Map Series 4 of 7:
Mortality Indicator

31 December 2019
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Acknowledgement

The *Syilx* Okanagan Flood and Debris Flow Risk Assessment is made possible by the many *Syilx* Okanagan Nation members from across the territory who generously contributed their input, knowledge, and lived experience – all of which form the foundations of this Assessment. Special recognition is given to the *Syilx* Okanagan traditional knowledge keepers and Elders who led the watershed tours and were a guiding force in rooting the assessment in traditional *Syilx* Okanagan perspectives.

This Assessment is a testament to the power of collaboration and partnership between *Syilx* and non-*Syilx* organizations, including the project team at Ebbwater Consulting Inc. (Ebbwater), and exhibits a shared concern for how water is managed and recognized in the territory.

Support for this project came from Emergency Management British Columbia (EMBC) and Public Safety Canada (PSC) as part of the National Disaster Mitigation Program (NDMP), First Nation Adapt Program and the Real Estate Foundation of B.C. through successful applications submitted by the Okanagan Nation Alliance (ONA).

Okanagan Nation Alliance would like to acknowledge Ebbwater for the production of this Map Book, which was completed by Dickon Wells, M. Eng, with support from Silja Hund, Ph.D., Nikoletta Stamataou, M.Sc., and Robert Larson, M.Sc. Qualitative input for the Map Book is owed to project participants, as well as Erica Crawford (SHIFT Collaborative) and Kelly Terbasket (indigenEYEZ) for leading the workshops. Cory McGregor, GIT and Derek Cronmiller, P.Geo (both of Palmer Environmental Consulting Group Ltd.) provided the information to quantitively map debris flow hazard. The Map Book contains significant input from ONA team members Tessa Terbasket, Kathy Holland, and Skyeler Folks. The Map Book was reviewed by Tamsin Lyle, P.Eng of Ebbwater.

The team is grateful to *Syilx* Okanagan community staff who contributed to and supported the process; Colleen Marchand (OKIB), Brody Armstrong (PIB), Stephanie Paul (WFN), Jonathan Ford (WFN), Wendy Hawkes (LSIB), Trudy Peterson (LSIB), Mike Allison (USIB) and Robin Irwin (USIB). Finally, the team would like to thank the *Syilx* Okanagan Flood Adaptation Initiative Steering Committee members who will continue to work together and provide direction to co-build flood resilience in the region.
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Introduction
The ONA was a successful Stream 1 applicant to the National Disaster Mitigation Program (NDMP) to study flood and debris flow hazard risk in the Okanagan-Similkameen region. This project is the initial phase of a multi-year flood and debris flow adaptation initiative. This project’s goal is to understand the risk due to flood and debris flows within the project area, to support priority-setting of future work.

This Map Book is one of four outputs that form the risk assessment component of this project (Figure 1). The Map Book may also be used as the main visual reference to the Synthesis and Recommendations report, for readers to obtain a summary understanding of the project. The Qualitative, Quantitative, and Basis of, studies contain more detailed information. The Map Book summarizes the spatial results following the methods described in the Qualitative and Quantitative studies.

Figure 1: Project reporting diagram, with the Risk Assessment’s four distinct outputs (i.e., Map Book, Basis of Study, and the complementary Qualitative and Quantitative studies).
Overview of Maps

Ebbwater assessed the impacts from both flood and debris flow in the Okanagan-Similkameen watersheds. This assessment was done quantitively and qualitatively. This map series is one out of a series of 7 that together form the Map Book. In aggregate, the 7 series cover the 2 hazards assessed and 6 exposure indicators. The table below lists the 7 series, and highlights the series contained herein. The qualitative maps combine impacts from both flood and debris flow hazards. The quantitative maps show consequences from flood and debris flow hazards separately. In the quantitative maps, the consequences for flood hazard are shown for the moderate magnitude scenario only.

