

*McKelvie Creek and
Tahsis River
watersheds*

*Tahsis, B.C.
May 29, 2018*

*Glynnis Horel, P. Eng., FEC
G.M. Horel Engineering Ltd.*



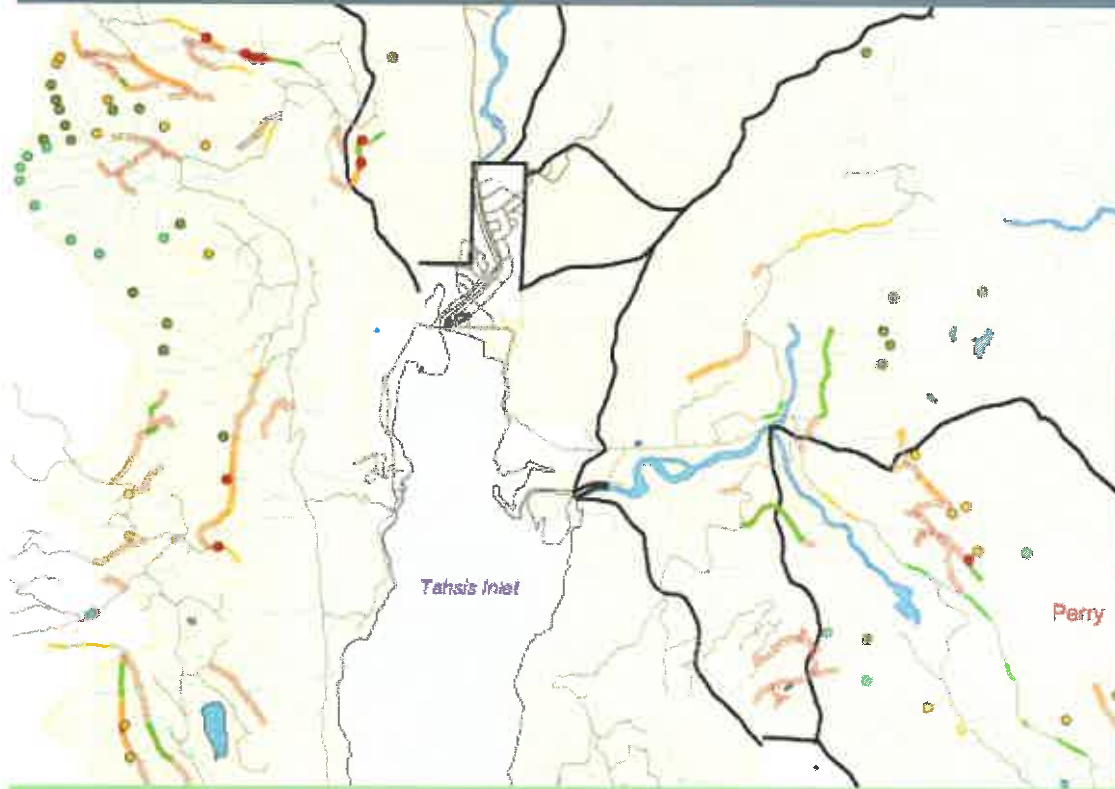
Background

- ✚ 2007 – FIA project to develop watershed indicators for Tree Farm Licence 19
 - Landslide inventory
 - Road stability hazard and sediment delivery potential to fish habitat
 - Stream channel type and condition
 - Riparian condition







→ Watershed indicators

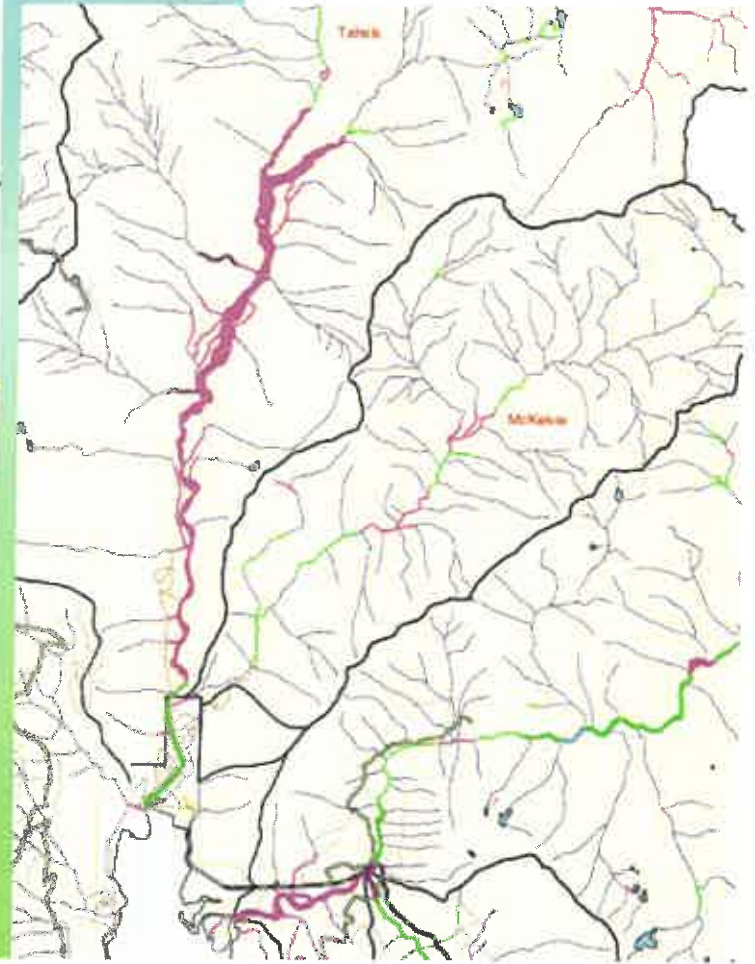
→ Watershed management strategies (2010)
 - ✚ 2010 – WFP Terrain Risk Management Strategy implemented at all WFP operations
 - ✚ 2012-2013 – new high resolution digital airphotos
 - ✚ 2014 – TFL 19 landslide inventory and road stability hazards updated to new imagery
 - ✚ 2016 lidar – *hillshade, slope mapping, streams, detailed contours particularly relevant to watershed assessment*
- Higher quality information base
- 2017 – update of McKelvie and Tahsis watershed management strategies

2007 TFL 19 watershed indicators project



Stream channel type

-  Alluvial
-  Semi-alluvial
-  Wetland
-  Nonalluvial
-  Not classified
-  Stream on fan or cone








Road stability hazard (not adjusted for deactivation)

-  High
-  Moderately high
-  Moderate
-  Other roads

Deactivation status

-  Permanent
-  Semi-permanent

Landslide point of origin

-  Harvested gully, escarpment or cutblock
-  Unharvested timber
-  Fully forested old natural
-  Road cut or road fill
-  Windthrow patch

-  Highway
-  Community roads

Watershed-level assessments and inventories

- ❑ Sensitive areas and key concerns (values)
- ❑ Inventories for landslides, stream channel types, riparian condition
- ❑ Road hazards and sediment delivery potential to values
- ❑ Watershed indicators – current condition and trend
- ❑ Watershed management strategies specific to watershed units

