Flood Hazard Mapping in Alberta

Highwood River Case Study

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Flood Hazard Mapping in Alberta
Presentation Outline

- Flood Hazard Identification Program (FHIP)
  - History
  - Objectives
  - Principles
- Flood Hazard Mapping Terminology
  - Design Flood
  - Flood Hazard Area – Floodway and Flood Fringe

Flood Hazard Mapping in Alberta
Presentation Outline (cont.)

- **New River Hazard Studies**
  - Flood Inundation Mapping
  - Flood Hazard Mapping
  - New Study Components

- **Highwood River Hazard Study**

Flood Hazard Identification Program
History

- Flood hazard mapping began in the 1970s
- Canada-Alberta Flood Damage Reduction Program (FDRP) began in 1989 to standardize and cost-share flood hazard mapping studies – a 10 year program
- The Government of Alberta has continued to create floo hazard mapping for communities since 1999 with the **Flood Hazard Identification Program** (FHIP)
- Joint Federal-Provincial FDRP focused on urban areas

Flood Hazard Identification Program
Objectives

- Increase public safety and awareness of flood hazards
- Promote appropriate development of flood hazard areas
- Reduce future flood damages and related financial cost

Flood Hazard Identification Program
Principles

- Floods are natural events and severe floods can occur i any year
- We have a responsibility to reduce flood hazards within our areas of jurisdiction, and have a role in managing flood hazard areas through appropriate land-use planni
- Development in flood hazard areas should not result in unacceptable level of risk to residents, the development or the environment

Flood hazard studies and maps identify an existing flood hazard, they do not create them.

Flood Hazard Mapping
Terminology

Design Flood

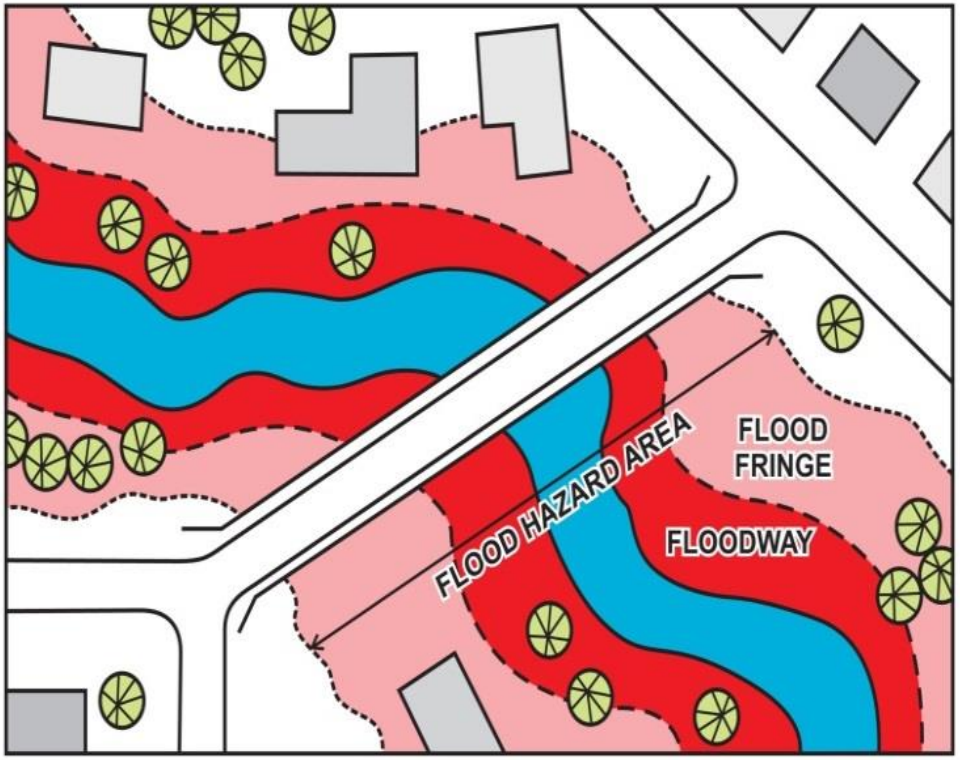
- A flood that has a 1% chance of occurring each year
- Referred to as the 100-year flood, but this does **not** me that it will only occur once every 100 years
- Can be an open water flood or an ice jam flood
- Determined by a hydrologic assessment

Flood Hazard Mapping
Terminology (cont.)

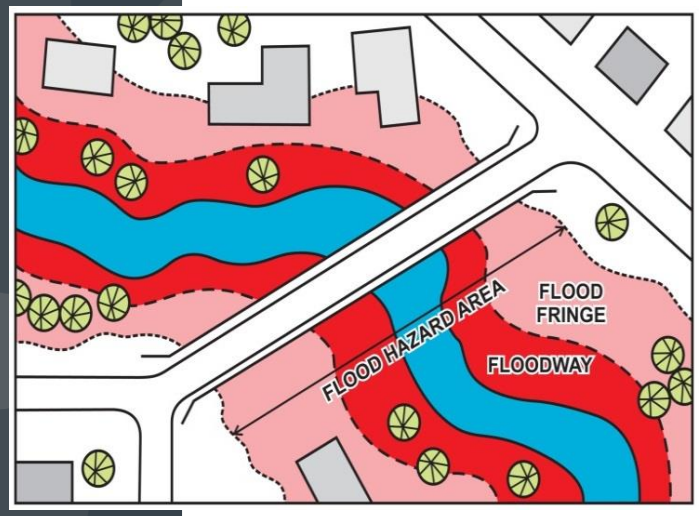
Flood Hazard Area

- Total area inundated by the design flood

- Divided into 2 zones
  - **Floodway**
  - **Flood Fringe**

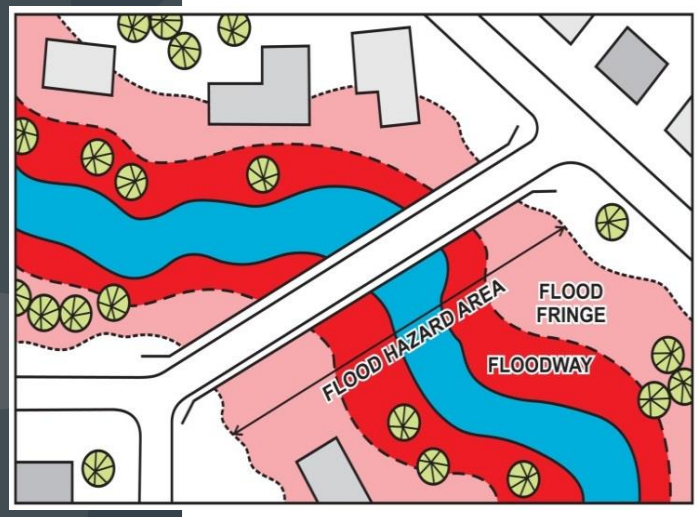


Flood Hazard Mapping
Defining the Floodway



- The portion of the flood hazard area where flows are deepest, fastest and most destructive
- Includes the main channel of a stream and typically a portion of the adjacent floodplain area
- Located where design flood waters:
  - are 1 m deep or greater
  - are flowing at 1 m/s velocity or higher

