TOWN OF CANMORE REGULATION OF STEEP CREEK HAZARDS

Western Conference, February 2025

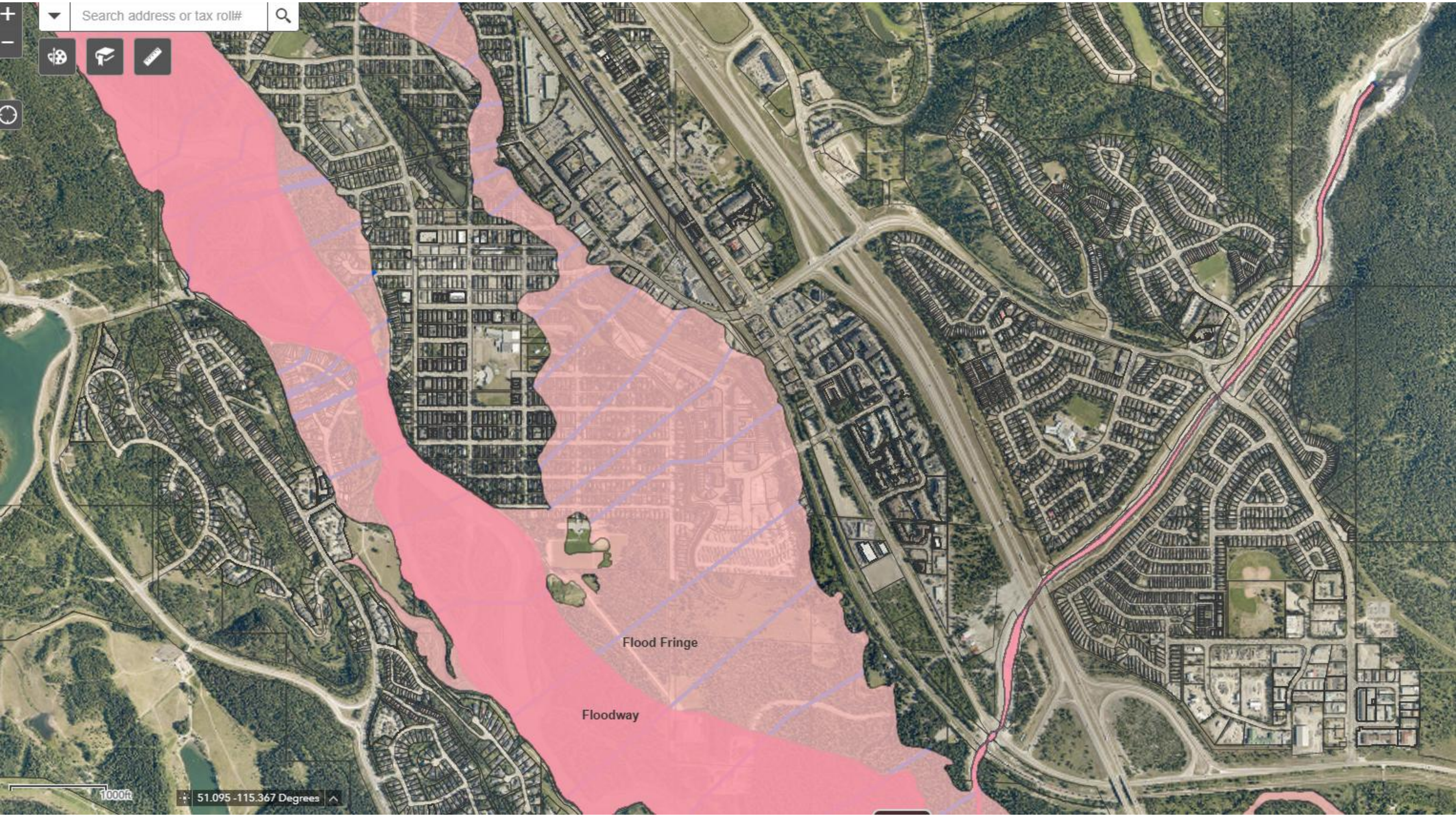
Presentation Outline

- Background
- 2013 Flood Event
- Hazard & Risk Assessments
- Canmore's Policies and Guidelines
- Modelling Data into Hazard Maps

