

## MEMO

**To:** Michelle McConnell, Regional Shoreline Planner, Ecology SWRO SEA Program

**From:** Lynn Schmidt, PE, CFM, Statewide Flood Engineer, Ecology SEA Program

**CC:** Board of Clallam County Commissioners  
Steve Gray, DCD Deputy Director/Planning Manager, Clallam County  
Brian Lynn, Coastal/Shorelands Section Manager, Ecology SEA Program

**Date:** April 23, 2018

**Subject:** Stream Channel Migration and the Clallam County SMP Update – Release of final documents and response to County questions

---

This technical assistance memo is provided to help support and provide guidance for the Clallam County Shoreline Master Program (SMP) Comprehensive Update as the Board of County Commissioners is wrapping-up the local approval process. In response to the county's email and letter inquiries regarding stream channel migration, Ecology is providing final versions of some key documents and additional explanation to assist the Board's understanding. The content of this memo is presented in the order of the following topics:

- Final Channel Migration Assessment Reports
  - Puget Sound Streams (WRIAs 18 – 19)
  - Lower Morse Creek
  - Pacific Streams (WRIA 20)
  - Quality Assurance Project Plan (QAPP)
- Response to County Questions
  - General
  - West End
  - Policy & Regulatory Implementation
  - Future Mapping Efforts

### Final Channel Migration Assessment Reports

The initial draft versions of the key documents were prepared by a team of highly qualified professionals and provided to the county by our agency as complete and accurate for their intended purpose. I have reviewed these finalized Channel Migration Assessment (CMA) reports and confirm they are technically sound and represent an accurate planning-level understanding of channel migration in Clallam County.

These key documents include three stream channel migration assessments (CMAs) and the related quality assurance plan completed by a team of Ecology staff and consultants. These documents were originally provided to the county as drafts in 2011 – 2013. The timing for these Clallam CMAs was based on 1) the County's June 2013 deadline for local approval of the SMP Update, and 2) the County's lack of resources to complete this technical analysis themselves. Serving our role as technical advisors to local

government, these assessments were intended to help supplement the county's inventory and characterization as a required part of the update process. The planning-level channel migration zones (pCMZs) were identified to meet SMP guidelines, assist with planning, and to indicate areas that warrant additional detailed study.

Ecology received an EPA grant for this work that also included CMAs on streams in Kitsap, Mason, and Skagit Counties. Concurrently, [A Methodology for Delineating Planning-Level Channel Migration Zones](#) was authored by the team, then finalized and published by Ecology (#14-06-025, July 2014). Prior to publication, the methodology and the CMA reports were peer-reviewed by additional agency, academic and private sector qualified professionals including representatives of NOAA, USGS, WA Ecology, Montana DNRC, UC Santa Barbara, and an independent geomorphology/geology expert.

As the county is currently still working towards local approval of an updated SMP, the Clallam CMAs are now being released as final versions with minimal changes that address minor errors, typos, and clarifications. No additional technical analysis was conducted so, overall, these reports are not substantively different than the earlier drafts (minor exceptions noted below):

Puget Sound Streams (WRIAs 18 – 19) – The draft version was dated December 2011, the final version is dated April 2018. Minor non-substantive edits include:

- Chapters 1.2 (pg. 6) and 5.2 (pg. 40) - additional description of context and limitations;

The information in Appendices A – F is the same with two exceptions:

- Appendix D. Relative Water Surface Elevation (RWSE) Method Description is replaced with the final QAPP, which includes the RWSE method description; and
- Appendix E. Data Sheets and Appendix F. CMZ Maps have been reversed.

Lower Morse Creek – This assessment for a limited area of concern was issued in January 2013 as an addendum to the 2011 report on Puget Sound streams.<sup>1</sup> While the memo was not issued as a draft, the Appendix A Map Folio images were not readily accessible. The memo is provided unchanged, but the finalized maps are now included. These maps were re-created from the 2013 map package of GIS data (MPK file); one exception is the background aerial photo is now the current Bing mapping image.