Flood Hazard Mapping
Defining the Flood Fringe

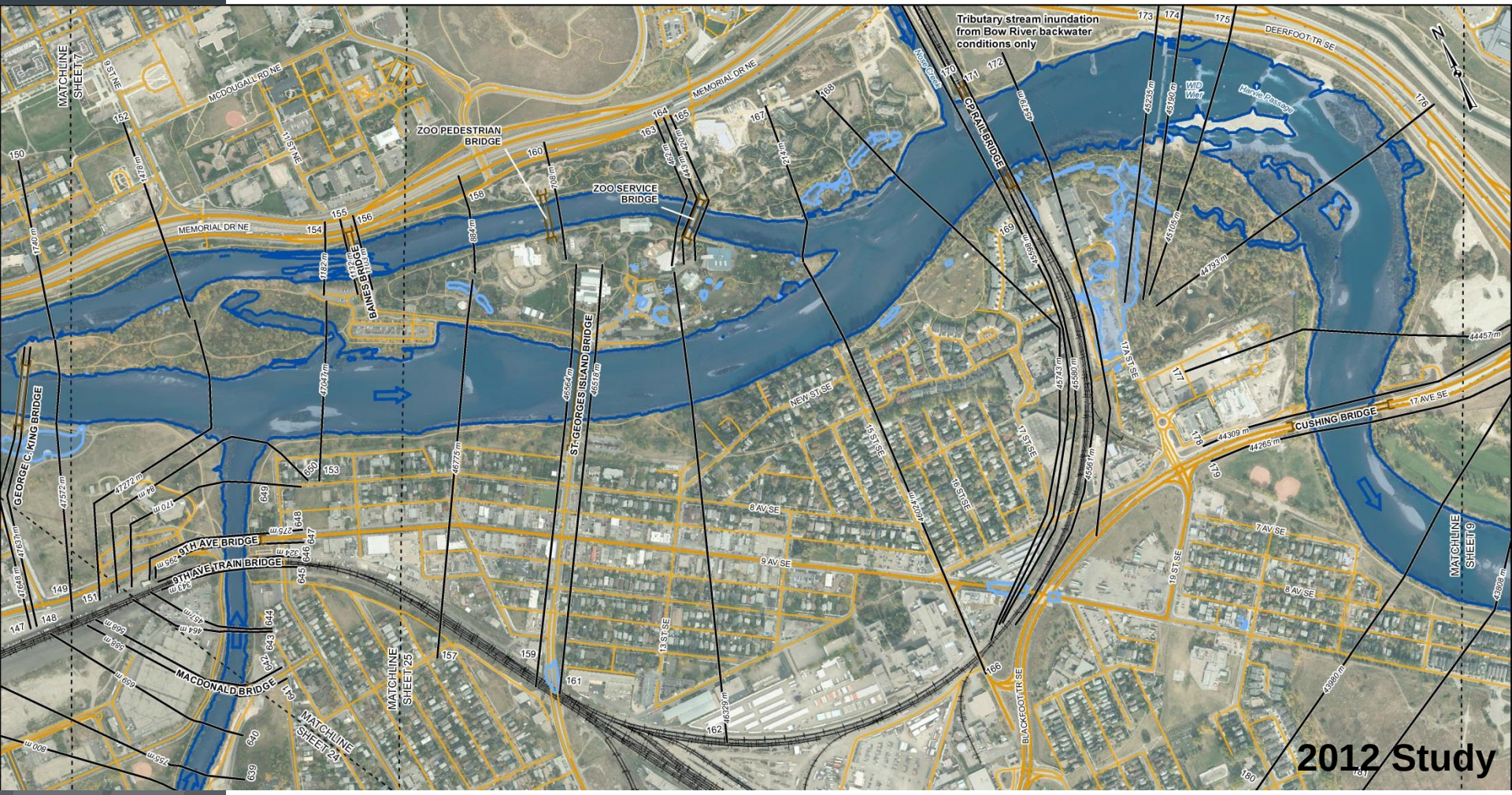


- The portion of the flood hazard area not included in the floodway, but still inundated in design flood event
- Typically has shallower water and lower velocities during the design flood event
- Assumed to be fully developed in the future – so this development will not increase the design flood levels above what was been calculated and mapped
- Development should be floodproofed