Terrain Risk
Management
Strategy

Gully
Assessment
Procedure

Other hydrologic
assessments
FSW, CWS, big
blocks, road
drainage issues

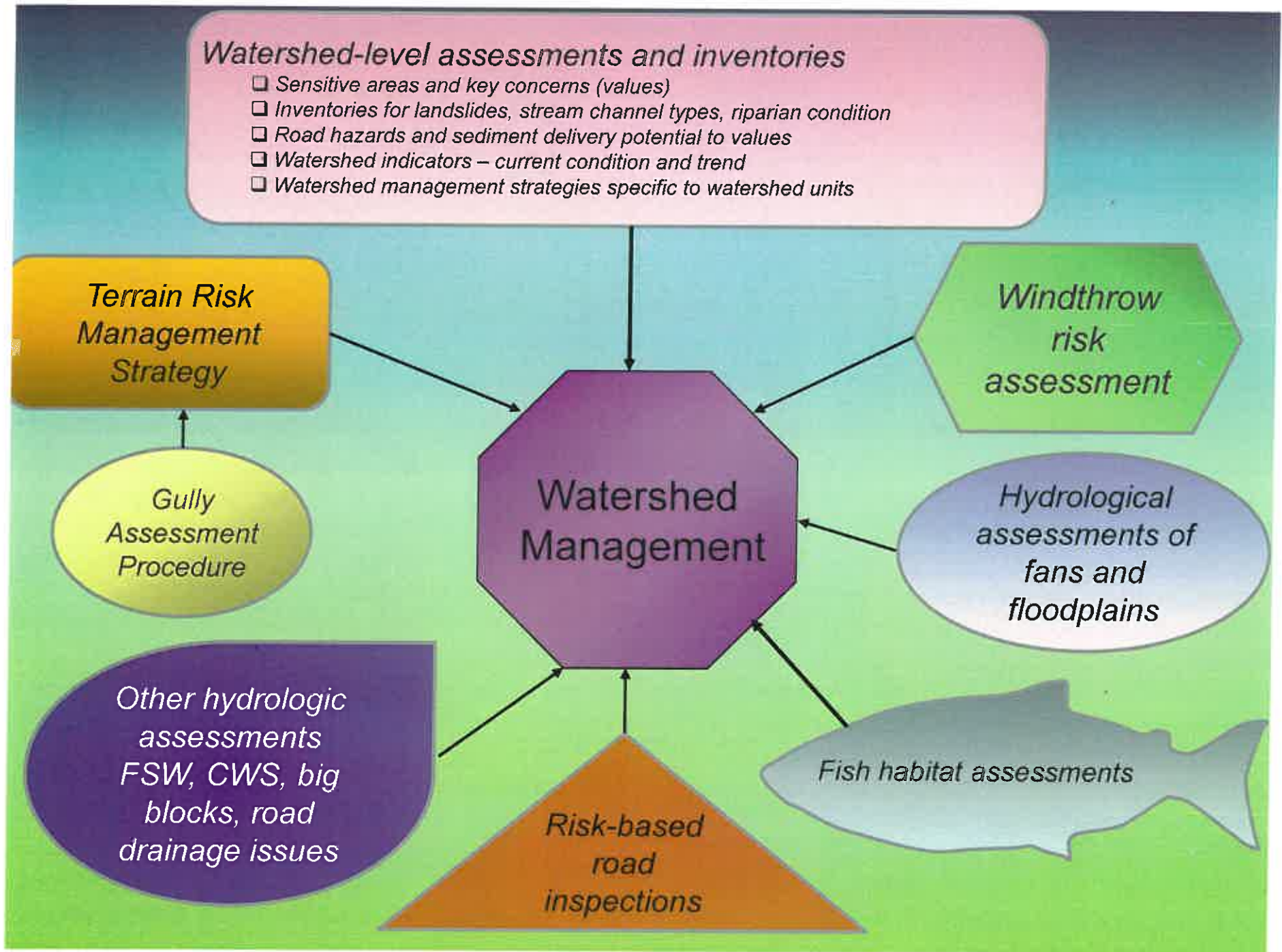
Watershed
Management

Risk-based
road
inspections

Windthrow
risk
assessment

Hydrological
assessments of
fans and
floodplains

Fish habitat assessments



Tahsis

- High to very high fish capacity, potentially large anadromous runs
- Chinook, chum, coho, pink, steelhead
- Extensive floodplain habitat

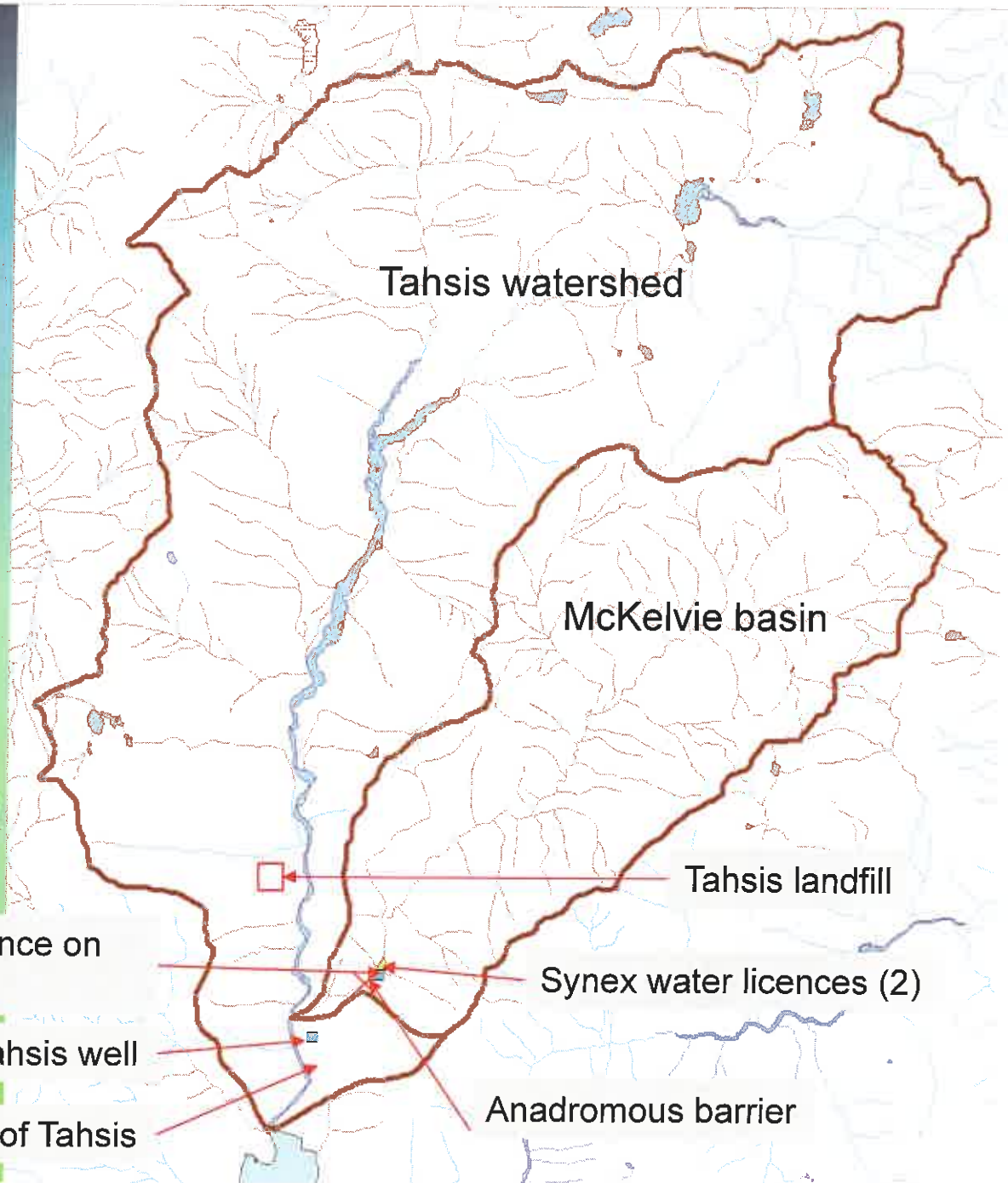
McKelvie

- Designated community watershed
- Fish habitat
- Anadromous barrier at approx. 900 m from Tahsis confluence
- Chum, coho
- Cutthroat trout, Dolly Varden above barrier

Village of Tahsis water licence on McKelvie Creek

Village of Tahsis well

Community of Tahsis



🚧 In 2015 in response to new provincial water quality standards for community water supply, the Village of Tahsis commissioned a firm of hydrogeologists to undertake studies and develop a water well.



