

**City of Courtenay
Flood Risk Assessment
Consequence Map**

*Mid-Term Future - Less Likely Event
Affected People*

| | |
|---------------------------------------|-----|
| Affected People | |
| Affected People in the Floodplain (#) | 479 |
| Affected Residential Buildings | 105 |

This map highlights the number and location of residents who would be affected in a less likely flood (0.5% annual exceedance probability) in the mid-term future (loosely linked to the 2100s). Residential buildings in the floodplain are coloured based on the number of residents assigned to each building (2021 Census). Note that affected people numbers are averaged across census dissemination areas.



- Map Notes**
1. Map produced by Ebbwater Consulting Inc. on 28 April 2023.
 2. The affected people layer is associated with the less likely event, mid-term future climate change scenario and is shown on top of this hazard layer. Please refer to the Flood Risk Assessment Appendix (Ebbwater, 2023) for definitions of terms, and details on datasets, methodology and limitations.
 3. Affected population is based on the census 2021 dissemination areas and building footprints within the project area boundary. The number of people per building is averaged within each census dissemination area, and its accuracy at a building level is limited by the available information.
 4. The mid-term future climate change scenario considers a 1 m Sea Level Rise (SLR) and a 15% increase in riverine flows compared to present-day (nominally 2020) conditions. A less likely event has a 0.5% Annual Exceedance Probability (AEP).
 5. Inset map shows an indicative area. It is not meant to necessarily show areas of higher or lesser importance.
 6. Depth classifications are based on Flood Hazard Mapping Guidelines for British Columbia (Ebbwater, 2022).
 7. This map is intended to support an understanding of risk. IT SHOULD NOT BE RELIED ON FOR ENGINEERING DESIGN OR REGULATORY CONTROLS.

- Data Sources**
1. The flood hazard extents were received from CVRD on 28 May 2021 (KWL, 2021).
 2. Building footprints, parcel layer, and BC Assessment 2021 valuation and land data were obtained from the City of Courtenay on 15 July 2022. Current Flood Protection Infrastructure locations were received from COC on 20 December 2022 (2019/2020 Dike Crest Survey completed by WSP on behalf of the Province).
 3. Base Layer (Main Map): OSM Humanitarian Data Model and CARTO's Positron, created using derivatives of OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography licence CC BY-SA). Base Layer (Overview Map): OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography licence CC BY-SA).

- References**
1. Ebbwater Consulting Inc. (2023). City of Courtenay Flood Management Plan – Appendix A Flood Risk Assessment. Prepared for the City of Courtenay.
 2. Kerr Wood Leidal Associates Ltd. (2021). Coastal Flood Mapping Project. Final Report. Prepared for Comox Valley Regional District.
 3. Ebbwater Consulting Inc. (2022). Flood Hazard Mapping Guidelines for British Columbia. Draft Report. Prepared for the Province of British Columbia.

Legend

| | |
|---|--|
| <p>Affected People per Residential Building (#)</p> <ul style="list-style-type: none"> 2 - 4 4 - 6 6 - 10 >10 | <p>Background</p> <ul style="list-style-type: none"> Current Flood Protection Infrastructure City Boundary K'ómoks First Nation Reserve Lands Municipal & Commercial Buildings in Flood Hazard Extent Building Footprints outside of Flood Hazard Extent |
|---|--|