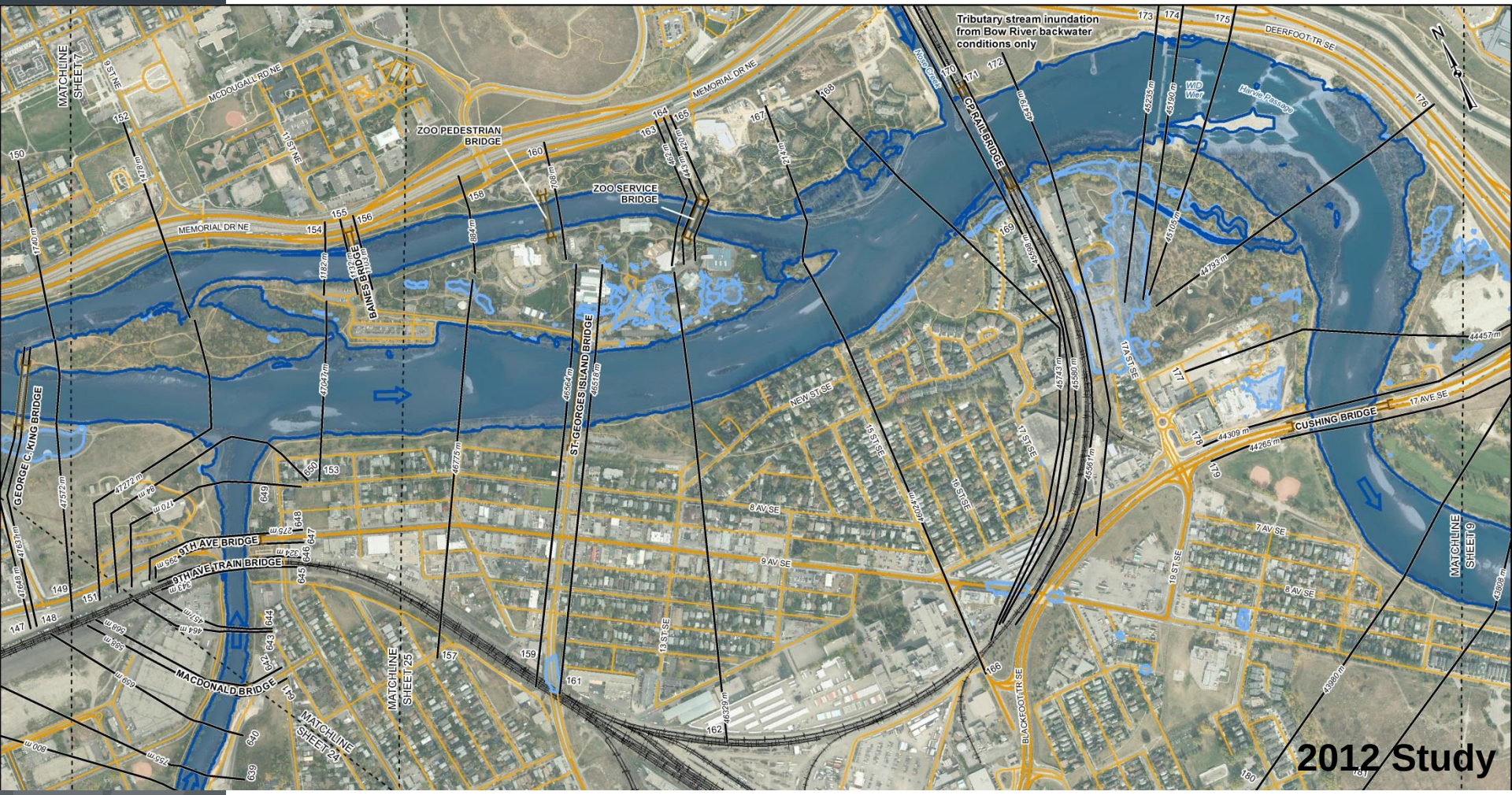
Flood Inundation Mapping

- Flood levels computed by hydraulic model are transferred to base mapping to delineate areas at risk from flooding
  - Previous Flood Hazard Studies mapped 10-, 50-, 100-year floods
  - New River Hazard Studies will map 2-, 5-, 10-, 20-, 35- 50-, 75-, 100-, 200-, 350-, 500-, 750-, and 1000-year open water floods
- Maps show the inundated extent for these flood scenarios
- Primarily used by stakeholders in emergency response planning and preparation

