April 2023

BOW AND ELBOW RIVER HAZARD STUDY

Flood Risk Inventory and Assessment Report

Submitted to:
Alberta Environment and Parks
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Report Number: 1536673_R0006_Rev0

REPORT

Golder Associates

Public Engagement Note – January 2024

This version of the draft Bow and Elbow River flood study is based on naturalized design flood flows that do not take into account the effect of flow regulation by reservoirs with a dedicated flood mitigation purpose.

Hydraulic modelling, flood mapping, and flood risk assessment along the Elbow River downstream of the Springbank Off-stream Reservoir and along the Bow River downstream of the Elbow River confluence will be revised to account for the joint effect of Springbank Off-stream Reservoir and Glenmore Dam operations in early 2025.

Until such time, draft flood hazard zones along the Elbow River between Glenmore Dam and the Bow River confluence, where the impact to landowners is expected to be most significant, are not being displayed in the Government of Alberta's online flood map viewer and information related to flood hazard zones has been removed from this draft report.

https://www.alberta.ca/bow-elbow-river-flood-study-engagement

Executive Summary

Alberta Environment and Parks (AEP) commissioned Golder Associates Ltd. (Golder) in September 2015 to undertake the Bow and Elbow River Hazard Study. The primary purpose of the study is to identify and assess river and flood hazards along the Bow River (from Bearspaw Dam to the Highwood River confluence) and the Elbow River (from Bragg Creek to the Bow River confluence), including lengths of Bragg and Lott Creeks.

The study is conducted under the provincial Flood Hazard Identification Program (FHIP), the goals of which include enhancement of public safety and reduction of future flood damages through the identification of river and flood hazards. Project stakeholders include the Government of Alberta, local authorities, and the public. Key municipal stakeholders include the City of Calgary, Foothills County, and Rocky View County. The project includes working with Tsuut'ina Nation.

The study includes multiple components and deliverables. This report documents the methodology and results of the flood risk assessment and inventory component. The assessment compares open water flood inundation and design flood hazard mapping with collected and interpreted spatial data that contain an inventory of land parcels, buildings, major transportation infrastructure, and population. Flood risk statistics are calculated to quantify flood vulnerabilities for each of the 13 open water flood scenarios and the design flood scenario. The statistics pertain to the number of affected parcels, buildings, and population, as well as the length of affected road and railroad infrastructure, including bridges and culverts.

The main results of the flood risk assessment for the open water flood inundation are summarized below:

- The number of affected land parcels, buildings, and population, as well as the length of roads and railroads, increases from the 2-year to the 1,000-year floods. A significant increase typically occurs between the 100-year and 350-year floods.
- In Calgary, a first significant increase in impact occurs between the 20-year and 35-year floods, as parts of Bowness, Erlton, Mission, Roxboro, and Rideau Park experience direct inundation and the area of flood control structure failure inundation in Sunnyside expands. A second significant increase in impact occurs between the 100-year and 350-year floods, as large parts of Inglewood, Hillhurst, West Hillhurst, Sunnyside, Downtown, and Bridgeland experience direct inundation.
- No critical, non-residential buildings (i.e., government buildings, hospitals, schools, or water treatment facilities) are affected up to the 20-year flood, and no hospitals are affected by any open water floods.
- The length of roads affected remains low until the 5-year flood, and then increases from the 10-year to the 1,000-year floods. Some of the major roads that would be affected in the study area include:
  - Memorial Drive NW in West Hillhurst, Hillhurst, and Sunnyside starting at the 200-year flood.
  - Highway 22 between Bragg Creek and its intersection with Highway 8 starting at the 75-year flood.
  - Deerfoot Trail at the intersection with 17th Avenue SE starting at the 350-year flood.
  - 16th Avenue NW (Trans-Canada Highway) starting at the 350-year flood.

- The length of railroads affected by direct inundation remains low until the 20-year flood. The length increases steadily from the 35-year to the 1,000-year floods.
- The south leg of the CTrain Red Line in Calgary would be affected starting at the 35-year flood. The north leg of the CTrain Red Line would be affected by direct inundation in Sunnyside starting at the 200-year flood. The northeast leg of the CTrain Blue Line would be affected by direct inundation in Bridgeland starting at the 100-year flood and in the East Village starting at 200-year flood.
- The CP mainline (Calgary-Vancouver) in Calgary would be affected on the right bank of the Bow River, southeast of Edworthy Park, starting at the 75-year flood. A large part of the CP Alyth Yard would be affected at the 350-year flood, causing a significant increase in impact between the 200-year and 350-year floods.

The main results of the flood risk assessment for the design flood scenario are summarized below:

- 35 residential buildings and 104 non-residential buildings are located in the floodway. A total of 3,255 residential and 694 non-residential buildings are located in the flood fringe (including high hazard flood fringe and protected flood fringe areas). Of this flood fringe total, 682 residential and 174 non-residential buildings are located in the high hazard flood fringe, and 1,442 residential and 214 non-residential buildings are located in the protected flood fringe.
- A total estimated population of 79 is located in the floodway, and a total estimated population of 24,127 is in the flood fringe (including high hazard flood fringe and protected flood fringe areas). Of this flood fringe total, 3,641 are in the high hazard flood fringe and 7,985 are in the protected flood fringe.
- None of the water treatment plants in Calgary would be affected by the design flood. The Bonnybrook Wastewater Treatment Plant is partially located in the protected flood fringe.
- Some of the major roads that would be affected are Edmonton Trail, including 4th Street NE in Bridgeland north of the Old and New Langevin Bridges, Memorial Drive NE in Bridgeland, Elbow Drive SW in Elbow Park, 4th Street SW in Mission, as well as Highway 22 between Bragg Creek and Redwood Meadows.
- The south leg of the CTrain Red Line in Calgary would be affected in the Beltline and Manchester Industrial neighbourhoods. The northeast leg of the CTrain Blue Line would be affected in Bridgeland.
- The CP mainline (Calgary-Vancouver) in Calgary would be affected in the Spruce Cliff and Wildwood neighbourhoods (along the toe of the right bank of the Bow River, southeast of Edworthy Park).

Acknowledgements

This component of the Bow and Elbow River Hazard Study was led by Peter Thiede. Overall project management was provided by Dr. Wolf Ploeger with direction by Dr. Dejiang Long. The flood risk inventory and assessment were conducted by Peter Thiede, Brian Pendergast, and Wolf Ploeger.

The authors express their special thanks to Peter Onyshko, Abdullah Mamun, and Lance Katan, Project Managers for Alberta Environment and Parks, who provided overall study management, background data, and technical guidance.

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1.0 INTRODUCTION

1.1 Study Objectives

Alberta Environment and Parks (AEP) commissioned Golder Associates Ltd. (Golder) in September 2015 to undertake the Bow and Elbow River Hazard Study. The primary purpose of the study is to identify and assess river and flood hazards along the Bow River (from Bearspaw Dam to the Highwood River confluence) and the Elbow River (from Bragg Creek to the Bow River confluence), including lengths of Bragg and Lott Creeks.

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The study includes multiple components and deliverables. This report documents the methodology and results of the flood risk assessment and inventory component. The assessment compares open water flood inundation and design flood hazard mapping with collected and interpreted spatial data that contain an inventory of land parcels, buildings, major transportation infrastructure, and population. Flood risk statistics are calculated to quantify flood vulnerabilities for each of the 13 open water flood scenarios and the design flood scenario. The statistics pertain to the number of affected parcels, buildings, and population, as well as the length of affected road and railroad infrastructure, including bridges and culverts.

1.2 Study Area and Reaches

The study area includes approximately 72 km of the Bow River between Bearspaw Dam and the Highwood River confluence, approximately 66 km of the Elbow River from Bragg Creek to the Bow River confluence in Calgary, approximately 1 km of Bragg Creek upstream of the Elbow River confluence, and approximately 7 km of Lott Creek upstream of the Elbow River confluence (see Figure 1).

The study area includes the following local authorities and communities: Bragg Creek, Calgary, Elbow Valley Residents Club, Foothills County, Redwood Meadows, Rocky View County, and Tsuut'ina Nation.

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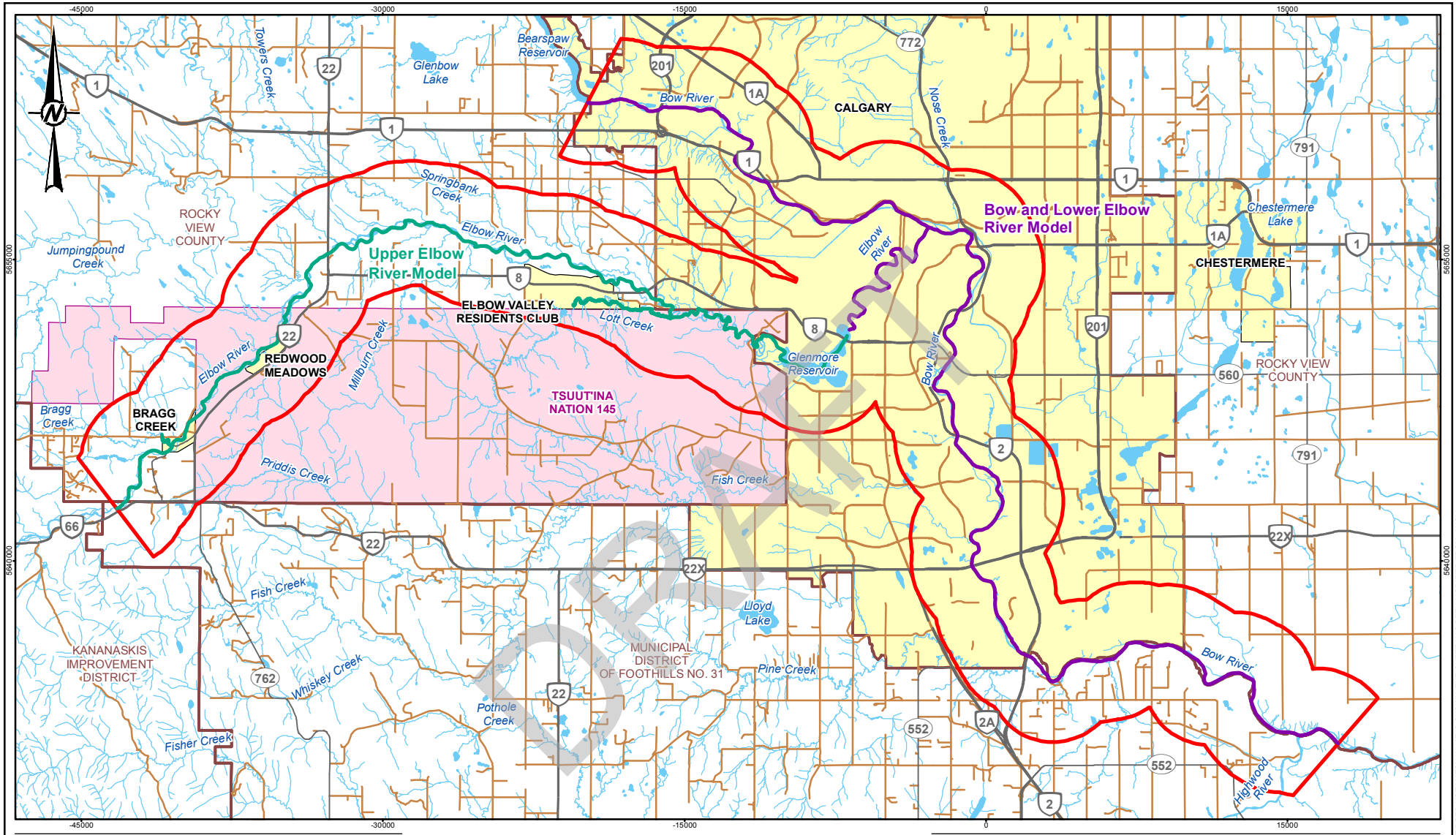

LEGEND

- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- LOCAL ROAD
- WATERCOURSE
- MUNICIPAL DISTRICT BOUNDARY
- URBAN AREA
- WATERBODY
- FIRST NATION RESERVE
- RIVER HAZARD STUDY AREA

HYDRAULIC MODEL

- BOW AND LOWER ELBOW
- UPPER ELBOW

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1:275,000 KILOMETRES

REFERENCE(S)

URBAN AREAS, MUNICIPAL DISTRICTS AND HYDROGRAPHY OBTAINED FROM ALTALIS, © GOVERNMENT OF ALBERTA 2015. ALL RIGHTS RESERVED.
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DATUM: NAD 83 CSRS PROJECTION: 3TM 114

CLIENT
ALBERTA ENVIRONMENT AND PARKS

Alberta Government

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-11-05
DESIGNED	W.PLOEGER
PREPARED	P.THIEDE
REVIEWED	W. PLOEGER
APPROVED	W. PLOEGER

PROJECT
BOW AND ELBOW RIVER HAZARD STUDY

TITLE
STUDY AREA

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2.0 AVAILABLE SPATIAL DATA

2.1 Data Sources

Readily available spatial data for the flood risk inventory included road data obtained from AltaLIS (the distributor of provincial spatial data). The City of Calgary provided additional road data, bridge data, railroad data, cadastral data, building footprints, and critical infrastructure information. Cadastral data for the areas outside of Calgary was provided by AEP.

2.2 Cadastral Data

Cadastral data (i.e., boundaries of registered land parcels) was provided by the City of Calgary for Calgary and by AEP for the areas outside of Calgary. The data was provided to Golder in October and November of 2016. No cadastral data was available for Tsuut'ina Nation, which includes Redwood Meadows.

2.3 Building Footprints

Building footprints within Calgary were provided by the City of Calgary in January 2017. This data included information on the use (e.g., commercial, industrial, residential, or secondary residential) and number of units in each building. Residential buildings were classified as single family or multifamily. Secondary residential buildings (e.g., sheds and garages) were not added to the inventory.

No building footprints were available for areas outside of Calgary, which were interpreted from available aerial imagery (see Section 3.2).

2.4 Roads, Bridges, and Railroads

Road data within Calgary was provided by the City of Calgary in October 2016. Road data for the areas outside of Calgary was obtained from AltaLIS in February 2017.

Bridge data within Calgary was provided by the City of Calgary in January 2017. This data includes the bridges over the Bow and Elbow Rivers, as well as all other roadway (e.g., overpasses), railway, and pedestrian bridges within Calgary. Bridge data for areas outside of Calgary was interpreted from aerial imagery (see Section 3.2).

Railroad data within Calgary was provided by the City of Calgary in October 2017. This data includes the CP and CN rail tracks as well as the CTrain light rail tracks. There are no railroads outside of Calgary within the study area.

2.5 Other Infrastructure Data

2.5.1 Data Sources

The City of Calgary provided critical infrastructure data in October 2016. The information from this dataset was reclassified and added to the buildings point datasets as non-residential buildings. The following categories of non-residential buildings were added:

- government buildings
- hospitals
- schools
- water treatment facilities
- other non-residential

Other features from the City of Calgary critical infrastructure dataset (e.g., emergency services buildings, parks and recreation infrastructure, etc.) were included in the non-residential buildings point dataset and classified as "other non-residential". No information on other infrastructure was provided for areas outside of Calgary, and the data for these areas was interpreted from aerial imagery (see Section 3.2). Government buildings, hospitals, and water treatment facilities included in the flood risk inventory are detailed in the following sections.

2.5.2 Government Buildings

The flood risk inventory includes the federal Harry Hays Building, the provincial McDougall Centre, the Calgary Courts Centre and the Calgary Municipal Building, which are all located in downtown Calgary, as well as other municipal buildings (i.e., the Manchester Centre and the Water Centre) located on and around Spiller Road.

2.5.3 Hospitals

The flood risk inventory includes: Foothills Medical Centre, Alberta Children's Hospital, Rockyview General Hospital, and South Health Campus, which are located within the study area.

2.5.4 Water Treatment Facilities

The flood risk inventory includes: Bearspaw Water Treatment Plant and Glenmore Water Treatment Plant; the Bonnybrook, Fish Creek, and Pine Creek Wastewater Treatment Plants in Calgary; and the Redwood Meadows and Bragg Creek Water Treatment Plants.

2.6 Census Data

Population statistics were obtained from Statistics Canada 2016 census dissemination blocks (Statistics Canada 2017). The census tallies the number of people whose usual place of residence is in the area. Dissemination blocks are the smallest geographic area for which population counts are disseminated in Canada.

3.0 INTERPRETED SPATIAL DATA

3.1 Interpretation Method

Additional data for roads, bridges, and other infrastructure was created by interpreting aerial imagery as required.

Cadastral data and building footprints were converted from polygons to points (centroids), large infrastructure features (e.g., hospitals) were reduced to single points, and census data was assigned to building points to allow for more efficient tallying of affected features.

The interpretation method is further described in the following sections.

3.2 Aerial Imagery Interpretation

Aerial imagery for the study area was collected by GeodesyGroup Inc. on May 6, 2016 (Golder 2017). The imagery has a 0.30 m Ground Sampling Distance (GSD) resolution and was provided as 4-band orthophotos.

The imagery was used to derive building and bridge points in areas outside of Calgary where no other spatial data was provided. It was also used to check and update (and add where required) building and infrastructure locations within Calgary, as well as roads throughout the study area.

3.3 Cadastral Data

The polygon datasets representing the land parcels were converted to points (centroids) for further analysis.

3.4 Building Footprints

The polygon datasets representing the building footprints within Calgary were converted to points (centroids) for further analysis. A manual check was performed to ensure that points created from the building footprints dataset did not create duplicates of the points derived from the critical infrastructure dataset.

3.5 Other Infrastructure Data

Large infrastructure features within Calgary were often represented by multiple features in the critical infrastructure dataset provided by the City of Calgary. All government buildings, hospital, and water treatment facilities in the study area were reduced to single points for the flood risk assessment. For example, the Manchester Centre in Calgary is represented by its centroid, even though it consists of a campus of multiple buildings.

Considering the size and importance of these features, manual checks were performed to determine whether they are affected by flood events, instead of relying on a point-based overlay analysis (see Section 4.2).

3.6 Census Data

To more accurately estimate the population affected by each flood event, the population count for each dissemination block was evenly distributed between all residential buildings that fall into the block. Where multifamily buildings existed, it was assumed that their average number of residents would be ten times that of the single family homes within the block. Retirement homes were treated as multifamily buildings. Spot checks showed reasonable estimates of residents per building.

Distributing the population numbers to the residential buildings ensures that residents are only counted as affected when their building falls within the inundation extent.

4.0 FLOOD RISK ASSESSMENT AND INVENTORY

4.1 Approach

After the spatial data was compiled, flood-affected features were identified by overlaying flood polygon datasets with the parcel, building, or infrastructure datasets. Features falling within a flood extent were flagged as being affected or potentially affected by the flood event.

Flood statistics were then generated by tallying all affected features for the following categories:

- land parcels
- residential buildings
- non-residential buildings
- major transportation infrastructure
- population (based on residential buildings)

The following sections provide further information on the analysis methodology and the results of the assessment.