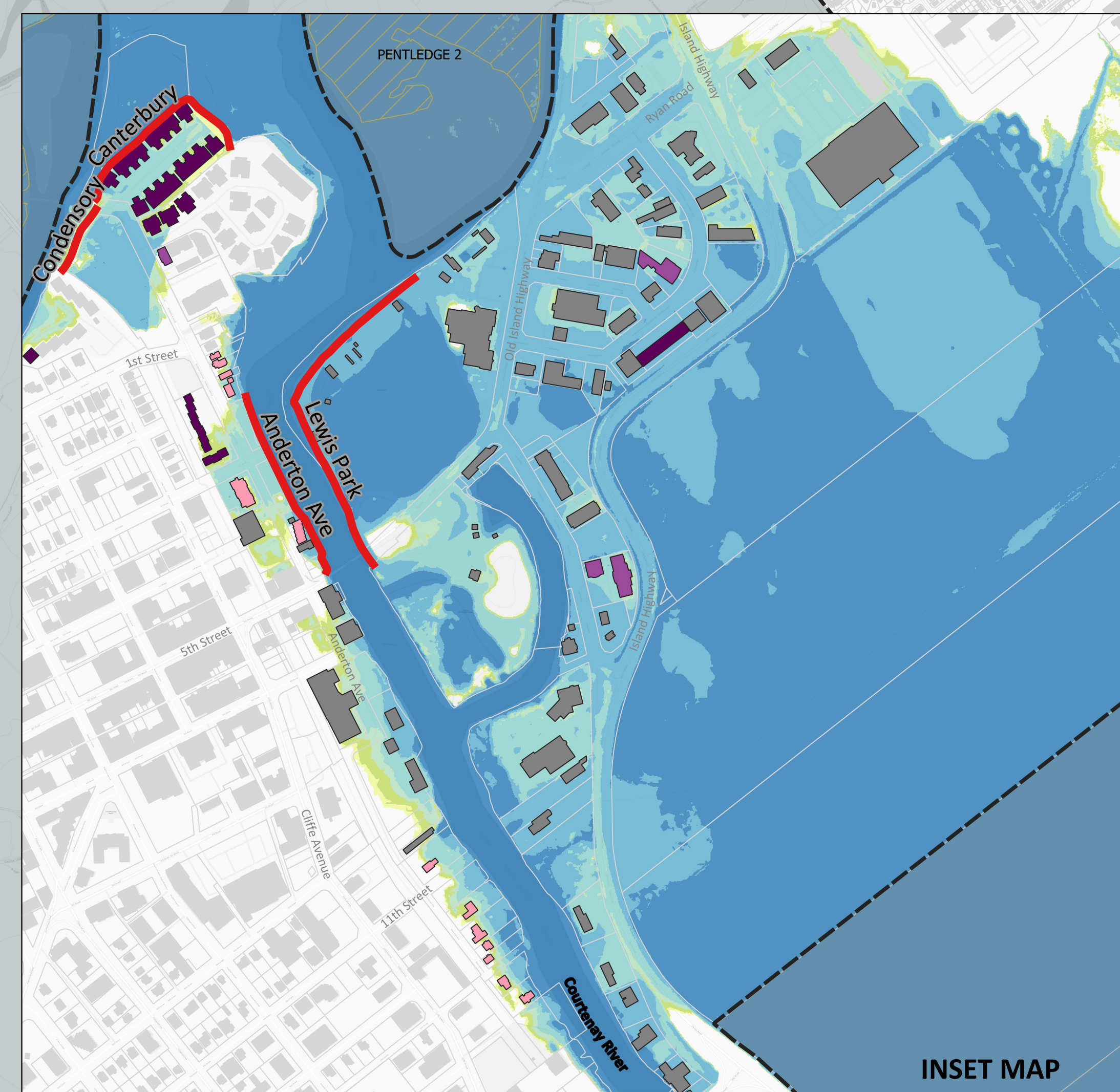
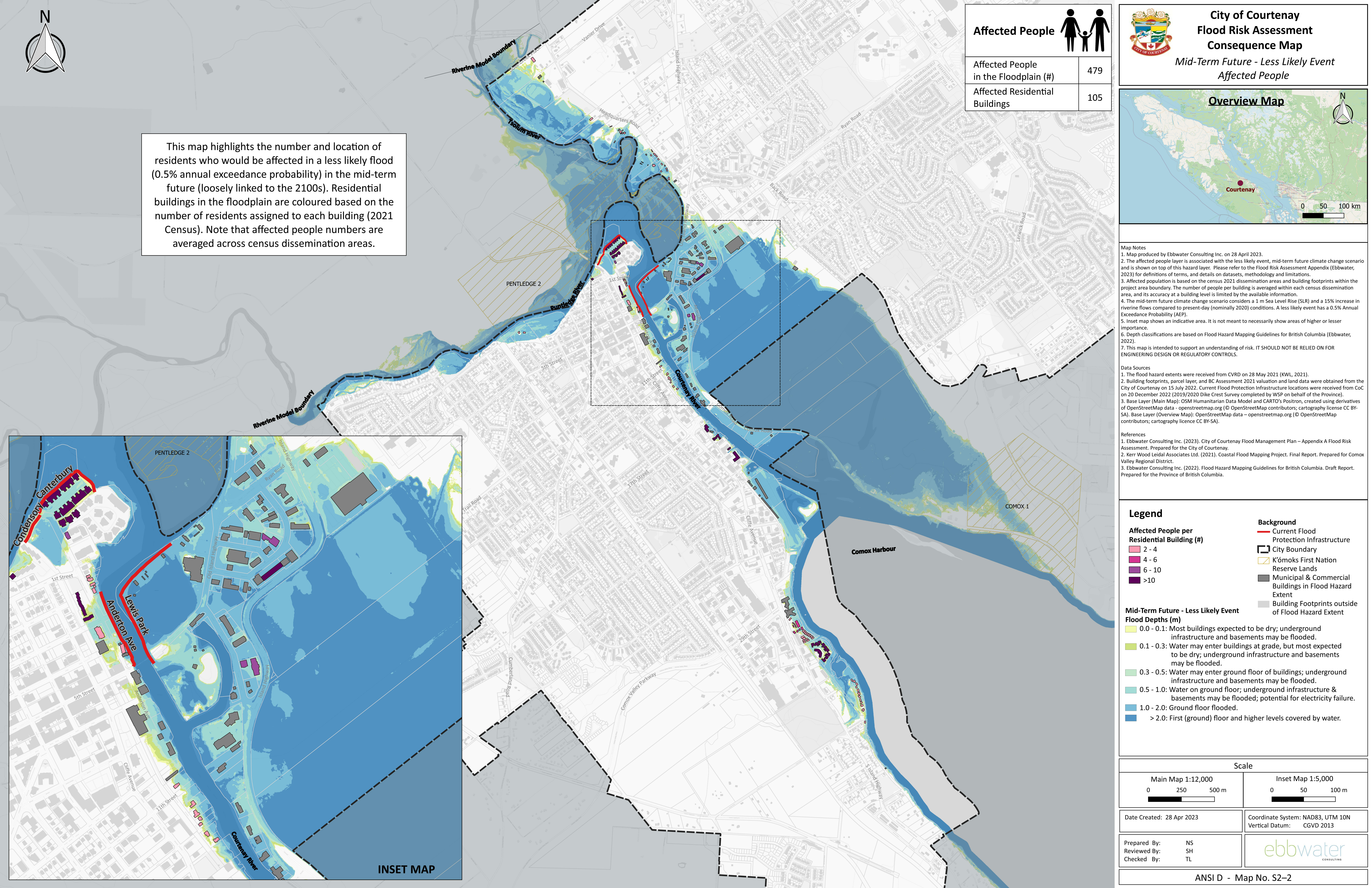
Mid-Term Future - Less Likely Event Flood Depths (m)

- 0.0 - 0.1: Most buildings expected to be dry; underground infrastructure and basements may be flooded.
- 0.1 - 0.3: Water may enter buildings at grade, but most expected to be dry; underground infrastructure and basements may be flooded.
- 0.3 - 0.5: Water may enter ground floor of buildings; underground infrastructure and basements may be flooded.
- 0.5 - 1.0: Water on ground floor; underground infrastructure & basements may be flooded; potential for electricity failure.
- 1.0 - 2.0: Ground floor flooded.
- > 2.0: First (ground) floor and higher levels covered by water.

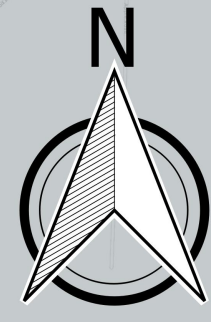
| Scale | |
|---|--|
| <p>Main Map 1:12,000</p> <p>0 250 500 m</p> | <p>Inset Map 1:5,000</p> <p>0 50 100 m</p> |

Date Created: 28 Apr 2023
Coordinate System: NAD83, UTM 10N
Vertical Datum: CGVD 2013