Background

Credit: Kayla Stegen - Alltrails.com

Background



Search address or tax roll#
Flood Fringe
Floodway
1000ft
51.095 -115.367 Degrees

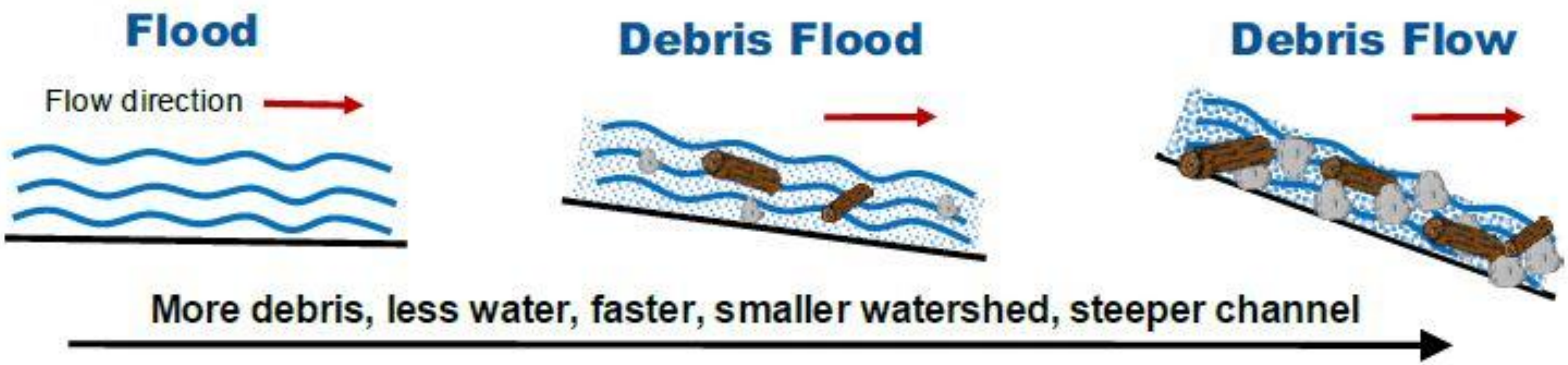
2013 Flood Event

Mountain Creek Hazard Mitigation Program initiated after the 2013 floods.

Hazard and Risk Assessments

- BGC Engineering completed a hydroclimatic (storm) analysis of the event, and a forensic analysis of our steep creeks.
- BGC completed most hazard and risk assessments.
- These assessments increased our understanding of steep creeks and their associated hazards.