Pacific Streams (WRIA 20) - The draft version was dated April 2013 and serves as a companion piece to the above two documents; the final version is dated April 2018. Minor non-substantive edits include:

- Chapters 1.2 (pg. 6) and 5.2 (pg. 40) - additional description of context and limitations;
- Pages 10 and 42: References to Elk Creek were added to correct the unintentional omission; and
- Chapter 4.2 includes additional description of the West-end's Sooes River CMA in the Puget Sound Streams (WRIAs 18 -19) and the Pacific Streams (WRIA 20) reports.
- Page 43, Section 6.2 first paragraph – better description of Dickey River and Thunder Creek conditions and potential for erosion.

The information in Appendices A – E is the same with two exceptions:

---

<sup>1</sup> The additional work resulted from the county's review of the 2011 draft and follow-up discussions between Ecology, the consultants, and the county about their issues and concerns at this one geographic location.

- Appendix D. Relative Water Surface Elevation (RWSE) Method Description is replaced with the final QAPP, which includes the RWSE method description; and
- The Chapter 8 Maps of CMZs for Clallam County Streams are now located in Appendix E;

Note, no data sheets were prepared for this assessment due to time and resource constraints.

QAPP – Initially, a draft version of the [Quality Assurance Project Plan](#) (QAPP) for the EPA grant project was provided in 2011 as a related and supporting document to the Puget Sound Streams CMA report. The QAPP was subsequently finalized as part of the grant work and published by Ecology in June 2012 (#12-06-006). The final version is applicable to both reports and appended to each.

## Response to County Questions

As the Board of Clallam County Commissioners has been reviewing the Draft SMP and public comments received, they have had questions and concerns about the planning-level CMAs' data, methods, the resulting maps, and reliance on this technical information for regulatory purposes, particularly for West-end streams. Based on the email and letter inquiries the County sent to us in February and March this year, the County's concerns are shown below in **bold text** with shaded boxes and we provide the following explanations and clarifications to aid their review and approval process.

### General

**The wide to very-wide, generalized mapping of the outer extent of mapped CMZ's on the County's west end rivers that would put most west-end waterfront and many non-waterfront properties fully or substantially within the CMZ.**

Ecology Response: As noted in both reports, the pCMZs are recognized as general, coarse-scale assessments that should be used for planning purposes and to act as guidance for where more detailed studies may be needed. The mapping results show approximate boundaries rather than precise locations and do not provide adequate level of detail at the parcel scale for most project/permitting purposes. The pCMZ boundary may not seem immediately intuitive when plotted on recent aerial photography. Information used to determine the pCMZ includes not only recent channel location, but also channel migration over geologic time scales as evidenced by LiDAR maps, soils, and geology. See the 8 example locations for more specifics on particular waterfront properties.

### West End

**Large segments of river reaches that have incised channels and/or channels confined by topography that have experience little evidence of channel movement.**

Ecology Response: The western coastal lowland floodplains are still adjusting from the end of the last ice age about 13,000 years ago. The massive weight of the ice age glaciers had compressed the land surface, which is still rebounding following the retreat of the glaciers. When the land was at a lower elevation relative to sea level, the rivers filled-in the broader floodplains with highly erodible soils. As the land continues to rebound, the channels are incising in the erodible material, but are still capable of migrating across the entire erodible valley bottom. A detailed description of this phenomenon can be

found in the Geology section of both the Puget Sound Streams (WRIA 18 – 19) and Pacific Streams (WRIA 20) reports.

**Very wide CMZ's (e.g., 1,500 to over 3,000 feet in width on one side) where development sites are at both considerable distance and/or elevation above the river.**

Ecology Response: In general, many of these pCMZs extend beyond the valley walls because of the meander amplitude (i.e. the distance between river bends) and geologic context of the valley. Some channels are still widening their valleys as they continue to move towards equilibrium following the last ice age. In cases where the channel abuts the valley wall, landslides may occur. There is considerable evidence of historic landslide activity, particularly where the pCMZ extends into the valley walls. See the 8 example locations for more specifics on particular waterfront properties.