Prepared By: NS
Reviewed By: SH
Checked By: TL

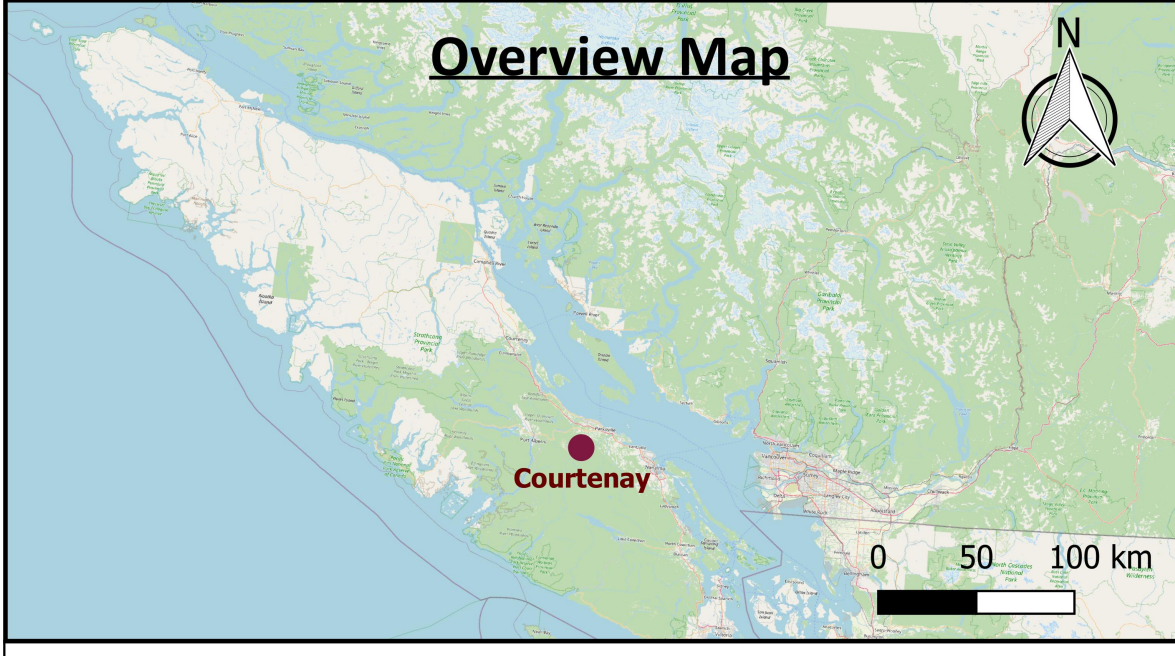


INSET MAP



**City of Courtenay
Flood Risk Assessment
Consequence Map**
*Mid-Term Future - Less Likely Event
Critical Infrastructure*

| Critical Infrastructure | |
|---|-----|
| Roads in the Floodplain (km) | 6.5 |
| CI Facilities in the Floodplain (#) | 8 |
| Transmission Structures in the Floodplain (#) | 2 |



This map highlights the number and location of critical infrastructure facilities, transmission structures, and the length and location of roads, which would be affected in a less likely flood (0.5% annual exceedance probability) in the mid-term future (loosely linked to the 2100s). Critical infrastructure in the floodplain is highlighted, and then coloured based on the type of the building or road it depicts.

- Map Notes**
- Map produced by Ebbwater Consulting Inc. on 28 April 2023.
 - The Critical Infrastructure (CI) layers are associated with the less likely event, mid-term future climate change scenario and is shown on top of this layer. Please refer to the Flood Risk Assessment Appendix (Ebbwater, 2023) for definitions of terms, and details on datasets, methodology and limitations.
 - Critical infrastructure facilities include emergency response and first responder facilities, hospitals and medical clinics, sanitary sewer lift stations, public administration buildings, water distribution systems, water tanks and pump stations, BC Hydro substations, as well as transportation hubs (airports and ports), and food banks.
 - Location of line/point features of basic services in hazard extent include BC Hydro and Fortis distribution poles and transmission structures, Telus and Shaw telecommunication facilities (pedestals), roads and railways. BC Hydro and Fortis distribution poles are not shown on the map for clarity but are included in the quantitative analysis and reporting.
 - The mid-term future climate change scenario considers a 1 m Sea Level Rise (SLR) and a 15% increase in riverine flows compared to present-day (nominally 2020) conditions. A less likely event has a 0.5% Annual Exceedance Probability (AEP).
 - Inset map shows an indicative area. It is not meant to necessarily show areas of higher or lesser importance.
 - Depth classifications are based on Flood Hazard Mapping Guidelines for British Columbia (Ebbwater, 2022).
 - This map is intended to support an understanding of risk. IT SHOULD NOT BE RELIED ON FOR ENGINEERING DESIGN OR REGULATORY CONTROLS.

- Data Sources**
- The flood hazard extents were received from CVRD on 28 May 2021 (KWL, 2021).
 - Building footprints, and parcel layer were obtained from the City of Courtenay on 15 July 2022. Current Flood Protection Infrastructure locations were received from CoC on 20 December 2022 (2019/2020 Dike Crest Survey completed by WSP on behalf of the Province).
 - Base Layer (Main Map): OSM Humanitarian Data Model and CARTO's Positron, created using derivatives of OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography license CC BY-SA). Base Layer (Overview Map): OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography license CC BY-SA).

- References**
- Ebbwater Consulting Inc. (2023). City of Courtenay Flood Management Plan – Appendix A Flood Risk Assessment. Prepared for the City of Courtenay.
 - Kerr Wood Leidal Associates Ltd. (2021). Coastal Flood Mapping Project. Final Report. Prepared for Comox Valley Regional District.
 - Ebbwater Consulting Inc. (2022). Flood Hazard Mapping Guidelines for British Columbia. Draft Report. Prepared for the province of British Columbia.

Legend

| | | |
|--|-----------------------|---|
| Affected Critical Infrastructure (CI) | Affected Roads | Background |
| Transportation | Local | Transmission Structures (Electricity) |
| Water Distribution Systems | Moderate | CI Facilities |
| Sanitary Sewer Lift Stations | Major | Current Flood Protection Infrastructure |
| Transmission Structures (Electricity) | | City Boundary |
| | | Roads |
| | | Train Tracks (not in service) |
| | | Land Parcels & Building Footprints |
| | | K'ómoks First Nation Reserve Lands |