GW SOLUTIONS

ASSESSMENT & PROTECTION OF GROUNDWATER

 New well in Tahsis River delta aquifer



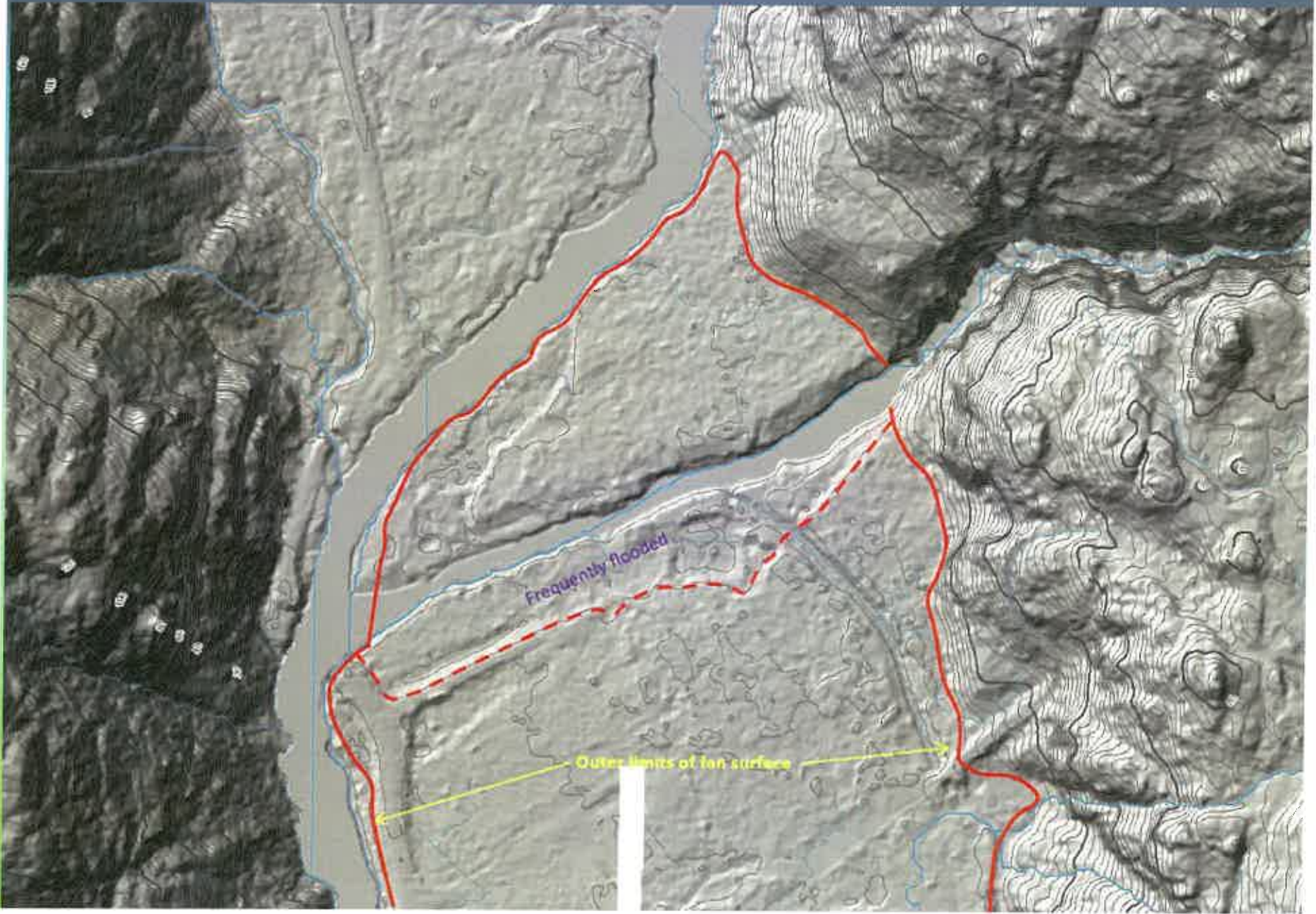


Tahsis River floodplain

🏡 Broad floodplain, deep gravel/sand fluvial and glaciofluvial deposits

→ Runoff from adjacent valley slopes infiltrates into the permeable valley-bottom floodplain deposits