**Many instances of developed and vacant rural lots that are fully within CMZ's, and in some areas include multiple non-waterfront ownerships with one or more intervening ownerships.**

Ecology Response: Land use at the parcel level is not a primary factor in determining planning level CMZ delineations. It could be a consideration at the watershed scale if a particular land use was intense enough to cause changes to the landscape. For example, highly regulated urban areas (i.e. with dams, levees, bridges, culverts, and expansive impervious surfaces) may afford a different channel response than less developed rural areas. Please refer to Chapter 3 of the Pacific Streams (WRIA 20) report for further description of the landscape context.

**Wide mapped CMZ's with no evidence of significant channel movement based on at aerial photos dating back to 1990's reviewed by Ecology and characterized by mature tree stands.**

Ecology Response: It is important to note that evidence of channel movement is pieced together from a number of sources, and is estimated over a timeframe much greater than a few decades. The 1990 era aerial photographs are but one small piece of evidence as they show only very recent historic channel location but give no indication as to the potential for the channel to migrate in the future. Please also refer to the LiDAR maps and relative water surface elevation maps, which more clearly show the geomorphic context of the valleys. Geologic maps also give context clues as to the erodibility of the soils in the valley bottom and walls.

**A mapped "erosion hazard buffer" at varying widths that appears to be a significant, but unknown factor in establishing the outer CMZ boundary.**

Ecology Response: The erosion hazard buffer accounts for potential future migration areas, and is not as easily defined as the recent channel migration areas. It takes into account professional judgement of the fluvial geomorphologists who based the buffer on soil erodibility, channel meander geometry, and topography near the stream. Note, this mapping buffer is not to be confused with the 'erosion hazard area' data used in more detailed delineations, or a regulatory buffer that determines the location of shoreline uses/structures. Please see Figure 4.4 and related descriptions in the Pacific Streams (WRIA 20) report.

**Areas mapped in CMZ's with significant topographic changes (i.e., areas in CMZ at elevations well above the river bed).**

Ecology Response: Elevation above the river bed alone is not an adequate indication of risk or safety. These areas were generally included within the planning level CMZ because of the potential for landslide activity initiated by channel migration. Each location depends on the geomorphic context; for example in some cases, the valley walls are widening, and in others, the geologic character of the valley walls indicate a high fluvial erosion potential. Some of these areas have geotechnical 'flags', which indicate the need for additional geologic investigation.

**Below are 8 examples of CMZ mapping typical of the variety of situations on west-end rivers; the related Ecology CMZ maps are referenced:**

**Example 1: Bogachiel River – Vicinity of US 101/ Fuhrman Road & Walter Way Road –Map 9**

The mapped CMZ in this reach between the river and US 101 ranges between 1,500 to 3,500+ feet in width, including all or most of the land between the Bogachiel River and US 101. This area of the CMZ is also characterized by multiple lots and low density residential development separated from the river by other developed rural residential lots. There does not appear to have been any significant channel movement. What data sources and model assumptions resulted in this very large area being mapped as CMZ? How much of the CMZ is attributed to "erosion hazard buffer" calculation?

Ecology Response: The pCMZ in most of this Bogachiel River reach appears to be dominated by the active channel corridor and avulsion hazard area data layers. Much of the valley bottom is composed of highly-erodible alluvium, which has been deposited by the river moving back and forth across the valley over geologic time. LiDAR data shows evidence of current and historic side channels and potential avulsion pathways. The extent of the pCMZ was based on all these influencing factors, which incorporate an "erosion hazard buffer"; see also the responses above to similar topics. Characterization of existing residential development patterns is not part of the pCMZ methodology.

The channel is somewhat widening its valley in this area as evidenced by scallops on the valley margins with a similar radius of curvature as the current channel. Geotechnical flags are located in two areas on the southern end of the channel where the pCMZ intersects erodible material over 25 feet in height above the water surface and where there is evidence of past landslides. This flag does not increase the width of the CMZ, but notes that future geotechnical analysis is warranted.