4.2 Method

Using the inventory datasets developed and described in Sections 2 and 3, flood statistics were generated for the various flood events and flood scenarios considered in this study. The method to generate these flood statistics consisted of the following four steps:

- Flood polygons for the 2-, 5-, 10-, 20-, 35-, 50-, 75-, 100-, 200-, 350-, 500-, 750-, and 1,000-year open water flood and the design flood scenarios were generated as part of open water flood inundation and flood hazard mapping work undertaken for this study (Golder 2022 and 2023).
- For each mapped flood scenario, the flood polygons were compared to the inventory dataset in GIS. Land parcels, buildings, and infrastructure were classified as being "affected" if they were located within a mapped flood extent (centroid for parcels). Road and railroad lengths affected by a flooding were also calculated.
- The estimated population affected for each flood scenario was calculated by tallying the number of residents assigned to each affected residential building (see Section 3.6).
- The flood statistics for each category were summarized in a series of tables.

A manual check using aerial imagery was performed for non-residential buildings classified as government buildings, hospital, and water treatment facilities. As these large facilities are represented by single points in the flood risk inventory dataset, the result of the GIS-based overlay analysis may show the structure as not affected, even though some of the actual building footprint is located within the flood extent. The flood statistics were changed accordingly, to include buildings which footprints are affected.

Flood statistics were calculated for two areas of flooding based on flood inundation mapping (Golder 2022) and for multiple areas of flooding based on design flood hazard mapping (Golder 2023), as summarized below:

Flood Inundation Mapping:

- Direct flood inundation areas: Areas expected to be inundated for various flood events and which have a direct overland or other hydraulic connection to main river channels.
- Flood control structure failure inundation areas: Areas of residual risk behind flood control structures, which are protected for various flood events but could be flooded if the structures fail or do not perform as expected.

Flood Hazard Mapping:

- Floodway: The floodway typically represents the area of highest hazard for the 100-year design flood, where flows are deepest, fastest, and most destructive, but it can also be based on previously-defined floodways. The floodway always includes the main river channel and typically includes portions of adjacent floodplain.
- Flood Fringe: The flood fringe is the portion of the 100-year design flood area outside the floodway. The flood fringe can be divided into three sub-zones, with the following characteristics:
  - Flood Fringe: Areas of shallower or slower-moving water outside of the floodway.
  - High Hazard Flood Fringe: Areas of deeper or faster-moving water outside of the floodway.

- Protected Flood Fringe: Areas of residual risk behind flood control structures, which are protected for the 100-year design flood but could be flooded if the structures fail or do not perform as expected.

Unless otherwise noted, results for the design flood scenario assessment in Section 4.4 report statistics for each of the three flood fringe sub-zones separately.

All results are reported by local authority and aggregate totals. The local authorities include the following:

- City of Calgary;
- Rocky View County, and
- Foothills County.

4.3 Open Water Flood Inundation Scenarios

4.3.1 General

Flood inundation extents were delineated for 13 open water flood scenarios (Golder 2022). Flood statistics for direct and flood control structure failure inundation areas were calculated for each mapped flood event, and the results are presented in the following sections.

4.3.2 Land Parcels

A summary of land parcels affected by direct inundation is presented in Table 1, including total number, as well as a breakdown of parcels affected in each local authority. A summary of land parcels potentially affected by flood control structure failure is presented in Table 2, including total number, as well as a breakdown of parcels affected in each local authority. Figure 2 shows the parcels affected by direct inundation per flood scenario, and Figure 3 shows the parcels potentially affected by flood control structure failure per flood scenario.

Table 1: Affected Land Parcels – Open Water Flood Inundation Scenarios, Direct Inundation

Flood Event	City of Calgary	Rocky View County	Foothills County	Total
2-Year	17	10	2	**29**
5-Year	46	23	3	**72**
10-Year	131	52	4	**187**
20-Year	551	74	6	**631**
35-Year	1,295	89	8	**1,392**
50-Year	1,832	100	12	**1,944**
75-Year	2,418	107	14	**2,539**
100-Year	2,868	111	18	**2,997**
200-Year	6,110	131	23	**6,264**
350-Year	7,441	307	26	**7,774**
500-Year	8,800	316	28	**9,144**
750-Year	10,798	323	28	**11,149**
1,000-Year	12,036	330	28	**12,394**

Table 2: Affected Land Parcels – Open Water Flood Inundation Scenarios, Flood Control Structure Failure

Flood Event	City of Calgary	Rocky View County	Foothills County	Total
2-Year	0	0	0	**0**
5-Year	0	0	0	**0**
10-Year	8	0	0	**8**
20-Year	161	11	0	**172**
35-Year	493	32	0	**525**
50-Year	644	35	0	**679**
75-Year	1,407	69	0	**1,476**
100-Year	1,570	82	0	**1,652**
200-Year	63	133	0	**196**
350-Year	0	0	0	**0**
500-Year	0	0	0	**0**
750-Year	0	0	0	**0**
1,000-Year	0	0	0	**0**

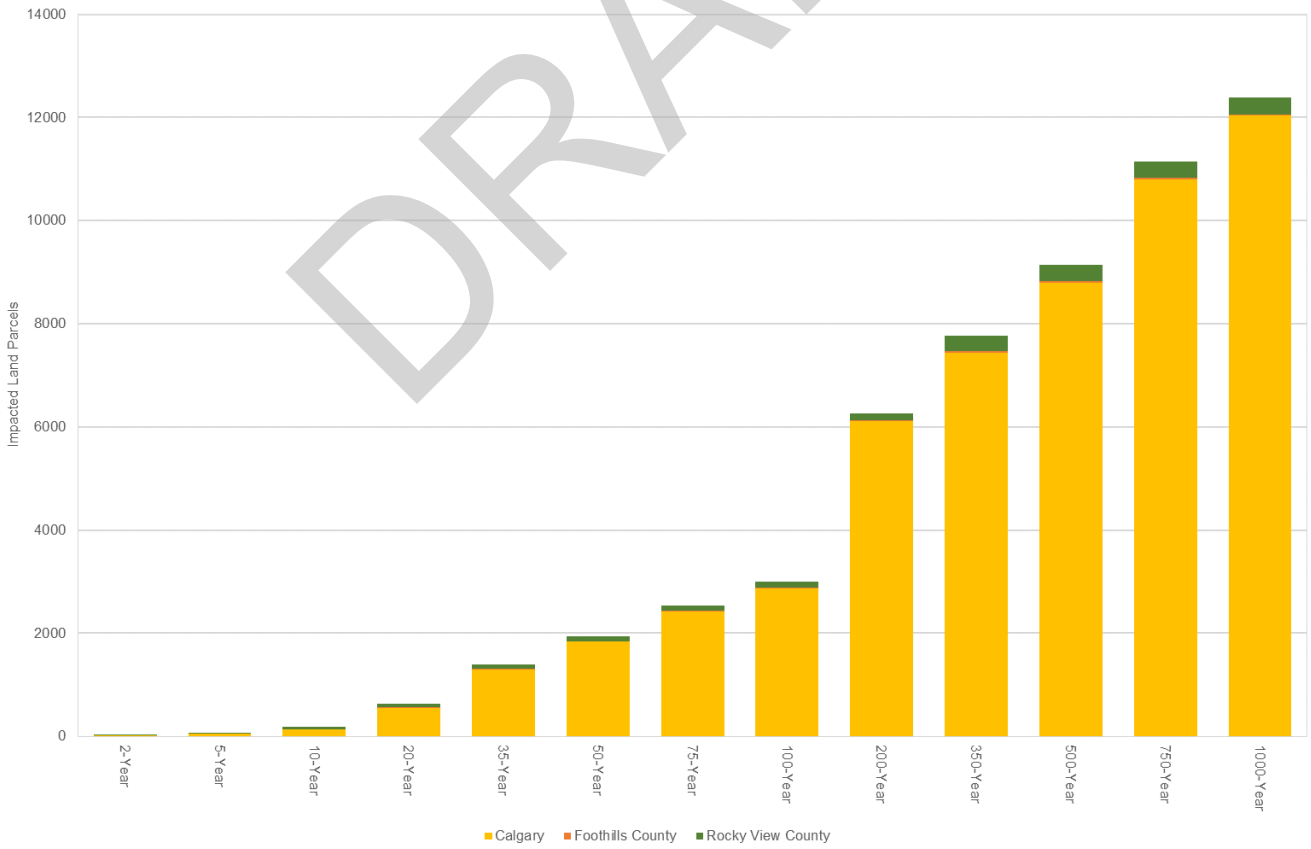

Figure 2: Affected Land Parcels for the Open Water Flood Inundation Scenarios, Direct Inundation

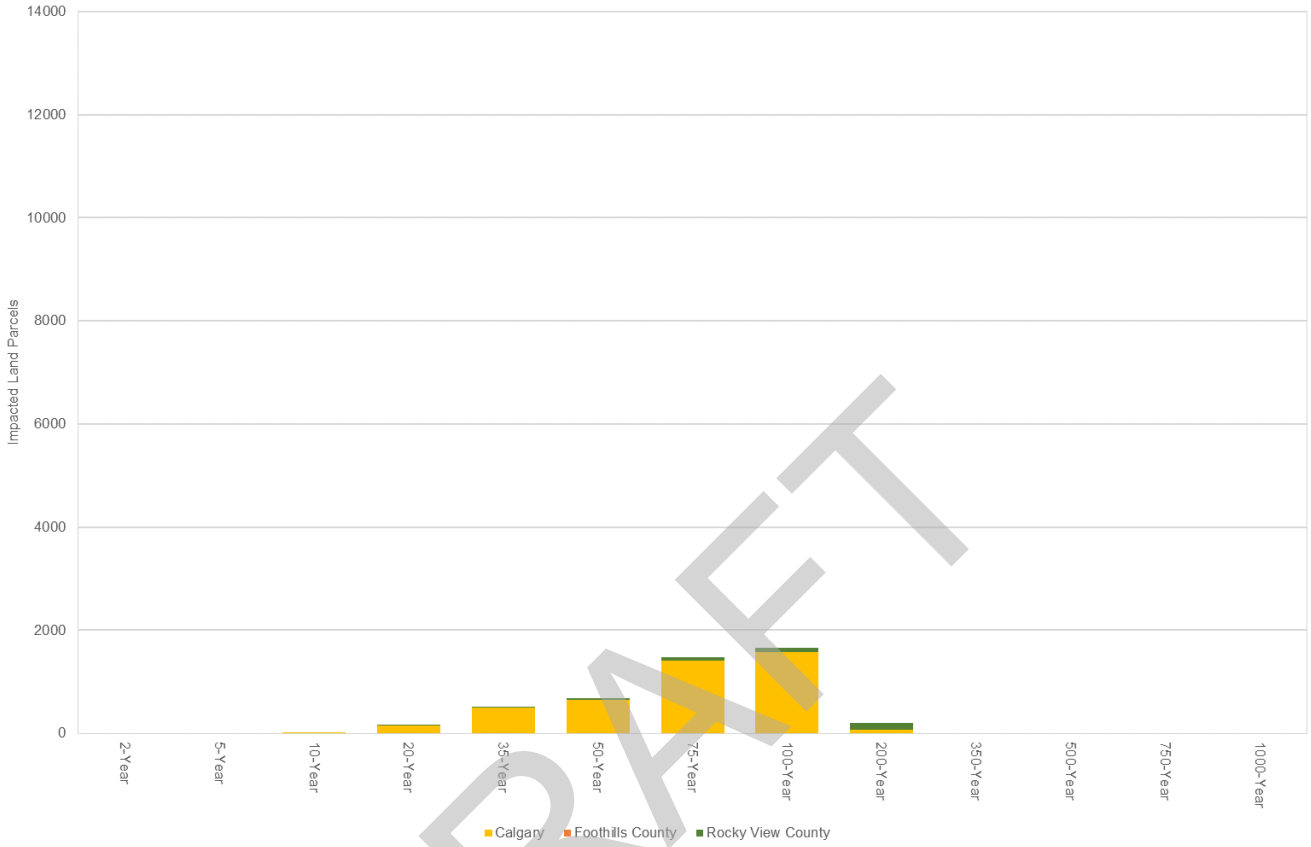

Figure 3: Affected Land Parcels for the Open Water Flood Inundation Scenarios, Flood Control Structure Failure

In the study area, the number of parcels affected by direct inundation remains low until the 5-year flood and then increases steadily from the 10-year to the 100-year floods. A significant increase occurs between the 100-year and 350-year floods in Calgary, and then the number of parcels affected by direct inundation increases steadily up to the 1000-year flood. The number of parcels affected by potential flood control structure failure peaks at the 100-year flood and then decreases as flood control structure failure inundation is replaced by direct inundation.

In Calgary, the number of parcels affected by direct inundation remains low until the 5-year flood. A significant increase in the number of parcels affected occurs between the 20-year and 35-year floods, as parts of the Bowness, Erlton, Mission, Roxboro, and Rideau Park neighbourhoods experience direct inundation. An additional significant increase occurs between the 100-year and 350-year floods, as large parts of the Inglewood, Hillhurst, West Hillhurst, Sunnyside, and Downtown neighbourhoods experience direct inundation instead of potential flood control structure failure. Bridgeland and the densely-populated Beltline and Lower Mount Royal neighbourhoods also experience increased direct inundation. The number of parcels affected by direct inundation then increases steadily up to the 1000-year flood.

The number of parcels affected by potential flood control structure failure steadily increases between the 20-year and 100-year floods, mainly in the Inglewood, Hillhurst, West Hillhurst, Sunnyside, and Downtown neighbourhoods. The number of affected parcels then decreases sharply, as potential flood control structure inundation is replaced by direct inundation.

In Rocky View County, the number of parcels affected by direct inundation remains zero until the 10-year flood and then increases very slowly from the 20-year to the 200-year floods. A significant increase in the number of parcels affected occurs between the 200-year and 350-year floods, as large areas of potential flood control structure failure inundation in Bragg Creek and Redwood Meadows are replaced by direct inundation. All flood control structure failure inundation is replaced by direct inundation at the 350-year flood, and the number of parcels affected by direct inundation increases steadily up to the 1000-year flood.

In Foothills County, the number of parcels affected by direct inundation increases steadily from the 2-year to the 1000-year floods, reaching a maximum of 28 parcels.

For the 100-year flood, 2,997 land parcels would be directly inundated and 1,652 would be potentially inundated in the case of flood control structure failure. In comparison, 12,394 land parcels would be directly inundated for the 1,000-year flood.

4.3.3 Residential Buildings

A summary of affected residential buildings for each local authority is presented in Tables 3 to 5, including total numbers, as well as a breakdown of residential buildings affected by direct inundation and potential flood control structure failure inundation. Figures 4 to 6 show affected residential and non-residential buildings per flood scenario (see Section 4.3.4 for non-residential buildings).

Table 3: Affected Residential Buildings City of Calgary – Open Water Flood Inundation Scenarios

Flood Event	2-Year	5-Year	10-Year	20-Year	35-Year	50-Year	75-Year	100-Year	200-Year	350-Year	500-Year	750-Year	1,000-Year
Total	**1**	**1**	**21**	**460**	**1,230**	**1,670**	**2,597**	**3,031**	**4,175**	**4,876**	**5,649**	**6,930**	**7,875**
Single Family	1	1	16	423	1,063	1,421	2,252	2,606	3,653	4,203	4,857	6,030	6,878
Multifamily	0	0	5	37	164	241	336	413	506	653	770	876	972
Retirement Home	0	0	0	0	3	8	9	12	16	20	22	24	25
Direct Inundation	**1**	**1**	**20**	**319**	**816**	**1,133**	**1,513**	**1,832**	**4,171**	**4,876**	**5,649**	**6,930**	**7,875**
Single Family	1	1	15	287	705	965	1,297	1,557	3,652	4,203	4,857	6,030	6,878
Multifamily	0	0	5	32	108	163	211	267	503	653	770	876	972
Retirement Home	0	0	0	0	3	5	5	8	16	20	22	24	25
Flood Control Structure Failure	**0**	**0**	**1**	**141**	**414**	**537**	**1,084**	**1,199**	**4**	**0**	**0**	**0**	**0**
Single Family	0	0	1	136	358	456	955	1,049	1	0	0	0	0
Multifamily	0	0	0	5	56	78	125	146	3	0	0	0	0
Retirement Home	0	0	0	0	0	3	4	4	0	0	0	0	0

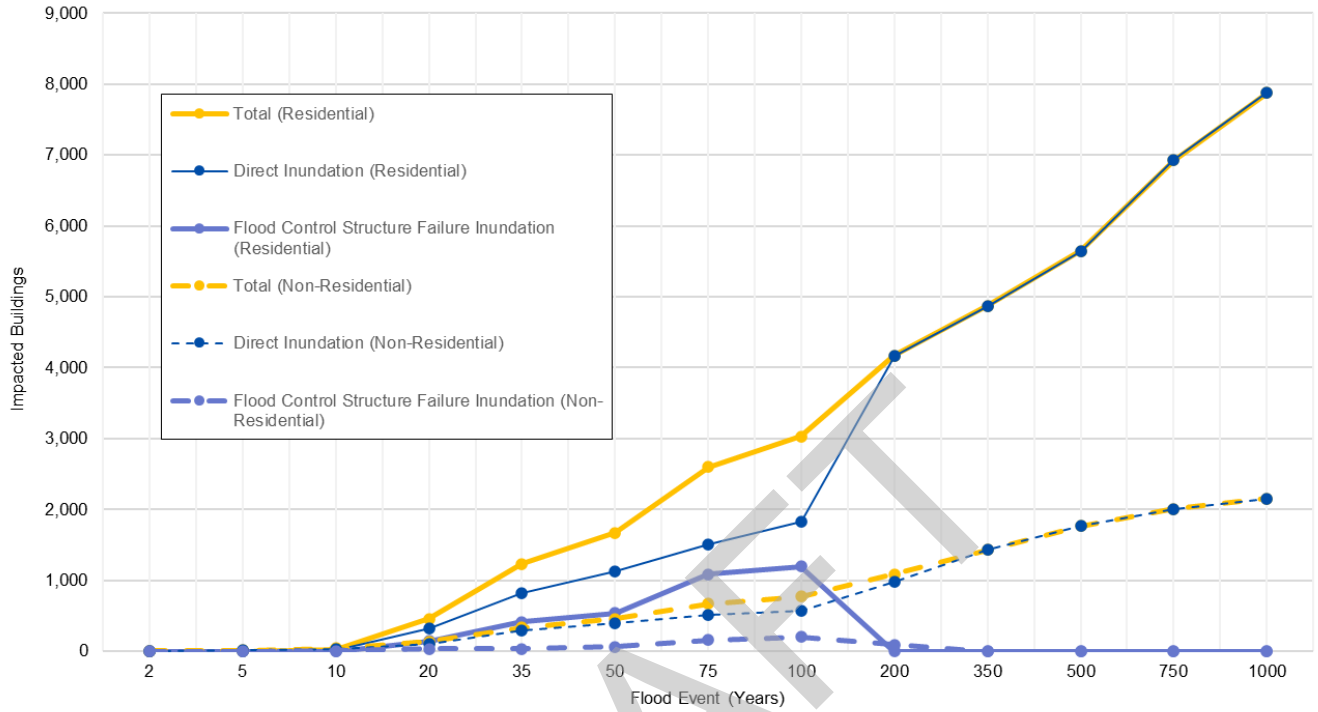

Figure 4: Affected Buildings City of Calgary - Open Water Flood Inundation Scenarios