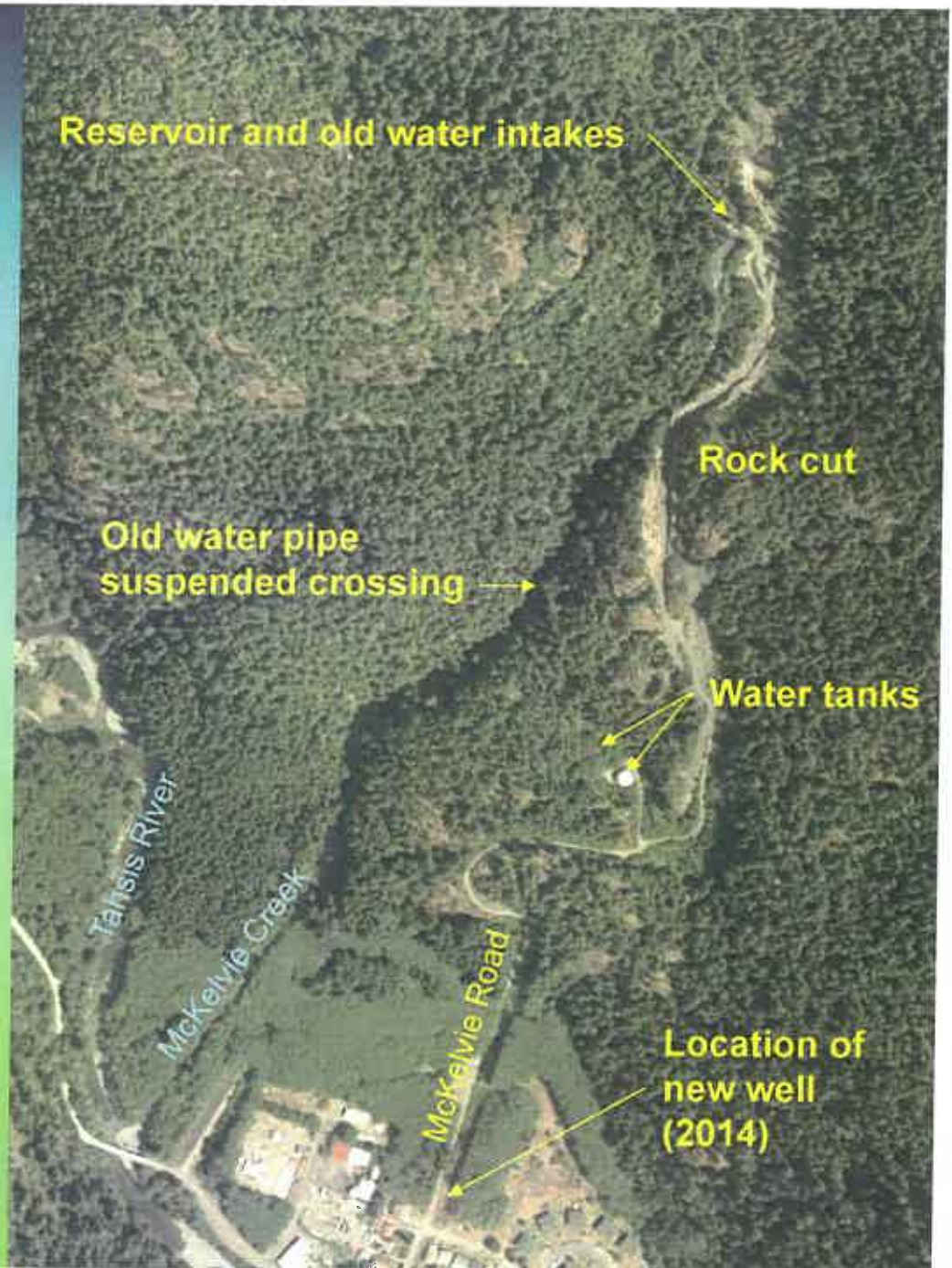




Village of Tahsis water supply

→ keeps McKelvie Creek water licence as a backup supply

- ✦ Intake in stream channel behind small dam
- ✦ Surface water source
- ✦ McKelvie Creek channel is subject to aggressive fluvial processes with a high rate of bedload transport including logs and large stones
- ✦ Experiences debris floods
- ✦ In 1989 a severe storm event washed out the dam and water intake lines





*Road for Synex power project upstream of McKelvie Creek intake
→ road stable, minimal erosion*

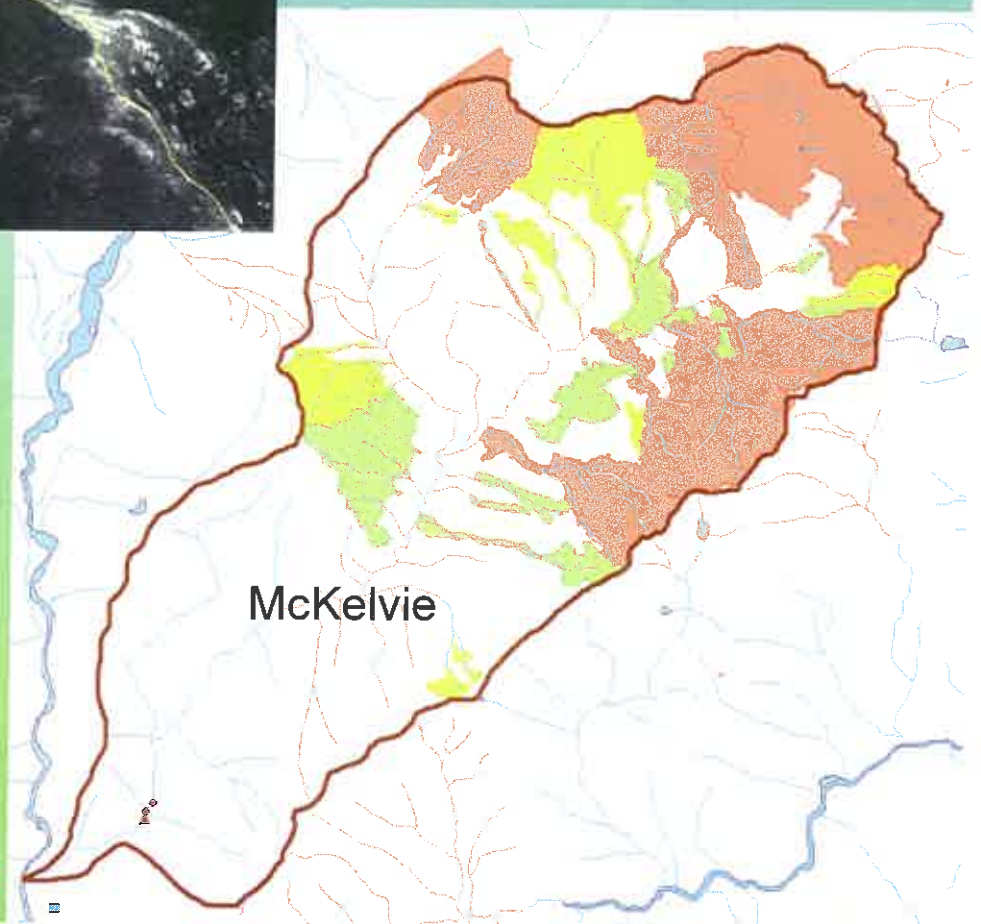




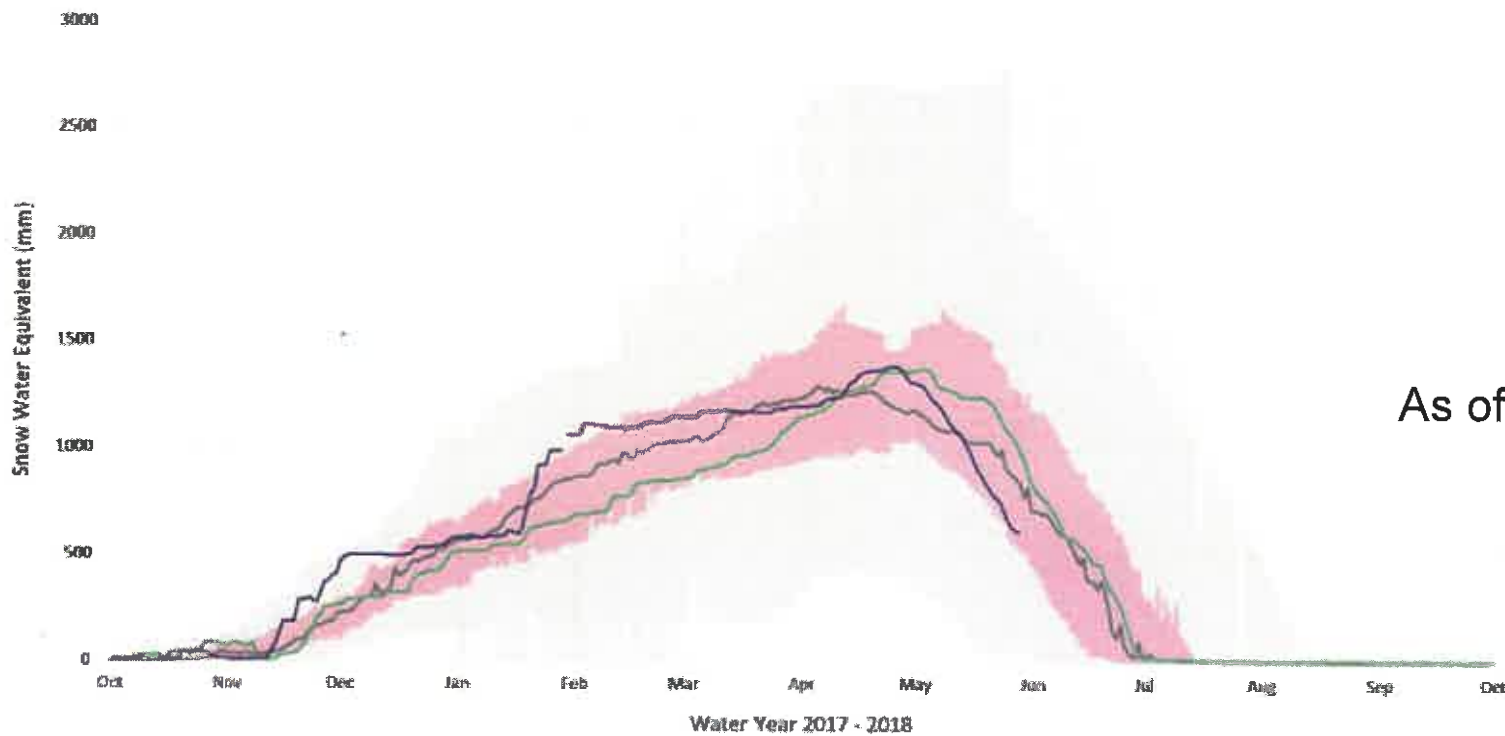
High elevations of upper McKelvie and Tahsis have snow accumulation zones, frequent snow avalanches