**Example 2: Bogachiel River – Between US 101 and Bogachiel River - Map 7**

This reach of the Bogachiel River also has a very wide CMZ (1,500 to 3,000 feet). The west/south side of the river here is commercial forest land. The area between the river and US 101 are rural lands much of which remains forested and undeveloped. As seen on Map 7, this reach contains two developed residential home sites that are fully within the mapped CMZ and a log mill site that is partially within the mapped CMZ. All three of these developed sites are separated from the channel by a significant elevation change. For example, the southern developed residential site visible on Map 7 is over a 100 feet above the elevation of the river and over 300 feet away from the channel, with no evidence of any significant channel movement in 20+ years. Why are these 3 developed sites included within the CMZ given their significant elevation rise and distance from the river and no evidence of significant channel movement based on the aerial photo history analyzed by Ecology? What was the data sources and

model assumptions that resulted in this large area being mapped as CMZ? How much of the CMZ is attributed to "erosion hazard buffer" calculation?

Ecology Response: The pCMZs are intended to capture at least the 100-year time frame, so 1990 channel location is only one small piece of the picture (see also response to the related general question above). For this reach of the Bogachiel River, LiDAR shows evidence of the channel actively engaging with the valley bottom and valley walls. The meander amplitude stretches from valley wall to valley wall (roughly 2,000 feet) with potential avulsion pathways in between the meanders and bank erosion occurring at the outside of meander bends.

The geology of the southeast portion of this map panel is landslide deposits, extending to the east river bank. The valley margin to the northeast is comprised of glacial outwash. These geologic units have moderately high to high fluvial erosion potential.

This is an area where valley widening is evident, particularly on the eastern edge of the valley, as erosional scallops in the valley wall are present with a similar radius of curvature as the active channel. In these areas, the pCMZ extends beyond the valley bottom into the valley hillslopes to account for the valley widening process. A more detailed geotechnical study would help refine the extent of the CMZ in this area, particularly on the western pCMZ boundary where geotechnical flags are located.

**Example 3: Quillayute River - Vicinity of Mora Road (SR 110) and Richwine Road intersection - Map 1**

The CMZ mapped lands on the south side of the river channel are undeveloped commercial forest lands and clearly show an old channel meander. The mapped CMZ area on the north side of the river ranges between 750 feet and 2000 feet in width, and is primarily characterized by a mix of rural lots of various lots sizes from small to large and contains many lots that are not waterfront. What data and model factors resulted in the wide width of the CMZ on the north side of the river in this segment of the Quillayute River? How much of the CMZ is attributed to "erosion hazard buffer" calculation?

Ecology Response: Similar to the large meander on the south side of the river that is a recently abandoned relict channel, there are also smaller and less recent relict channels and meander scrolls on the north side of the river. On the north side of the river, the pCMZ boundary roughly follows scallops in the secondary terrace, which are within 25 feet in elevation of the water surface. Please see the related Relative Water Surface Elevation map that depicts the 25 foot elevation difference underlain by LiDAR data.

Also, please note that no modeling was performed for this study. The Relative Water Surface Elevation "Model" maps are simply a colored depiction of the normal water surface elevation in relation to the ground surface at the time of the LiDAR flight; no hydraulic modeling or use of stream gage data was included.

**Example 4: Calawah River - East of US 101 crossing - Maps 4, 5 and 6**

This reach of the Calawah River east of the US 101 crossing borders the Forks Urban Growth Area (UGA). The south bank is City/UGA and the north bank is commercial forest lands. Much of the Calawah River in the reaches shown on Maps 4-6 are incised and/or confined by steep banks on both sides of the channel. Review of aerial photo history considered by Ecology shows no significant channel movement on these 3 maps. The width of the mapped CMZ in the confined channel areas is still very wide at 250+ feet on both sides. The CMZ on the first meander bend upstream from the US 101 bridge is very wide.