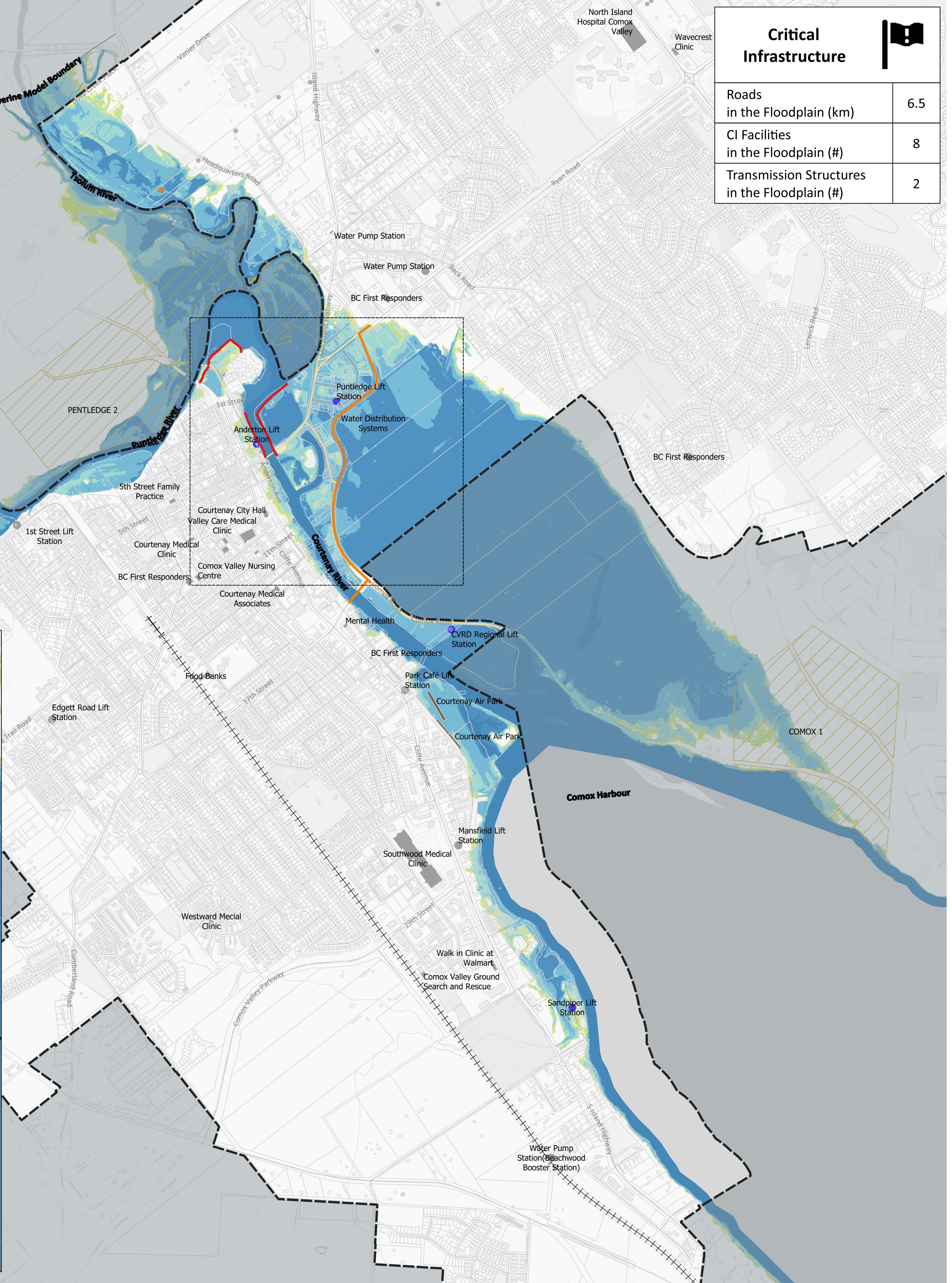
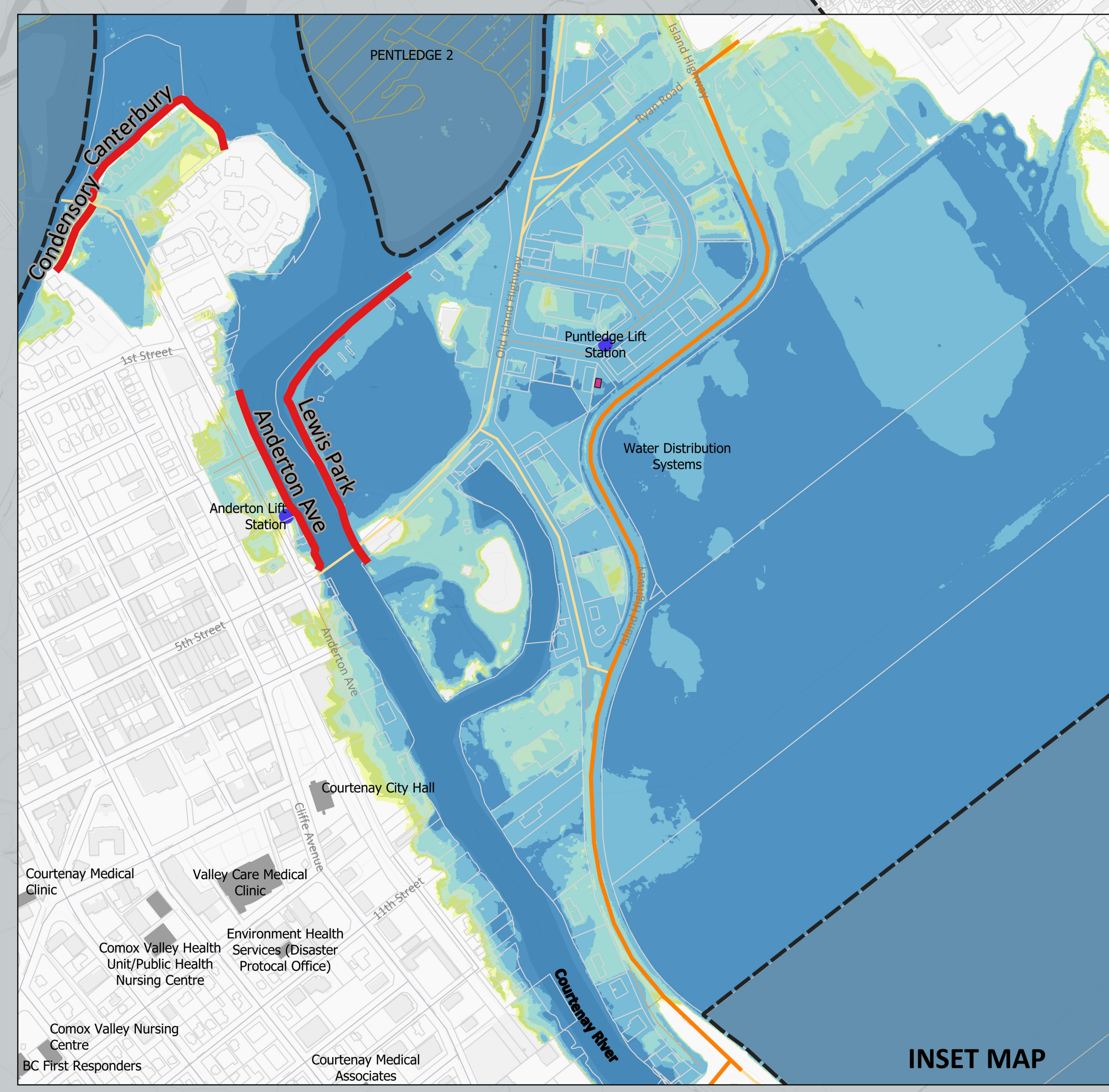
- Mid-Term Future - Unlikely Event Flood Depths (m)**
- 0.0 - 0.1: Most buildings expected to be dry; underground infrastructure and basements may be flooded.
 - 0.1 - 0.3: Water may enter buildings at grade, but most expected to be dry; underground infrastructure and basements may be flooded.
 - 0.3 - 0.5: Water may enter ground floor of buildings; underground infrastructure and basements may be flooded.
 - 0.5 - 1.0: Water on ground floor; underground infrastructure & basements may be flooded; potential for electricity failure.
 - 1.0 - 2.0: Ground floor flooded.
 - > 2.0: First (ground) floor and higher levels covered by water.