**Snow avalanche
Estimated frequency of occurrence**

-  High
-  Moderate
-  Infrequent



Wolf River Upper automated snow station
Elevation 1,430 m
Established 1981



As of May 28, 2018

— 2017 - 2018 — 2016 - 2017 — Historical Daily Median Historical 25-75 Range of Min & Max (Oct 01, 1987 - Sep 30, 2017)

Peak stream flows

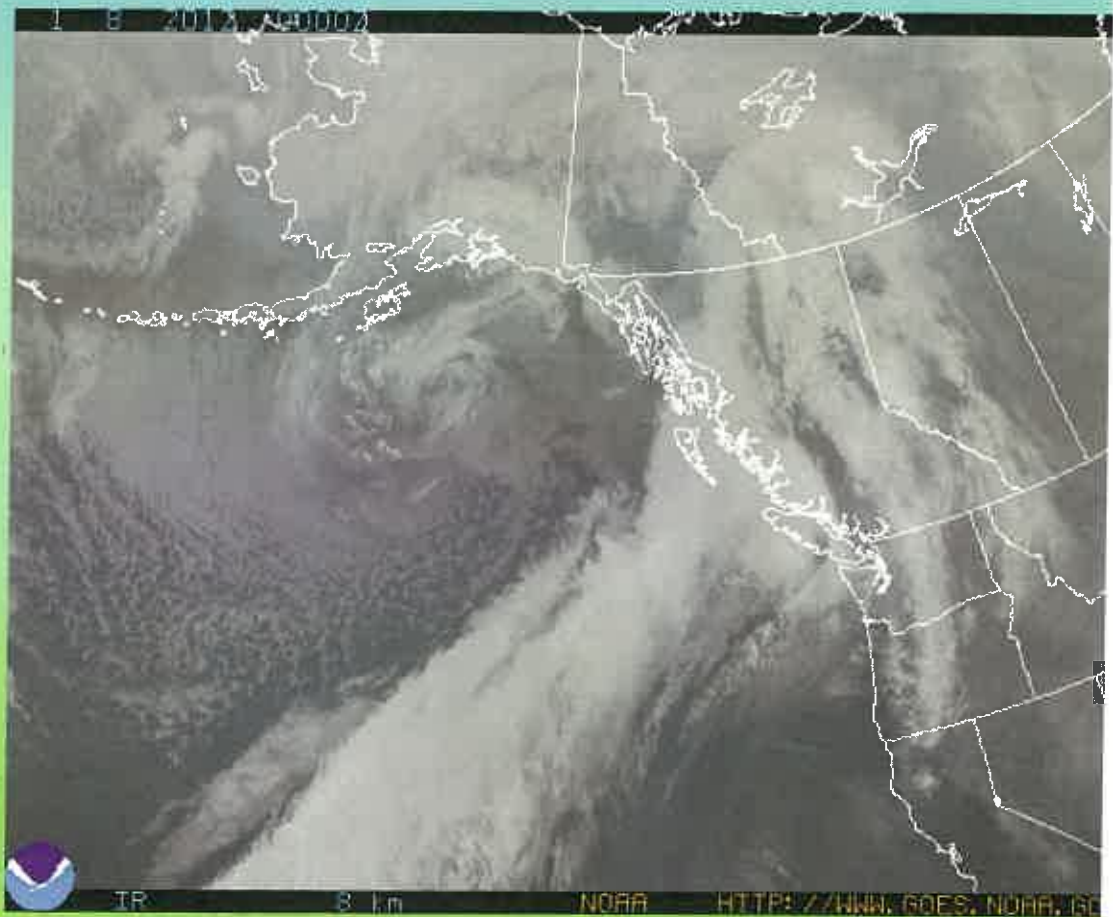
- Peak flows in coastal watersheds occur from
 - Rain
 - Rain-on-snow→do not occur in the absence of rain

A 2003 study of 7 Vancouver Island watersheds found that peak flow magnitude correlated strongly with 2-day storm precipitation and 10-day antecedent precipitation

Title: Long-term effects of forest harvest on peak streamflow rates in coastal BC rivers

