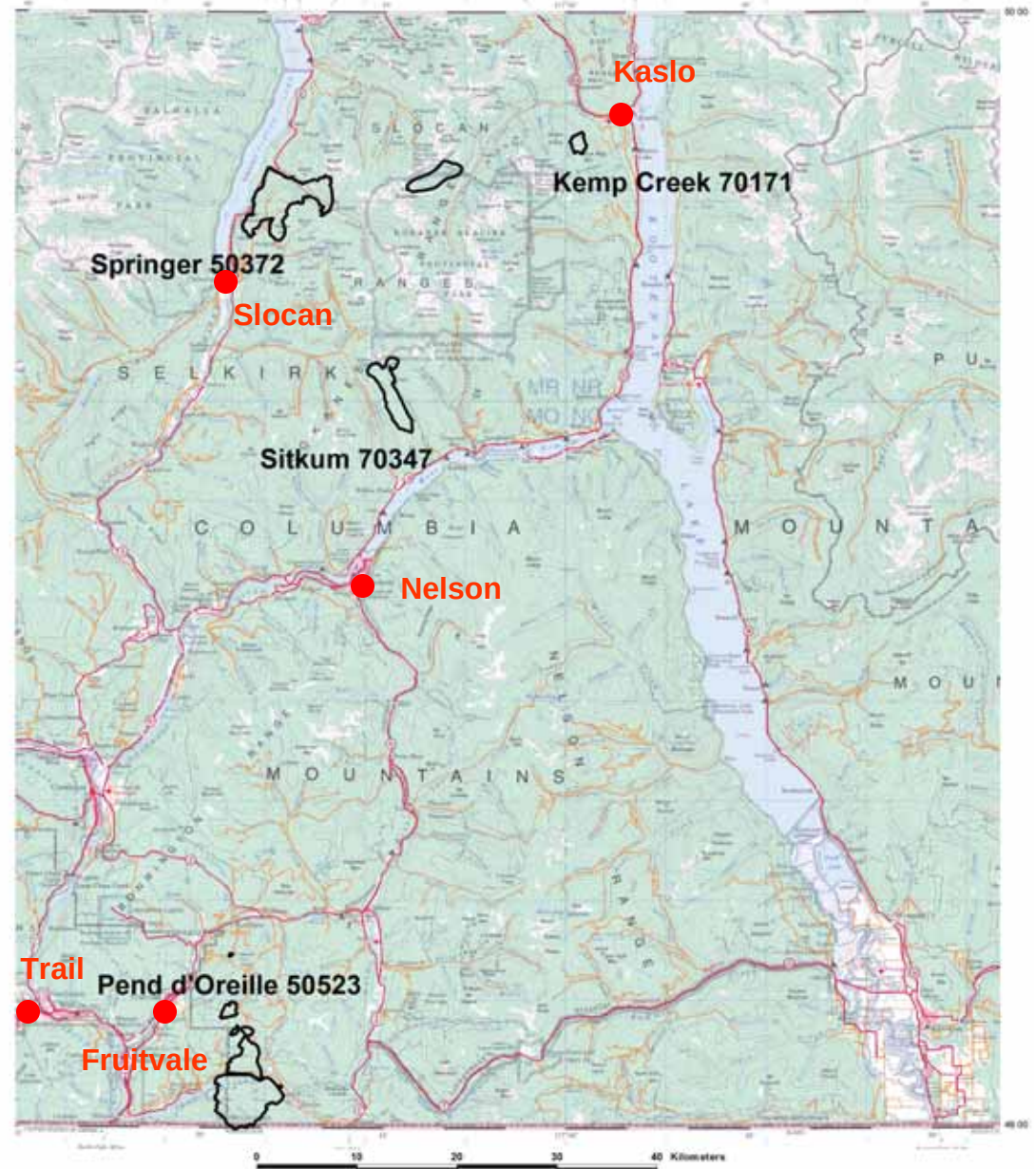
- According to policy, Protection will fund risk analysis expenses such as contractors, and will fund incremental rehabilitation such as erosion control treatments on Crown land.
- Protection will provide aircraft, and assistance from crews (as possible considering operations), and advice on access and safety.
- We depend on access to Protection systems resources (whiteboard, dispatch, LAN, maps).