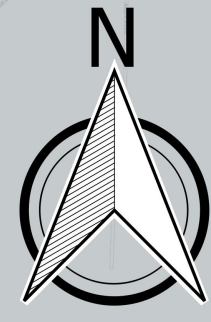
Scale

| | |
|-------------------|-------------------|
| Main Map 1:12,000 | Inset Map 1:5,000 |
| 0 250 500 m | 0 50 100 m |

Date Created: 28 Apr 2023
Coordinate System: NAD83, UTM 10N
Vertical Datum: CGVD 2013

Prepared By: NS
Reviewed By: SH
Checked By: TL





Culture & Recreation



| | |
|---|-----|
| Cultural Facilities in the Floodplain (#) | 19 |
| Trails and Greenways in the Floodplain (km) | 8.3 |
| Publicly Documented Indigenous Archaeological Sites in the Floodplain (#) | 13 |



City of Courtenay Flood Risk Assessment Consequence Map

Mid-Term Future - Less Likely Event
Culture & Recreation



This map highlights the number and location of cultural facilities and trails and greenways, which would be affected in a less likely flood (0.5% annual exceedance probability) in the mid-term future (loosely linked to the 2100s). Cultural facilities and trails and greenways in the floodplain are highlighted, and then coloured based on the type of cultural facility or trail/greenways they depict). Locations of archaeological sites are not included on the map, as it is sensitive information that cannot be distributed publicly.

Map Notes

- Map produced by Ebbwater Consulting Inc. on 28 April 2023.
- The culture layers are associated with the less likely event, mid-term future climate change scenario and are shown on top of this layer. Please refer to the Flood Risk Assessment Appendix (Ebbwater, 2023) for definitions of terms, and details on datasets, methodology and limitations.
- Culture indicator layers include educational facilities (childcare, schools, post-secondary education buildings), related agricultural facilities, municipal buildings, recreational facilities such as cinemas, park buildings, aquatic centres, and youth centres, civic facilities such as museums, and community halls, religious centres, trails and greenways, and archaeological and heritage sites (including publicly documented Indigenous archaeological and traditional use sites and trails). Locations of archaeological sites are not included on the map, as it is sensitive information that cannot be distributed publicly. Parks and riverine areas were removed from the dataset to avoid double-counting areas.
- The mid-term future climate change scenario considers a 1 m Sea Level Rise (SLR) and a 15% increase in riverine flows compared to present-day (nominally 2020) conditions. A less likely event has a 0.5% Annual Exceedance Probability (AEP).
- Inset map shows an indicative area. It is not meant to necessarily show areas of higher or lesser importance.
- Depth classifications are based on Flood Hazard Mapping Guidelines for British Columbia (Ebbwater, 2022).
- This map is intended to support an understanding of risk. IT SHOULD NOT BE RELIED ON FOR ENGINEERING DESIGN OR REGULATORY CONTROLS.

Data Sources

- The flood hazard extents were received from CVRD on 28 May 2021 (KWL, 2021).
- Trails, greenways, building footprints, parcel layer, and BC Assessment 2022 valuation and land data were obtained from the City of Courtenay on 15 July 2022. Current Flood Protection Infrastructure locations were received from COC on 20 December 2022 (2019/2020 Dike Crest Survey completed by WSP on behalf of the Province).
- Cultural facilities were assembled from information received from the City of Courtenay on 15 July 2022, and BC Data Catalogue. Archaeological data received from the Archaeology Branch on 13 July 2022.
- Base Layer (Main Map): OSM Humanitarian Data Model and CARTO's Positron, created using derivatives of OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography licence CC BY-SA). Base Layer (Overview Map): OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography licence CC BY-SA).

References

- Ebbwater Consulting Inc. (2023). City of Courtenay Flood Management Plan – Appendix A Flood Risk Assessment. Prepared for the City of Courtenay.
- Kerr Wood Leidal Associates Ltd. (2021). Coastal Flood Mapping Project. Final Report. Prepared for Comox Valley Regional District.

Legend

| | |
|-------------------------------------|---|
| Affected Culture | Background |
| Trails & Greenways | Building Footprints |
| Affected Cultural Facilities | Current Flood Protection Infrastructure |
| Educational Facilities | City Boundary |
| Municipal Buildings | Roads |
| Recreational Facilities | Heritage Sites & Cultural Facilities |
| Heritage Sites | K'ómoks First Nation Reserve Lands |

Mid-Term Future - Unlikely Event Flood Depths (m)