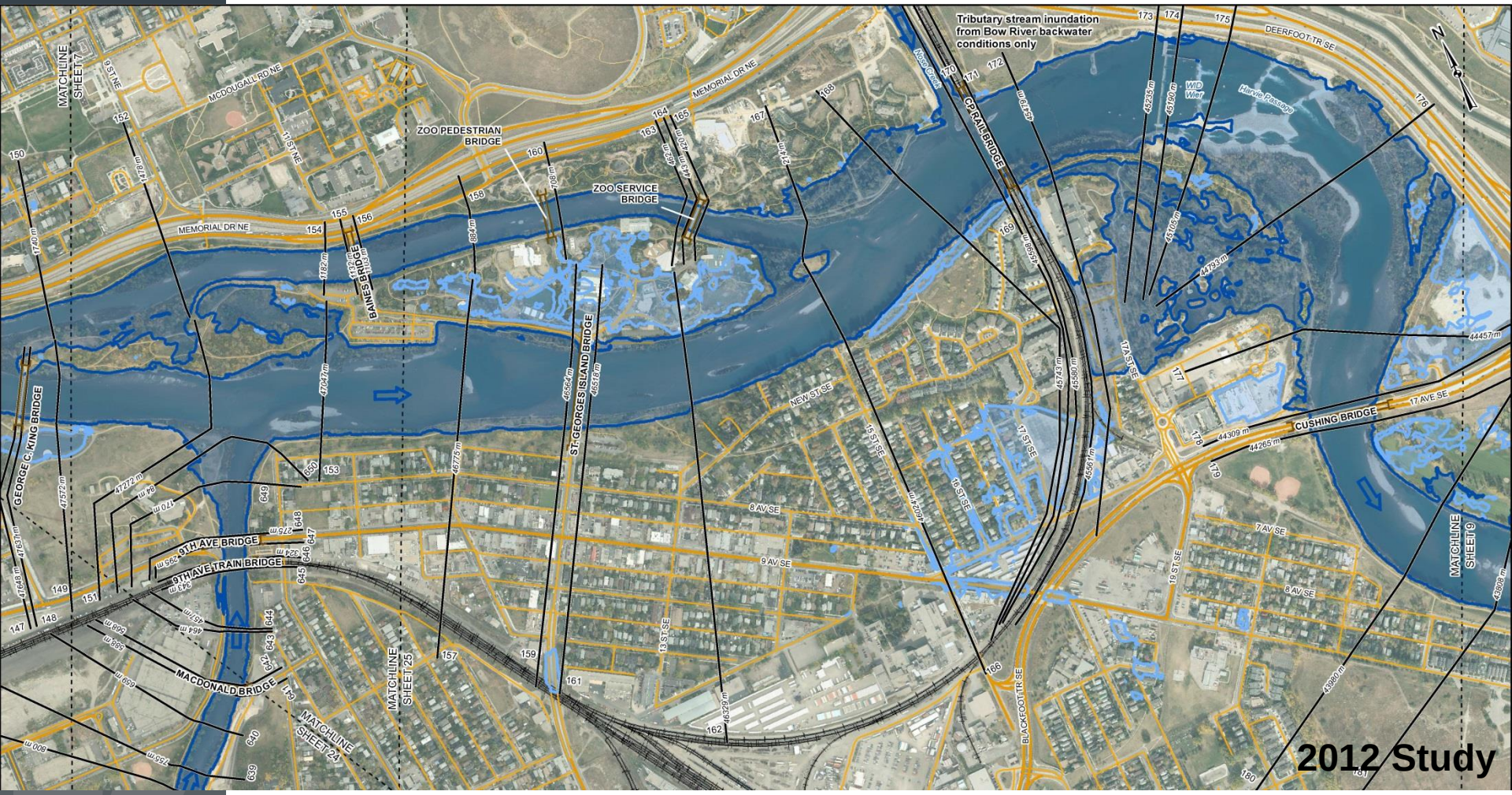
Inundation – 5-Year Flood



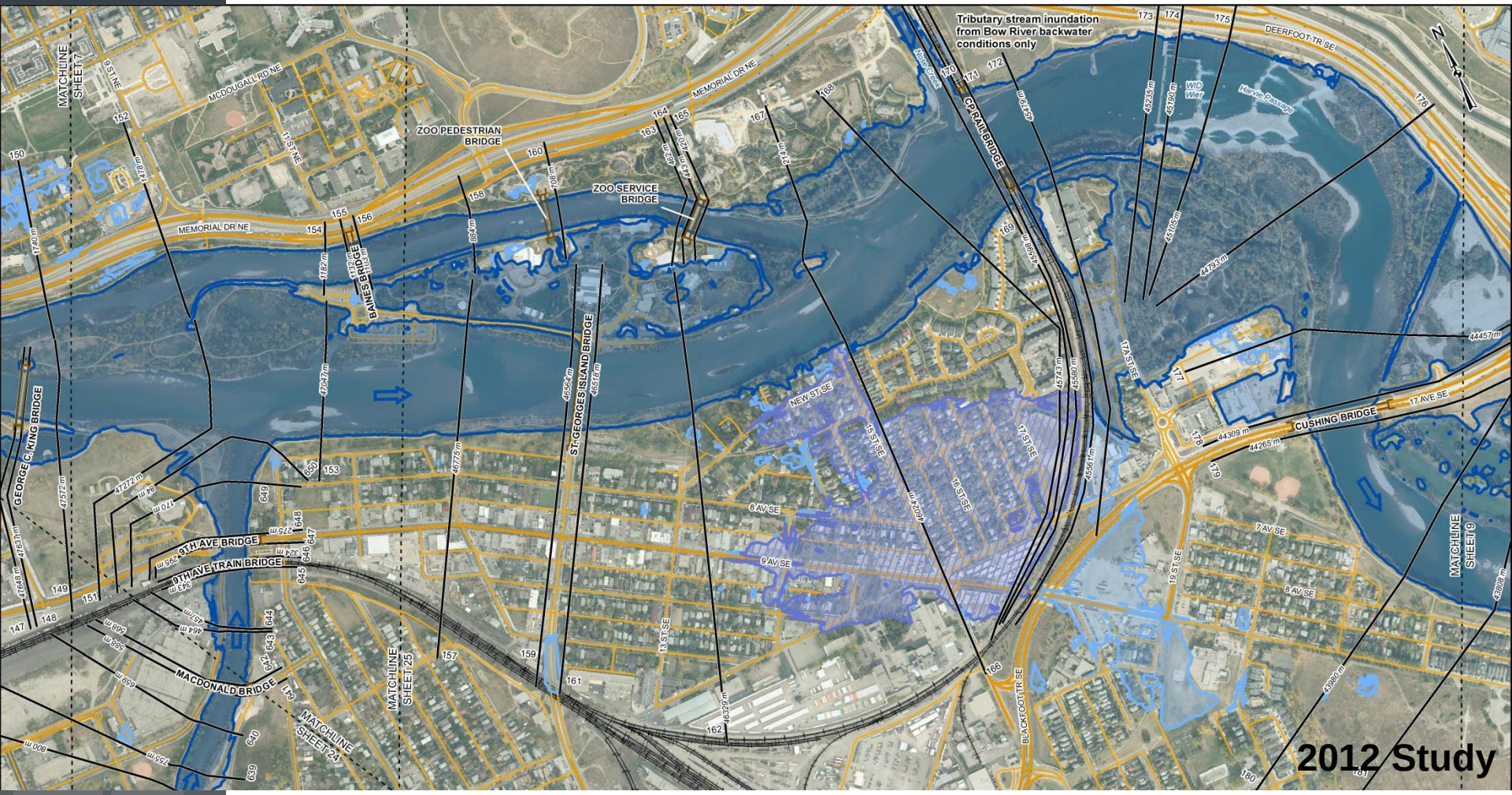
Inundation – 10-Year Flood



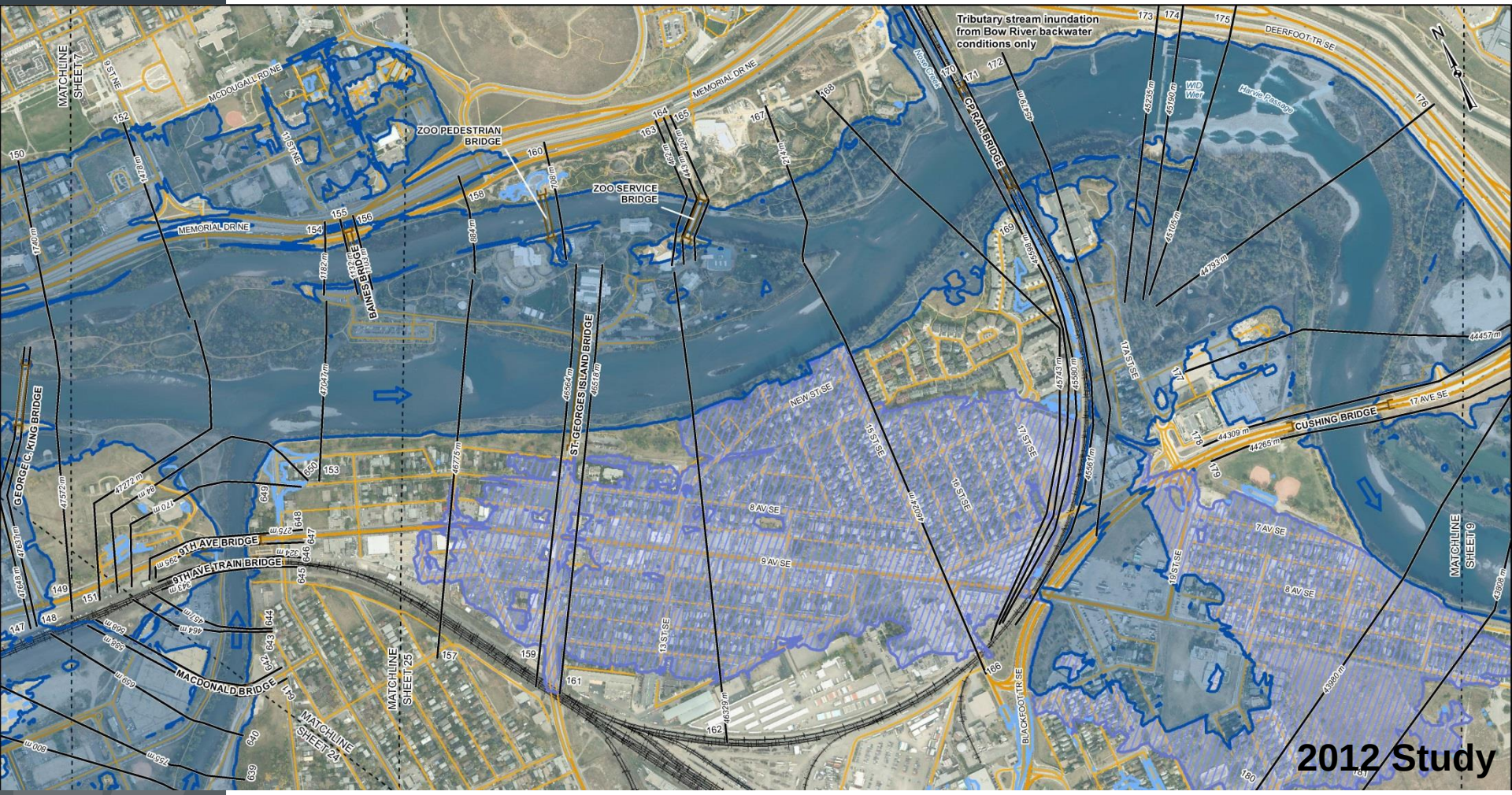
Inundation – 20-Year Flood



Inundation – 50-Year Flood



Inundation – 100-Year Flood

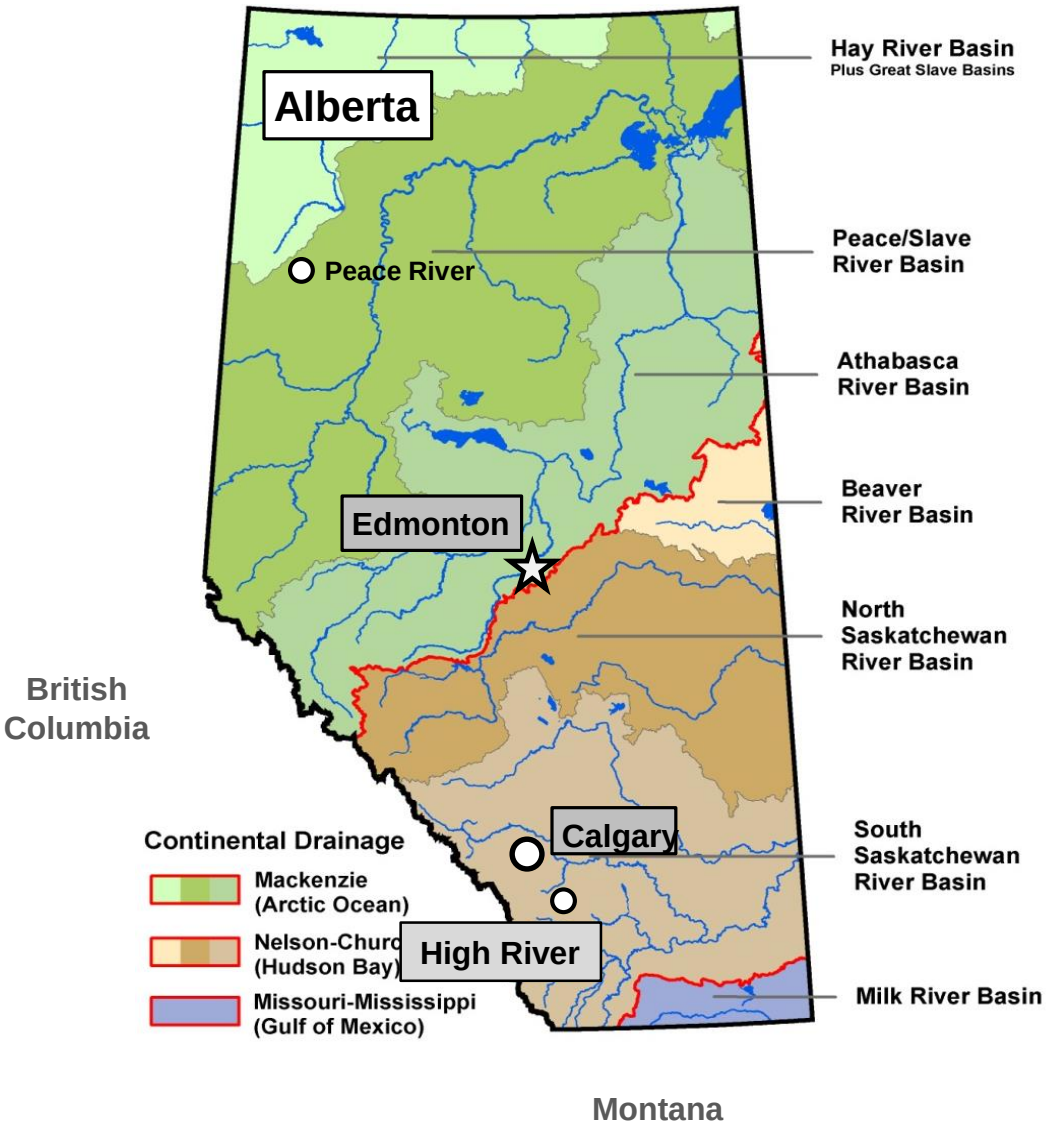


Flood Hazard Mapping in Alberta

New Study Components

- Flood Risk Assessment & Inventory
  - Inventory of land parcels, buildings, infrastructure, and population
  - Various flood scenarios will be used to identify land, buildings, infrastructure, and population at risk
- Channel Stability Investigation
  - Delineates historical and current channel bank locations
  - Identifies areas where river migration is occurring

Highwood River Hazard Study



Little Bow River

- Source in Town of High River
- Flows south to the Oldman River
- Areas south of town and the Little Bow valley are part of a glacial meltwater route that carried all of the Highwood River basin runoff when the retreating glacier blocked the flow from going north 13,000 years ago