Author: A. Chapman

Report for: Forest Innovation Investment Project R2003-0119



NOAA Jan 8, 2012



IR

8 1, n

NOAA

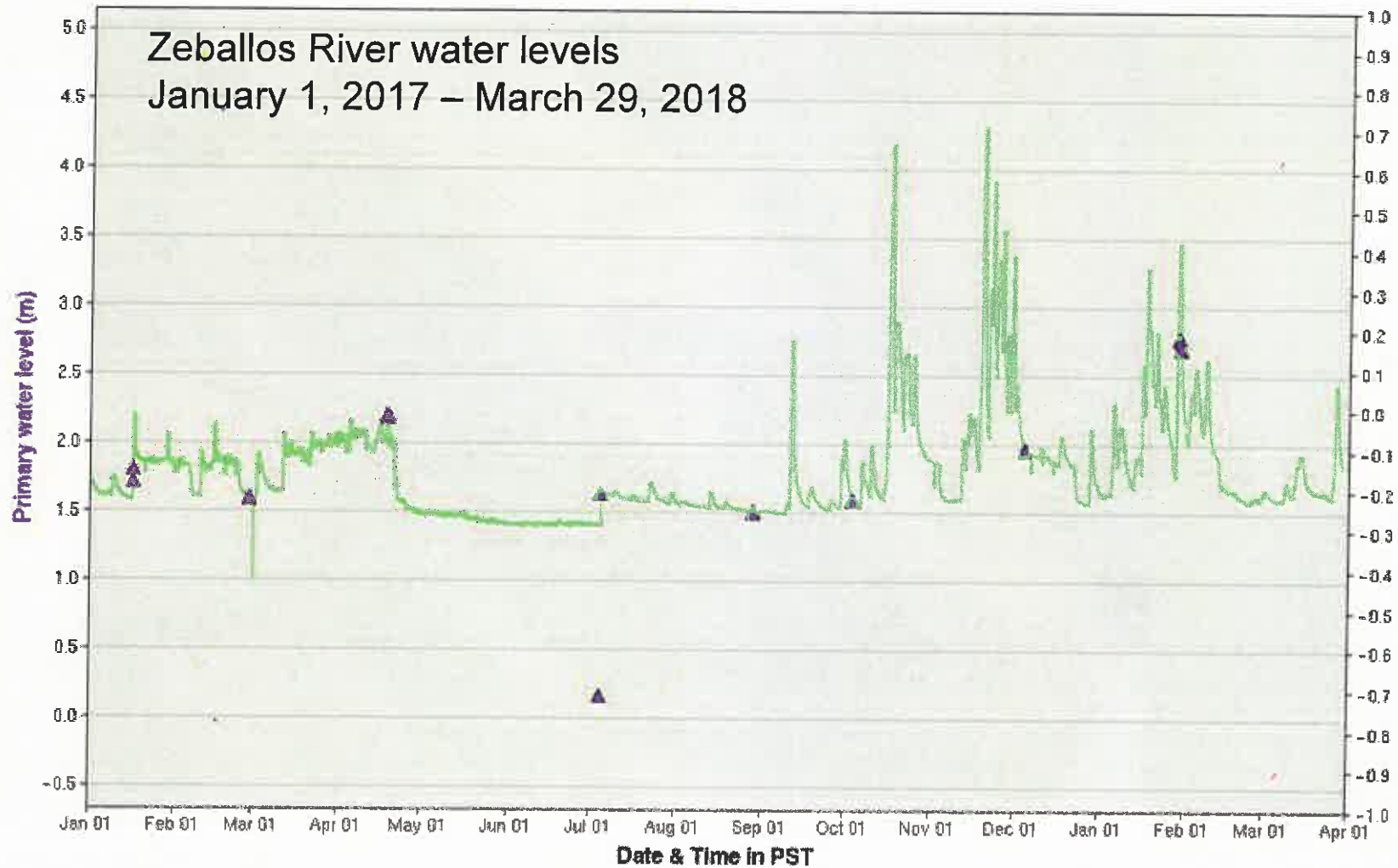
HTTP://WWW.GOES.NOAA.GOV

Station: 08HE006

Data Type: Real-Time

App

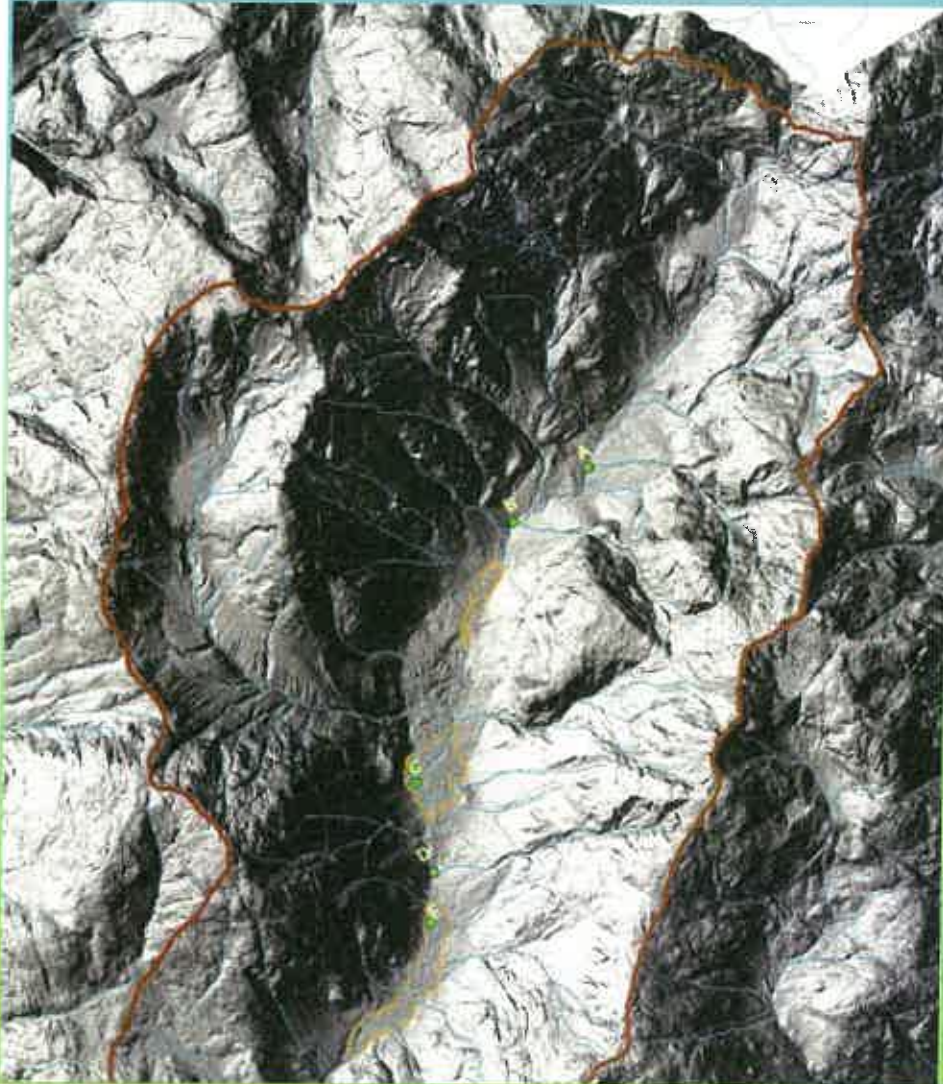
▲ Stage Measurements — Primary Water Level Approved (100% Quality Controlled) — Primary Water Level Provisional (subject to change)