Flood Hazards in Canmore



Artwork by BGC Engineering

Bow River

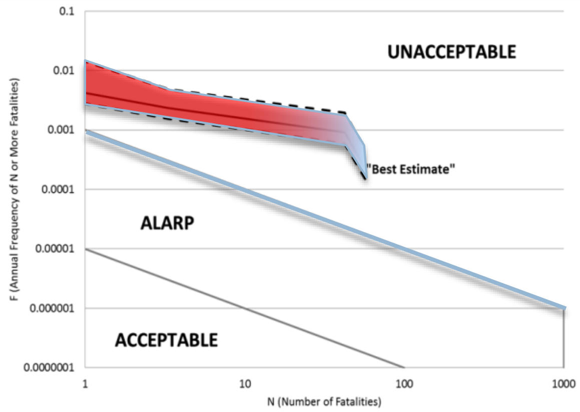
Cougar Creek

Stone Creek

Hazard and Risk Assessments

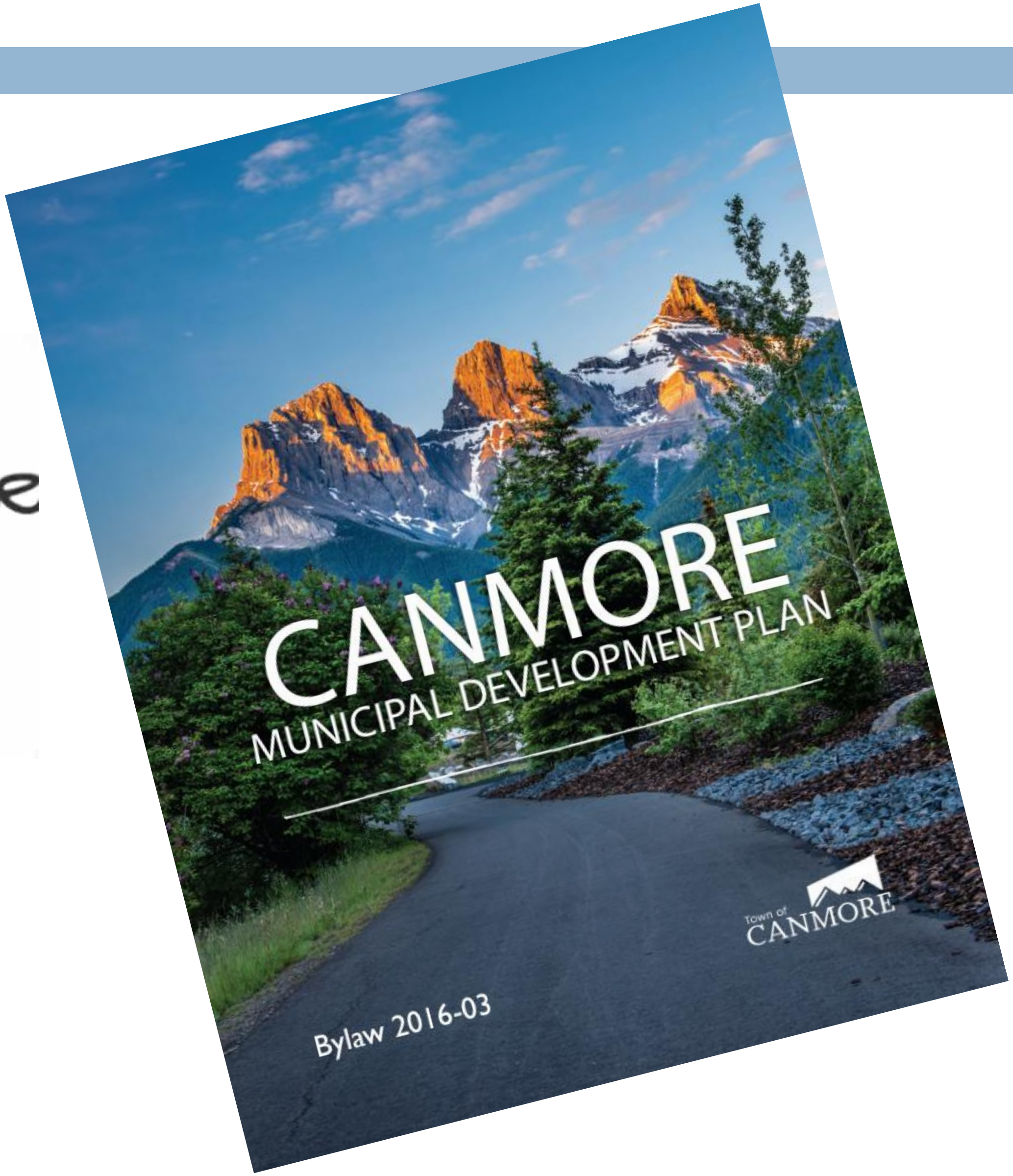
- Hazard assessments
  - 1:100-yr to 1:3000-yr events

- Risk assessments
  - Group risk of loss of life
  - Individual risk of loss of life
  - Economic risk



Policy: Risk Levels in MDP (2016)

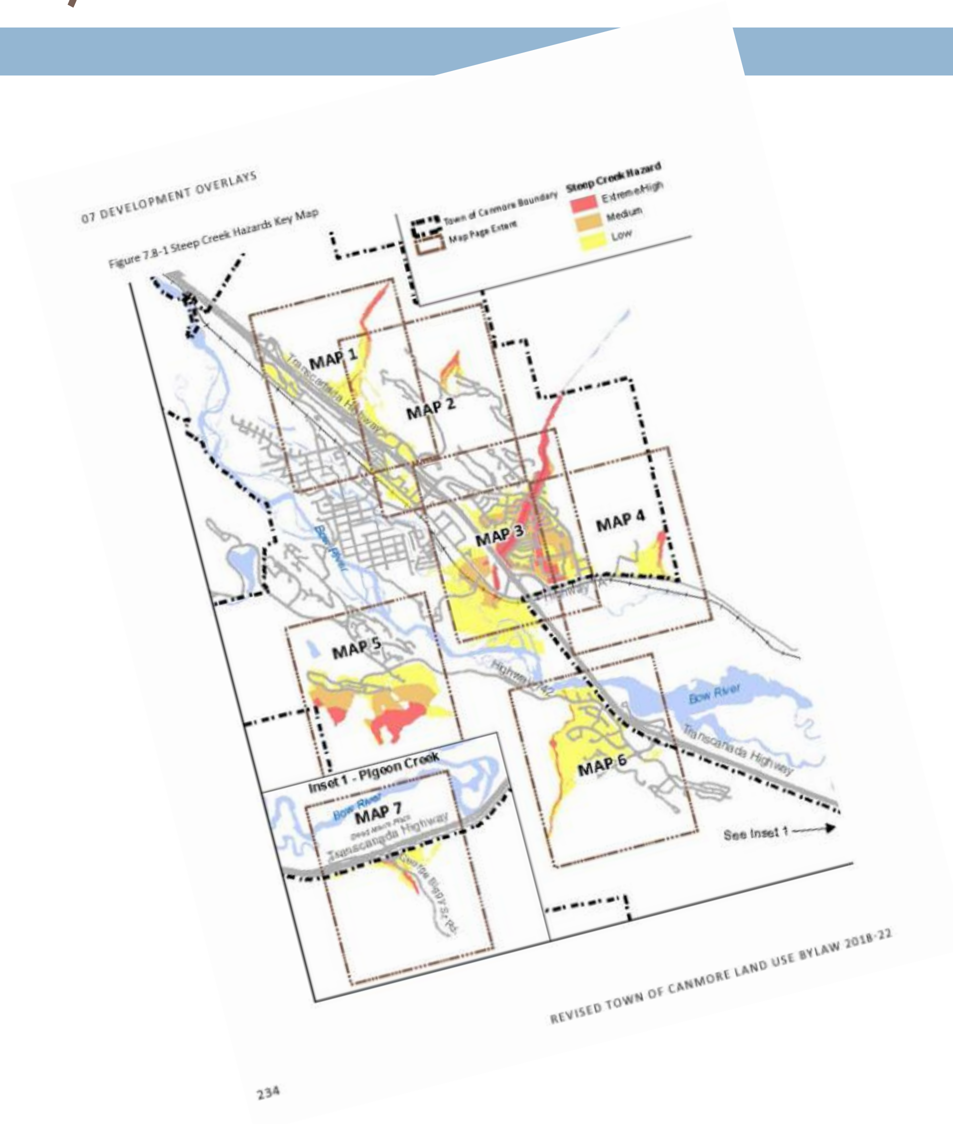
Risk tolerance established in section 3.5 of MDP