Table 4: Affected Residential Buildings Rocky View County – Open Water Flood Inundation Scenarios

Flood Event	2-Year	5-Year	10-Year	20-Year	35-Year	50-Year	75-Year	100-Year	200-Year	350-Year	500-Year	750-Year	1,000-Year
Total	**0**	**0**	**0**	**58**	**112**	**141**	**203**	**252**	**362**	**466**	**504**	**525**	**536**
Single Family	0	0	0	58	112	141	203	252	362	466	504	525	536
Multifamily	0	0	0	0	0	0	0	0	0	0	0	0	0
Retirement Home	0	0	0	0	0	0	0	0	0	0	0	0	0
Direct Inundation	**0**	**0**	**0**	**0**	**4**	**7**	**7**	**9**	**18**	**466**	**504**	**525**	**536**
Single Family	0	0	0	0	4	7	7	9	18	466	504	525	536
Multifamily	0	0	0	0	0	0	0	0	0	0	0	0	0
Retirement Home	0	0	0	0	0	0	0	0	0	0	0	0	0
Flood Control Structure Failure	**0**	**0**	**0**	**58**	**108**	**134**	**196**	**243**	**344**	**0**	**0**	**0**	**0**
Single Family	0	0	0	58	108	134	196	243	344	0	0	0	0
Multifamily	0	0	0	0	0	0	0	0	0	0	0	0	0
Retirement Home	0	0	0	0	0	0	0	0	0	0	0	0	0

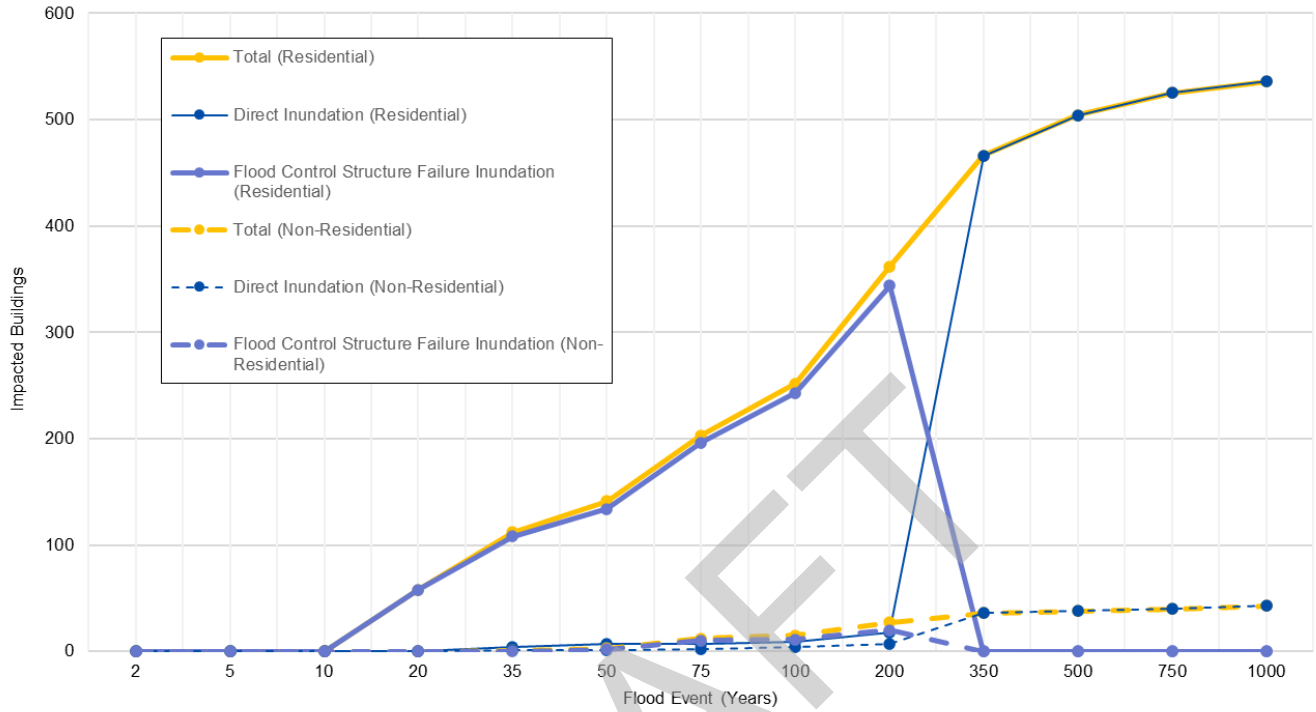

Figure 5: Affected Buildings Rocky View County - Open Water Flood Inundation Scenarios

Table 5: Affected Residential Buildings Foothills County – Open Water Flood Inundation Scenarios

Flood Event	2-Year	5-Year	10-Year	20-Year	35-Year	50-Year	75-Year	100-Year	200-Year	350-Year	500-Year	750-Year	1,000-Year
Total	**0**	**0**	**0**	**0**	**0**	**1**	**2**	**3**	**6**	**8**	**10**	**10**	**10**
Single Family	0	0	0	0	0	1	2	3	6	8	10	10	10
Multifamily	0	0	0	0	0	0	0	0	0	0	0	0	0
Retirement Home	0	0	0	0	0	0	0	0	0	0	0	0	0
Direct Inundation	**0**	**0**	**0**	**0**	**0**	**1**	**2**	**3**	**6**	**8**	**10**	**10**	**10**
Single Family	0	0	0	0	0	1	2	3	6	8	10	10	10
Multifamily	0	0	0	0	0	0	0	0	0	0	0	0	0
Retirement Home	0	0	0	0	0	0	0	0	0	0	0	0	0
Flood Control Structure Failure	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Single Family	0	0	0	0	0	0	0	0	0	0	0	0	0
Multifamily	0	0	0	0	0	0	0	0	0	0	0	0	0
Retirement Home	0	0	0	0	0	0	0	0	0	0	0	0	0

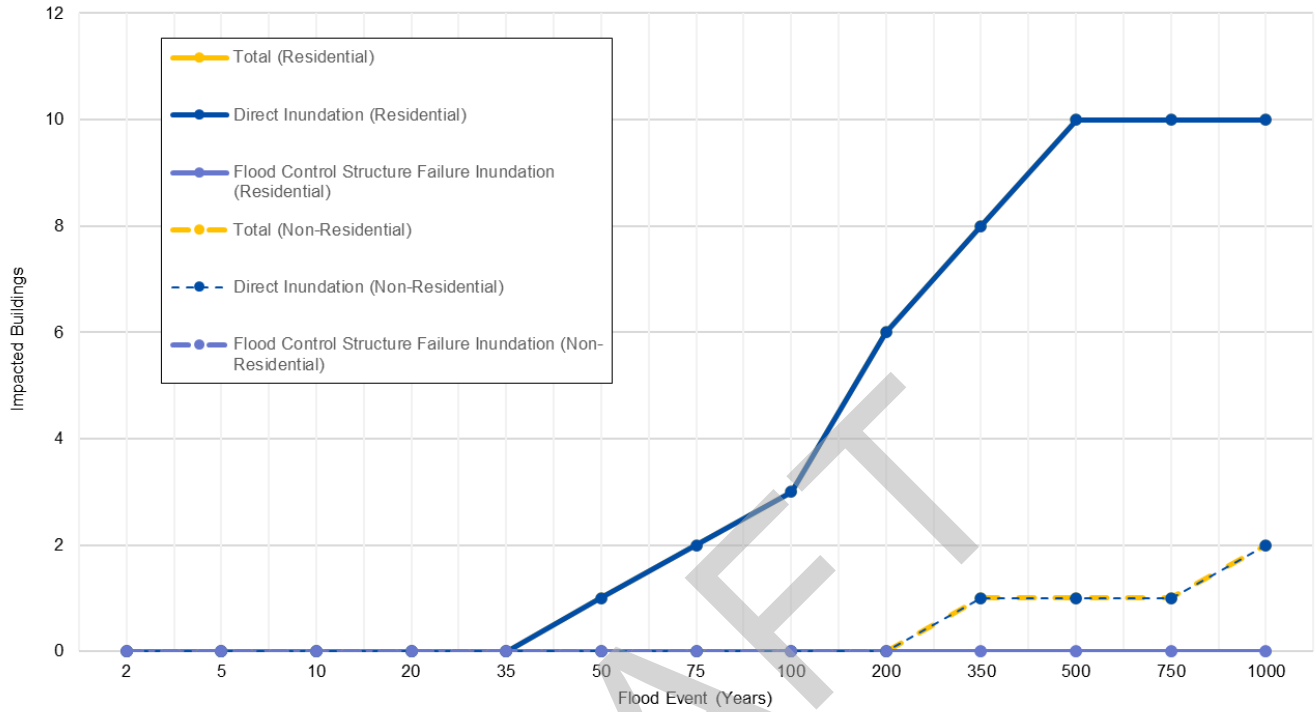

Figure 6: Affected Buildings Foothills County - Open Water Flood Inundation Scenarios

In the study area, the number of residential buildings affected by direct inundation remains low until the 5-year flood and then increases steadily from the 10-year to the 100-year floods. A significant increase occurs between the 100-year and 350-year floods in Calgary, and then the number of residential buildings affected by direct inundation increases steadily up to the 1000-year flood. The number of residential buildings affected by potential flood control structure failure peaks at the 100-year flood and then decreases as flood control structure failure inundation is replaced by direct inundation.

In Calgary, the number of residential buildings affected by direct inundation remains low until the 5-year flood. A significant increase in the number of residential buildings affected occurs between the 20-year and 35-year floods, as parts of the Bowness, Erlton, Mission, Roxboro, and Rideau Park neighbourhoods experience direct inundation. An additional, more significant increase occurs between the 100 year and 350-year floods, as large parts of the Inglewood, Hillhurst, West Hillhurst, Sunnyside, and Downtown neighbourhoods experience direct inundation instead of potential flood control structure failure. Bridgeland and the densely-populated Beltline and Lower Mount Royal neighbourhoods also experience increased direct inundation. The number of residential buildings affected by direct inundation then increases steadily up to the 1000-year flood.

The number of residential buildings affected by potential flood control structure failure steadily increases between the 20-year and 100-year floods, mainly in the Inglewood, Hillhurst, West Hillhurst, Sunnyside, and Downtown neighbourhoods. The number of affected residential buildings then decreases sharply, as potential flood control structure inundation is replaced by direct inundation.

In Rocky View County, the number of residential buildings affected by direct inundation remains zero until the 10-year flood and then increases very slowly from the 20-year to the 200-year floods. A significant increase in the

number of residential buildings affected occurs between the 200-year and 350-year floods, as large areas of potential flood control structure failure inundation in Bragg Creek and Redwood Meadows are replaced by direct inundation. All flood control structure failure inundation is replaced by direct inundation at the 350-year flood, and the number of residential buildings affected by direct inundation increases steadily up to the 1000-year flood.

In Foothills County, the number of residential buildings affected by direct inundation increases steadily from the 50-year to the 1000-year floods, reaching a maximum of ten buildings.

At the 100-year flood, 1,844 residential buildings would be directly inundated and 1,442 would be potentially inundated in the case of flood control structure failure. In comparison, 8,421 residential buildings would be directly inundated for the 1,000-year flood.

4.3.4 Non-Residential Buildings

A summary of affected non-residential buildings for each local authority is presented in Tables 6 to 8, including total numbers, as well as a breakdown of non-residential buildings affected by direct inundation and potential flood control structure failure inundation. Figures 4 to 6 show affected buildings per flood scenario, including non-residential buildings.

In the study area, the number of non-residential buildings affected by direct inundation remains low until the 5-year flood and then increases steadily from the 10-year to the 100-year floods. A significant increase occurs between the 100-year and 350-year floods in Calgary, and then the number of non-residential buildings affected by direct inundation increases steadily up to the 1000-year flood. The number of non-residential buildings affected by potential flood control structure failure peaks at the 100-year flood and then decreases as flood control structure failure inundation is replaced by direct inundation.

In Calgary, the number of non-residential buildings affected by direct inundation remains low until the 5-year flood. A significant increase in the number of non-residential buildings affected occurs between the 20-year and 35-year floods, as parts of the Bowness, Erlton, Mission, Roxboro, and Rideau Park neighbourhoods experience direct inundation. An additional, more significant increase occurs between the 100-year and 350-year floods, as large parts of the Inglewood, Hillhurst, West Hillhurst, Sunnyside, and Downtown neighbourhoods experience direct inundation instead of potential flood control structure failure. Bridgeland and the Beltline and Lower Mount Royal neighbourhoods also experience increased direct inundation. The number of non-residential buildings affected by direct inundation then increases steadily up to the 1000-year flood.

The number of non-residential buildings affected by potential flood control structure failure steadily increases between the 20-year and 100-year floods, mainly in the Inglewood, Hillhurst, West Hillhurst, Sunnyside, and Downtown neighbourhoods. The number then decreases sharply, as potential flood control structure inundation is replaced by direct inundation.

In Rocky View County, number of non-residential buildings affected by direct inundation remains zero until the 35-year flood and then increases slowly up to the 1000-year flood. The number of non-residential buildings affected by flood control structure failure slowly increases between the 50-year and the 200-year floods. All flood control structure failure inundation is replaced by direct inundation starting at the 350-year flood.

In Foothills County, the number of non-residential buildings affected by direct inundation increases very slowly from the 350-year to the 1000-year floods, reaching a maximum of two buildings.

At the 100-year flood, 576 non-residential buildings would be directly inundated and 215 would be potentially inundated in the case of flood control structure failure. In comparison, 2,202 non-residential buildings would be directly inundated for the 1,000-year flood.

No critical, non-residential buildings (i.e., government buildings, hospitals, schools, or water treatment facilities) are affected up to the 20-year flood. Four schools would be affected at the 35-year flood, with the number of affected schools increasing to 27 at the 1,000-year flood. The following sections provide additional information on some of the other more critical non-residential building infrastructure.

Table 6: Affected Non-Residential Buildings City of Calgary – Open Water Flood Inundation Scenarios

Flood Event	2-Year	5-Year	10-Year	20-Year	35-Year	50-Year	75-Year	100-Year	200-Year	350-Year	500-Year	750-Year	1,000-Year
Total	**6**	**11**	**45**	**139**	**331**	**456**	**670**	**776**	**1,084**	**1,430**	**1,764**	**2,010**	**2,157**
Commercial	1	1	5	17	111	166	282	326	470	668	832	966	1,054
Industrial	0	0	2	4	9	17	29	36	66	112	157	172	183
Government Building	0	0	0	0	1	1	1	1	1	3	4	4	4
Hospital	0	0	0	0	0	0	0	0	0	0	0	0	0
School	0	0	0	0	4	7	12	16	17	18	21	25	27
Water Treatment Facility	0	0	0	0	1	1	1	1	2	2	3	3	3
Other Non-Residential	5	10	38	118	205	264	345	396	528	627	747	840	886
Direct Inundation	**6**	**11**	**36**	**105**	**296**	**393**	**508**	**572**	**988**	**1,430**	**1,764**	**2,010**	**2,157**
Commercial	1	1	1	5	109	158	211	238	463	668	832	966	1,054
Industrial	0	0	0	1	7	11	13	14	29	112	157	172	183
Government Building	0	0	0	0	0	0	0	0	0	3	4	4	4
Hospital	0	0	0	0	0	0	0	0	0	0	0	0	0
School	0	0	0	0	4	6	7	10	17	18	21	25	27
Water Treatment Facility	0	0	0	0	0	0	0	0	1	2	3	3	3
Other Non-Residential	5	10	35	99	176	218	277	310	478	627	747	840	886
Flood Control Structure Failure	**0**	**0**	**9**	**34**	**35**	**63**	**162**	**204**	**96**	**0**	**0**	**0**	**0**
Commercial	0	0	4	12	2	8	71	88	7	0	0	0	0
Industrial	0	0	2	3	2	6	16	22	37	0	0	0	0
Government Building	0	0	0	0	1	1	1	1	1	0	0	0	0
Hospital	0	0	0	0	0	0	0	0	0	0	0	0	0
School	0	0	0	0	0	1	5	6	0	0	0	0	0
Water Treatment Facility	0	0	0	0	1	1	1	1	1	0	0	0	0
Other Non-Residential	0	0	3	19	29	46	68	86	50	0	0	0	0

Table 7: Affected Non-Residential Buildings Rocky View County – Open Water Flood Inundation Scenarios

Flood Event	2-Year	5-Year	10-Year	20-Year	35-Year	50-Year	75-Year	100-Year	200-Year	350-Year	500-Year	750-Year	1,000-Year
Total	**0**	**0**	**0**	**0**	**1**	**3**	**12**	**15**	**27**	**36**	**38**	**40**	**43**
Commercial	0	0	0	0	0	1	9	12	20	26	28	29	31
Industrial	0	0	0	0	0	0	0	0	0	0	0	0	0
Government Building	0	0	0	0	0	0	0	0	0	0	0	0	0
Hospital	0	0	0	0	0	0	0	0	0	0	0	0	0
School	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Treatment Facility	0	0	0	0	0	0	0	0	0	0	0	0	1
Other Non-Residential	0	0	0	0	1	2	3	3	7	10	10	11	11
Direct Inundation	**0**	**0**	**0**	**0**	**1**	**1**	**2**	**4**	**7**	**36**	**38**	**40**	**43**
Commercial	0	0	0	0	0	0	1	3	5	26	28	29	31
Industrial	0	0	0	0	0	0	0	0	0	0	0	0	0
Government Building	0	0	0	0	0	0	0	0	0	0	0	0	0
Hospital	0	0	0	0	0	0	0	0	0	0	0	0	0
School	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Treatment Facility	0	0	0	0	0	0	0	0	0	0	0	0	1
Other Non-Residential	0	0	0	0	1	1	1	1	2	10	10	11	11
Flood Control Structure Failure	**0**	**0**	**0**	**0**	**0**	**2**	**10**	**11**	**20**	**0**	**0**	**0**	**0**
Commercial	0	0	0	0	0	1	8	9	15	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0	0
Government Building	0	0	0	0	0	0	0	0	0	0	0	0	0
Hospital	0	0	0	0	0	0	0	0	0	0	0	0	0
School	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Treatment Facility	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Residential	0	0	0	0	0	1	2	2	5	0	0	0	0

Table 8: Affected Non-Residential Buildings Foothills County – Open Water Flood Inundation Scenarios

Flood Event	2-Year	5-Year	10-Year	20-Year	35-Year	50-Year	75-Year	100-Year	200-Year	350-Year	500-Year	750-Year	1,000-Year
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**2**
Commercial	0	0	0	0	0	0	0	0	0	1	1	1	2
Industrial	0	0	0	0	0	0	0	0	0	0	0	0	0
Government Building	0	0	0	0	0	0	0	0	0	0	0	0	0
Hospital	0	0	0	0	0	0	0	0	0	0	0	0	0
School	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Treatment Facility	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Residential	0	0	0	0	0	0	0	0	0	0	0	0	0
Direct Inundation	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**2**
Commercial	0	0	0	0	0	0	0	0	0	1	1	1	2
Industrial	0	0	0	0	0	0	0	0	0	0	0	0	0
Government Building	0	0	0	0	0	0	0	0	0	0	0	0	0
Hospital	0	0	0	0	0	0	0	0	0	0	0	0	0
School	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Treatment Facility	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Residential	0	0	0	0	0	0	0	0	0	0	0	0	0
Flood Control Structure Failure	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Commercial	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0	0
Government Building	0	0	0	0	0	0	0	0	0	0	0	0	0
Hospital	0	0	0	0	0	0	0	0	0	0	0	0	0
School	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Treatment Facility	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Residential	0	0	0	0	0	0	0	0	0	0	0	0	0

Government Buildings

The federal Harry Hays building in Calgary would be affected by potential flood control structure failure inundation starting at the 35-year flood and by direct inundation starting at the 200-year flood. The Calgary Municipal Building and the Calgary Courts Centre would be affected by direct inundation starting at the 350-year flood. The provincial McDougall Centre in Calgary would be affected by direct inundation at the 500-year flood.