Landslides and sediment sources to McKelvie Creek

 Chronic sources in upper valley

2016 hillshade



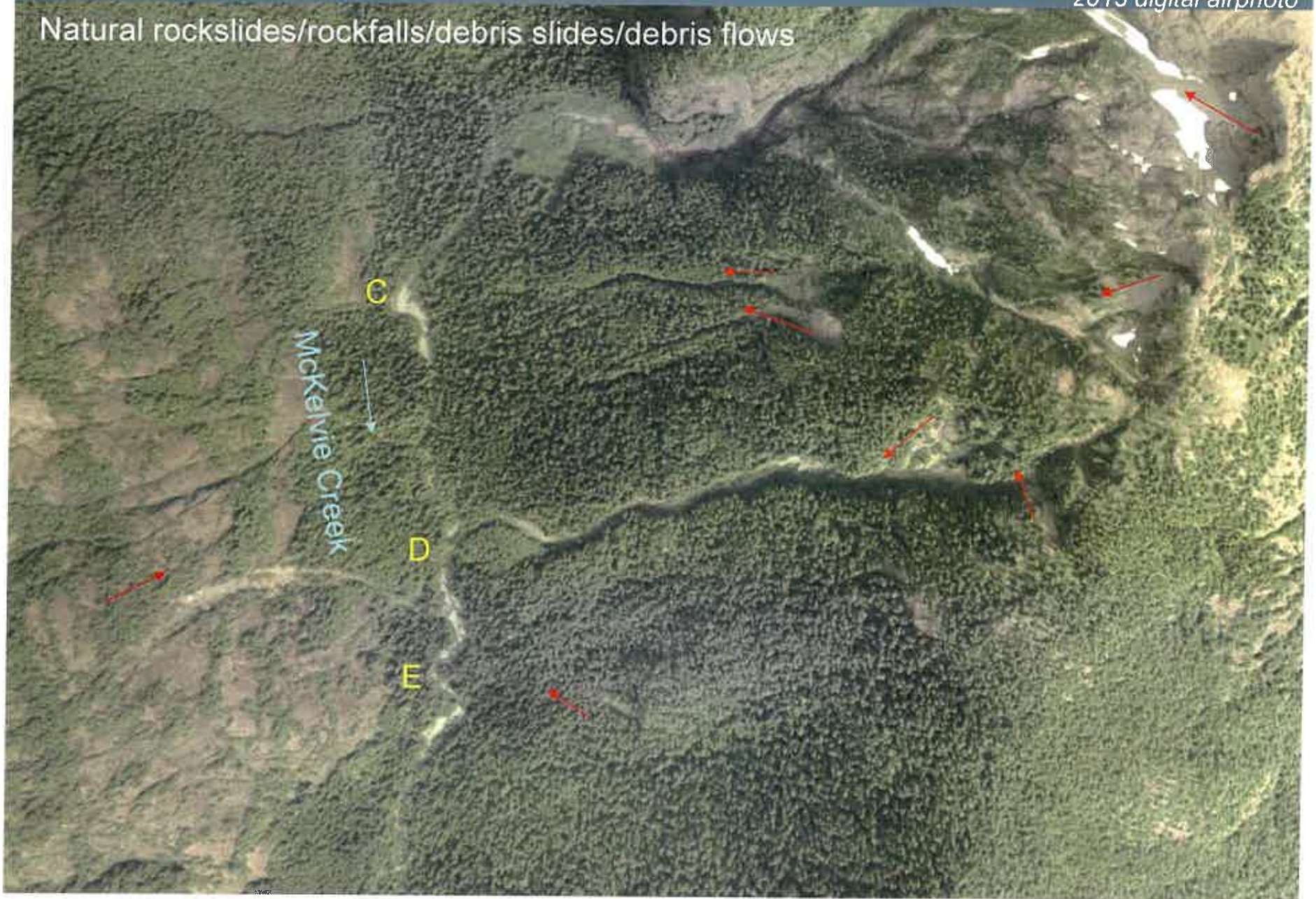
2013 ortho



Natural landslides, upper McKelvie Creek

2013 digital airphoto

Natural rockslides/rockfalls/debris slides/debris flows

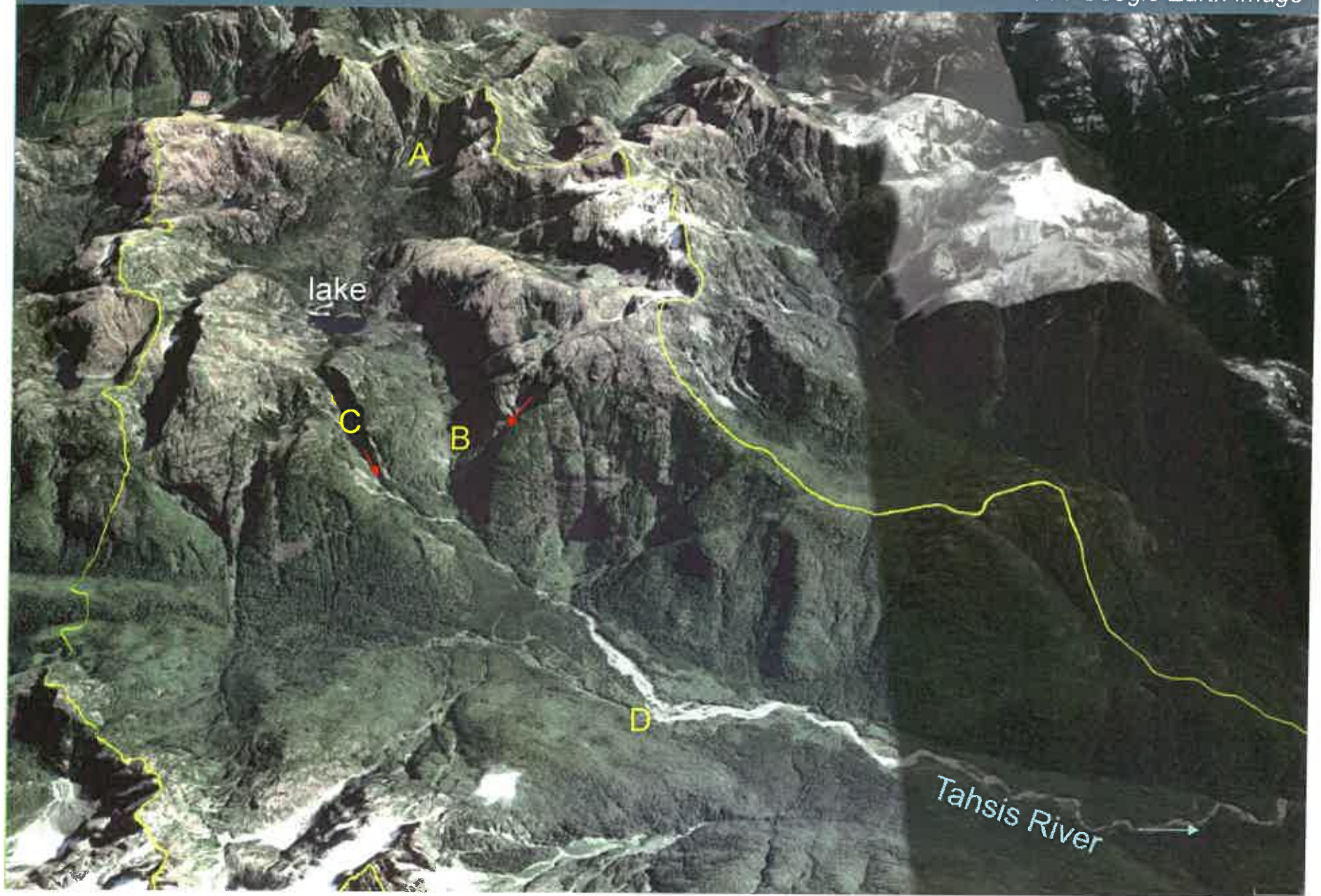


Landslides and sediment sources to Tahsis River



Coarse sediment sources to upper Tahsis River

2014 Google Earth image



*Coarse sediment sources to
upper Tahsis River*



2013 ortho



2014 Google Earth image

Going downstream on Tahsis River floodplain....

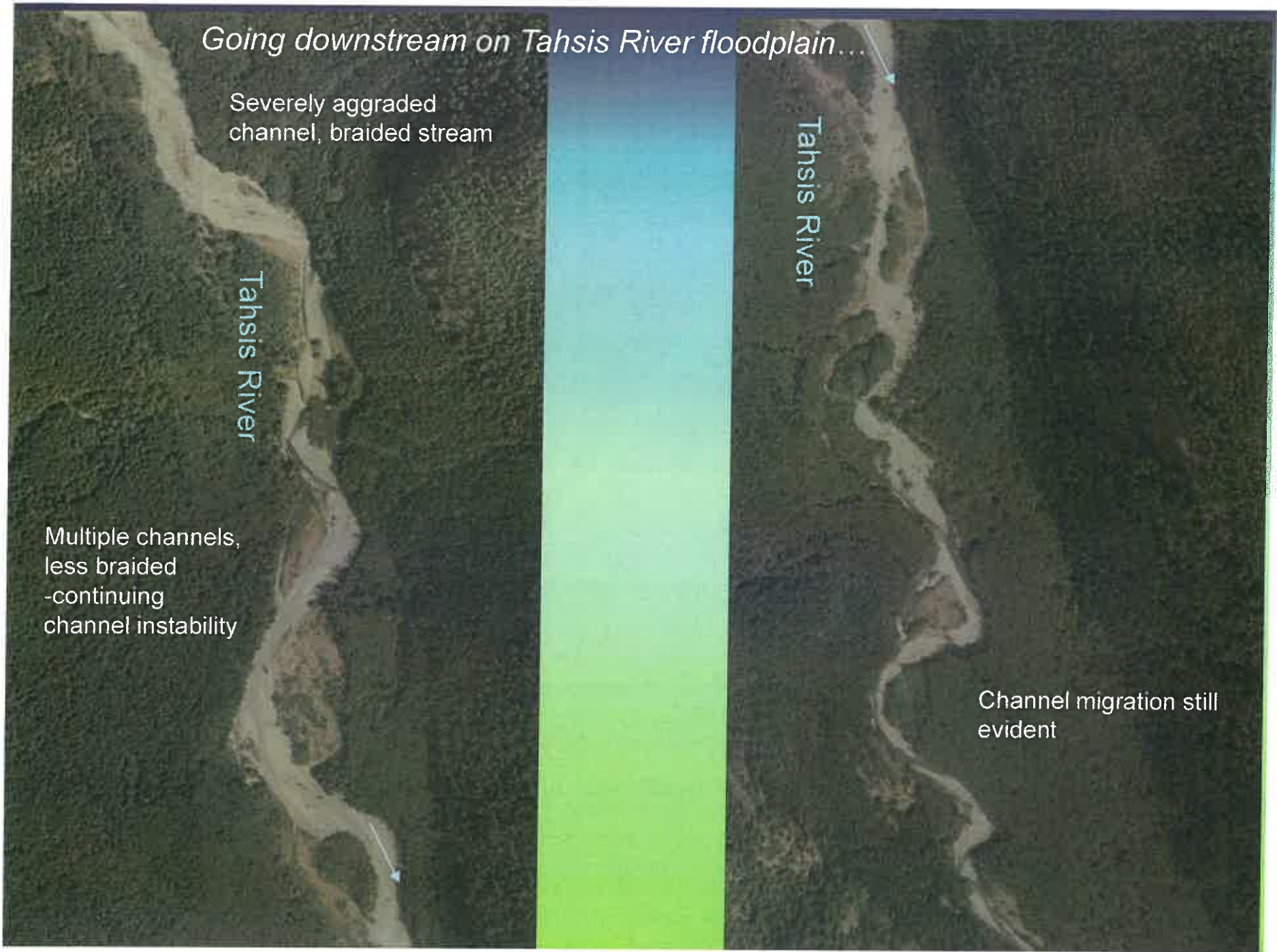
Severely aggraded
channel, braided stream