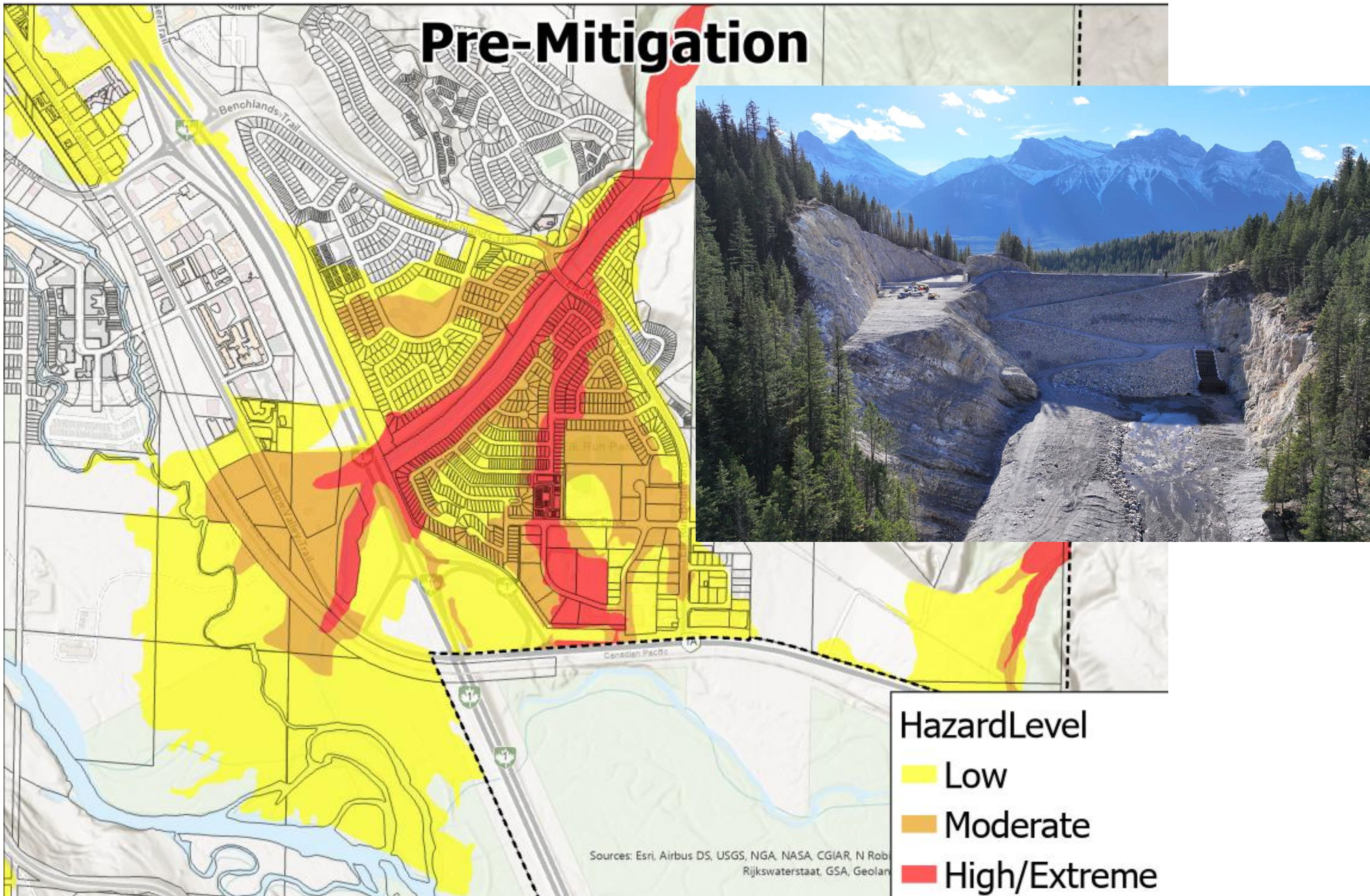
- Reduce risks to acceptable levels
- Ensure no new unacceptable risks