What to expect: On a large fire above populated areas or highways – 2 or 3 Region specialists using aircraft for photography and mapping, and doing ground inspections in freshly burned areas – and perhaps needing crew assistance.

What else can we do: Assist with rehab plans; assist with fireguard location, stream crossing etc. to protect sensitive resources; provide engineering or geoscience expertise.

2007 Fires in South-East BC

- Springer Creek – 3137 ha
- Pend D'Oreille – 3969 ha
- Sitkum – 1075 ha
- Kemp Creek – 200 ha
- Hamill – 1528 ha
- Penstock – 315 ha



What the BC Forest Service did for 2007 fires

- One SIFR specialist (Jordan) screened all wildfires in SE Fire Centre, and did preliminary field reviews of some fires with Protection staff.
- Once several fires were of serious concern, we assigned a coordinator (Curran) to assist risk analysis teams, and be responsible for communication with PEP, Fire Centre, others.
- Risk Analysis teams (led by Jordan, Nicol and Alcock)
 - mapped burn severity based on helicopter aerial photos
 - field work on the ground: test soils, inspect channels & fans
 - identified areas of high landslide or debris flow hazard.
- For highest risk fires:
 - informed PEP who contacted affected stakeholders of the risks
 - prepared hillslope soil mitigation plans (Curran)
 - assisted Forest Districts in implementation of mitigative treatments.