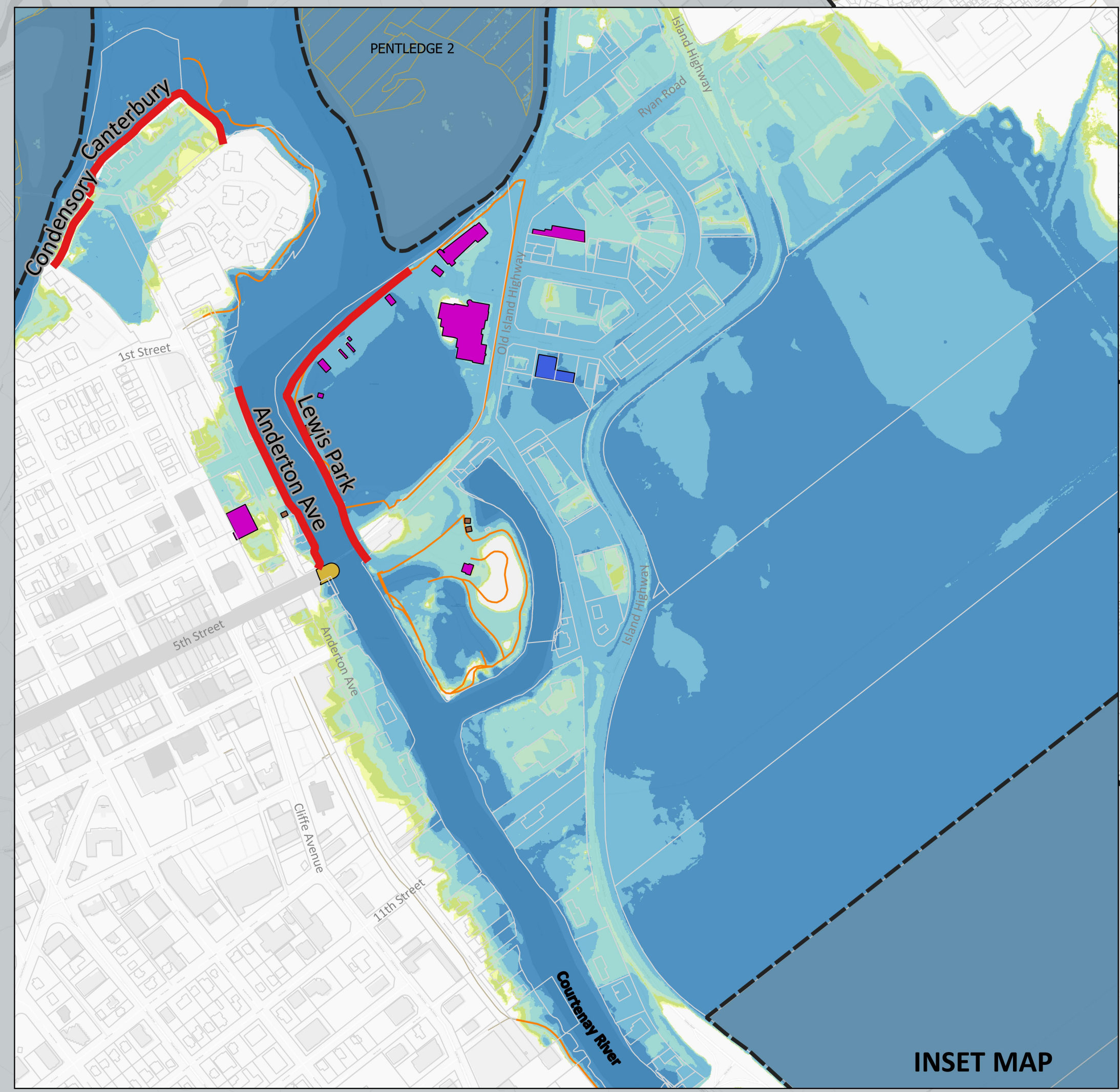
- 0.0 - 0.1: Most buildings expected to be dry; underground infrastructure and basements may be flooded.
- 0.1 - 0.3: Water may enter buildings at grade, but most expected to be dry; underground infrastructure and basements may be flooded.
- 0.3 - 0.5: Water may enter ground floor of buildings; underground infrastructure and basements may be flooded.
- 0.5 - 1.0: Water on ground floor; underground infrastructure & basements may be flooded; potential for electricity failure.
- 1.0 - 2.0: Ground floor flooded.
- > 2.0: First (ground) floor and higher levels covered by water.

Scale

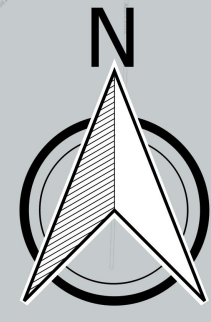
| | |
|-------------------|-------------------|
| Main Map 1:12,000 | Inset Map 1:5,000 |
| 0 250 500 m | 0 50 100 m |

Date Created: 28 Apr 2023
Coordinate System: NAD83, UTM 10N
Vertical Datum: CGVD 2013

Prepared By: NS
Reviewed By: SH
Checked By: TL



INSET MAP



**City of Courtenay
Flood Risk Assessment
Consequence Map**

*Mid-Term Future - Less Likely Event
Economy*

| | |
|---|-----------|
| Economy | \$ |
| Total Building Value in the Floodplain (M\$) | 139.5 |
| Total Buildings in the Floodplain (#) | 208 |
| Total Agriculture Area in the Floodplain (ha) | 91 |



This map highlights the total building value and location of buildings, which would be affected in a less likely flood (0.5% annual exceedance probability) in the mid-term future (loosely linked to the 2100s). Buildings in the floodplain are highlighted, and then coloured based on the 2022 BC Assessment total building value assigned to the building.

- Map Notes**
1. Map produced by Ebbwater Consulting Inc. on 28 April 2023.
 2. The economy layers are associated with the less likely event, mid-term future climate change scenario and is shown on top of this layer. Please refer to the Flood Risk Assessment Appendix (Ebbwater, 2023) for definitions of terms, and details on datasets, methodology and limitations.
 3. Total building values are based on BC Assessment 2022 information (BCA, 2022) for the parcels and have been assigned to the respective building footprints within the parcels. The accuracy of the results at building level is limited by the available information.
 4. The mid-term future climate change scenario considers a 1 m Sea Level Rise (SLR) and a 15% increase in riverine flows compared to present-day (nominally 2020) conditions. A less likely event has a 0.5% Annual Exceedance Probability (AEP).
 5. Inset map shows an indicative area. It is not meant to necessarily show areas of higher or lesser importance.
 6. Depth classifications are based on Flood Hazard Mapping Guidelines for British Columbia (Ebbwater, 2022).
 7. This map is intended to support an understanding of risk. IT SHOULD NOT BE RELIED ON FOR ENGINEERING DESIGN OR REGULATORY CONTROLS.

- Data Sources**
1. The flood hazard extents were received from CVRD on 28 May 2021 (KWL, 2021).
 2. Building footprints, parcel layer, Agricultural Land Reserve (ALR), and BC Assessment 2022 valuation and land data were obtained from the City of Courtenay on 15 July 2022. Current Flood Protection Infrastructure locations were received from CoC on 20 December 2022 (2019/2020 Dike Crest Survey completed by WSP on behalf of the Province).
 3. Base Layer (Main Map): OSM Humanitarian Data Model and CARTO's Positron, created using derivatives of OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography license CC BY-SA). Base Layer (Overview Map): OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography license CC BY-SA).

- References**
1. Ebbwater Consulting Inc. (2023). City of Courtenay Flood Management Plan – Appendix A Flood Risk Assessment. Prepared for the City of Courtenay.
 2. Kerr Wood Leidal Associates Ltd. (2021). Coastal Flood Mapping Project. Final Report. Prepared for Comox Valley Regional District.
 3. BCA. (2022). 2022 BC Assessment data for Areas of Interest. Received via the City of Courtenay.