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<tr>
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• Low, Moderate, and High Magnitude Flood |
| Series 2 | Environment Indicator   | • Qualitative (Impacts)  
• Quantitative (Consequences) |
| Series 3 | Culture Indicator       | • Qualitative (Impacts)  
• Quantitative (Consequences) |
| **Series 4** | Mortality Indicator | • Quantitative (Consequences) |
| Series 5 | Affected People Indicator | • Qualitative (Impacts)  
• Quantitative (Consequences) |
| Series 6 | Economy Indicator        | • Qualitative (Impacts)  
• Quantitative (Consequences) |
| Series 7 | Disruption Indicator     | • Qualitative (Impacts)  
• Quantitative (Consequences) |

Printing and Document Navigation

All maps are designed and scaled to be printed in ‘ANSI D’ format. Maps are linked and can be navigated through by clicking within the following:

- Index line items on page 3.
- Blue tiles, watersheds or text, located in the top right-hand corner of the maps, where present.
- Sub-watershed index map on page 9.
- Hyperlinked Map index on page 7.
Notes to User

Quantitative
1. Building footprints have been used as an indicator of missing and mortality as these are the locations where people are more likely to be. All buildings within the hazard area have been shown as these are all areas of high potential exposure. In reality the missing and mortality rate is expected to be lower than that indicated on this map.
2. The building footprint (exposure) layer was clipped to the debris flow hazard areas. The hazard layer is shown in the hazard maps, and was produced by Palmer Environmental Consulting Group Inc. The method used to produce the hazard layer is described in the Quantitative Study.

Data Sources
1. Lakes and Watercourses: BC Data Catalogue.
3. Syilx Place Names: Okanagan Nation Alliance
4. Building Footprints: Regional district and municipalities and hand digitized using Bing Satellite Imagery.
5. Base Layer: OpenStreetMap data – openstreetmap.org (© OpenStreetMap contributors; cartography licence CC BY-SA) and hill shade created using CDEM and USGM GMTED2010.
Map Index

Quantitative Maps
M-D-001-001  Debris Flow - Mortality - Sub-watershed Index
M-D-002-001  Debris Flow - Mortality - Quantitative Project Area Map
M-D-002-002  Debris Flow - Mortality - Quantitative Okanagan Map
M-D-002-003  Debris Flow - Mortality - Quantitative Similkameen Map
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M-D-003-020  Debris Flow - Mortality - Quantitative Map Tile 20 of 20
Map Notes:
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Scale 1:350,000
Map Notes
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Scale:
Main Map 1:400,000
Inset Maps 1:150,000

Legend:
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Date: 31 December 2019
Produced by: Ebbwater Consulting Inc.
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Scale 1:50,000

Legend
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Date: 31 December 2019
Produced by: Ebbwater Consulting Inc.
Syilx (Okanagan) Flood and Debris Flow Risk Assessment Project
Debris Flow - Missing and Mortality
ANSI D - Map No. M-D-003-001
Map Notes:
1. Map produced by Ebbwater Consulting Inc.
2. Building footprints have been used as an indicator of missing and mortality as these are the locations where people are more likely to be. All buildings within the hazard areas have been shown as these are all areas of high potential exposure. In reality the missing and mortality is expected to be lower than that indicated on this map.
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Scale 1:50,000

Legend
Background
- Watershed Boundary
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- Reserves
- Building Footprints
- Lakes
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- Highway
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- Okanagan - Similkameen Boundary

Affected Assets
- Building Density
- Affected Buildings

Date: 31 December 2019
Produced by: Ebbwater Consulting Inc.
Syilx (Okanagan) Flood and Debris Flow Risk Assessment Project
Debris Flow - Missing and Mortality
ANSI D - Map No. M-D-003-002
Map Notes:
1. Map produced by Ebbwater Consulting Inc.
2. Building footprints have been used as an indicator of missing and mortality as these are the locations where people are more likely to be. All buildings within the hazard areas have been shown as these are all areas of high potential exposure. In reality, the missing and mortality rate is expected to be lower than that indicated on this map.
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Legend
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Affected Assets
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Scale 1:50,000

Date: 31 December 2019
Produced by: Ebbwater Consulting Inc.

Syilx (Okanagan) Flood and Debris Flow Risk Assessment Project
Debris Flow - Missing and Mortality
ANSI D - Map No. M-D-003-003
Map Notes:
1. Map produced by Ebbwater Consulting Inc.
2. Building footprints have been used as an indicator of missing and mortality as these are the locations where people are more likely to be. All buildings within the hazard areas have been shown as these are all areas of high potential exposure. In reality the missing and mortality rate is expected to be lower than that indicated on this map.
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Scale 1:50,000

Legend
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  - Building Density
    - Affected Buildings

Date: 31 December 2019
Produced by: Ebbwater Consulting Inc.
Syilx (Okanagan) Flood and Debris Flow Risk Assessment Project
Debris Flow - Missing and Mortality
ANSI D - Map No. D-003-004
Map Notes:
1. Map produced by Ebbwater Consulting Inc.
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Affected Assets
- Affected Buildings

Scale 1:50,000
0 1 2 3 4 5 km
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Scale 1:50,000

Legend
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Date: 31 December 2019
Produced by: Ebbwater Consulting Inc.