Hospitals

No hospitals in the study area would be affected by any of the open water flood events.

Water Treatment Facilities

The Bearspaw Water Treatment Plant would be affected by direct inundation starting at the 200-year flood, but all impacts are limited to the water intake structure only. The Glenmore Water Treatment Plant would not be affected by any of the open water flood events.

The Bonnybrook Wastewater Treatment Plant would be affected by potential flood control structure failure starting at the 35-year flood and by direct inundation starting at the 350-year flood. The Fish Creek Wastewater Treatment Plant would be affected by direct inundation starting at the 500-year flood. The Pine Creek Wastewater Treatment Plant itself would not be affected by any of the open water flood events. However, access would potentially be cut off starting at the 500-year flood.

The Redwood Meadows Water Treatment Plant would be potentially inundated in the case of flood control structure failure starting at the 35-year flood and would be affected by direct inundation starting at the 350-year flood. The Bragg Creek Water Treatment Plant would not be affected by any open water flood events.

4.3.5 Major Transportation Infrastructure

Roads

A summary of roads affected by direct inundation is presented in Table 9, including total lengths, as well as a breakdown of roads affected in each local authority. A summary of roads potentially affected by flood control structure failure is presented in Table 10, including total lengths, as well as a breakdown of roads affected in each local authority. Figure 7 shows the length of roads affected by direct inundation per flood scenario, and Figure 8 shows the length of roads potentially affected by flood control structure failure per flood scenario.

Table 9: Lengths of Affected Roads – Open Water Flood Inundation Scenarios, Direct Inundation

Flood Event	Length (km)			
	City of Calgary	Rocky View County	Foothills County	Total
2-Year	0.7	0.1	0.1	**0.8**
5-Year	1.3	0.8	0.1	**2.2**
10-Year	6.0	2.0	0.2	**8.2**
20-Year	23.1	5.6	0.5	**29.2**
35-Year	58.2	7.7	1.0	**67.0**
50-Year	77.5	10.0	2.9	**90.5**
75-Year	96.9	11.6	3.6	**112.1**
100-Year	114.3	12.6	4.8	**131.8**
200-Year	215.6	16.5	6.5	**238.6**
350-Year	282.0	37.6	9.1	**328.7**
500-Year	351.0	40.4	9.8	**401.2**
750-Year	413.8	42.3	10.2	**466.4**
1,000-Year	453.6	44.1	10.9	**508.6**

Table 10: Lengths of Affected Roads – Open Water Flood Inundation Scenarios, Flood Control Structure Failure

Flood Event	Length (km)			
	City of Calgary	Rocky View County	Foothills County	Total
2-Year	0.0	0.0	0.0	**0.0**
5-Year	0.2	0.0	0.0	**0.2**
10-Year	2.7	0.0	0.0	**2.7**
20-Year	7.3	3.6	0.0	**10.9**
35-Year	13.8	5.6	0.0	**19.4**
50-Year	18.6	6.8	0.0	**25.4**
75-Year	43.4	8.8	0.0	**52.2**
100-Year	50.2	10.0	0.0	**60.2**
200-Year	10.4	13.7	0.0	**24.1**
350-Year	0.0	0.0	0.0	**0.0**
500-Year	0.0	0.0	0.0	**0.0**
750-Year	0.0	0.0	0.0	**0.0**
1,000-Year	0.0	0.0	0.0	**0.0**

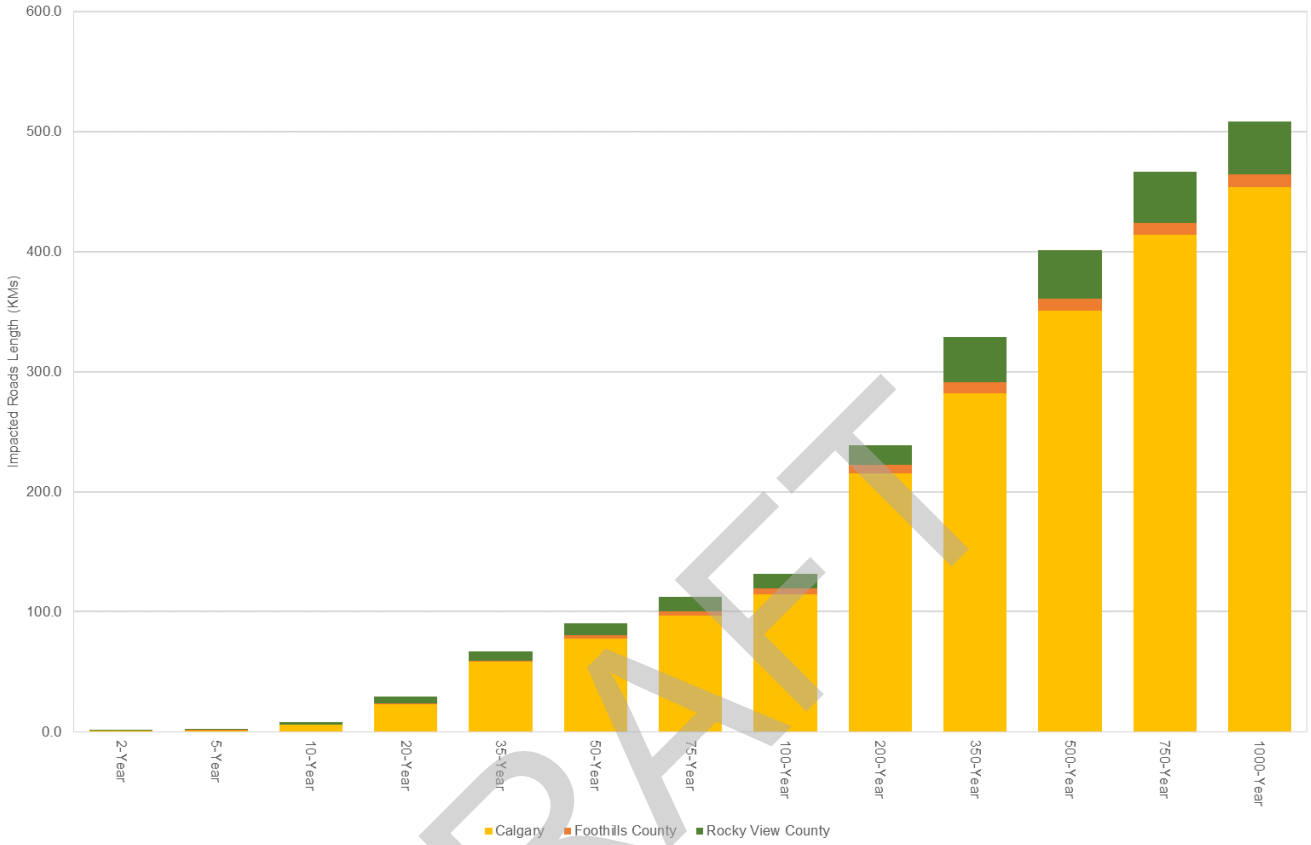

Figure 7: Lengths of Affected Roads – Open Water Flood Inundation Scenarios, Direct Inundation

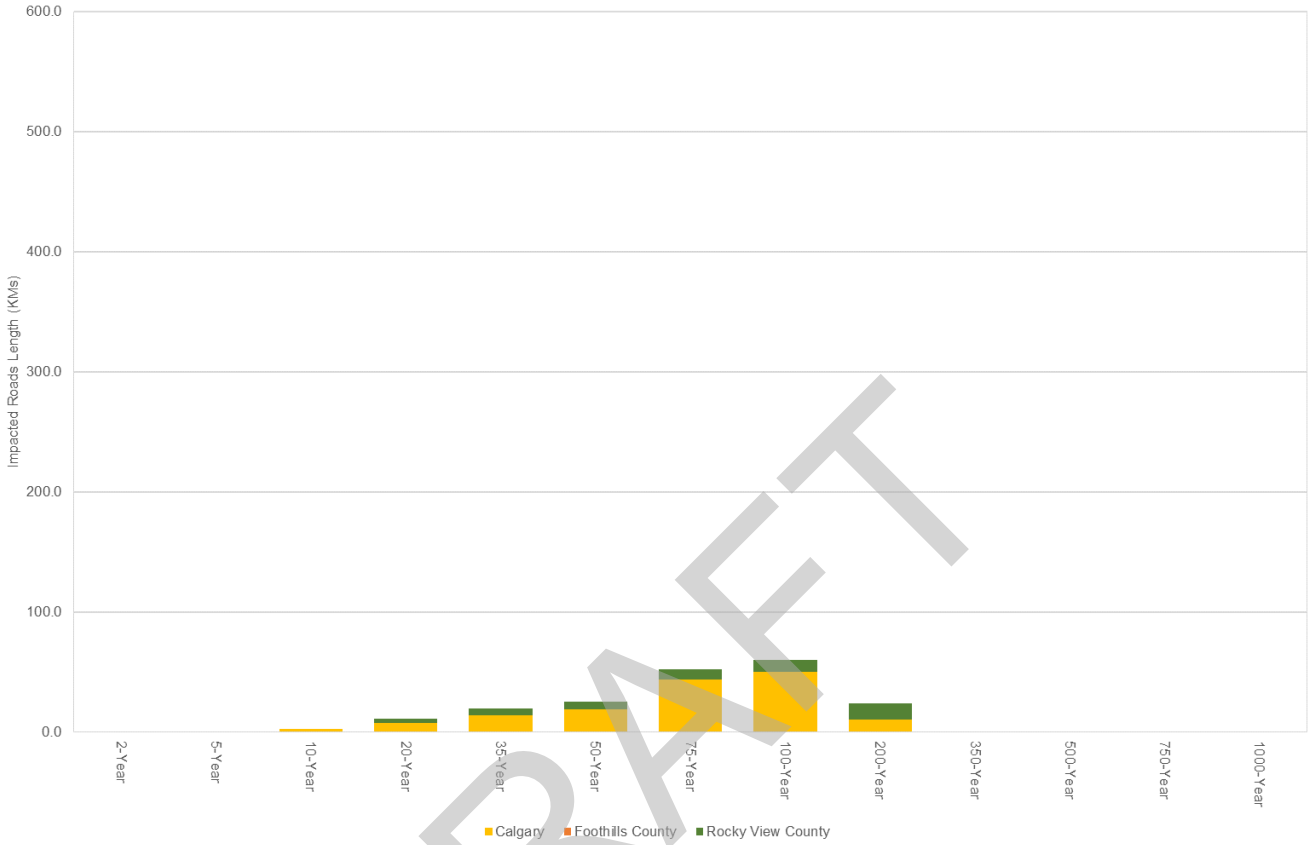

Figure 8: Lengths of Affected Roads – Open Water Flood Inundation Scenarios, Flood Control Structure Failure

In the study area, the length of roads affected by direct inundation remains low until the 5-year flood and then increases steadily from the 10-year to the 100-year floods. A significant increase occurs between the 100-year and 200-year floods in Calgary, and then the length of affected roads increases steadily up to the 1000-year flood. The length of roads affected by flood control structure failure increases up to the 100-year flood and then decreases as flood control structure failure inundation is replaced by direct inundation.

In Calgary, the length of roads affected by direct inundation remains low until the 5-year flood and increases steadily from the 10-year to the 100-year floods. A significant increase occurs between the 100-year and 200-year floods, as large parts of the Inglewood, Hillhurst, West Hillhurst, and Bridgeland neighbourhoods experience direct inundation, and then increases steadily up to the 1000-year flood. The length of roads affected by flood control structure failure increases up to the 100-year flood and then decreases as flood control structure failure inundation is replaced by direct inundation.

The following list provides details on direct inundation impacts on major roads within Calgary.

- 16th Avenue NW (Trans-Canada Highway) in Montgomery, east of the Trans-Canada Highway Bridge, starting at the 350-year flood.
- Crowchild Trail NW in West Hillhurst, between Kensington Road NW and the Bow River, starting at the 200-year flood.

- 14th Street NW in Hillhurst, between 6th Avenue NW and the Bow River, starting at the 200-year flood
- 10th Street NW in Hillhurst, between 5th Avenue NW and the Bow River, starting at the 200-year flood.
- Centre Street South in Chinatown and Downtown, between 6th Avenue SE and the Bow River, starting at the 200-year flood.
- Edmonton Trail, including 4th Street NE in Bridgeland north of the Old and New Langevin Bridges, starting at the 100-year flood.
- Memorial Drive NE in Bridgeland starting at the 100-year flood.
- Edmonton Trail, 4th Avenue SE, and 5th Avenue SE in East Village and Downtown, southwest of the Old and New Langevin Bridges, starting at the 200-year flood.
- Memorial Drive NW in West Hillhurst, Hillhurst, and Sunnyside starting at the 200-year flood.
- Blackfoot Trail SE in Inglewood, between 9th Avenue SE and 17A Street SE, starting at the 200-year flood.
- Deerfoot Trail at the intersection with 17th Avenue SE starting at the 350-year flood.
- Deerfoot Trail at the intersection with 24th Street SE starting at the 500-year flood.
- Deerfoot Trail south of the intersection with Southland Drive SE, south of the intersection with Glenmore Trail SE, and east of the Calf Robe Bridge, starting at the 500-year flood.
- An approximately 700 m long stretch of Deerfoot Trail between the Calf Robe Bridge and the intersection with Glenmore Trail NE starting at the 1,000-year flood.
- Ogden Road SE between 16A Street SE and the Bow River starting at the 350-year flood.
- Glenmore Trail SE at the Deerfoot Trail intersection starting at the 350-year flood.
- Elbow Drive SW between the 4th Street SW intersection and the Elboya Bridge starting at the 35-year flood.
- 4 Street SW between 10th Avenue SW and the Mission Bridge starting at the 35-year flood.
- McLeod Trail SW between 10th Avenue SE and Erlton starting at the 35-year flood.
- 9th Avenue SE south of Fort Calgary starting at the 200-year flood.
- 9th Avenue SE in Inglewood, between the 9th Avenue Bridge and Blackfoot Trail SE, starting at the 200-year flood.

In Rocky View County, the length of roads affected by direct inundation remains low until the 5-year flood and increases steadily from the 10-year to the 200-year floods. A significant increase occurs between the 200-year and 350-year floods, as large areas of potential flood control structure failure inundation in Bragg Creek and Redwood Meadows are replaced by direct inundation. All flood control structure failure inundation is replaced by direct inundation at the 350-year flood, and the length of roads affected by direct inundation increases steadily up to the 1000-year flood.

The following list provides details on direct inundation impacts on major roads within Rocky View County:

- Highway 758 within Bragg Creek starting at the 350-year flood.
- Highway 22 between Bragg Creek and its intersection with Highway 8 starting at the 75-year flood.
- Highway 8 immediately west of the Highway 8 Bridge and through the Elbow Valley Residents Club community starting at the 200-year flood.
- Grey Eagle Drive near the Grey Eagle Drive Bridge starting at the 20-year flood.

In Foothills County, the length of roads affected by direct inundation increases steadily from the 2-year to the 1000-year floods, reaching a maximum of about 11 km of roads.

At the 100-year flood, about 132 km of roads would be directly inundated and about 60 km would be potentially inundated in the case of flood control structure failure. In comparison, about 509 km of roads would be directly inundated for the 1,000-year flood.

Bridges and Culverts

A summary of bridge and culvert clearances during floods is presented in Tables 5 to 11.