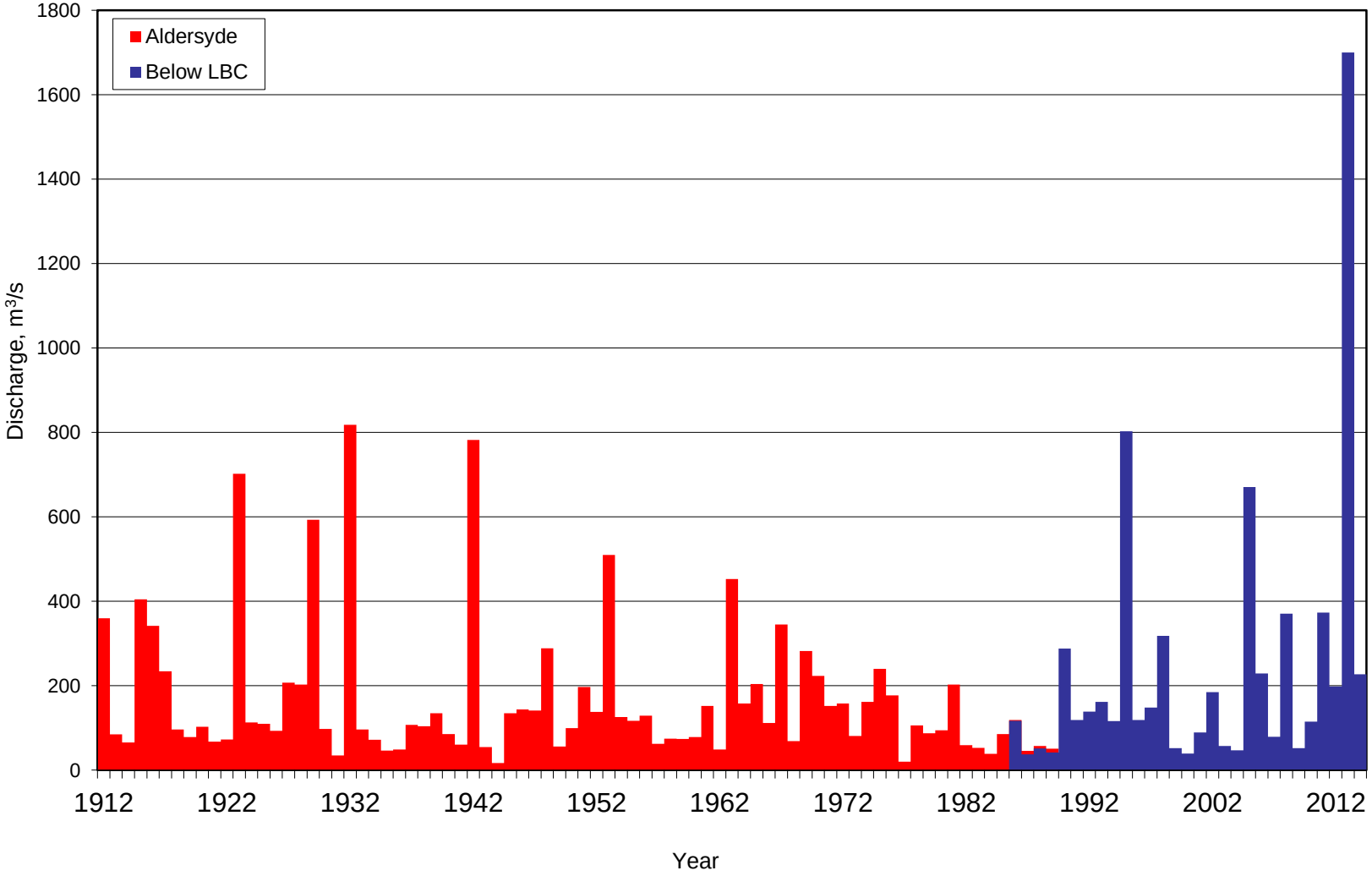
Little Bow River

- Overflow from the Highwood River into the Little Bow River starts around 400 m^3/s (upstream of High River)
- Between a 1:10 and 1:20 year flow


Highwood River Hazard Study
Legen
543
291
Longview Trail
191
498 Ave E
96 St E
284
Centre St N
Source of Little Bow
2
High River
5 St SE
5 St NE
10 St SE
23
Baker Creek
290
2
10 St E
120 St E
Google earth
© 2018 Google
Image © 2018 DigitalGlobe
N
2 mi

1923

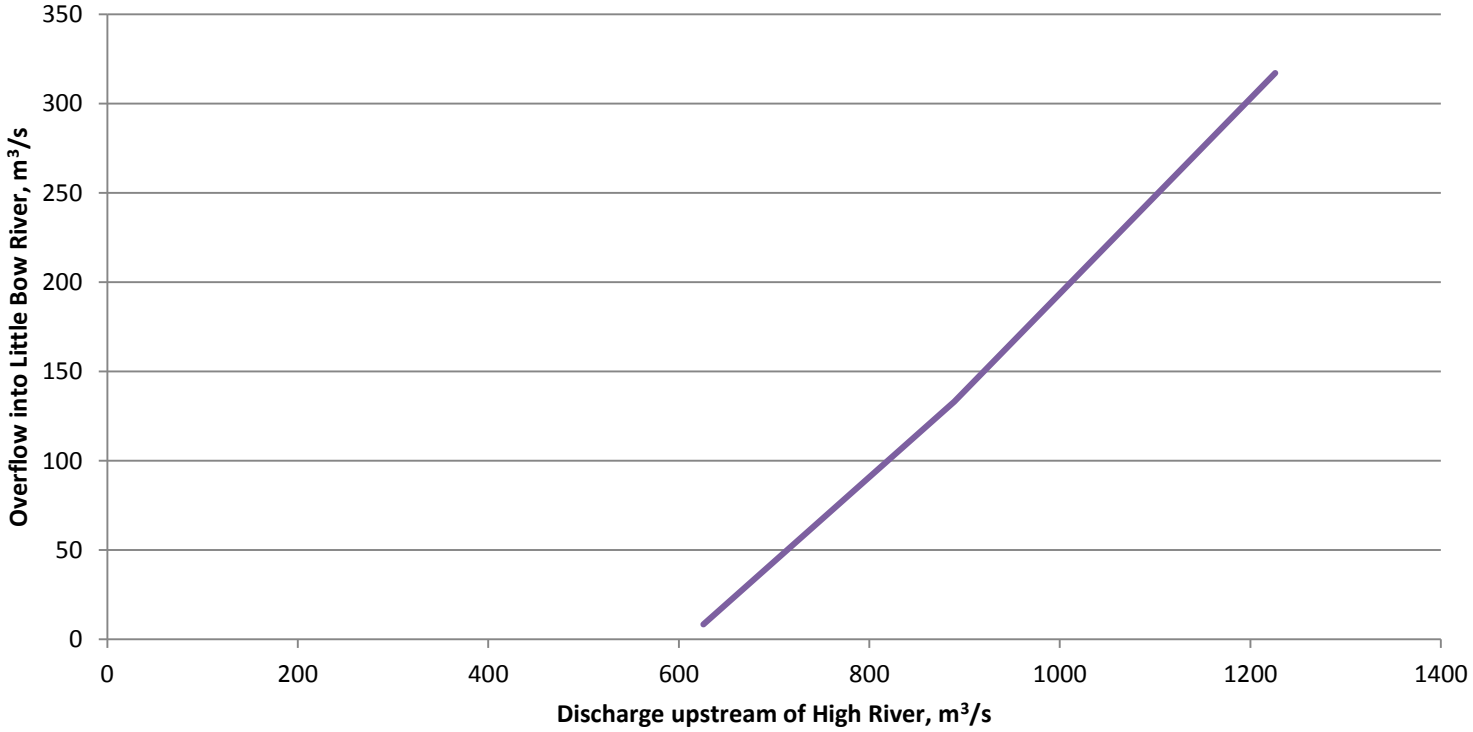
Recorded discharges for Highwood River at Aldersyde and Below Little Bow Canal 1912 - 2014.