Policy: Steep Creek Hazard Overlay in Land Used Bylaw (LUB 2018)

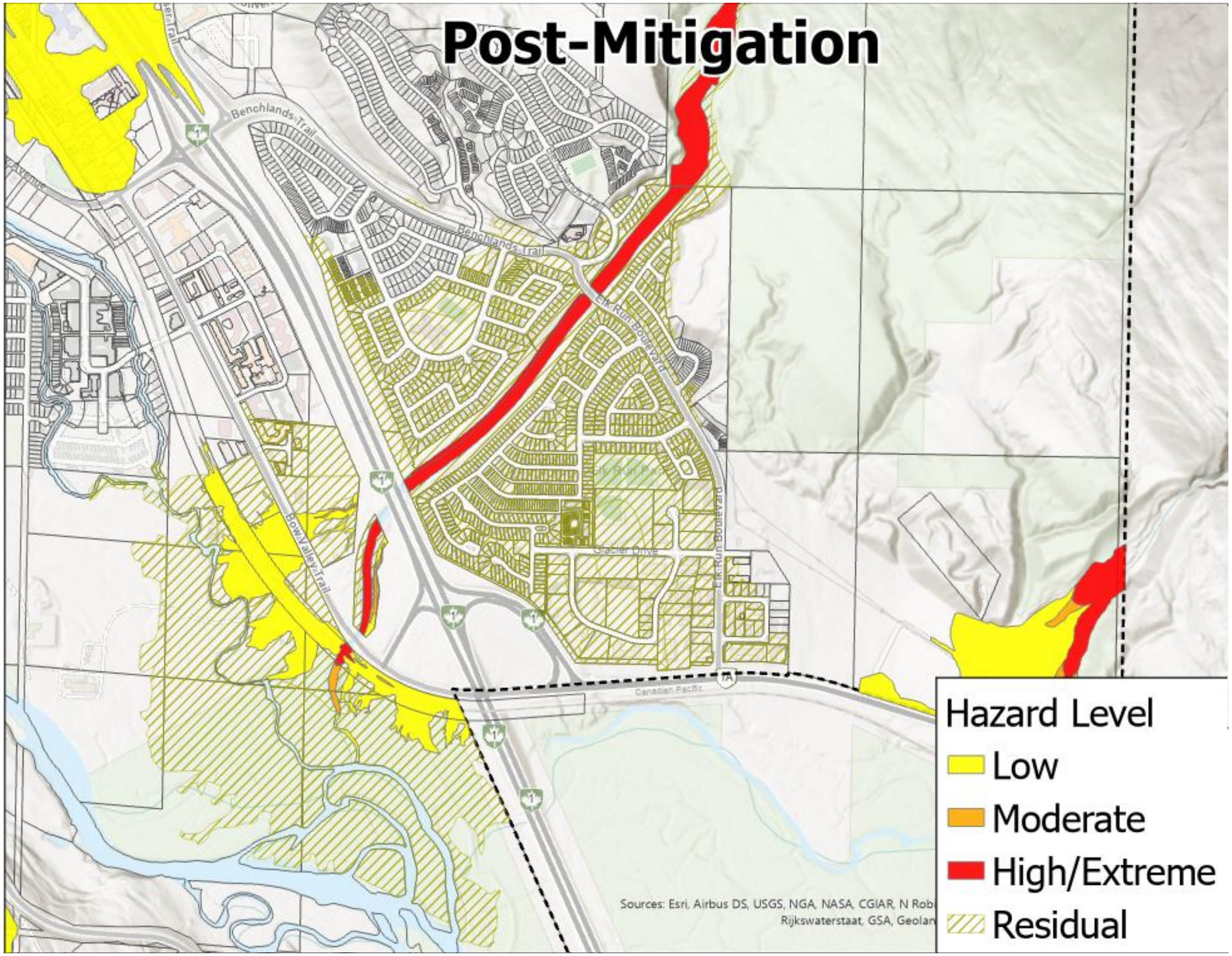
- High / Extreme Hazard:
  - Limited uses (no increase to risk)
  - B&B time-of-year restrictions
- Moderate Hazard:
  - Only underlying uses
  - Risk assessment required
- Low Hazard:
  - Only underlying uses
  - Follow Engineering Construction & Design Guidelines
  - Risk assessment may be required
- Study Areas:
  - Limited permitted uses
  - Require Hazard and Risk assessment to remove Study Area overlay