Table 11: Bridge Clearances Bow River – Open Water Flood Inundation Scenarios

Bridge Station (m)	Name	Minimum Low Chord (m)	2-Year		5-Year		10-Year		20-Year		35-Year		50-Year		75-Year		100-Year		200-Year		350-Year		500-Year		750-Year		1,000-Year	
			Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)
66,108	Stoney Trail Bridge	1,078.0	1,071.5	6.5	1,072.2	5.8	1,072.7	5.3	1,073.3	4.7	1,073.8	4.2	1,074.1	3.9	1,074.5	3.5	1,074.7	3.3	1,075.5	2.5	1,076.1	1.9	1,076.6	1.4	1,077.2	0.8	1,077.8	0.2
64,541	85 St SW Bridge	1,074.4	1,069.3	5.1	1,069.9	4.5	1,070.4	4.0	1,070.8	3.6	1,071.2	3.2	1,071.5	2.9	1,071.9	2.5	1,072.1	2.3	1,072.8	1.6	1,073.5	0.9	1,073.9	0.5	1,074.5	-0.1	1,075.4	-1.0
63,899	Bowmont Bridge	1,071.7	1,068.0	3.7	1,068.8	2.9	1,069.3	2.4	1,069.9	1.8	1,070.4	1.3	1,070.7	1.0	1,071.2	0.5	1,071.4	0.3	1,072.2	-0.5	1,072.9	-1.2	1,073.4	-1.7	1,074.0	-2.3	1,074.5	-2.8
63,809	CP Rail Twin Bridges	1,072.4	1,067.9	4.5	1,068.6	3.8	1,069.2	3.2	1,069.7	2.7	1,070.3	2.1	1,070.6	1.8	1,071.0	1.4	1,071.3	1.1	1,072.1	0.3	1,072.8	-0.4	1,073.3	-0.9	1,073.9	-1.5	1,074.4	-2.0
59,938	Hextall Bridge	1,065.1	1,062.1	3.0	1,062.7	2.4	1,063.2	1.9	1,063.8	1.3	1,064.3	0.8	1,064.6	0.5	1,065.0	0.1	1,065.4	-0.3	1,066.4	-1.3	1,067.0	-1.9	1,067.4	-2.3	1,067.9	-2.8	1,068.3	-3.2
59,917	Souldice Bridge	1,064.8	1,061.9	2.9	1,062.4	2.4	1,062.9	1.9	1,063.5	1.3	1,063.9	0.9	1,064.2	0.6	1,064.6	0.2	1,064.9	-0.1	1,065.7	-0.9	1,066.4	-1.6	1,066.8	-2.0	1,067.3	-2.5	1,067.8	-3.0
59,516	Trans-Canada Highway Bridge	1,065.5	1,061.2	4.3	1,061.8	3.7	1,062.3	3.2	1,062.9	2.6	1,063.5	2.0	1,063.8	1.7	1,064.1	1.4	1,064.3	1.2	1,065.1	0.4	1,065.9	-0.4	1,066.4	-0.9	1,067.1	-1.6	1,067.7	-2.2
57,063	Harry Boothman Bridge	1,060.0	1,056.3	3.7	1,056.9	3.1	1,057.3	2.7	1,057.8	2.2	1,058.3	1.7	1,058.6	1.4	1,059.0	1.0	1,059.3	0.7	1,060.2	-0.2	1,061.0	-1.0	1,061.5	-1.5	1,062.0	-2.0	1,062.3	-2.3
53,501	Crowchild Trail Bridge	1,054.6	1,050.0	4.6	1,050.5	4.1	1,051.0	3.6	1,051.5	3.1	1,052.0	2.6	1,052.4	2.2	1,052.8	1.8	1,053.1	1.5	1,053.7	0.9	1,054.3	0.3	1,054.8	-0.2	1,055.2	-0.6	1,055.5	-0.9
52,040	Mewata Bridge	1,053.9	1,047.3	6.6	1,047.8	6.1	1,048.2	5.7	1,048.6	5.3	1,049.0	4.9	1,049.3	4.6	1,049.6	4.3	1,049.9	4.0	1,050.4	3.5	1,050.6	3.3	1,051.2	2.7	1,051.5	2.4	1,051.8	2.1
51,264	Louise Bridge	1,050.6	1,045.4	5.2	1,046.0	4.6	1,046.5	4.1	1,047.1	3.5	1,047.6	3.0	1,048.0	2.6	1,048.4	2.2	1,048.6	2.0	1,049.1	1.5	1,049.8	0.8	1,049.7	0.9	1,050.2	0.4	1,050.5	0.1
51,148	North West Light Rail Bridge	1,048.7	1,044.9	3.8	1,045.6	3.1	1,046.1	2.6	1,046.7	2.0	1,047.2	1.5	1,047.5	1.2	1,047.9	0.8	1,048.0	0.7	1,048.8	-0.1	1,049.4	-0.7	1,049.5	-0.8	1,050.0	-1.3	1,050.4	-1.7
50,745	Peace Bridge	1,048.0	1,044.5	3.5	1,045.2	2.8	1,045.7	2.3	1,046.2	1.8	1,046.7	1.3	1,047.0	1.0	1,047.5	0.5	1,047.6	0.4	1,048.4	-0.4	1,049.1	-1.1	1,049.1	-1.1	1,049.6	-1.6	1,050.0	-2.0
49,960	Prince's Island Bridge	1,050.1	1,043.5	6.6	1,044.1	6.0	1,044.6	5.5	1,045.2	4.9	1,045.7	4.4	1,046.1	4.0	1,046.5	3.6	1,046.9	3.2	1,047.6	2.5	1,048.2	1.9	1,048.6	1.5	1,049.2	0.9	1,049.6	0.5
49,266	Centre St Bridge	1,045.6	1,041.9	3.7	1,042.5	3.1	1,043.1	2.5	1,043.7	1.9	1,044.3	1.3	1,044.8	0.8	1,045.3	0.3	1,045.7	-0.1	1,046.5	-0.9	1,047.2	-1.6	1,047.7	-2.1	1,048.2	-2.6	1,048.6	-3.0
48,501	4th Avenue Flyover Bridge	1,048.0	1,040.4	7.6	1,041.0	7.0	1,041.5	6.5	1,042.0	6.0	1,042.5	5.5	1,042.9	5.1	1,043.2	4.8	1,043.6	4.4	1,044.4	3.6	1,045.0	3.0	1,045.5	2.5	1,045.6	2.4	1,045.9	2.1
48,466	Old Langevin Bridge	1,043.0	1,040.3	2.7	1,040.9	2.1	1,041.3	1.7	1,041.9	1.1	1,042.3	0.7	1,042.6	0.4	1,042.9	0.1	1,043.2	-0.2	1,043.4	-0.4	1,044.7	-1.7	1,045.3	-2.3	1,045.3	-2.3	1,045.5	-2.5
48,357	New Langevin (Edmonton Trail) Bridge	1,046.0	1,040.2	5.8	1,040.7	5.3	1,041.2	4.8	1,041.7	4.3	1,042.1	3.9	1,042.4	3.6	1,042.6	3.4	1,042.8	3.2	1,042.8	3.2	1,043.4	2.6	1,043.8	2.2	1,044.3	1.7	1,044.8	1.2
48,322	Harry Kroeger Bridge	1,046.6	1,040.1	6.5	1,040.6	6.0	1,041.0	5.6	1,041.5	5.1	1,041.9	4.7	1,042.2	4.4	1,042.4	4.2	1,042.6	4.0	1,043.4	3.2	1,043.5	3.1	1,043.6	3.0	1,044.5	2.1	1,044.8	1.8
48,039	St. Patrick's Island Pedestrian Bridge	1,042.3	1,039.6	2.7	1,040.1	2.2	1,040.5	1.8	1,040.9	1.4	1,041.3	1.0	1,041.5	0.8	1,041.8	0.5	1,042.0	0.3	1,042.2	0.1	1,042.3	0.0	1,043.1	-0.8	1,043.6	-1.3	1,044.0	-1.7
46,875	St. Georges Island Bridge	1,042.8	1,037.3	5.5	1,037.9	4.9	1,038.4	4.4	1,038.9	3.9	1,039.3	3.5	1,039.5	3.3	1,039.8	3.0	1,040.1	2.7	1,040.8	2.0	1,041.1	1.7	1,041.5	1.3	1,041.9	0.9	1,042.2	0.6
45,907	CP Rail Bridge	1,038.9	1,036.2	2.7	1,036.9	2.0	1,037.3	1.6	1,037.7	1.2	1,038.1	0.8	1,038.2	0.7	1,038.4	0.5	1,038.5	0.4	1,038.9	0.0	1,039.3	-0.4	1,039.6	-0.7	1,040.0	-1.1	1,040.2	-1.3
44,622	Cushing Bridge	1,035.9	1,032.8	3.1	1,033.5	2.4	1,034.0	1.9	1,034.5	1.4	1,034.9	1.0	1,035.1	0.8	1,035.4	0.5	1,035.6	0.3	1,036.1	-0.2	1,036.9	-1.0	1,037.3	-1.4	1,037.8	-1.9	1,038.1	-2.2
41,346	Abandoned CP Rail Bridge	1,035.4	1,027.2	8.2	1,028.1	7.3	1,028.7	6.7	1,029.4	6.0	1,030.0	5.4	1,030.4	5.0	1,030.8	4.6	1,031.2	4.2	1,032.2	3.2	1,033.1	2.3	1,033.5	1.9	1,034.1	1.3	1,034.4	1.0

Table 11: Bridge Clearances Bow River – Open Water Flood Inundation Scenarios

Bridge Station (m)	Name	Minimum Low Chord (m)	2-Year		5-Year		10-Year		20-Year		35-Year		50-Year		75-Year		100-Year		200-Year		350-Year		500-Year		750-Year		1,000-Year	
			Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)
41,283	CP Rail Bridge	1,031.2	1,027.2	4.0	1,028.0	3.2	1,028.6	2.6	1,029.3	1.9	1,029.8	1.4	1,030.2	1.0	1,030.6	0.6	1,030.9	0.3	1,031.9	-0.7	1,032.7	-1.5	1,033.0	-1.8	1,033.7	-2.5	1,034.2	-3.0
41,149	Bonnybrook Bridge	1,032.8	1,027.0	5.8	1,027.7	5.1	1,028.3	4.5	1,028.8	4.0	1,029.3	3.5	1,029.6	3.2	1,029.8	3.0	1,030.0	2.8	1,030.6	2.2	1,031.1	1.7	1,031.4	1.4	1,031.6	1.2	1,031.6	1.2
40,475	Calf Robe Bridge	1,032.9	1,025.9	7.0	1,026.6	6.3	1,027.1	5.8	1,027.6	5.3	1,028.0	4.9	1,028.2	4.7	1,028.7	4.2	1,028.9	4.0	1,029.7	3.2	1,030.3	2.6	1,030.8	2.1	1,031.4	1.5	1,031.9	1.0
39,960	CN Rail Bridge	1,032.1	1,025.3	6.8	1,026.0	6.1	1,026.4	5.7	1,026.7	5.4	1,027.1	5.0	1,027.2	4.9	1,027.4	4.7	1,027.5	4.6	1,028.0	4.1	1,028.4	3.7	1,028.7	3.4	1,029.1	3.0	1,030.0	2.1
37,493	Graves Bridge, Upstream	1,025.9	1,020.5	5.4	1,021.0	4.9	1,021.5	4.4	1,022.0	3.9	1,022.3	3.6	1,022.6	3.3	1,022.8	3.1	1,023.1	2.8	1,023.6	2.3	1,024.1	1.8	1,024.5	1.4	1,024.9	1.0	1,025.2	0.7
37,472	Graves Bridge, Downstream	1,025.9	1,020.4	5.5	1,020.9	5.0	1,021.3	4.6	1,021.8	4.1	1,022.1	3.8	1,022.3	3.6	1,022.6	3.3	1,022.8	3.1	1,023.3	2.6	1,023.8	2.1	1,024.1	1.8	1,024.5	1.4	1,024.8	1.1
34,768	Eric Harvie Bridge	1,019.7	1,015.9	3.8	1,016.6	3.1	1,017.1	2.6	1,017.6	2.1	1,018.0	1.7	1,018.2	1.5	1,018.6	1.1	1,018.7	1.0	1,019.1	0.6	1,019.5	0.2	1,019.9	-0.2	1,020.3	-0.6	1,020.7	-1.0
32,758	Ivor Strong Bridge	1,020.3	1,012.2	8.1	1,012.9	7.4	1,013.4	6.9	1,013.9	6.4	1,014.3	6.0	1,014.5	5.8	1,014.8	5.5	1,015.1	5.2	1,015.9	4.4	1,016.1	4.2	1,016.1	4.2	1,016.2	4.1	1,016.9	3.4
31,203	Sue Higgins Bridge	1,012.7	1,009.7	3.0	1,010.2	2.5	1,010.5	2.2	1,010.9	1.8	1,011.2	1.5	1,011.4	1.3	1,011.6	1.1	1,011.8	0.9	1,012.2	0.5	1,012.5	0.2	1,012.8	-0.1	1,012.9	-0.2	1,013.0	-0.3
26,722	McKenzie Bridge	1,005.0	1,001.3	3.7	1,001.8	3.2	1,002.1	2.9	1,002.4	2.6	1,002.6	2.4	1,002.9	2.1	1,003.2	1.8	1,003.4	1.6	1,003.9	1.1	1,004.2	0.8	1,004.5	0.5	1,004.7	0.3	1,004.9	0.1
23,949	Marquis de Lorne Bridge, Upstream	1,002.1	995.5	6.6	996.2	5.9	996.8	5.3	997.3	4.8	997.8	4.3	998.1	4.0	998.5	3.6	998.7	3.4	999.4	2.7	1,000.1	2.0	1,000.6	1.5	1,001.3	0.8	1,001.8	0.3
23,908	Marquis de Lorne Bridge, Downstream	1,002.5	995.4	7.1	996.1	6.4	996.6	5.9	997.1	5.4	997.6	4.9	997.9	4.6	998.2	4.3	998.4	4.1	999.0	3.5	999.7	2.8	1,000.1	2.4	1,000.8	1.7	1,001.3	1.2
18,365	Dunbow Road Bridge, Upstream	991.6	984.7	6.9	985.3	6.3	985.7	5.9	986.1	5.5	986.5	5.1	986.8	4.8	987.1	4.5	987.3	4.3	988.0	3.6	988.6	3.0	989.0	2.6	989.5	2.1	989.9	1.7
18,333	Dunbow Road Bridge, Downstream	991.6	984.5	7.1	984.9	6.7	985.3	6.3	985.6	6.0	985.9	5.7	986.1	5.5	986.4	5.2	986.6	5.0	987.2	4.4	987.8	3.8	988.1	3.5	988.6	3.0	989.0	2.6

Note: Clearances are the elevation differences between bridge low chord and simulated water levels. A negative value indicates the water depth above the low chord.

Table 12: Bridge Clearances Elbow River – Open Water Flood Inundation Scenarios

Bridge Station (m)	Name	Minimum Low Chord (m)	2-Year		5-Year		10-Year		20-Year		35-Year		50-Year		75-Year		100-Year		200-Year		350-Year		500-Year		750-Year		1,000-Year	
			Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)
60,538	Balsam Avenue	1,299.8	1,294.70	5.1	1,295.30	4.5	1,295.80	4.0	1,296.40	3.4	1,296.90	2.9	1,297.30	2.5	1,297.70	2.1	1,298.00	1.8	1,298.90	0.9	1,300.10	-0.3	1,300.10	-0.3	1,300.20	-0.4	1,300.40	-0.6
48,182	Highway 22 Bridge	1,207.4	1,204.2	3.2	1,204.6	2.8	1,204.9	2.5	1,205.3	2.1	1,205.6	1.8	1,205.8	1.6	1,206.1	1.3	1,206.3	1.1	1,206.8	0.6	1,207.3	0.1	1,207.6	-0.2	1,207.6	-0.2	1,207.6	-0.2
29,253	Highway 8 Bridge	1,105.5	1,102.7	2.8	1,103.3	2.2	1,103.8	1.7	1,104.3	1.2	1,104.7	0.8	1,105.1	0.4	1,105.4	0.1	1,105.7	-0.2	1,106.7	-1.2	1,107.2	-1.7	1,107.6	-2.1	1,107.8	-2.3	1,108.0	-2.5
20,501	Grey Eagle Drive	1,082.4	1,080.5	1.9	1,081.2	1.2	1,081.6	0.8	1,081.9	0.5	1,082.1	0.3	1,082.3	0.1	1,082.4	0.0	1,082.5	-0.1	1,082.8	-0.4	1,083.0	-0.6	1,083.2	-0.8	1,083.3	-0.9	1,083.5	-1.1
18,229	Weaselhead Glenmore Pathway	1,078.5	1,077.0	1.5	1,077.3	1.2	1,077.5	1.0	1,077.8	0.7	1,078.1	0.4	1,078.2	0.3	1,078.4	0.1	1,078.5	0.0	1,079.0	-0.5	1,079.4	-0.9	1,079.7	-1.2	1,080.0	-1.5	1,080.3	-1.8
12,319	Glenmore Trail Bridge	1,080.2	1,076.9	3.3	1,076.9	3.3	1,076.9	3.3	1,076.9	3.3	1,077.2	3.0	1,077.4	2.8	1,077.7	2.5	1,077.9	2.3	1,078.4	1.8	1,078.8	1.4	1,079.1	1.1	1,079.5	0.7	1,079.8	0.4
8,851	Sandy Beach Bridge	1,057.9	1,053.7	4.2	1,054.5	3.4	1,055.2	2.7	1,055.9	2.0	1,056.5	1.4	1,057.0	0.9	1,057.4	0.5	1,057.8	0.1	1,058.6	-0.7	1,059.4	-1.5	1,059.8	-1.9	1,060.3	-2.4	1,060.7	-2.8
7,601	Riverdale Avenue Bridge	1,055.8	1,051.7	4.1	1,052.6	3.2	1,053.3	2.5	1,054.1	1.7	1,054.7	1.1	1,055.2	0.6	1,055.6	0.2	1,055.9	-0.1	1,056.5	-0.7	1,056.8	-1.0	1,057.1	-1.3	1,057.4	-1.6	1,057.7	-1.9
7,206	Elboya Bridge	1,054.2	1,051.2	3.0	1,052.2	2.0	1,052.9	1.3	1,053.7	0.5	1,054.4	-0.2	1,054.8	-0.6	1,055.2	-1.0	1,055.5	-1.3	1,056.0	-1.8	1,056.3	-2.1	1,056.6	-2.4	1,056.9	-2.7	1,057.1	-2.9
5,506	Rideau Park Bridge	1,052.9	1,049.7	3.2	1,050.5	2.4	1,051.1	1.8	1,051.7	1.2	1,052.3	0.6	1,052.6	0.3	1,053.0	-0.1	1,053.2	-0.3	1,053.8	-0.9	1,054.3	-1.4	1,054.6	-1.7	1,055.0	-2.1	1,055.2	-2.3
4,783	Mission Bridge	1,050.6	1,048.5	2.1	1,049.2	1.4	1,049.9	0.7	1,050.7	-0.1	1,051.4	-0.8	1,051.8	-1.2	1,052.2	-1.6	1,052.4	-1.8	1,053.0	-2.4	1,053.4	-2.8	1,053.6	-3.0	1,053.9	-3.3	1,054.2	-3.6
4,043	25th Avenue SW Bridge	1,048.5	1,046.9	1.6	1,047.7	0.8	1,048.4	0.1	1,049.2	-0.7	1,049.7	-1.2	1,049.9	-1.4	1,050.2	-1.7	1,050.3	-1.8	1,050.8	-2.3	1,051.2	-2.7	1,051.5	-3.0	1,051.8	-3.3	1,052.1	-3.6
3,483	Lindsay Park	1,048.6	1,045.7	2.9	1,046.4	2.2	1,047.0	1.6	1,047.7	0.9	1,048.2	0.4	1,048.5	0.1	1,048.8	-0.2	1,049.1	-0.5	1,049.7	-1.1	1,050.3	-1.7	1,050.7	-2.1	1,051.1	-2.5	1,051.3	-2.7
3,243	Lindsay Park CNR Bridge	1,048.6	1,045.1	3.5	1,045.9	2.7	1,046.5	2.1	1,047.2	1.4	1,047.7	0.9	1,048.0	0.6	1,048.3	0.3	1,048.6	0.0	1,049.3	-0.7	1,049.9	-1.3	1,050.2	-1.6	1,050.6	-2.0	1,050.8	-2.2
2,954	Pattison Bridge	1,045.6	1,044.0	1.6	1,044.8	0.8	1,045.5	0.1	1,046.3	-0.7	1,047.0	-1.4	1,047.4	-1.8	1,047.7	-2.1	1,048.0	-2.4	1,048.6	-3.0	1,049.1	-3.5	1,049.5	-3.9	1,049.9	-4.3	1,050.2	-4.6
2,720	Victoria Bridge	1,045.6	1,043.0	2.6	1,044.0	1.6	1,044.8	0.8	1,045.6	0.0	1,046.4	-0.8	1,046.8	-1.2	1,047.4	-1.8	1,047.7	-2.1	1,048.4	-2.8	1,048.9	-3.3	1,049.3	-3.7	1,049.8	-4.2	1,050.1	-4.5
2,677	LRT Bridge	1,046.7	1,042.9	3.8	1,043.9	2.8	1,044.7	2.0	1,045.6	1.1	1,046.3	0.4	1,046.7	0.0	1,047.2	-0.5	1,047.5	-0.8	1,048.3	-1.6	1,048.9	-2.2	1,049.3	-2.6	1,049.7	-3.0	1,050.0	-3.3
2,455	Stampede Park Access Bridge	1,045.9	1,042.5	3.4	1,043.5	2.4	1,044.2	1.7	1,045.1	0.8	1,045.7	0.2	1,046.1	-0.2	1,046.5	-0.6	1,046.9	-1.0	1,047.4	-1.5	1,048.0	-2.1	1,048.4	-2.5	1,048.8	-2.9	1,048.9	-3.0
1,902	Horse Barn Bridge (New)	1,044.7	1,041.4	3.3	1,042.3	2.4	1,043.0	1.7	1,043.7	1.0	1,044.3	0.4	1,044.6	0.1	1,045.0	-0.3	1,045.3	-0.6	1,045.8	-1.1	1,046.1	-1.4	1,046.4	-1.7	1,046.9	-2.2	1,046.9	-2.2
1,855	Horse Barn Bridge (Old)	1,044.3	1,041.3	3.0	1,042.2	2.1	1,042.9	1.4	1,043.6	0.7	1,044.2	0.1	1,044.5	-0.2	1,044.8	-0.5	1,045.4	-1.1	1,045.9	-1.6	1,046.1	-1.8	1,046.4	-2.1	1,046.9	-2.6	1,046.9	-2.6
1,244	Weadick Crossing	1,043.4	1,040.2	3.2	1,041.0	2.4	1,041.7	1.7	1,042.3	1.1	1,042.8	0.6	1,043.1	0.3	1,043.5	-0.1	1,043.8	-0.4	1,044.7	-1.3	1,045.4	-2.0	1,046.0	-2.6	1,046.6	-3.2	1,046.6	-3.2
991	Stampede Park (N) Saddledome Access Bridge	1,043.4	1,039.6	3.8	1,040.4	3.0	1,041.1	2.3	1,041.8	1.6	1,042.4	1.0	1,042.8	0.6	1,043.3	0.1	1,043.7	-0.3	1,044.6	-1.2	1,045.4	-2.0	1,045.9	-2.5	1,046.6	-3.2	1,046.6	-3.2
576	MacDonald Bridge	1,041.2	1,038.7	2.5	1,039.5	1.7	1,040.1	1.1	1,040.8	0.4	1,041.4	-0.2	1,041.8	-0.6	1,042.3	-1.1	1,042.7	-1.5	1,043.8	-2.6	1,044.6	-3.4	1,045.1	-3.9	1,045.9	-4.7	1,045.9	-4.7
334	CP Rail Bridge	1,042.0	1,038.4	3.6	1,039.1	2.9	1,039.7	2.3	1,040.2	1.8	1,040.7	1.3	1,041.1	0.9	1,041.6	0.4	1,041.8	0.2	1,042.9	-0.9	1,043.5	-1.5	1,045.0	-3.0	1,045.7	-3.7	1,045.7	-3.7
287	9th Avenue SE Bridge	1,041.4	1,038.3	3.1	1,039.0	2.4	1,039.5	1.9	1,039.9	1.5	1,040.3	1.1	1,040.6	0.8	1,041.0	0.4	1,041.1	0.3	1,042.9	-1.5	1,043.6	-2.2	1,043.8	-2.4	1,044.1	-2.7	1,044.3	-2.9
165	Travers Bridge	1,041.1	1,038.2	2.9	1,038.8	2.3	1,039.2	1.9	1,039.7	1.4	1,040.0	1.1	1,040.3	0.8	1,040.5	0.6	1,040.7	0.4	1,041.2	-0.1	1,042.4	-1.3	1,042.5	-1.4	1,042.8	-1.7	1,043.1	-2.0