Overflow estimate (1974)

- 1974 study estimated overflow using HEC-2 to determine when access to the highwater channels might occur
- Once the side channel (Baker Creek) was overtopped that flow was in the Little Bow Basin

Overflow from the Highwood River into the Little Bow River calculated for the Flood Regime Study of the Highwood River at High River (1974).



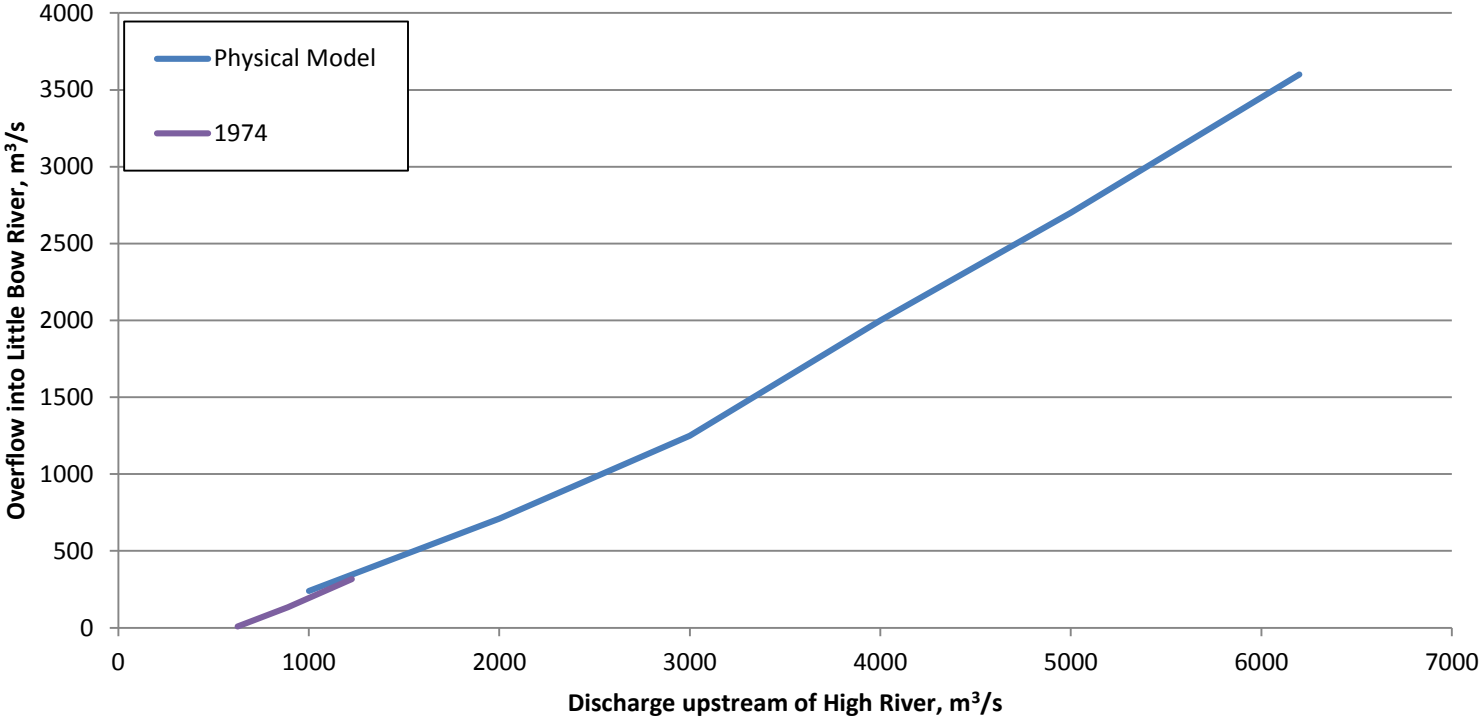
Overflow estimate (1990)

- To calculate the Probable Maximum Flood (PMF) for the Twin Valley Reservoir on the Little Bow River a study was conducted (1990).
- The overflow was calculated using a physical model and an unsteady flow model
- The results from each method were used to inform the other

Physical modelling (1990)

- The physical model represented a land area of 6 km by 4 km at a scale of 1:400 horizontally and 1:150 vertically (50 x 32 ft. in size)
- Detailed modeling of ground topography was difficult given the small model scales
- No calibration data available as modeled flows went up to 6200 m^3/s