Risk Analysis – Springer Fire



Risk Analysis - Springer Fire

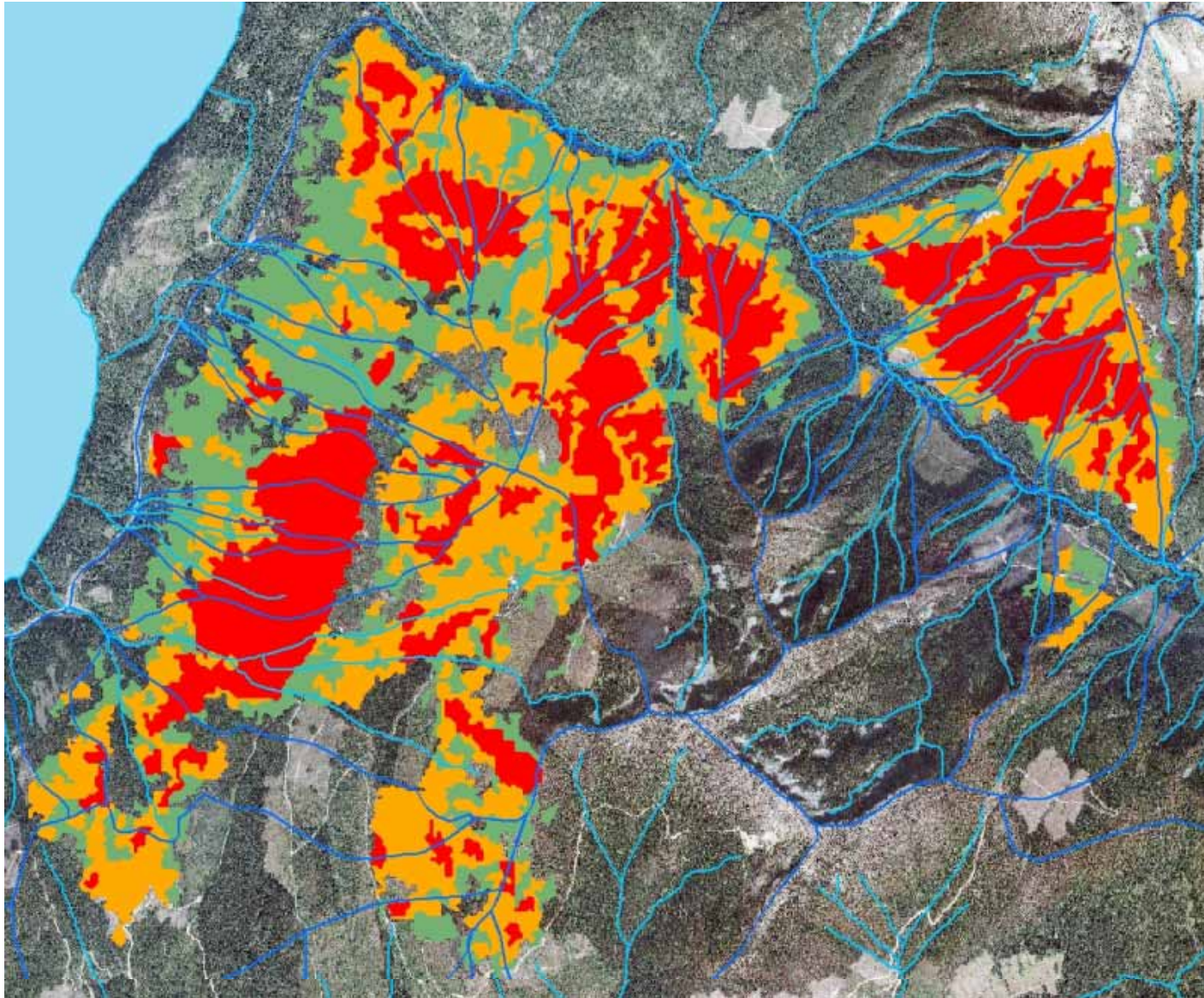


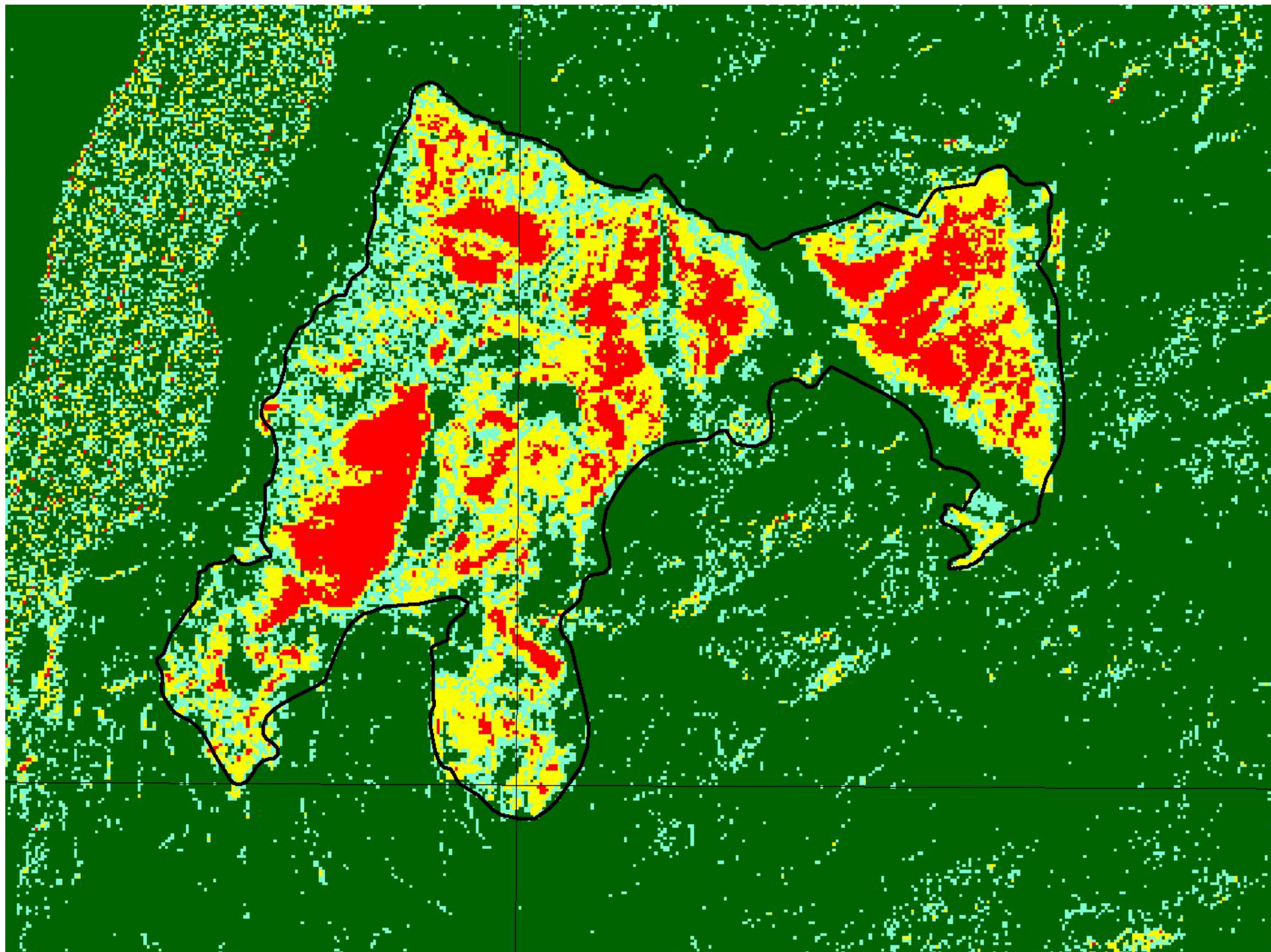
Risk Analysis – Springer Fire



- Ground truth burn severity maps
- Test for water repellency
- Assess hazards

Springer Fire – Vegetation Burn Severity Map

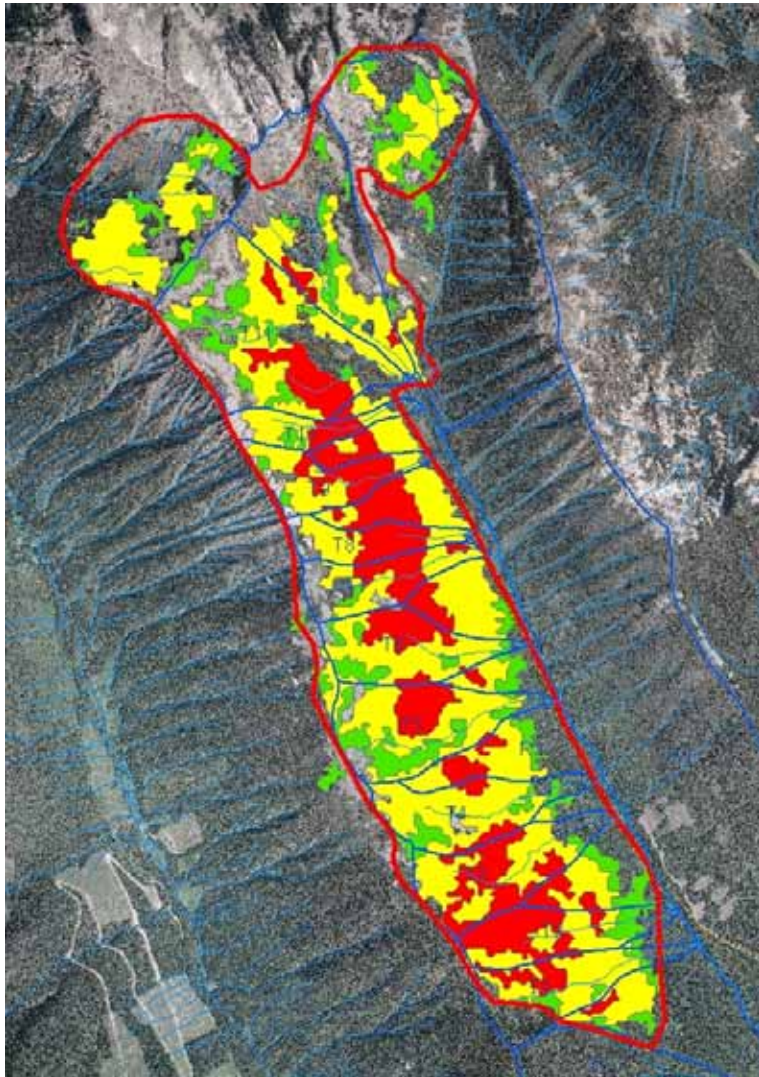