Note: Clearances are the elevation differences between bridge low chord and simulated water levels. A negative value indicates the water depth above the low chord.

Table 13: Bridge Clearances Bragg Creek – Open Water Flood Inundation Scenarios

Bridge Station (m)	Name	Minimum Low Chord (m)	2-Year		5-Year		10-Year		20-Year		35-Year		50-Year		75-Year		100-Year		200-Year		350-Year		500-Year		750-Year		1,000-Year	
			Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)
1,065	Centre Avenue	1,315.8	1,312.8	3.0	1,313.2	2.6	1,313.6	2.2	1,313.8	2.0	1,314.0	1.8	1,314.1	1.7	1,314.2	1.6	1,314.4	1.5	1,314.6	1.2	1,314.9	0.9	1,315.2	0.6	1,315.4	0.4	1,315.6	0.3
117	Bracken Road	1,306.4	1,304.90	1.5	1,305.30	1.1	1,305.60	0.8	1,306.00	0.4	1,306.40	0.0	1,306.70	-0.3	1,307.10	-0.7	1,307.50	-1.1	1,308.10	-1.7	1,308.60	-2.2	1,308.80	-2.4	1,309.00	-2.6	1,309.20	-2.8

Note: Clearances are the elevation differences between bridge low chord and simulated water levels. A negative value indicates the water depth above the low chord

Table 14: Bridge Clearances Lott Creek – Open Water Flood Inundation Scenarios

Bridge Station (m)	Name	Minimum Low Chord (m)	2-Year		5-Year		10-Year		20-Year		35-Year		50-Year		75-Year		100-Year		200-Year		350-Year		500-Year		750-Year		1,000-Year	
			Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)
4,093	Fishermans Lake Pedestrian Bridge	1,109.7	1,108.5	1.2	1,108.6	1.1	1,108.6	1.1	1,108.7	1.0	1,108.7	1.0	1,108.7	1.0	1,108.8	0.9	1,108.9	0.8	1,109.8	-0.1	1,110.3	-0.5	1,110.4	-0.7	1,110.5	-0.8	1,110.6	-0.9
3,530	Golf Course Bridge 1	1,106.9	1,106.5	0.4	1,107.0	-0.1	1,107.2	-0.3	1,107.3	-0.4	1,107.4	-0.5	1,107.5	-0.6	1,107.7	-0.8	1,107.7	-0.8	1,107.9	-1.0	1,108.0	-1.1	1,108.0	-1.1	1,108.0	-1.1	1,108.0	-1.1
3,431	Golf Course Bridge 2	1,106.9	1,106.1	0.8	1,106.5	0.4	1,106.8	0.2	1,107.1	-0.2	1,107.3	-0.4	1,107.5	-0.6	1,107.6	-0.7	1,107.7	-0.8	1,107.8	-0.9	1,107.9	-1.0	1,108.0	-1.1	1,108.0	-1.1	1,108.0	-1.1
3,390	Golf Course Bridge 3	1,106.9	1,106.1	0.8	1,106.4	0.5	1,106.5	0.4	1,106.7	0.2	1,106.9	0.0	1,107.0	-0.1	1,107.2	-0.3	1,107.3	-0.4	1,107.5	-0.6	1,107.6	-0.7	1,107.6	-0.7	1,107.9	-1.0	1,107.9	-1.0

Note: Clearances are the elevation differences between bridge low chord and simulated water levels. A negative value indicates the water depth above the low chord

Table 15: Bridge Clearance Prince's Island Side Channel – Open Water Flood Inundation Scenarios

Bridge Station (m)	Name	Minimum Low Chord (m)	2-Year		5-Year		10-Year		20-Year		35-Year		50-Year		75-Year		100-Year		200-Year		350-Year		500-Year		750-Year		1,000-Year	
			Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)
476	Jaipur Bridge	1,046.2	1,044.2	2.0	1,044.4	1.8	1,044.5	1.7	1,044.8	1.4	1,045.2	1.0	1,045.6	0.6	1,046.1	0.1	1,046.5	-0.3	1,047.4	-1.2	1,048.1	-1.9	1,048.5	-2.3	1,049.1	-2.9	1,049.50	-3.3
308	Prince's Island Bridge on Side Channel	1,045.0	1,042.9	2.1	1,043.1	1.9	1,043.7	1.3	1,044.4	0.6	1,045.0	0.0	1,045.5	-0.5	1,046.0	-1.0	1,046.4	-1.4	1,047.2	-2.2	1,047.9	-2.9	1,048.4	-3.4	1,049.0	-4.0	1,049.40	-4.4

Note: Clearances are the elevation differences between bridge low chord and simulated water levels. A negative value indicates the water depth above the low chord

Table 16: Bridge Clearances Zoo Island Side Channel – Open Water Flood Inundation Scenarios

Bridge Station (m)	Name	Minimum Low Chord (m)	2-Year		5-Year		10-Year		20-Year		35-Year		50-Year		75-Year		100-Year		200-Year		350-Year		500-Year		750-Year		1,000-Year	
			Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)
1,868	St. Patrick's Island Bridge on Zoo Side Channel	1,042.9	1,039.5	3.4	1,040.1	2.8	1,040.5	2.4	1,041.0	1.9	1,041.4	1.5	1,041.6	1.3	1,041.9	1.0	1,042.2	0.7	1,042.6	0.3	1,043.4	-0.5	1,043.7	-0.8	1,044.1	-1.2	1,044.4	-1.5
1,119	Baines Bridge	1,041.4	1,038.3	3.1	1,038.7	2.7	1,039.1	2.3	1,039.6	1.8	1,040.0	1.4	1,040.3	1.1	1,040.6	0.8	1,040.9	0.5	1,041.6	-0.2	1,042.6	-1.2	1,043.0	-1.6	1,043.6	-2.2	1,044.0	-2.6
434	Zoo Service Bridge	1,040.4	1,036.8	3.6	1,037.4	3.0	1,037.8	2.6	1,038.3	2.1	1,038.7	1.7	1,038.9	1.5	1,039.2	1.2	1,039.4	1.0	1,040.0	0.4	1,040.6	-0.2	1,040.9	-0.5	1,041.5	-1.1	1,042.0	-1.6

Note: Clearances are the elevation differences between bridge low chord and simulated water levels. A negative value indicates the water depth above the low chord

Table 17: Culvert Clearances – Open Water Flood Inundation Scenarios

Culvert Station (m)	Name	Top of Culvert (m)	2-Year		5-Year		10-Year		20-Year		35-Year		50-Year		75-Year		100-Year		200-Year		350-Year		500-Year		750-Year		1,000-Year	
			Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)	Water Level (m)	Clearance (m)
29,253	Highway 8 Bridge [1]	1,105.9	1,102.7	3.2	1,103.3	2.6	1,103.8	2.2	1,104.3	1.6	1,104.7	1.2	1,105.1	0.9	1,105.4	0.5	1,105.7	0.2	1,106.7	-0.8	1,107.2	-1.3	1,107.6	-1.7	1,107.8	-1.9	1,108.0	-2.1
5,239	Misty Morning Drive Culvert [2]	1,115.9	1,115.4	0.5	1,116.3	0.3	1,116.6	-0.7	1,116.8	-0.9	1,116.9	-1.0	1,117.0	-1.0	1,117.0	-1.1	1,117.1	-1.2	1,117.2	-1.3	1,117.3	-1.3	1,117.3	-1.4	1,117.4	-1.5	1,117.4	-1.5
5,015	Elbow Valley Lake Culvert [2]	1,114.6	1,115.2	-0.6	1,115.5	-0.9	1,115.6	-1.0	1,115.8	-1.2	1,115.9	-1.3	1,116.0	-1.4	1,116.0	-1.4	1,116.2	-1.6	1,116.6	-2.0	1,116.9	-2.3	1,117.0	-2.4	1,117.1	-2.5	1,117.1	-2.5
4,581	Lott Creek Hollow Culvert [2]	1,113.9	1,113.6	0.3	1,113.6	0.3	1,113.7	0.2	1,113.7	0.2	1,113.7	0.2	1,113.8	0.1	1,113.8	0.1	1,113.9	0.1	1,114.9	-1.0	1,115.0	-1.1	1,115.1	-1.2	1,115.2	-1.3	1,115.2	-1.3
4,482	Wolfwillow Lane Culvert [2]	1,113.4	1,113.1	0.3	1,113.2	0.2	1,113.2	0.2	1,113.3	0.1	1,113.3	0.1	1,113.3	0.1	1,113.4	0.0	1,113.5	0.0	1,114.3	-0.9	1,114.5	-1.1	1,114.5	-1.1	1,114.6	-1.2	1,114.7	-1.3
4,273	Coulee Ridge Culvert [2]	1,111.8	1,111.2	0.6	1,111.3	0.5	1,111.3	0.5	1,111.4	0.5	1,111.4	0.4	1,111.4	0.4	1,111.4	0.4	1,111.5	0.3	1,112.0	-0.2	1,112.3	-0.5	1,112.4	-0.6	1,112.5	-0.7	1,112.6	-0.8
3,933	Owl Haven Culvert [2]	1,108.5	1,107.9	0.6	1,108.0	0.5	1,108.1	0.4	1,108.2	0.3	1,108.3	0.2	1,108.5	0.0	1,108.6	-0.1	1,108.7	-0.2	1,109.7	-1.2	1,110.1	-1.6	1,110.3	-1.8	1,110.4	-1.9	1,110.5	-2.0
3,860	Lott Creek Drive Bridge [2]	1,109.8	1,107.2	2.6	1,107.5	2.3	1,107.7	2.1	1,107.9	1.9	1,108.1	1.8	1,108.2	1.6	1,108.3	1.5	1,108.4	1.5	1,108.6	1.2	1,108.8	1.0	1,108.9	0.9	1,109.0	0.8	1,109.1	0.7

Notes: 1) Elbow River, 2) Lott Creek

Railroads

A summary of railroads affected by direct inundation is presented in Table 18, including total lengths, as well as a breakdown of railroads affected in each local authority. A summary of railroads potentially affected by flood control structure failure is presented in Table 19, including total lengths, as well as a breakdown of railroads affected in each local authority. Figure 9 shows the length of railroads affected by direct inundation per flood scenario, and Figure 10 shows the length of railroads potentially affected by flood control structure failure per flood scenario.

Table 18: Lengths of Affected Railroads – Open Water Flood Inundation Scenarios, Direct Inundation

Flood Event	Length (km)			
	City of Calgary	Rocky View County	Foothills County	Total
2-Year	0.1	0.0	0.0	**0.1**
5-Year	0.1	0.0	0.0	**0.1**
10-Year	0.1	0.0	0.0	**0.1**
20-Year	0.1	0.0	0.0	**0.1**
35-Year	1.6	0.0	0.0	**1.6**
50-Year	2.4	0.0	0.0	**2.4**
75-Year	3.6	0.0	0.0	**3.6**
100-Year	5.0	0.0	0.0	**5.0**
200-Year	14.8	0.0	0.0	**14.8**
350-Year	48.1	0.0	0.0	**48.1**
500-Year	73.1	0.0	0.0	**73.1**
750-Year	91.7	0.0	0.0	**91.7**
1,000-Year	101.2	0.0	0.0	**101.2**

Table 19: Lengths of Affected Railroads – Open Water Flood Inundation Scenarios, Flood Control Structure Failure

Flood Event	Length (km)			
	City of Calgary	Rocky View County	Foothills County	Total
2-Year	0.0	0.0	0.0	**0.0**
5-Year	0.0	0.0	0.0	**0.0**
10-Year	0.0	0.0	0.0	**0.0**
20-Year	0.0	0.0	0.0	**0.0**
35-Year	0.0	0.0	0.0	**0.0**
50-Year	1.0	0.0	0.0	**1.0**
75-Year	2.1	0.0	0.0	**2.1**
100-Year	2.2	0.0	0.0	**2.2**
200-Year	0.0	0.0	0.0	**0.0**
350-Year	0.0	0.0	0.0	**0.0**
500-Year	0.0	0.0	0.0	**0.0**
750-Year	0.0	0.0	0.0	**0.0**
1,000-Year	0.0	0.0	0.0	**0.0**

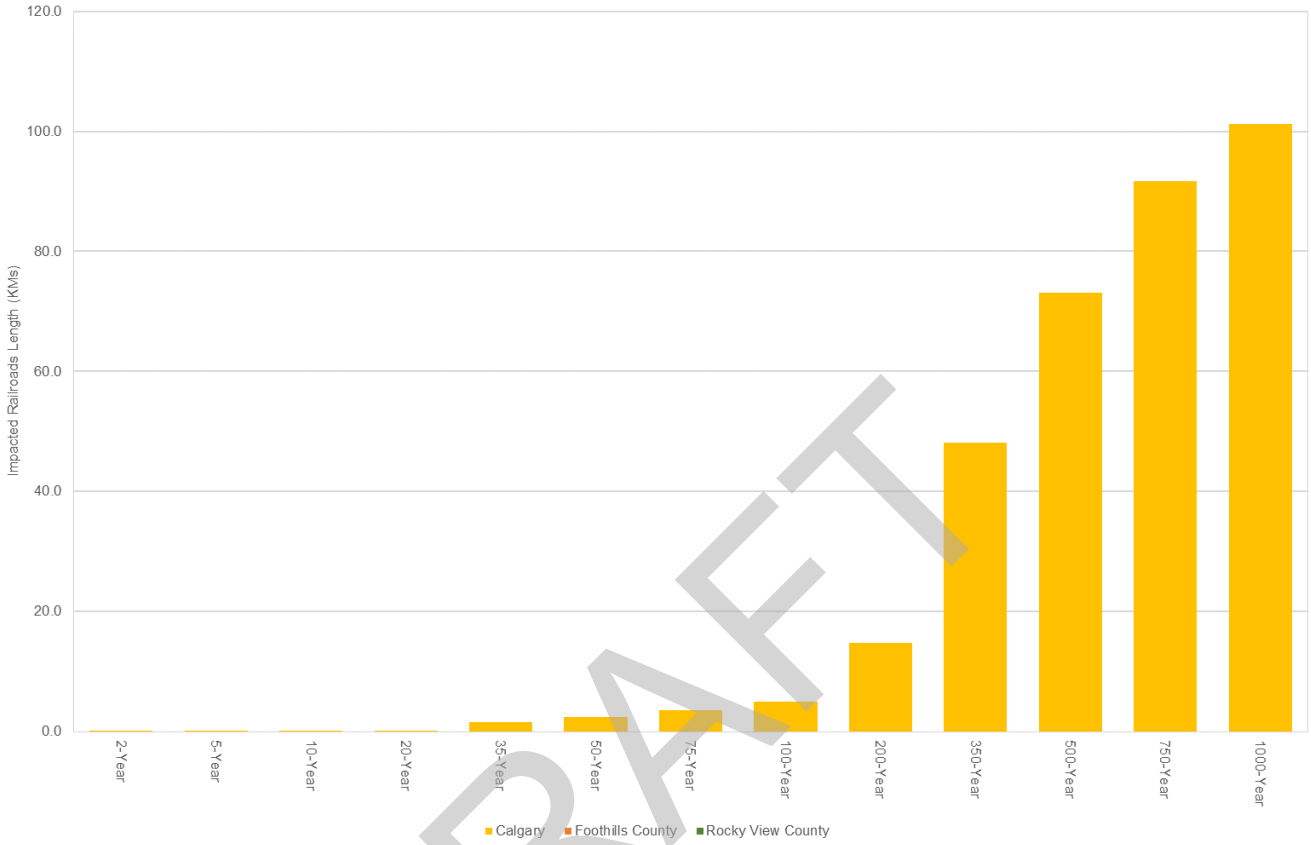

Figure 9: Lengths of Affected Railroads – Open Water Flood Inundation Scenarios, Direct Inundation

