Channel Migration Mapping to Support Shoreline Master Program Updates in Washington State

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Introduction

The Washington State Shoreline Master Program (SMP) Guidelines requires counties to identify the general location of Channel Migration Zones (CMZ) as part of the shoreline planning process. Managing development within the CMZ allows for the occurrence of fluvial processes, maintains channel complexity and habitat diversity, and reduces potential damages to infrastructure within hazardous areas. The SMP planning level approach decreases the cost of SMP updates by not requiring detailed CMZ assessments.

Washington Department of Ecology (Ecology) administers the shoreline program and provides technical assistance to local communities completing SMP updates. As part of SMP technical assistance, Ecology and its partners are mapping the general location of CMZs for more than 500 stream miles within Kitsap, Mason, Clallam and Skagit Counties.

The US Environmental Protection Agency provided funding to Ecology to map the general location of CMZs on Puget Sound streams. This task is Phase 1 of the EPA funded project. The Phase 1 objective is to develop and apply a streamlined CMZ mapping approach to meet the requirements of SMP updates.

Objectives of this poster are:

- Describe the streamlined CMZ mapping approach developed for SMP planning level requirements
- Provide examples of mapping results using the streamlined approach

Methods

The streamlined CMZ mapping approach relies on a geomorphic assessment of reach-scale fluvial processes based on available GIS data sources. Method steps include:

- Identify stream reaches
- Assess reach-scale geomorphic characteristics
- Derive Relative Water Surface Elevation (RWSE) DEM from LiDAR
- Map alluvial landscape and Holocene channel migration area from the RWSE
- Preliminary CMZ Mapping Methods followed two tracks:
  - Streams obscured by tree canopy from aerial photo view:
    - Identify the alluvial landscape from RWSE and LiDAR
    - CMZ boundaries extend to edges of alluvial landscape
  - Streams visible from aerial photo view:
    - Alluvial landscape
    - Channel pattern and bend amplitude
    - Channel behavior over the aerial photo record (1990-2010)
    - Channel / valley interaction
- Modify and finalize CMZ boundaries using:
  - Erosion hazards
  - Geology and soil composition of adjacent valley walls
  - Geotechnical stability of slopes
  - Disconnected Migration Area (DMA)
- Special conditions and features addressed in CMZ delineations
  - Underfit stream conditions
  - Possible Inundation Zones (PIZ)
  - Channel widening
  - Alluvial fans (underlying main stem streams)
  - Alluvial fans (tributary streams)
  - Avulsion hazards

Results

Examples of CMZ maps for varied geomorphic conditions including small heavily canopied streams, alluvial fans, streams widening their glacial valleys, and changes in sediment loading are provided below.

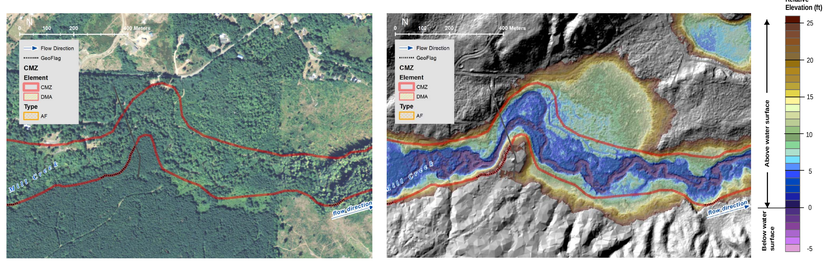

***Figure 1**. Example from Mill Creek illustrates delineation of a planning level CMZ on a stream reach obscured by tree canopy. The RWSE model shows the channel locations and alluvial landscape used to determine the CMZ.*