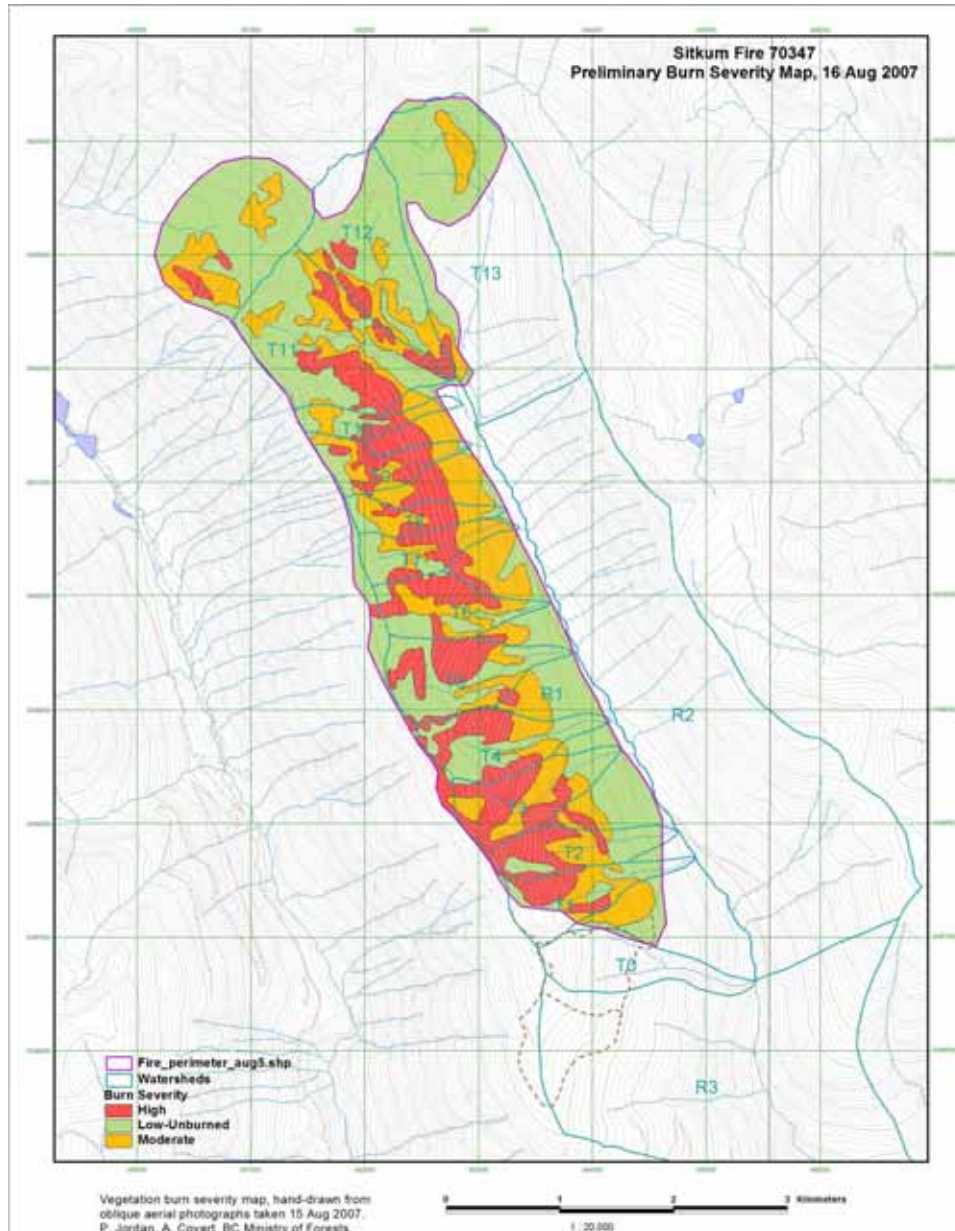
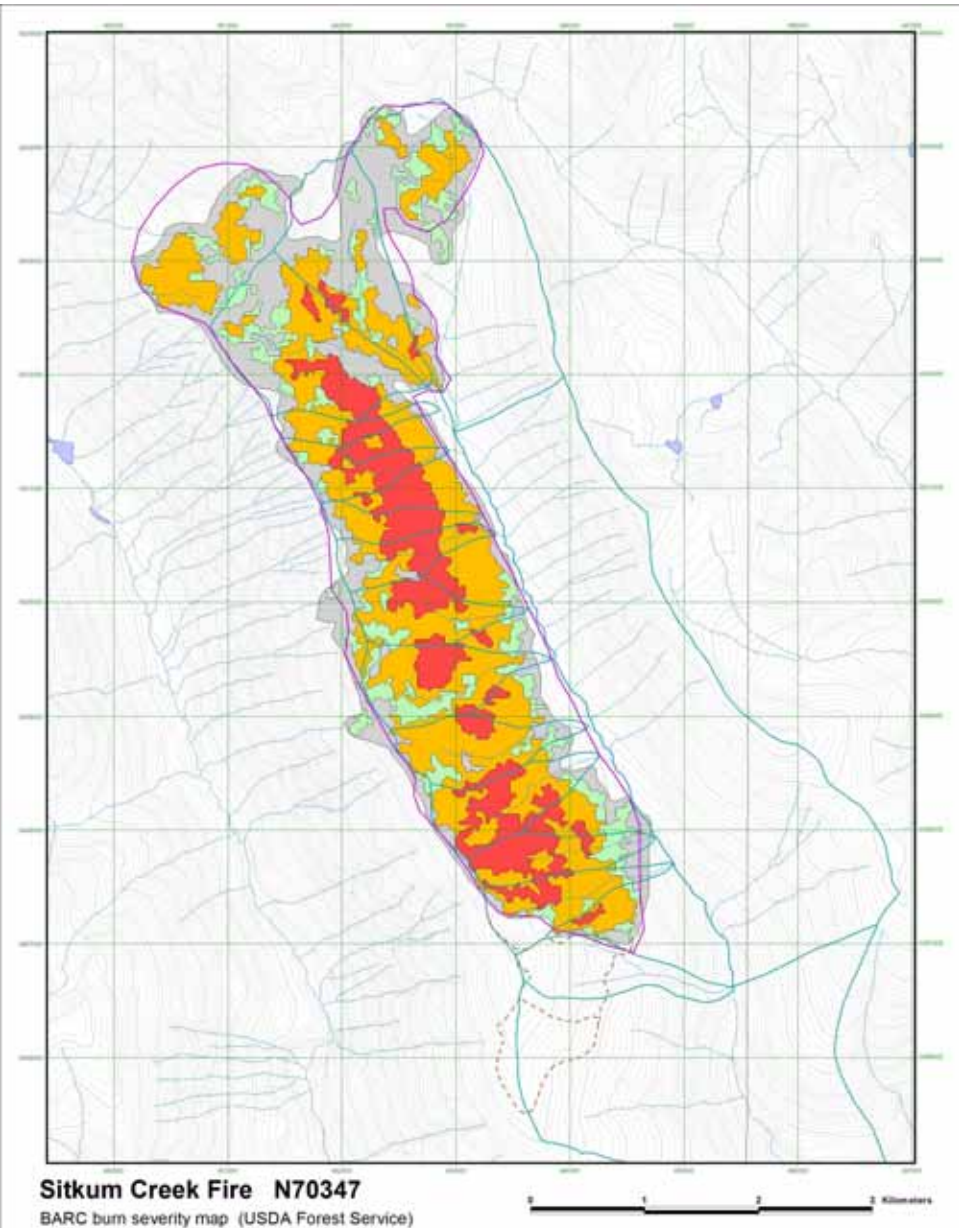
Risk Analysis – Sitkum Fire



Sitkum Fire



Sitkum Fire – two types of burn severity map



Mitigation (and other risk management) Options:

- Avoidance of the hazard
- Defensive structures in channels and on fans



Mitigation (and other risk management) Options:

- Engineering treatments – upgrade creek crossings, cross-drain culverts etc (forest roads, non-status roads, highways)



Mitigation (and other risk management) Options:

- Broadcast treatments of burned areas
 - straw mulching
 - contour log felling



Thank You ...

- Credits: Thanks to the following who contributed material, or worked on the risk analysis procedure

SIFR staff: Mike Curran, Ashley Covert, Peter Jordan (Nelson) Ken Soneff, Graeme Hope, Tim Giles, Kevin Turner, Rita Winkler (Kamloops), Andy Oetter (Kamloops District), Joe Alcock (Revelstoke),

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