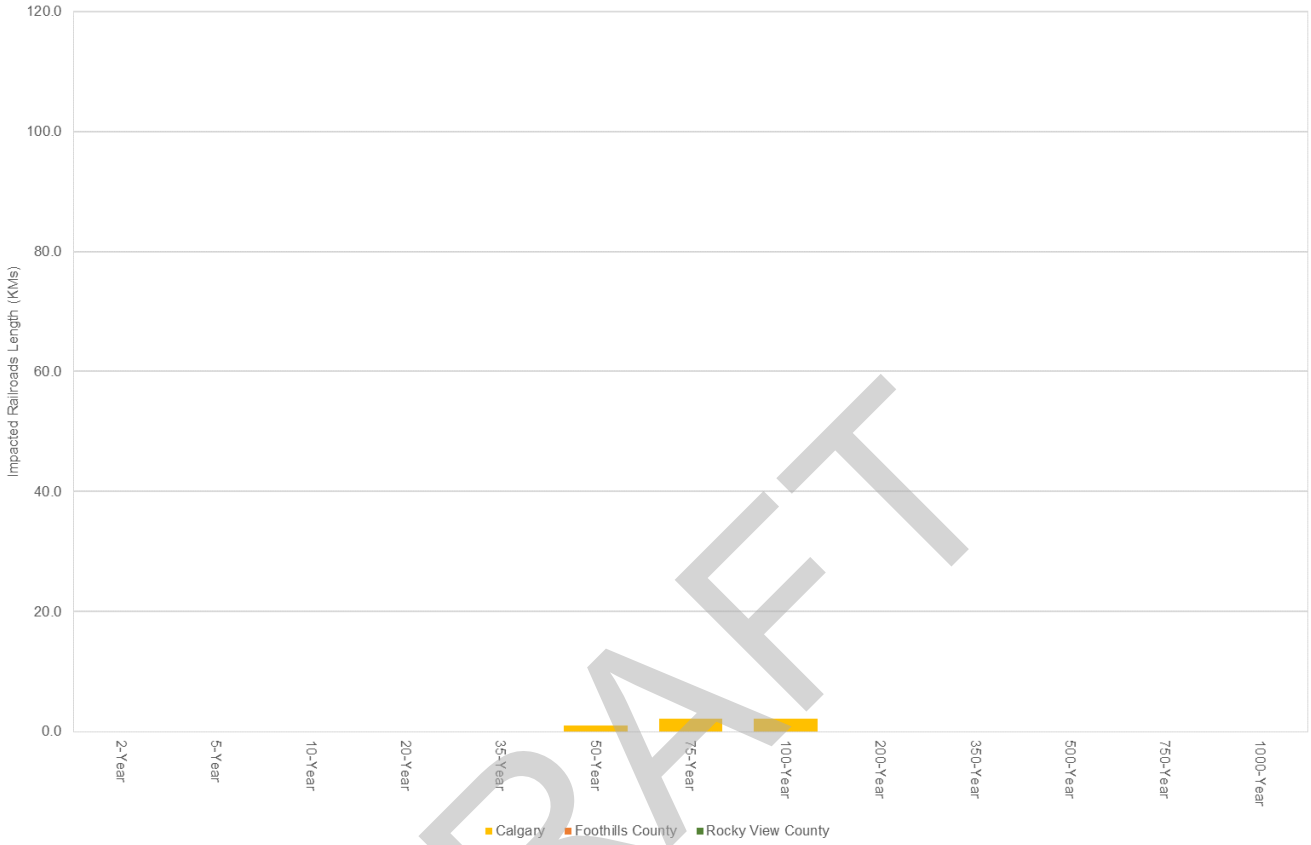

Figure 10: Lengths of Affected Railroads – Open Water Flood Inundation Scenarios, Flood Control Structure Failure

In the study area and in Calgary, the length of railroads affected by direct inundation remains low until the 20-year flood. The affected length then increases steadily from the 35-year to the 200-year floods. A significant increase in length of affected railroads occurs between the 200-year and 350-year floods, and increases steadily up to the 1000-year flood. The length of railroads potentially affected by flood control structure failure inundation remains low for all flood events.

The south leg of the CTrain Red Line in Calgary would be affected by direct inundation in the Beltline and Manchester Industrial neighbourhoods (tracks running parallel to McLeod Trail South, by overland flooding from the Elbow River through Erlton) starting at the 35-year flood. The north leg of the CTrain Red Line would be affected by direct inundation in the Sunnyside neighbourhood starting at the 200-year flood. The northeast leg of the CTrain Blue Line would be affected by direct inundation in the Bridgeland neighbourhood starting at the 100-year flood and in the East Village neighbourhood starting at 200-year flood.

The CP mainline (Calgary-Vancouver) in Calgary would be affected by direct inundation in the Spruce Cliff and Wildwood neighbourhoods, along the toe of the right bank of the Bow River southeast of Edworthy Park, starting at the 75-year flood. It would also be affected in the Beltline and Inglewood neighbourhoods starting at the 200-year flood and 350-year flood respectively.

Some parts of the CP Alyth Yard facility would be affected starting at the 200-year flood. A larger part of the Alyth Yard would be affected at the 350-year flood, causing a significant increase in the length of affected railroads

between the 200-year and 350-year floods. A short CN spur line (the G.T.P. Line) that connects the CN Sarcee Yard with the CP Alyth Yard would be affected starting at the 200-year flood.

No railroads are affected in Rocky View County or Foothills County.

At the 100-year flood, about 5 km of railroads would be directly inundated. In comparison, about 101 km of railroads would be directly inundated at the 1,000-year flood.

4.3.6 Population

Each residential building in the study area (including single family, multifamily, and retirement homes) was assigned a number of residents based on the population count of the census block they are located in (see Section 3.6). The population affected by each flood scenario was estimated based on a tally of the residents of all affected residential buildings.

A summary of the population affected by direct inundation is presented in Table 20, including total numbers, as well as a breakdown of population affected in each local authority. A summary of the population potentially affected by flood control structure failure is presented in Table 21, including total population, as well as a breakdown of population affected in each local authority. Figures 11 and 12 show the population affected by direct inundation and flood control structure failure per flood scenario respectively.

Table 20: Affected Population – Open Water Flood Inundation Scenarios, Direct Inundation

Flood Event	City of Calgary	Rocky View County	Foothills County	Total
2-Year	1	0	0	**1**
5-Year	1	0	0	**1**
10-Year	261	0	0	**261**
20-Year	1,605	0	0	**1,605**
35-Year	6,052	10	0	**6,062**
50-Year	9,493	17	3	**9,513**
75-Year	12,469	17	3	**12,489**
100-Year	16,157	21	6	**16,185**
200-Year	31,164	44	15	**31,223**
350-Year	40,155	1,190	21	**41,365**
500-Year	46,421	1,280	27	**47,728**
750-Year	57,553	1,329	27	**58,909**
1,000-Year	65,163	1,359	27	**66,549**

Table 21: Affected Population – Open Water Flood Inundation Scenarios, Flood Control Structure Failure

Flood Event	City of Calgary	Rocky View County	Foothills County	Total
2-Year	0	0	0	**0**
5-Year	0	0	0	**0**
10-Year	3	0	0	**3**
20-Year	484	170	0	**654**
35-Year	2,115	304	0	**2,419**
50-Year	3,288	376	0	**3,664**
75-Year	6,499	537	0	**7,036**
100-Year	7,324	661	0	**7,985**
200-Year	182	898	0	**1,081**
350-Year	0	0	0	**0**
500-Year	0	0	0	**0**
750-Year	0	0	0	**0**
1,000-Year	0	0	0	**0**

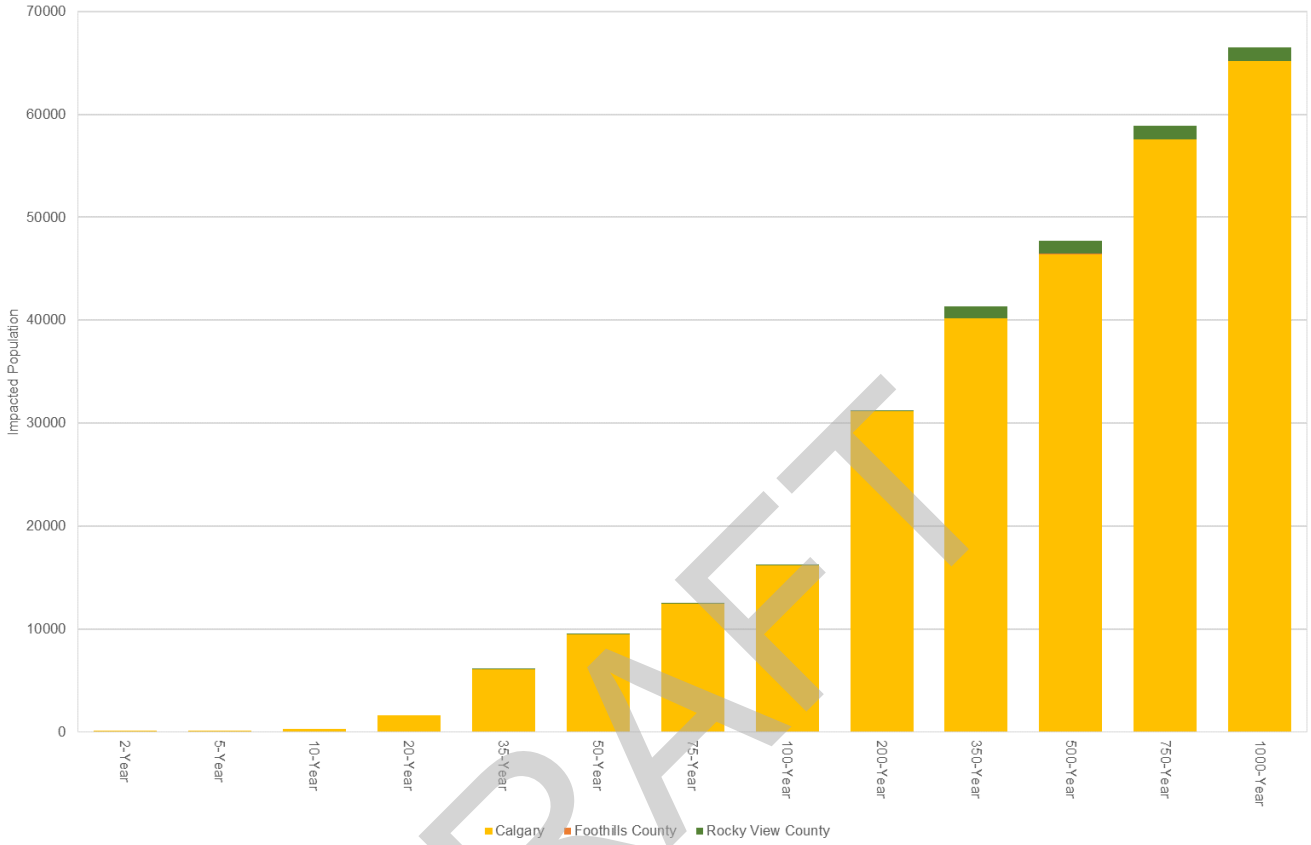

Figure 11: Affected Population – Open Water Flood Inundation Scenarios, Direct Inundation

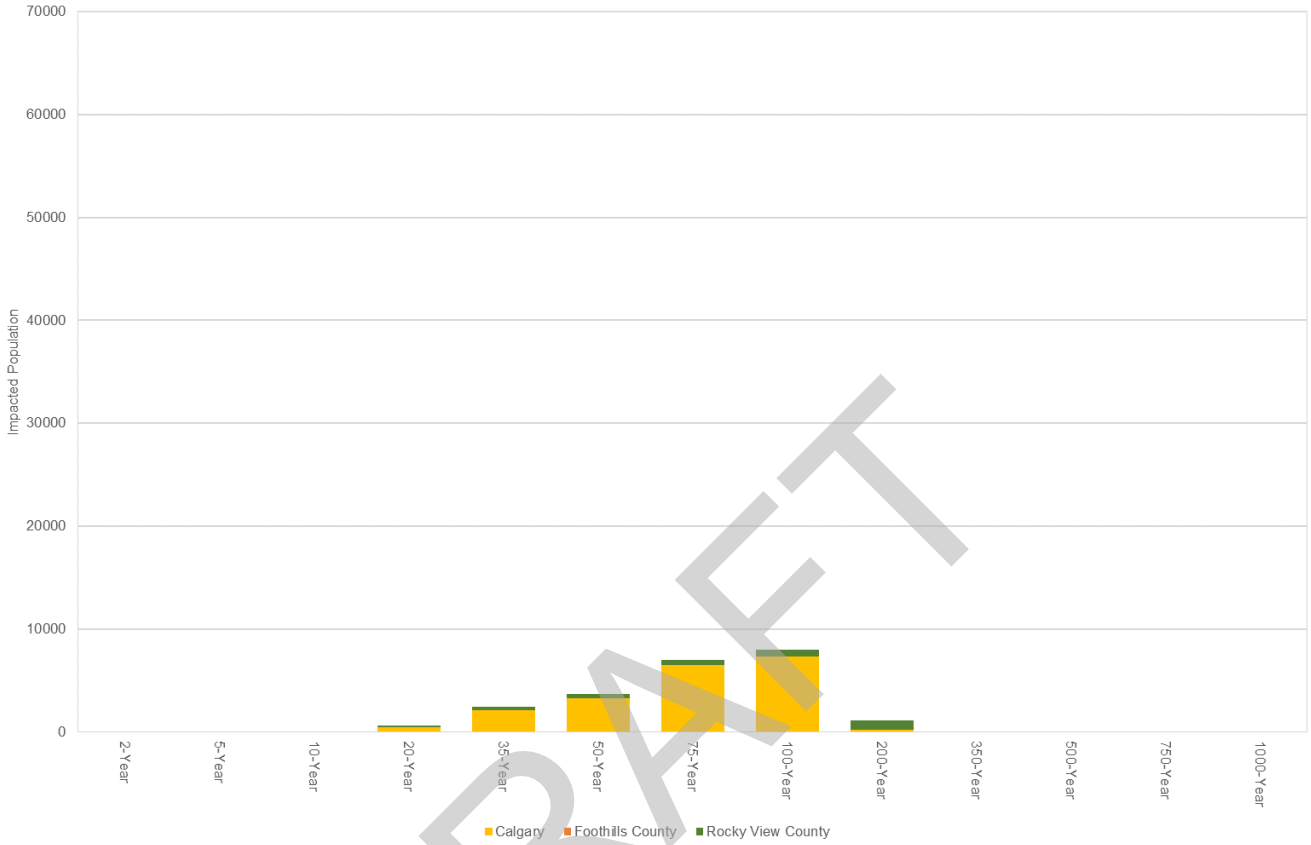

Figure 12: Affected Population – Open Water Flood Inundation Scenarios, Flood Control Structure Failure

In the study area, the population affected by direct inundation remains low until the 5-year flood and then increases steadily from the 10-year to the 100-year floods. A significant increase occurs between the 100-year and 350-year floods in Calgary, and then the population affected by direct inundation increases steadily up to the 1000-year flood. The population affected by potential flood control structure failure peaks at the 100-year flood and then decreases as flood control structure failure inundation is replaced by direct inundation.

In Calgary, the population affected by direct inundation remains low until the 5-year flood. A significant increase in affected population occurs between the 20-year and 35-year floods as parts of the Bowness, Erlton, Mission, Roxboro, and Rideau Park neighbourhoods experience direct inundation. An additional, more significant increase in occurs between the 100-year and 350-year floods, as large parts of the Inglewood, Hillhurst, West Hillhurst, Sunnyside, and Downtown neighbourhoods experience direct inundation instead of potential flood control structure failure. Bridgeland and the densely-populated neighbourhoods of the Beltline and Lower Mount Royal, also experience increased direct inundation. The population affected by direct inundation then increases steadily up to the 1000-year flood.

The population affected by potential flood control structure failure steadily increases between the 20-year and 100-year floods, mainly in the Inglewood, Hillhurst, West Hillhurst, Sunnyside, and Downtown neighbourhoods. The affected population then decreases sharply, as potential flood control structure inundation is replaced by direct inundation.

In Rocky View County, the population affected by direct inundation remains zero until the 10-year flood and then increases very slowly from the 20-year to the 200-year floods. A significant increase occurs between the 200-year and 350-year floods, as large areas of potential flood control structure failure inundation in Bragg Creek and Redwood Meadows are replaced by direct inundation. All flood control structure failure inundation is replaced by direct inundation at the 350-year flood, and the population affected by direct inundation increases steadily up to the 1000-year flood.

In Foothills County, the population affected by direct inundation increases steadily from the 50-year to the 500-year floods, reaching a maximum of 27 people.

At the 100-year flood, a population of 16,185 would be affected by direction inundation and a population of 7,985 would be potentially affected in the case of flood control structure failure. In comparison, a population of 66,549 would be affected by direction inundation for the 1,000-year flood.

4.4 Design Flood Scenario

4.4.1 General

Flood statistics were generated for the design flood scenario (Golder 2023), and the results are presented in the following sections.

4.4.2 Land Parcels

A summary of affected land parcels for the design flood scenario is presented in Table 22, including total number, numbers for each local authority, as well as a breakdown of parcels located in the floodway, flood fringe (neither high hazard nor protected flood fringe), high hazard flood fringe, and protected flood fringe.

Table 22: Affected Land Parcels – Design Flood Scenario

Location	City of Calgary	Rocky View County	Foothills County	Total
Floodway	174	102	12	**288**
Flood Fringe	1,766	11	6	**1,783**
High Hazard Flood Fringe	934	4	1	**939**
Protected Flood Fringe	1,569	82	0	**1,651**

For the design flood, 288 land parcels would be located in the floodway, 1,783 in the flood fringe, 939 in the high hazard flood fringe, and 1,651 in the protected flood fringe zone.

4.4.3 Residential Buildings

A summary of affected residential buildings for the design flood scenario is presented in Tables 23 to 25, including total numbers, numbers for each local authority, as well as a breakdown of residential buildings located in the floodway, flood fringe (neither high hazard nor protected flood fringe), high hazard flood fringe, and protected flood fringe.