Residual Hazard (2025 update)



Residual Hazard



Guidelines: EDCG (2020)

- Section 9.3 of Canmore's Engineering Design and Construction Guidelines provides:
  - Specific guidance for development in steep creek hazard zones
  - Suggestions to increase flood resiliency
  - Guidance for undertaking site specific risk assessments
  - General guidance on structure mitigation (2025)

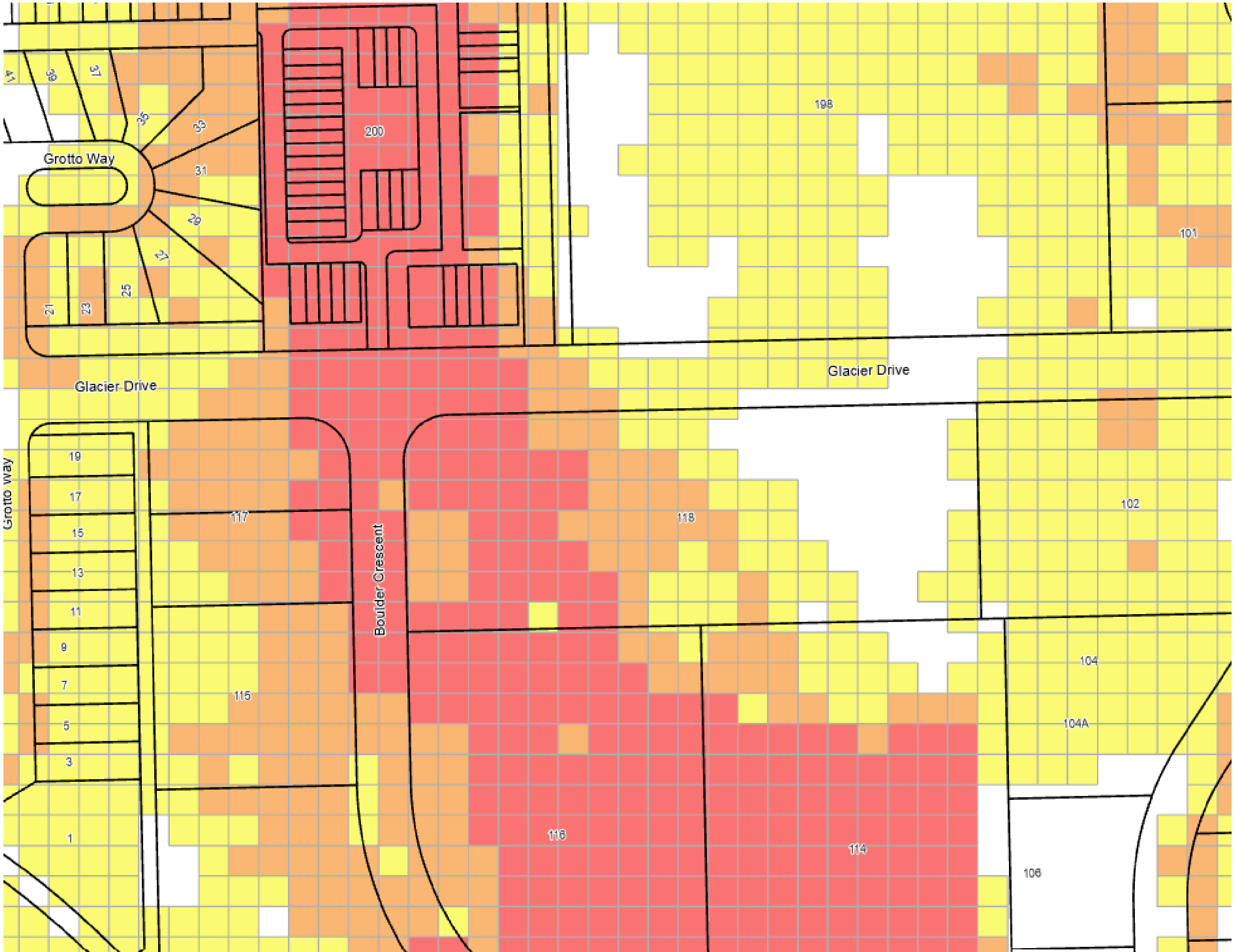
Hazard Mapping: Data Inputs

- Raster GIS data prepared by BGC Engineering
  - Water Surface Elevation, Flow depth, Velocity
    - Multiple scenarios
    - Return periods
  - $I_{DF} = DV^2$