Syilx (Okanagan) Flood and Debris Flow Risk Assessment Project
Debris Flow - Missing and Mortality
ANSI D - Map No. M-D-003-008
Map Notes:
1. Map produced by Ebbwater Consulting Inc.
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Scale 1:50,000

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Date: 31 December 2019
Produced by: Ebbwater Consulting Inc.

Syilx (Okanagan) Flood and Debris Flow Risk Assessment Project
Debris Flow - Missing and Mortality
ANSI D - Map No. M-D-003-010
Map Notes:
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Scale 1:50,000

Legend

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ANSI D - Map No. M-D-003-012
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Legend

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<th>Affected Assets</th>
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<tbody>
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<td>Watershed Boundary</td>
<td>Building Density</td>
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<tr>
<td>Canada - US Border</td>
<td>Affected Buildings</td>
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<tr>
<td>Reserves</td>
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<td>Building Footprints</td>
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<td>Major Road</td>
<td></td>
</tr>
<tr>
<td>Okanagan - Similkameen Boundary</td>
<td></td>
</tr>
</tbody>
</table>

Date: 31 December 2019
Produced by: Ebbwater Consulting Inc.

Syilx (Okanagan) Flood and Debris Flow Risk Assessment Project
Debris Flow - Missing and Mortality
ANSI D - Map No. M-D-003-013
Map Notes:
1. Map produced by Ebbwater Consulting Inc.
2. Building footprints have been used as an indicator of missing and mortality as these are the locations where people are more likely to be. All buildings within the hazard area have been shown as these are all areas of high potential exposure. In reality the missing and mortality rate is expected to be lower than that indicated on this map.
3. The building footprint (exposure) layer was clipped to the debris flow hazard areas. The hazard layer is shown in the hazard maps, and was produced by Palmer Environmental Consulting Group Inc. The method used to produce the hazard layer is described in the Quantitative Study.

Data Sources:
1. Lakes and Watercourses: BC Data Catalogue.
3. Syilx Place Names: Okanagan Nation Alliance.
4. Building Footprints: Regional district and municipalities and hand digitized using Bing Satellite imagery.
5. Base Layer: OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography licence CC BY-SA) and hill shade created using CDEM and USGS GMTED2010.

Scale 1:50,000

Legend
- Watershed Boundary
- Canada - US Border
- Reserves
- Building Footprints
- Lakes
- Watercourses
- Highway
- Major Road
- Okanagan - Similkameen Boundary

Date: 31 December 2019
Produced by: Ebbwater Consulting Inc.
Syilx (Okanagan) Flood and Debris Flow Risk Assessment Project
Debris Flow - Missing and Mortality
ANSI D - Map No. M-D-003-014
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Scale 1:50,000

Legend
- Watershed Boundary
- Canada - US Border
- Reserves
- Building Footprints
- Lakes
- Watercourses
- Highway
- Major Road
- Okanagan - Similkameen Boundary

Affected Assets
- Building Density
- Affected Buildings

Date: 31 December 2019
Produced by: Ebbwater Consulting Inc.
Syilx (Okanagan) Flood and Debris Flow Risk Assessment Project
Debris Flow - Missing and Mortality
ANSI D - Map No. M-D-003-016
Map Notes:
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Scale 1:50,000

Legend
- Watershed Boundary
- Canada - US Border
- Reserves
- Building Footprints
- Lakes
- Watercourses
- Highway
- Major Road
- Okanagan - Similkameen Boundary
- Affected Assets
  - Building Density
  - Affected Buildings

Date: 31 December 2019
Produced by: Ebbwater Consulting Inc.

Syilx (Okanagan) Flood and Debris Flow Risk Assessment Project
Debris Flow - Missing and Mortality

ANSI D - Map No. M-D-003-018
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Scale 1:50,000

Legend
- Watershed Boundary
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Date: 31 December 2019
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Syilx (Okanagan) Flood and Debris Flow Risk Assessment Project
Debris Flow - Missing and Mortality
ANSI D - Map No. M-D-003-019
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