Legend

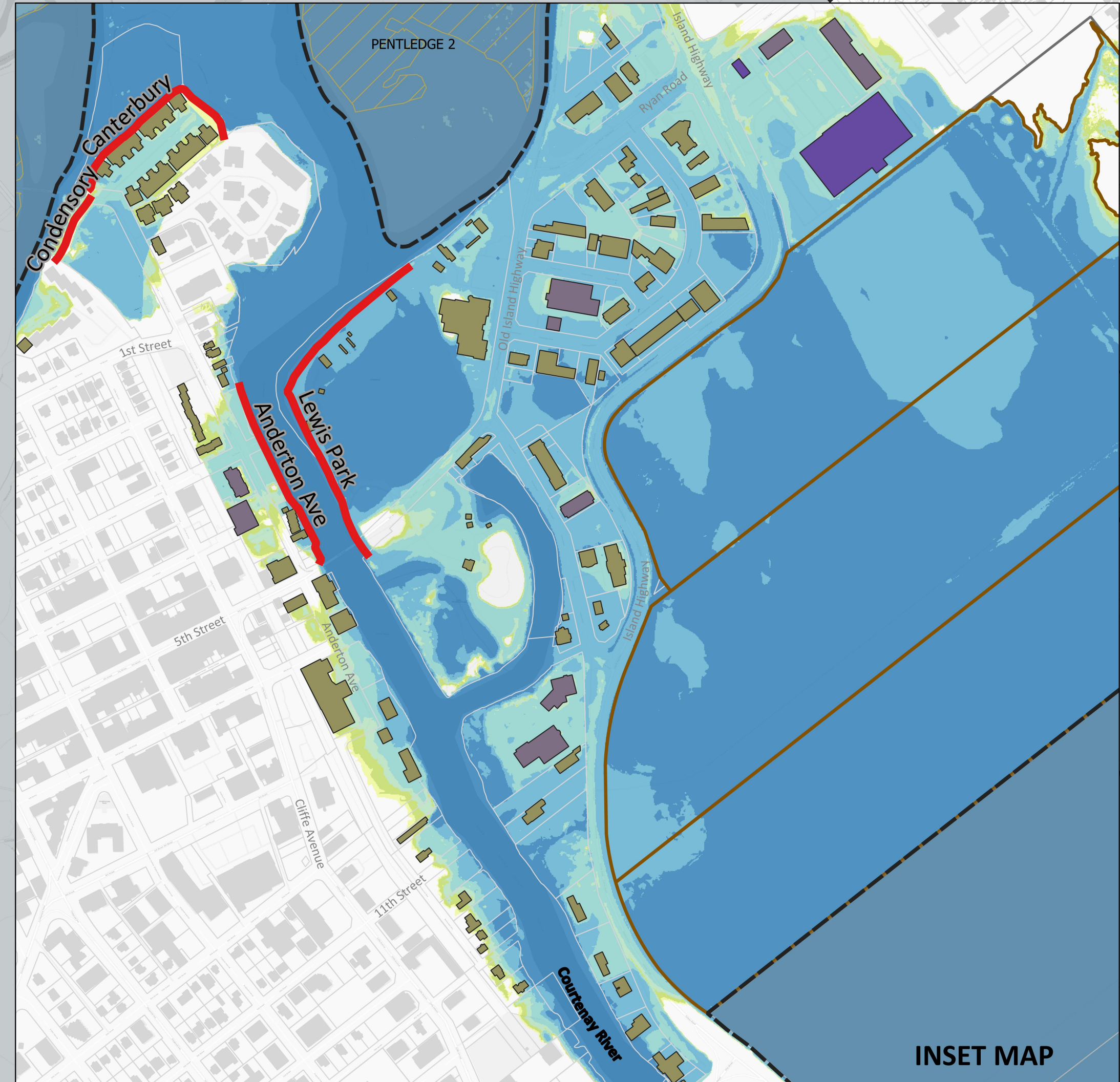
- | | |
|---|---|
| Total Affected Building Values (in M \$) | Background |
| 0 - 2 | — Current Flood Protection Infrastructure |
| 2 - 4 | ▭ City Boundary |
| 4 - 10 | ▭ Land Parcels |
| >10 | ▭ Building Footprints |
| Affected Agriculture | ▭ Agricultural Land Reserve (ALR) |
| ▭ Agricultural Land Reserve (ALR) Parcels | ▭ K'ómoks First Nation Reserve Lands |

- Mid-Term Future - Less Likely Event
Flood Depths (m)**
- 0.0 - 0.1: Most buildings expected to be dry; underground infrastructure and basements may be flooded.
 - 0.1 - 0.3: Water may enter buildings at grade, but most expected to be dry; underground infrastructure and basements may be flooded.
 - 0.3 - 0.5: Water may enter ground floor of buildings; underground infrastructure and basements may be flooded.
 - 0.5 - 1.0: Water on ground floor; underground infrastructure & basements may be flooded; potential for electricity failure.
 - 1.0 - 2.0: Ground floor flooded.
 - > 2.0: First (ground) floor and higher levels covered by water.

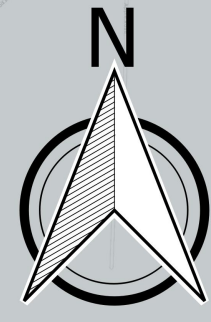
| Scale | |
|----------------------------------|---------------------------------|
| Main Map 1:12,000 0 250 500 m | Inset Map 1:5,000 0 50 100 m |

Date Created: 28 Apr 2023
Coordinate System: NAD83, UTM 10N
Vertical Datum: CGVD 2013

Prepared By: NS
Reviewed By: SH
Checked By: TL



INSET MAP



**City of Courtenay
Flood Risk Assessment
Consequence Map**

*Mid-Term Future - Less Likely Event
Environment*

| Environment | |
|---|------|
| Contamination Sources in the Floodplain (#) | 32 |
| Groundwater Wells in the Floodplain (#) | 2 |
| Species and Ecosystems at Risk in the Floodplain (ha) | 3 |
| Parks in the Floodplain (ha) | 47.8 |
| Conservation Areas in the Floodplain (ha) | 8.9 |



This map highlights the number and location of contamination sources and the location of parks/sensitive ecosystems that could be affected by contamination of flood waters in a less likely flood (0.5% annual exceedance probability) in the mid-term future (loosely linked to the 2100s). Contamination sources and sensitive ecosystems in the floodplain are highlighted, and then coloured based on the type of contamination source or sensitive ecosystem.

Map Notes

- Map produced by Ebbwater Consulting Inc. on 28 April 2023.
- The environment layers are associated with the less likely event, mid-term future climate change scenario and are shown on top of this layer. Please refer to the Flood Risk Assessment Appendix (Ebbwater, 2023) for definitions of terms, and details on datasets, methodology and limitations.
- The maps shows potential contamination sources in the flood hazard extent (incl. auto dealers, repair shops, body shops or potential sites, former and present gasoline/diesel bulk plants, former and present gasoline/diesel outlets), along with assets in the flood hazard extent that could be negatively affected by contamination. This includes groundwater wells and sensitive ecosystems (incl. species and ecosystems at risk, conservation lands, and parks).
- The mid-term future climate change scenario considers a 1 m Sea Level Rise (SLR) and a 15% increase in riverine flows compared to present-day (nominally 2020) conditions. A less likely event has a 0.5% Annual Exceedance Probability (AEP).
- Inset map shows an indicative area. It is not meant to necessarily show areas of higher or lesser importance.
- Depth classifications are based on Flood Hazard Mapping Guidelines for British Columbia (Ebbwater, 2022).
- This map is intended to support an understanding of risk. IT SHOULD NOT BE RELIED ON FOR ENGINEERING DESIGN OR REGULATORY CONTROLS.