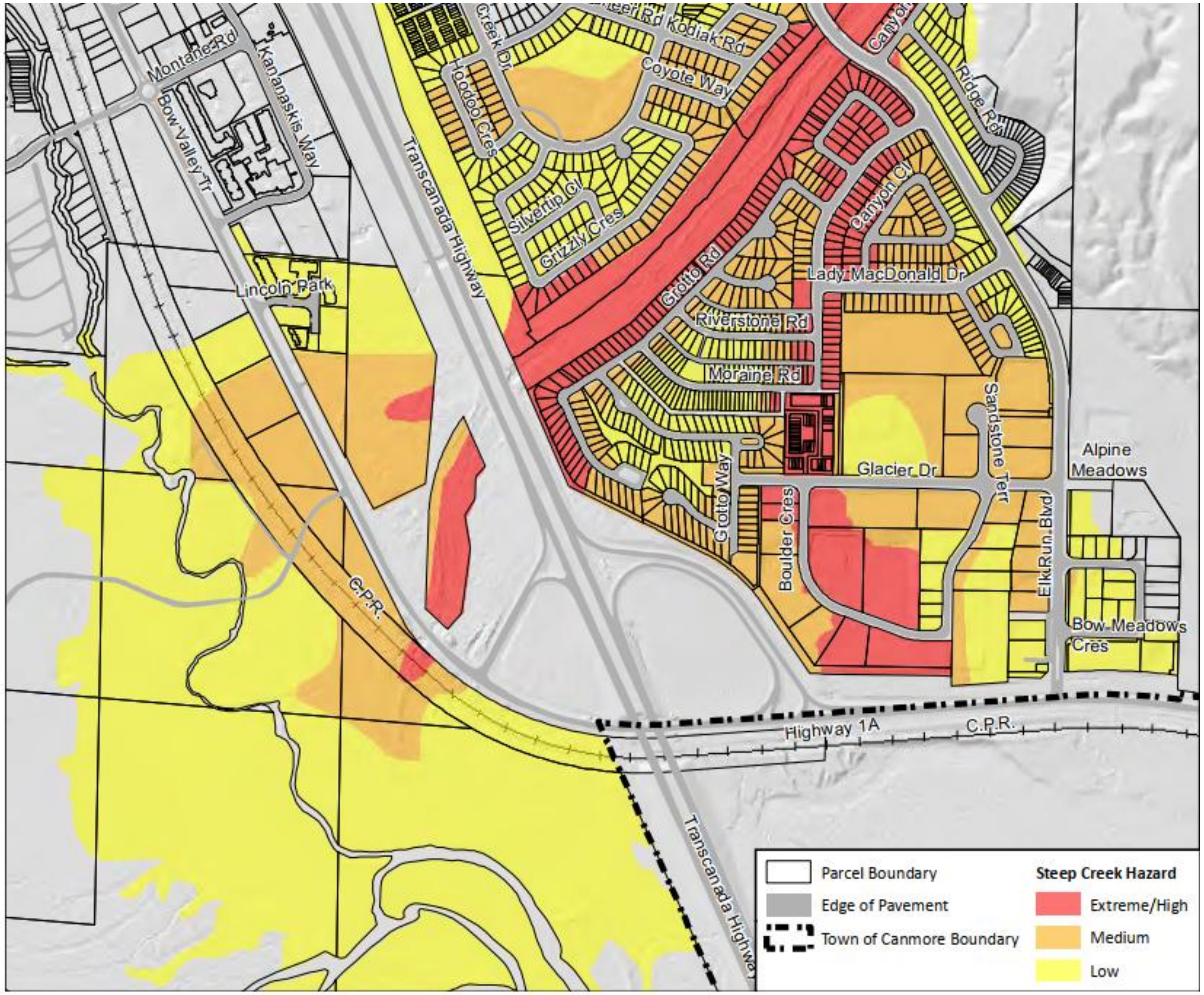
Hazard Mapping: Data Inputs

- Maximum Impact Intensity Rasters:
  - Maximum $I_{DF} = DV^2$ for all scenarios
    - Low (<1.0) - Flooding but no structural damage
    - Moderate(1-10) - Some structural damage but not complete destruction
    - High/Extreme(>10) - Likely the structure is damaged/destroyed
  - Converted from raster to simplified polygons