Tahsis River

Multiple channels,
less braided
-continuing
channel instability

Tahsis River

Channel migration still
evident

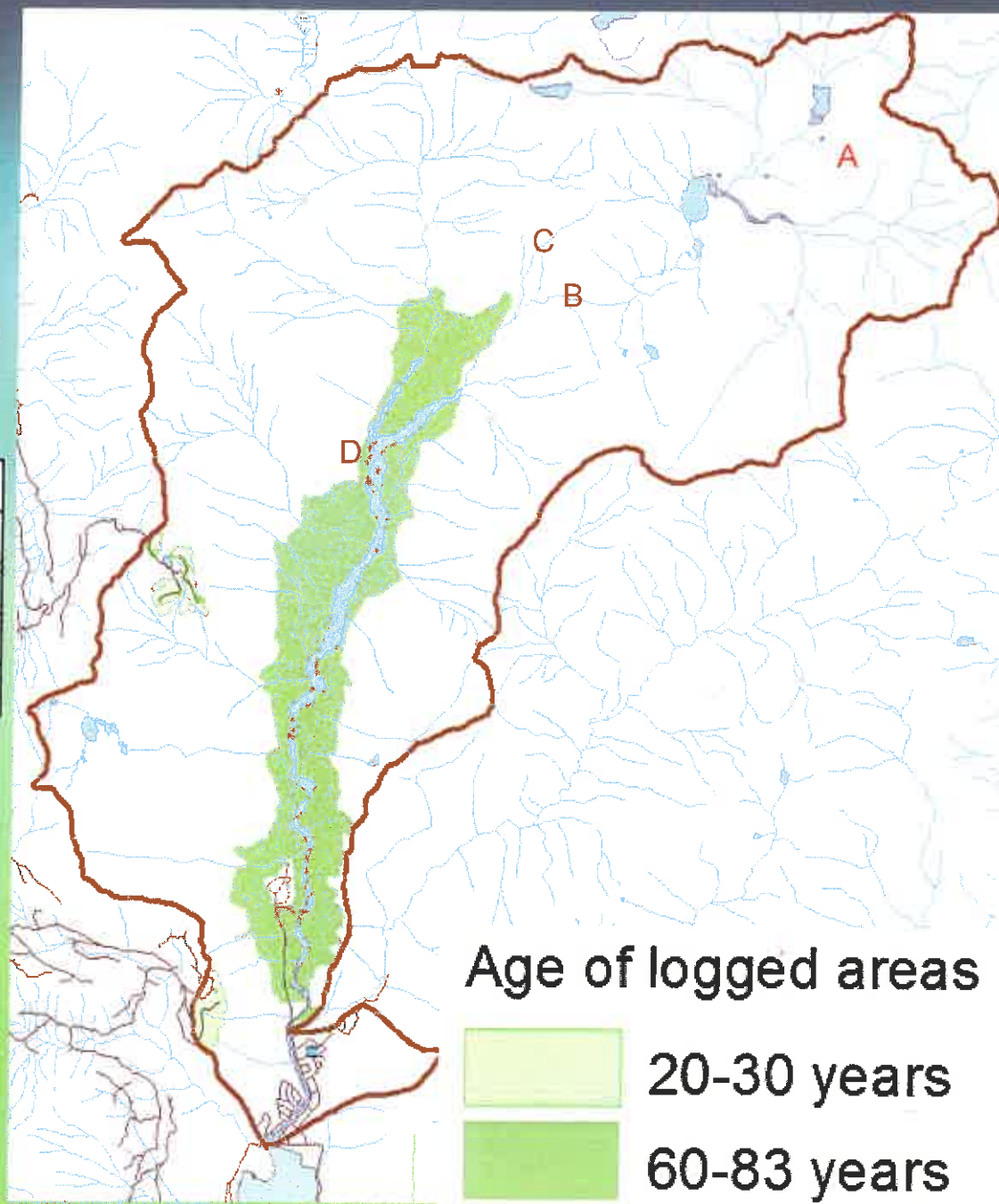


Tahsis watershed

Total watershed area: 5504 ha

Age of logging	Area, ha	%
20-30 years	42.9	0.8%
60-83 years	578.2	10.5%
Landfill	10.4	0.2%
Total	631.5	11.5%

Tahsis floodplain logged
1935 - 1957



Summing up

Hydrologic environment

- Very high rainfall environment – biggest rainstorms typically occur October → January
- Snow at high elevation – max snow depth occurs April-May
- Snowmelt a higher proportion of runoff in rainstorms April → June but these are not usually the annual peak flow – peak flows most common November-December
- Rapid runoff from valley slopes
- Deep fluvial/glaciofluvial deposits in Tahsis valley floor will absorb some runoff and provide groundwater storage
- McKelvie has more limited valley floor deposits and much of the mainstem has a confined channel with high energy flow – “flashier” than Tahsis
- No large lakes to buffer peak flows or for storage to sustain summer low flows
- Water storage for summer flows mainly in late-persisting snowpacks at high elevations – snowpack gone by early August
- Base flow in Tahsis River from deep valley floor deposits

Summing up

Landslides and sediment sources

- High natural chronic input of coarse sediment from rockfalls/rockslides/debris slides in the upper valley walls of both watersheds
- Upper reaches of Tahsis River still recruiting sediment from increased lateral bank erosion
- Bedload in Tahsis River mobilizes during peak flows
- High transport energy in McKelvie Creek and tributary creeks to Tahsis
→ sediment that enters streams moves through system
- High rainfall environment and intense storms – high regional landslide frequency

Management strategies (2010, 2017)

- ✚ For blocks planned next to floodplains or on fans, identify the limits of the wet floodplain or active portion of fan and exclude from harvesting
- ✚ Manage windthrow to maintain integrity of riparian buffers along streams
 - All streams in McKelvie community watershed are treated as fish streams
- ✚ Limit harvesting in McKelvie watershed to terrain with a low potential for a landslide to enter McKelvie Creek
 - Terrain stability assessments are done as per WFP's Terrain Risk Management Strategy and professional practice guidelines
- ✚ Manage windthrow at cutblock boundaries next to steep terrain

Climate change effects to consider for future

Trends (with large year to year variations):

- ⚡ More frequent intense rainstorms
- ⚡ Elevation range of transient snow zone moving up
- ⚡ Snowpack zone shrinking in area
- ⚡ Warmer summer temperatures