What is the mapping basis for the outer extent of the mapped CMZ along the reaches that are clearly confined by the topography and have shown no significant channel movement? How much of the CMZ is attributed to "erosion hazard buffer" calculation? What is the mapping basis for the outer extent location of the wide CMZ located on the inside of the first meander east of the US 101 crossing, given lack of any significant channel movement over past 20+ years? How much of the CMZ is based on the "erosion hazard buffer" calculation?

Ecology Response: Please refer to the general comments on methodology above for the themes related to these Calawah River reach examples. Chapter 6 of the Pacific Streams (WRIA 20) report describes the mapping results and sub basins, explaining this sub-basin in detail at section 6.1.

Please then refer to the related LiDAR and relative water surface elevation maps. The meander bend just upstream of the US 101 crossing is shown on Calawah River Map 4. The inside bend of the meander is a relatively low terrace, much of it within 10 feet above water surface elevation. Erosional scallops are evident in both sides of the valley wall in addition to meander bend migration scrolls, leaving evidence of river migration into the southern side of the valley. Avulsion pathways can also be seen in the inside of the bend (in darker green colors), which increase the width of the pCMZ.

**Example 5: Sol Duc River - Steelhead Ave and Shuwah Rd area - Map 11**

This reach, like some other segments of the Sol Duc River, is confined by topography. The west bank is characterized by rural residential development whereas the east bank is commercial forest lands. The mapped CMZ in this reach is very wide considering the relative straightness and confinement of the channel. The west bank is characterized by numerous developed residential lots that are at least 1 to 3 lots deep within the mapped CMZ. Review of aerial photo history dating back at least 20+ years (same time period of aerials considered by Ecology) shows no significant channel movement. What is the mapping basis for the outer extent of the mapped CMZ along the reaches that are clearly confined by the topography and have shown no significant channel movement? How much of the CMZ is attributed to "erosion hazard buffer" calculation?

**Example 6: Sol Duc River - US 101 and Hillstrom Rd area - Map 18.**

This reach is characterized by a meandering stretch of the Sol Duc River. On the north-side of the river there are developed rural residential lots on a narrow stretch of land between the river and US 101 and also on the inner meander bend served by Hillstrom Rd. The mapped CMZ is quite wide in this area and completely encompasses all of these residential lots. Developed lots near US 101 are setback from the steep river bank whereas the home sites within the inside of meander are setback from the river at various distances. Review of aerial photo history considered by Ecology shows no significant channel movement.

Ecology Response: These Sol Duc maps show part of an analysis reach that extends from the upper limit of maps down to the Highway 101 bridge. The pCMZ on reaches of the Sol Duc River below this extent are located in the glacial valley and were delineated as one channel width on each side with geotechnical buffers added in areas of highly erodible materials; see pg. 35 of the Pacific Streams (WRIA 20) report. The continental glacial outwash, a recessional outwash, has high fluvial erosion potential (see Table 4.2). See also response to Example #2 above regarding temporal scale.

**Example 7: Big River - Hoko-Ozette Road shown - Map 5**

This reach of the Big River closely parallels the Hoko-Ozette Road. This reach also contains rural residential on larger lots. The mapped CMZ includes a large Tributary 3 Alluvial Fan on east side of river. Other reaches of the Big Creek downstream also have mapped CMZ that include large areas of adjacent mapped alluvial fans. How were the tributary alluvial fans along Big River mapped? Are the mapped alluvial fan areas part of the CMZ? If not, how should the County address proposed development within these areas? How reliable is the data used to map alluvial fan areas in terms of County regulating development within such areas?

Ecology Response: Chapter 4.4 (6) in both reports (page 38 in the Pacific Streams (WRIA 20) report) describes how the entire surface of active alluvial fans are fully included in the pCMZs. As noted, the DEM and relative water surface elevation maps are usually excellent in revealing the alluvial fans. No field surveys or other data were used to delineate alluvial fans, therefore these pCMZs are considered approximate.