Hazard Mapping



Hazard Mapping



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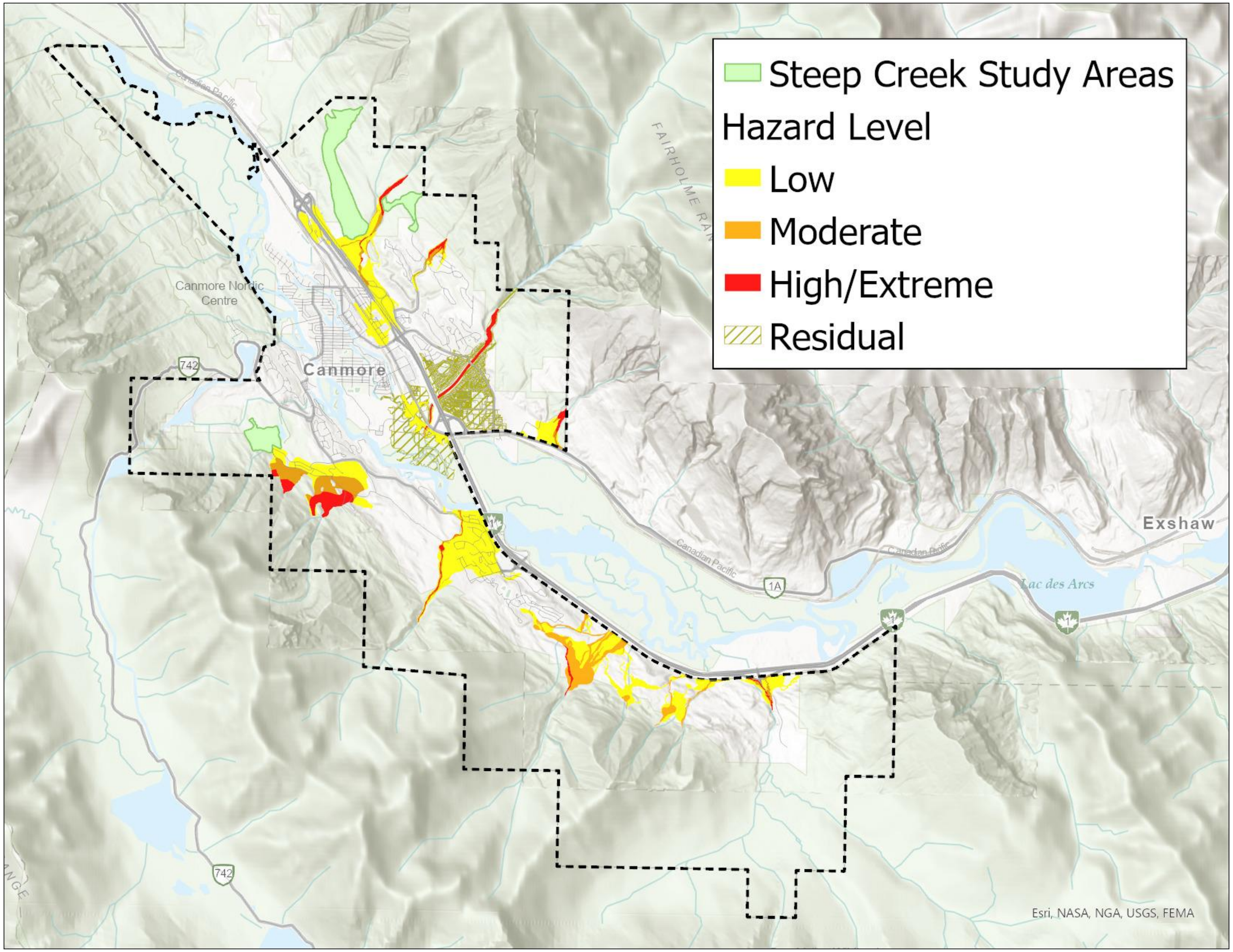

Questions?

Table 3-13. Definitions and colour coding for debris flow creeks.

Impact Intensity	Colour	Building Damage Potential	Description
< 1	Yellow	Minor	Slow flowing shallow and deep water with little or no debris. High likelihood of water damage. Potentially dangerous to people in buildings, on foot or in vehicles in areas with higher water depths.
1 to 10	Orange	Major	Potentially fast flowing but mostly shallow water with debris. Moderate likelihood of building structure damage and high likelihood of major sediment and/or water damage. Potentially dangerous to people on the first floor or in the basement of buildings, on foot or in vehicles.
10 to 100	Red	Severe	Fast flowing and deep water and debris. High likelihood of moderate to major building structure damage and severe sediment and water damage. Very dangerous to people in buildings, on foot or in vehicles.
>100	Dark Red	Destruction	Very fast flowing and deep water and debris. High likelihood of severe building structure damage and sever sediment and water damage. Extremely dangerous to people in buildings, on foot or in vehicles.

Interpreted hazard maps showing I_{DF} values at all locations within the study area were developed for X, Y and Z creeks, for each return period class. In addition, spatial impact probabilities were used to assign likelihoods to different avulsion scenarios. In general, the current main flow path was assigned a spatial impact probability of 70%, main avulsion paths were assigned spatial probabilities between 20% and 40%, and other fan areas were assigned spatial probabilities of 10%. Additional detail for each creek is provided in the results chapters.