Data Sources

- The flood hazard extents were received from CVRD on 28 May 2021 (KWL, 2021).
- Parks and sensitive areas were assembled from information received from the City of Courtenay on 15 July 2022, and BC Data Catalogue.
- Contamination sources, building footprints, and parcel layer were obtained from the City of Courtenay on 15 July 2022. Current Flood Protection Infrastructure locations were received from CoC on 20 December 2022 (2019/2020 Dike Crest Survey completed by WSP on behalf of the Province).
- Base Layer (Main Map): OSM Humanitarian Data Model and CARTO's Positron, created using derivatives of OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography license CC BY-SA). Base Layer (Overview Map): OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography license CC BY-SA).

References

- Ebbwater Consulting Inc. (2023). City of Courtenay Flood Management Plan – Appendix A Flood Risk Assessment. Prepared for the City of Courtenay.
- Kerr Wood Leidal Associates Ltd. (2021). Coastal Flood Mapping Project. Final Report. Prepared for Comox Valley Regional District.

Legend

| | |
|---------------------------------------|------------------------------------|
| Affected Parks/Sensitive Areas | Background |
| Species and Ecosystems at Risk | Land Parcels & Building Footprints |
| Conservation Areas | Current Flood |
| Parks | Protection Infrastructure |
| Groundwater Wells | City Boundary |
| | K'ómoks First Nation Reserve Lands |
| | Potential Contamination Sources |
| | Parks/Sensitive Areas |

Affected Potential Contamination Sources

- Auto Dealers, Repair Shops, Body Shops, or Potential Sites
- Gasoline/Diesel Bulk Plants (Former and Present)
- Gasoline/Diesel Outlets (Former and Present)
- Gas/Diesel Outlets and Auto Dealers, Repair Shops, Body Shops, or Potential Sites (Former)

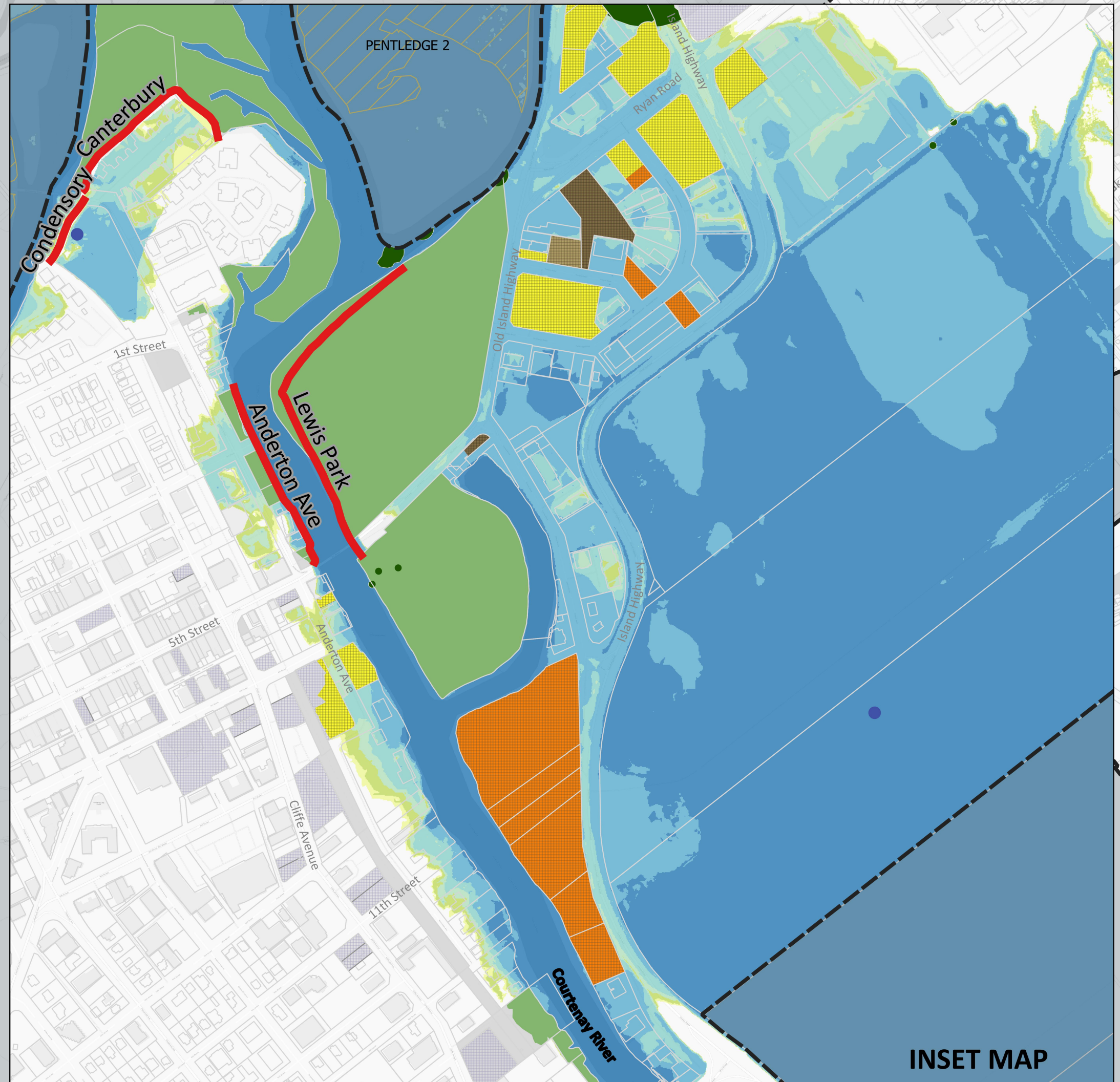
Mid-Term Future - Less Likely Event Flood Depths (m)

- 0.0 - 0.1: Most buildings expected to be dry; underground infrastructure and basements may be flooded.
- 0.1 - 0.3: Water may enter buildings at grade, but most expected to be dry; underground infrastructure and basements may be flooded.
- 0.3 - 0.5: Water may enter ground floor of buildings; underground infrastructure and basements may be flooded.
- 0.5 - 1.0: Water on ground floor; underground infrastructure & basements may be flooded; potential for electricity failure.
- 1.0 - 2.0: Ground floor flooded.
- > 2.0: First (ground) floor and higher levels covered by water.

| Scale | |
|-------------------|-------------------|
| Main Map 1:12,000 | Inset Map 1:5,000 |
| 0 250 500 m | 0 50 100 m |

Date Created: 28 Apr 2023
Coordinate System: NAD83, UTM 10N
Vertical Datum: CGVD 2013

Prepared By: NS
Reviewed By: SH
Checked By: TL



INSET MAP