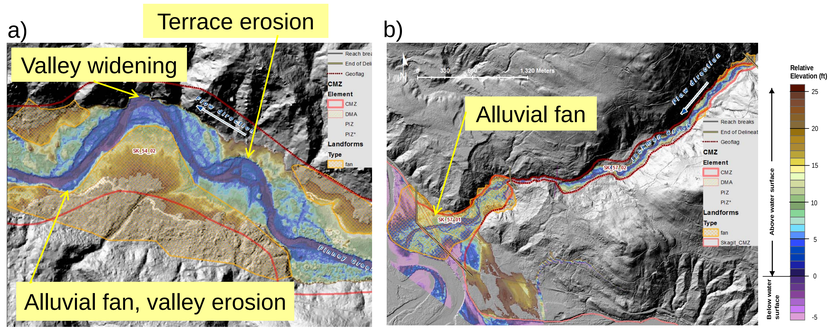

***Figure 2.** a) Finney Creek provides an example of a stream forming and expanding its valley through terrace erosion and active valley widening. b) Jackman Creek illustrates the CMZ location on a SMP stream alluvial fan and on tributary alluvial fans.*

***Figure 3.** Delineation of avulsion pathways needs to anticipate vertical channel changes associated with large wood accumulations or landslides that deflect flow and initiate side channels in the floodplain.*

Team and Acknowledgements

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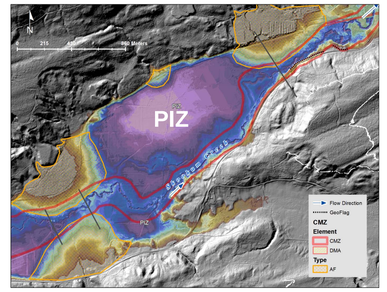


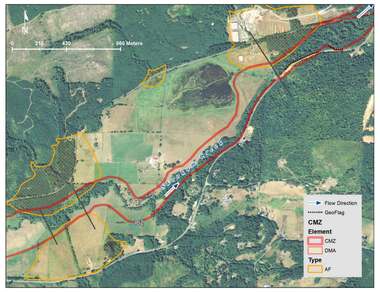
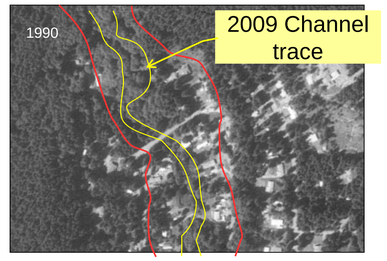


***Figure 4.** Skookum Creek illustrates a CMZ delineation for an underfit stream. Surfaces within the valley that lie below the estimated water surface elevation and outside the CMZ were labeled as possible inundation zones (PIZ). The PIZ are often associated with underfit streams and wetlands.*



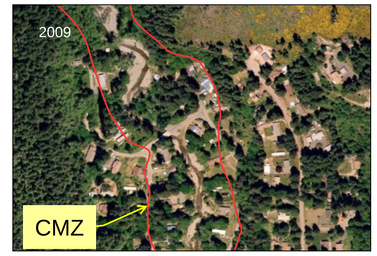


***Figure 5**. Fluvial processes and channel changes are episodic. CMZ delineations need to anticipate future changes in geomorphic conditions such as increases in sediment loading which can trigger aggradation and channel widening. The example shows a reach of Mission Creek which experienced channel widening in response to recent flood events.*

Phase 1 Conclusions

- The streamlined CMZ approach provides reasonable general location CMZ maps for SMP planning purposes based on prevailing geomorphic conditions.
- The streamlined approach does not substitute for more intensive CMZ investigations.
- Detailed CMZ mapping should be used to guide site-specific management actions, where necessary.
- The streamlined approach provides information for developing restoration opportunities related to channel migration processes. The streamlined method:
  - Shows distribution and abundance of off-channel habitats not visible on air photographs (Figure 1 and 3).
  - Identifies sediment loading and wood jam areas that provide floodplain restoration opportunities (Figure 3).
  - Identifies changes in channel morphology as a indicators of changes in watershed processes (Figure 5).
  - Identifies restoration opportunities for reconnecting DMAs.