Table 23: Affected Residential Buildings City of Calgary – Design Flood Scenario

Residential Category	Floodway	Flood Fringe	High Hazard Flood Fringe	Protected Flood Fringe
Multifamily	1	197	70	146
Single Family	24	922	611	1,049
Retirement Home	0	7	1	4
Total	**25**	**1,126**	**682**	**1,119**

Table 24: Affected Residential Buildings Rocky View County – Design Flood Scenario

Residential Category	Floodway	Flood Fringe	High Hazard Flood Fringe	Protected Flood Fringe
Multifamily	0	0	0	0
Single Family	6	4	0	243
Retirement Home	0	0	0	0
Total	**6**	**4**	**0**	**243**

Table 25: Affected Residential Buildings Foothills County – Design Flood Scenario

Residential Category	Floodway	Flood Fringe	High Hazard Flood Fringe	Protected Flood Fringe
Multifamily	0	0	0	0
Single Family	4	1	0	0
Retirement Home	0	0	0	0
Total	**4**	**1**	**0**	**0**

For the design flood, 35 residential buildings would be located in the floodway, 1,131 in the flood fringe, 682 in the high hazard flood fringe, and 1,362 in the protected flood fringe.

4.4.4 Non-Residential Buildings

A summary of affected non-residential buildings for the design flood scenario is presented in Tables 26 and 27, including total numbers, numbers for each local authority, as well as a breakdown of non-residential buildings located in the floodway, flood fringe (neither high hazard nor protected flood fringe), high hazard flood fringe, and protected flood fringe. There are no affected non-residential buildings in Foothills County.

Table 26: Affected Non-Residential Buildings City of Calgary – Design Flood Scenario

Non-Residential Category	Floodway	Flood Fringe	High Hazard Flood Fringe	Protected Flood Fringe
Commercial	15	169	54	88
Industrial	1	7	6	22
Government Building	0	0	0	1
Hospital	0	0	0	0
School	0	9	1	6
Water Treatment Facility	0	0	0	0
Other Non-Residential	86	117	113	86
Total	**102**	**302**	**174**	**203**

Table 27: Affected Non-Residential Buildings Rocky View County – Design Flood Scenario

Non-Residential Category	Floodway	Flood Fringe	High Hazard Flood Fringe	Protected Flood Fringe
Commercial	1	3	0	9
Industrial	0	0	0	0
Government Building	0	0	0	0
Hospital	0	0	0	0
School	0	0	0	0
Water Treatment Facility	0	0	0	0
Other Non-Residential	1	1	0	2
Total	**2**	**4**	**0**	**11**

For the design flood, 104 non-residential buildings would be located in the floodway, 304 in the flood fringe, 174 in the high hazard flood fringe, and 214 in the protected flood fringe.

16 schools would be affected by the design flood, with nine located in the flood fringe, one located in the high hazard flood fringe, and six in the protected flood fringe. The following sections provide additional information on some of the other more critical non-residential building infrastructure.

Government Buildings

The federal Harry Hays building in Calgary would be located in the protected flood fringe.

Hospitals

None of the hospitals in the study area would be affected by the design flood.

Water Treatment Facilities

None of the water treatment plants in Calgary would be affected by the design flood.

The Bonnybrook Wastewater Treatment Plant would be partially located in the protected flood fringe.

4.4.5 Major Transportation Infrastructure

Roads

A summary of affected roads for the design flood scenario is presented in Table 28, including total lengths, lengths for each local authority, as well as a breakdown of affected roads located in the floodway, flood fringe (neither high hazard nor protected flood fringe), high hazard flood fringe, and protected flood fringe.

Table 28: Lengths of Affected Roads – Design Flood Scenario

Location	Affected Road Length (km)			
	City of Calgary	Rocky View County	Foothills County	Total
Floodway	22.5	8.1	3.3	**33.9**
Flood Fringe	60.0	4.8	1.6	**66.4**
High Hazard Flood Fringe	33.2	0.2	0.2	**33.6**
Protected Flood Fringe	50.2	10.0	0.0	**60.2**

Details on direct inundation impacts on major roads within Calgary for the design flood are provided below:

- Edmonton Trail, including 4th Street NE in Bridgeland north of the Old and New Langevin Bridges.
- Memorial Drive NE in Bridgeland.
- Elbow Drive SW between the 4th Street SW intersection and the Elboya Bridge.
- 4th Street SW between 10th Avenue SW and the Mission Bridge.
- McLeod Trail SW between 10th Avenue SE and Erlton.

In addition, the following roads in Rocky View County would be affected by the design flood:

- A short stretch of Highway 22 between Bragg Creek and Redwood Meadows.
- Grey Eagle Drive near Grey Eagle Drive Bridge.

For the design flood, about 34 km of roads would be located in the floodway, about 66 km in the flood fringe, about 34 km in the high hazard flood fringe, and about 60 km in the protected flood fringe.

Bridges and Culverts

A summary of bridge clearances for the design flood scenario is presented in Table 29. A summary of culvert clearances for the design flood scenario is presented in Table 30.

Table 29: Bridge Clearances – Design Flood Scenario

River	Bridge Station (m)	Name	Minimum Low Chord (m)	Design Flood Level (m)	Clearance (m)
Bow River	66,108	Stoney Trail Bridge	1,078.0	1,074.7	3.3
Bow River	64,541	85 St SW Bridge	1,074.4	1,072.1	2.3
Bow River	63,899	Bowmont Bridge	1,071.7	1,071.5	0.2
Bow River	63,809	CP Rail Twin Bridges	1,072.4	1,071.3	1.1
Bow River	59,938	Hextall Bridge	1,065.1	1,065.5	-0.4
Bow River	59,917	Souldice Bridge	1,064.8	1,064.9	-0.1
Bow River	59,516	Trans-Canada Highway Bridge	1,065.5	1,064.4	1.1
Bow River	57,063	Harry Boothman Bridge	1,060.0	1,059.4	0.6
Bow River	53,501	Crowchild Trail Bridge	1,054.6	1,053.1	1.5
Bow River	52,040	Mewata Bridge	1,053.9	1,049.9	4.0
Bow River	51,264	Louise Bridge	1,050.6	1,048.7	1.9
Bow River	51,148	North West Light Rail Bridge	1,048.7	1,048.1	0.6
Bow River	50,745	Peace Bridge	1,048.0	1,047.7	0.3
Bow River	49,960	Prince's Island Bridge	1,050.1	1,046.9	3.2
Bow River	49,266	Centre St Bridge	1,045.6	1,045.7	-0.1
Bow River	48,501	4th Avenue Flyover Bridge	1,048.0	1,043.6	4.4
Bow River	48,466	Old Langevin Bridge	1,043.0	1,043.2	-0.2
Bow River	48,357	New Langevin (Edmonton Trail) Bridge	1,046.0	1,042.8	3.2
Bow River	48,322	Harry Kroeger Bridge	1,046.6	1,042.6	4.0
Bow River	48,039	St. Patrick's Island Pedestrian Bridge	1,042.3	1,042.0	0.3

Table 29: Bridge Clearances – Design Flood Scenario

River	Bridge Station (m)	Name	Minimum Low Chord (m)	Design Flood Level (m)	Clearance (m)
Bow River	46,875	St. Georges Island Bridge	1,042.8	1,040.1	2.7
Bow River	45,907	CP Rail Bridge	1,038.9	1,038.7	0.2
Bow River	44,622	Cushing Bridge	1,035.9	1,035.6	0.3
Bow River	41,346	Abandoned CP Rail Bridge	1,035.4	1,031.2	4.2
Bow River	41,283	CP Rail Bridge	1,031.2	1,031.0	0.2
Bow River	41,149	Bonnybrook Bridge	1,032.8	1,030.1	2.7
Bow River	40,475	Calf Robe Bridge	1,032.9	1,028.9	4.0
Bow River	39,960	CN Rail Bridge	1,032.1	1,027.6	4.5
Bow River	37,493	Graves Bridge, Upstream	1,025.9	1,023.1	2.8
Bow River	37,472	Graves Bridge, Downstream	1,025.9	1,022.8	3.1
Bow River	34,768	Eric Harvie Bridge	1,019.7	1,018.7	1.0
Bow River	32,758	Ivor Strong Bridge	1,020.3	1,015.1	5.2
Bow River	31,203	Sue Higgins Bridge	1,012.7	1,011.8	0.9
Bow River	26,722	McKenzie Bridge	1,005.0	1,003.4	1.6
Bow River	23,949	Marquis de Lorne Bridge, Upstream	1,002.1	998.7	3.4
Bow River	23,908	Marquis de Lorne Bridge, Downstream	1,002.5	998.4	4.1
Bow River	18,365	Dunbow Road Bridge, Upstream	991.6	987.3	4.3
Bow River	18,333	Dunbow Road Bridge, Downstream	991.6	986.6	5.0
Elbow River	60,538	Balsam Avenue	1,299.8	1,298.0	1.8
Elbow River	48,182	Highway 22 Bridge	1,207.4	1,206.3	1.1
Elbow River	29,253	Highway 8 Bridge	1,105.5	1,105.7	-0.2
Elbow River	20,501	Grey Eagle Drive	1,082.4	1,082.5	-0.1
Elbow River	18,229	Weaselhead Glenmore Pathway	1,078.5	1,078.5	0
Elbow River	12,319	Glenmore Trail Bridge	1,080.2	1,077.9	2.4
Elbow River	8,851	Sandy Beach Bridge	1,057.9	1,057.8	0.1
Elbow River	7,601	Riverdale Avenue Bridge	1,055.8	1,055.9	-0.1
Elbow River	7,206	Elboya Bridge	1,054.2	1,055.5	-1.3
Elbow River	5,506	Rideau Park Bridge	1,052.9	1,053.2	-0.3
Elbow River	4,783	Mission Bridge	1,050.6	1,052.5	-1.9
Elbow River	4,043	25th Avenue SW Bridge	1,048.5	1,050.5	-2.0
Elbow River	3,483	Lindsay Park	1,048.6	1,049.1	-0.5
Elbow River	3,243	Lindsay Park CNR Bridge	1,048.6	1,048.7	-0.1
Elbow River	2,954	Pattison Bridge	1,045.6	1,048.1	-2.5
Elbow River	2,720	Victoria Bridge	1,045.6	1,047.8	-2.2
Elbow River	2,677	LRT Bridge	1,046.7	1,047.6	-0.9
Elbow River	2,455	Stampede Park Access Bridge	1,045.9	1,047.0	-1.1
Elbow River	1,902	Horse Barn Bridge (New)	1,044.7	1,045.5	-0.8
Elbow River	1,855	Horse Barn Bridge (Old)	1,044.3	1,045.4	-1.1
Elbow River	1,244	Weadick Crossing	1,043.4	1,044.0	-0.6
Elbow River	991	Stampede Park (N) Saddledome Access Bridge	1,043.4	1,043.7	-0.3
Elbow River	576	MacDonald Bridge	1,041.2	1,042.7	-1.5
Elbow River	334	CP Rail Bridge	1,042.0	1,041.8	0.2

Table 29: Bridge Clearances – Design Flood Scenario

River	Bridge Station (m)	Name	Minimum Low Chord (m)	Design Flood Level (m)	Clearance (m)
Elbow River	287	9th Avenue SE Bridge	1,041.4	1,041.1	0.3
Elbow River	165	Travers Bridge	1,041.1	1,040.8	0.3
Bragg Creek	1,065	Centre Avenue	1,315.8	1,314.4	1.4
Bragg Creek	117	Bracken Road	1,306.4	1,307.5	-1.1
Lott Creek	4,093	Fisherman's Lake Pedestrian Bridge	1,109.7	1,108.9	0.8
Lott Creek	3,530	Golf Course Bridge 1	1,106.9	1,107.7	-0.8
Lott Creek	3,431	Golf Course Bridge 2	1,106.9	1,107.7	-0.8
Lott Creek	3,390	Golf Course Bridge 3	1,106.9	1,107.3	-0.4
Prince's Island	476	Jaipur Bridge	1,046.2	1,046.5	-0.3
Prince's Island	308	Prince's Island Bridge on Side Channel	1,045.0	1,046.5	-1.5
Zoo Island	1,868	St. Patrick's Island Bridge on Zoo Side Channel	1,042.9	1,042.2	0.7
Zoo Island	1,119	Baines Bridge	1,041.4	1,040.9	0.5
Zoo Island	434	Zoo Service Bridge	1,040.4	1,039.5	0.9

Note: The clearances for the design flood event are the elevation differences between bridge low chord or culvert road surface elevations and simulated water levels. A negative value indicates the water depth above the low chord for a bridge or above the road surface for a culvert.

Table 30: Culvert Clearances – Design Flood Scenario

River	Culvert Station (m)	Name	Minimum Low Chord (m)	Design Flood Level (m)	Clearance (m)
Elbow River	29,253	Highway 8 Bridge	1,105.9	1,105.7	0.2
Lott Creek	5,239	Misty Morning Drive Culvert	1,115.9	1,117.1	-1.2
Lott Creek	5,015	Elbow Valley Lake Culvert	1,114.6	1,116.2	-1.6
Lott Creek	4,581	Lott Creek Hollow Culvert	1,113.9	1,113.9	0.0
Lott Creek	4,482	Wolfwillow Lane Culvert	1,113.4	1,113.5	-0.1
Lott Creek	4,273	Coulee Ridge Culvert	1,111.8	1,111.5	0.3
Lott Creek	3,933	Owl Haven Culvert	1,108.5	1,108.7	-0.2
Lott Creek	3,860	Lott Creek Drive Bridge	1,109.8	1,107.3	2.5

Note: The clearances for the design flood event are the elevation differences between bridge low chord or culvert road surface elevations and simulated water levels. A negative value indicates the water depth above the low chord for a bridge or above the road surface for a culvert.

Railroads

A summary of affected railroads for the design flood scenario is presented in Table 31, including total lengths, lengths for each local authority, as well as a breakdown of railroads located in the floodway, flood fringe (neither high hazard nor protected flood fringe), high hazard flood fringe, and protected flood fringe.

Table 31: Lengths of Affected Railroads – Design Flood Scenario

Location	Affected Railroad Length (km)			
	City of Calgary	Rocky View County	Foothills County	Total
Floodway	0.7	0.0	0.0	**0.7**
Flood Fringe	3.4	0.0	0.0	**3.4**
High Hazard Flood Fringe	1.1	0.0	0.0	**1.1**
Protected Flood Fringe	2.2	0.0	0.0	**2.2**

The south leg of the CTrain Red Line in Calgary would be affected in the Beltline and Manchester Industrial neighbourhoods (tracks running parallel to McLeod Trail South, by overland flooding from the Elbow River through Erlton). The northeast leg of the CTrain Blue Line would be affected in the Bridgeland neighbourhood.

The CP mainline (Calgary-Vancouver) in Calgary would be affected by flooding in the Spruce Cliff and Wildwood neighbourhoods (on the right bank of the Bow River, southeast of Edworthy Park).

No railroads are affected by the design flood in Rocky View County or Foothills County.

For the design flood, about 1 km of railroads would be located in the floodway, about 3 km in the flood fringe, about 1 km in the high hazard flood fringe, and about 2 km in the protected flood fringe zone.

4.4.6 Population

A summary of the affected population for the design flood scenario is presented in Table 32, including total numbers, numbers for each local authority, as well as a breakdown of population located in the floodway, flood fringe (neither high hazard nor protected flood fringe), high hazard flood fringe, and protected flood fringe.

Table 32: Affected Population – Design Flood Scenario

Location	City of Calgary	Rocky View County	Foothills County	Total
Floodway	54	15	9	**79**
Flood Fringe	12,490	8	3	**12,501**
High Hazard Flood Fringe	3,641	0	0	**3,641**
Protected Flood Fringe	7,324	661	0	**7,985**

For the design flood, a population of 79 would be located in the floodway, 12,501 in the flood fringe, 3,641 in the high hazard flood fringe, and 7,985 in the protected flood fringe zone.

5.0 CONCLUSIONS

The main results of the flood risk assessment for the open water flood inundation are summarized below:

- The number of affected land parcels, buildings, and population, as well as the length of roads and railroads, increases from the 2-year to the 1,000-year floods. A significant increase typically occurs between the 100-year and 350-year floods.
- In Calgary, a first significant increase in impact occurs between the 20-year and 35-year floods, as parts of Bowness, Erlton, Mission, Roxboro, and Rideau Park experience direct inundation and the area of flood control structure failure inundation in Sunnyside expands. A second significant increase in impact occurs between the 100-year and 350-year floods, as large parts of Inglewood, Hillhurst, West Hillhurst, Sunnyside, Downtown, and Bridgeland experience direct inundation.
- No critical, non-residential buildings (i.e., government buildings, hospitals, schools, or water treatment facilities) are affected up to the 20-year flood, and no hospitals are affected by any open water floods.
- The length of roads affected remains low until the 5-year flood, and then increases from the 10-year to the 1,000-year floods. Some of the major roads that would be affected in the study area include:
  - Memorial Drive NW in West Hillhurst, Hillhurst, and Sunnyside starting at the 200-year flood.
  - Highway 22 between Bragg Creek and its intersection with Highway 8 starting at the 75-year flood.
  - Deerfoot Trail at the intersection with 17th Avenue SE starting at the 350-year flood.
  - 16th Avenue NW (Trans-Canada Highway) starting at the 350-year flood.
- The length of railroads affected by direct inundation remains low until the 20-year flood. The length increases steadily from the 35-year to the 1,000-year floods.
- The south leg of the CTrain Red Line in Calgary would be affected starting at the 35-year flood. The north leg of the CTrain Red Line would be affected by direct inundation in Sunnyside starting at the 200-year flood. The northeast leg of the CTrain Blue Line would be affected by direct inundation in Bridgeland starting at the 100-year flood and in the East Village starting at 200-year flood.
- The CP mainline (Calgary-Vancouver) in Calgary would be affected on the right bank of the Bow River, southeast of Edworthy Park, starting at the 75-year flood. A large part of the CP Alyth Yard would be affected at the 350-year flood, causing a significant increase in impact between the 200-year and 350-year floods.

The main results of the flood risk assessment for the design flood scenario are summarized below:

- 35 residential buildings and 104 non-residential buildings are located in the floodway. A total of 3,255 residential and 694 non-residential buildings are located in the flood fringe (including high hazard flood fringe and protected flood fringe areas). Of this flood fringe total, 682 residential and 174 non-residential buildings are located in the high hazard flood fringe, and 1,442 residential and 214 non-residential buildings are located in the protected flood fringe.

- A total estimated population of 79 is located in the floodway, and a total estimated population of 24,127 is in the flood fringe (including high hazard flood fringe and protected flood fringe areas). Of this flood fringe total, 3,641 are in the high hazard flood fringe and 7,985 are in the protected flood fringe.
- None of the water treatment plants in Calgary would be affected by the design flood. The Bonnybrook Wastewater Treatment Plant is partially located in the protected flood fringe.
- Some of the major roads that would be affected are Edmonton Trail, including 4th Street NE in Bridgeland north of the Old and New Langevin Bridges, Memorial Drive NE in Bridgeland, Elbow Drive SW in Elbow Park, 4th Street SW in Mission, as well as Highway 22 between Bragg Creek and Redwood Meadows.
- The south leg of the CTrain Red Line in Calgary would be affected in the Beltline and Manchester Industrial neighbourhoods. The northeast leg of the CTrain Blue Line would be affected in Bridgeland.
- The CP mainline (Calgary-Vancouver) in Calgary would be affected in the Spruce Cliff and Wildwood neighbourhoods (along the toe of the right bank of the Bow River, southeast of Edworthy Park).

Report Signature Page

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