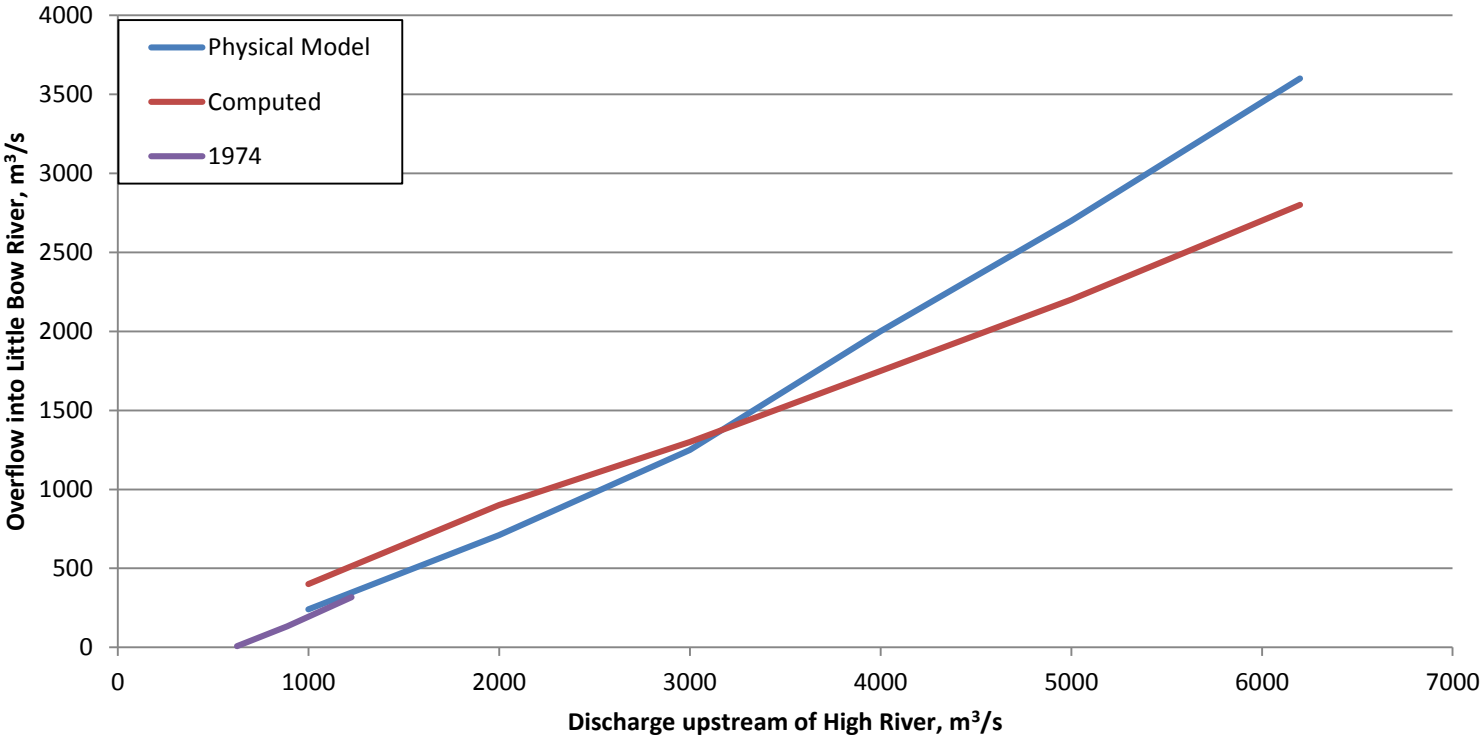
Overflow from the Highwood River into the Little Bow River calculated for Little Bow River Dam project using the physical model (1990).



Mathematical computations (1990)

- Overflow was calculated by matching computed stage discharge curves at the points of separation from the Highwood River

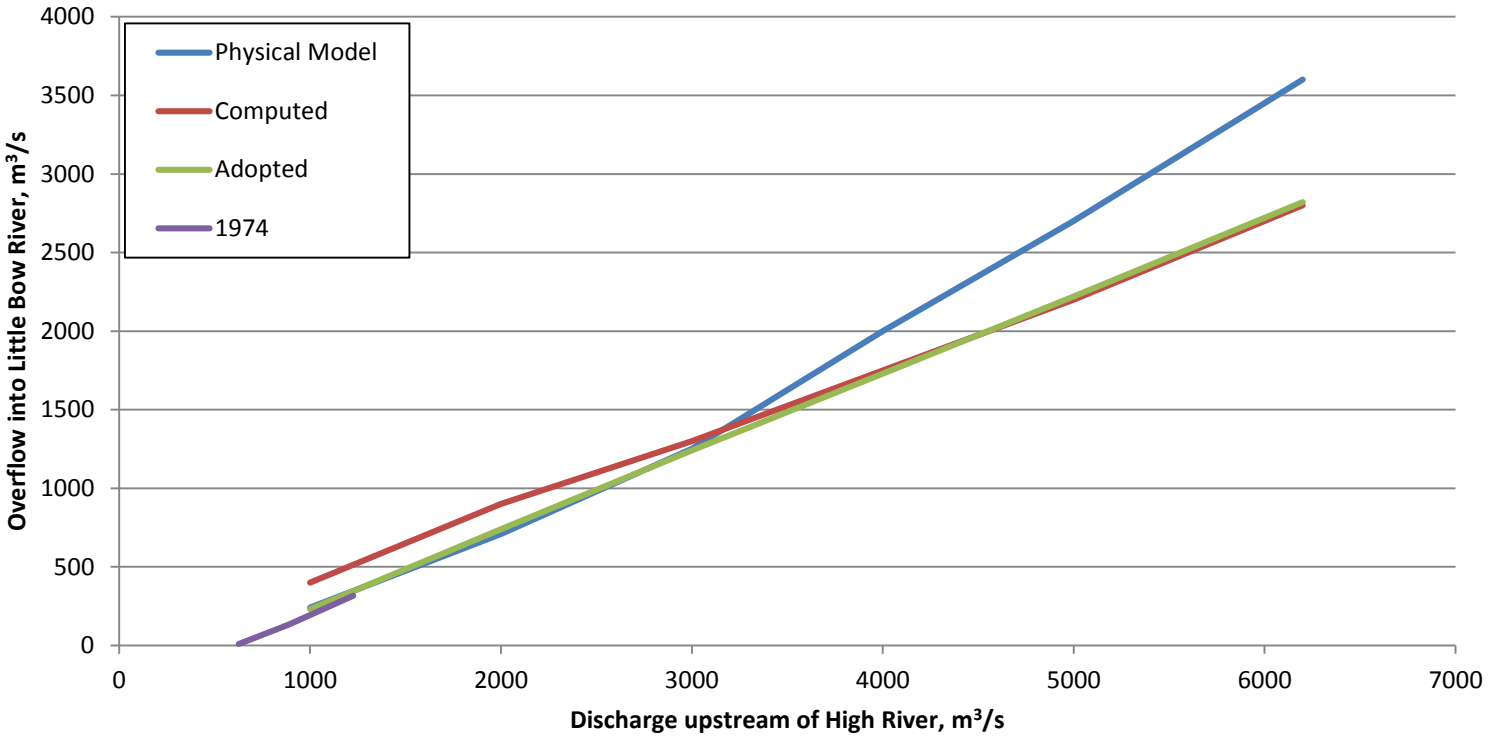
Overflow from the Highwood River into the Little Bow River calculated for Little Bow River Dam project for physical modeling and computations (1990).



Overflow (1990)

- Some significant differences between computed and physically modeled overflows for high flows
- It was concluded that the physical model represented a worst case scenario.
- Overall it was decided that the model gave reliable estimates for overflow patterns, but that the final computations gave more reliable estimates of the overflow discharges.

Overflow from the Highwood River into the Little Bow River calculated for Little Bow River Dam project (1990).



Summary

- Calculating the overflow into the Little Bow River has been an ongoing issue
- Old flow calculations are not necessarily better than newer ones, just different
- HEC-2, physical models and other models have been used to calculate the overflow with similar results up to 3000 m^3/s

Questions?