**Example 8: Lyre River – Near the mouth - Map 46 of the Puget Sound Streams (WRIAs 18 – 19) report.**

The CMZ area near the mouth of the Lyre River is characterized by state and conservation lands on the east-side and rural residential lands on the west-side. On the west side of the river, most of the rural residential lots between the river and W. Lyre River Road (north of intersection with Harrison Beach Rd) are fully or substantially within the mapped CMZ. Landowners in this lower river reach have questioned the width of the CMZ. The homes are setback generally more than 100 feet from the river and based on LIDAR on terraces 10+ feet above the river. There is no evidence of any significant channel movement on aerial photos in at least the last 20+ years. What is the basis of the outer extent of the CMZ on the west side of the river in the developed areas near the mouth? How much of this is based on the erosion hazard buffer calculation?

Ecology Response: In the Pacific Streams (WRIA 20) report, Chapter 4.4. (4) describes delineation of areas of potential channel migration, including Underfit Streams (page 33), and Figure 4.7 and related text (pages 34-35) addresses the issue of stream valleys formed by glacial processes such as scouring and outwash.

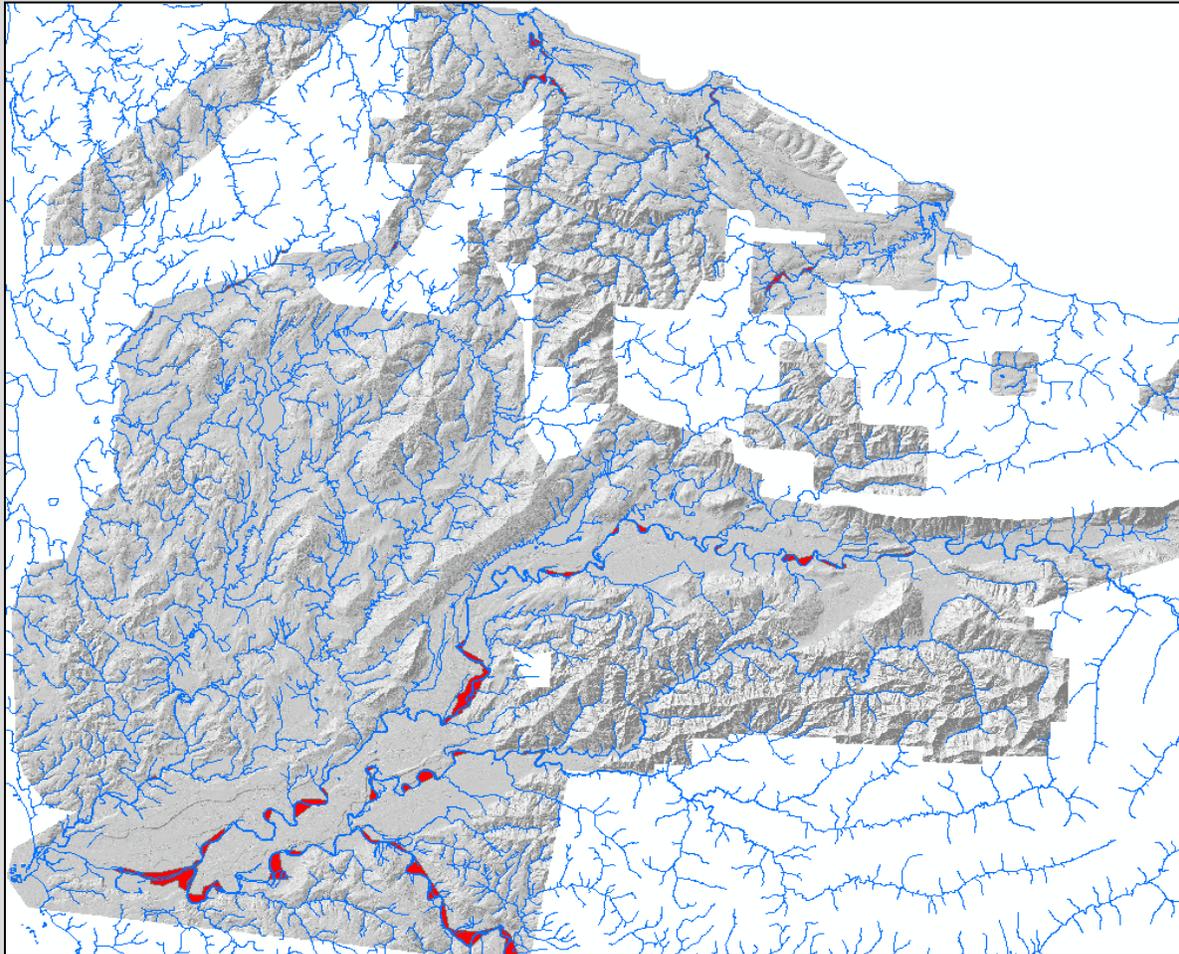
In addition, the Lyre River is specifically explained in Chapter 4.4 (7) on page 38-39:

"The Lyre River example of valley expansion (Figure 4.6) was observed in many streams evaluated by this study. Many included obvious examples of shallow or deep-seated landslides, both recent and prehistoric that had occurred along stream valleys. The potential channel migration boundary in reaches where evidence of valley widening is occurring includes the entire valley bottom plus a portion of the valley wall. The streamlined pCMZ delineations were not intended to be precise, but rather meant simply to call out areas where a more detailed assessment, including a geotechnical analysis, is needed to determine the geographic extent of the hazard. The area where a geotechnical setback buffer is needed is indicated on the maps with black dots in the CMZ boundary line."

See also responses to similar West-end questions above regarding elevation, and to Example #2 above regarding temporal scale.

### LiDAR Data Availability

Below is a general map prepared by the County's GIS Coordinator that shows the area of current LIDAR mapping on the west-end. The shaded areas are where LIDAR data layers currently exist. The areas shaded in "red" on the map correspond to the 1990's County CMZ mapped areas. It is the county's understanding that most of the west-end LIDAR (most of the shaded areas below) was done in 2001 or 2005 at a 6-foot pixel resolution. The county presumes that Ecology's contractors utilized these available 2001 and 2005 Lidar data sets for the west-end CMZ mapping. It would be helpful to confirm whether that is true.



However, not all of the area shaded area below had LIDAR available in 2013 when Ecology conducted the WRIA 20 CZM mapping. The Middle Reach of the Sol Duc River upstream from Steelhead Drive area (couple miles north of Forks) did not have available LIDAR until 2015, or after Ecology's WRIA 20 CMZ mapping. The 2015 Lidar mapping of the Middle Reach of the Sol Duc was at 3-foot pixel resolution. So, it would appear for this middle reach the consultants would have used the USGS 10-meter DEM data, based on the methodology described in the 2013 CZM Report. In regards to Ecology CZM mapping, it would be helpful in your response to the County to confirm:

- Was all available 2001 and 2005 Lidar Data Sets (most of the below shaded area) used in west-end CZM mapping?

- For the Middle Reach of the Sol Duc (no Lidar until 2015), was the USGS 10-meter DEM data used? Please confirm?
- What other mapped CZM reaches (if any) was LIDAR data NOT used where shown available in the below map?

Ecology Response: In the Puget Sound Streams (WRIAs 18 – 19) report (includes West-end Sooes River), Chapter 1.2 notes the use of high resolution (2m) LiDAR DEMs, Chapter 4.3 further describes the data sources and processing, and the Appendix E maps show the data sources depicted, including "2004 LIDAR topography (Puget Sound LIDAR Consortium)".

Similarly in the later Pacific Streams (WRIA 20) report (bulk of the West-end streams), Chapter 1.2 notes the use of high resolution (2m) LiDAR DEMs, Chapter 4.3 further describes the data sources and processing, and the Appenedix E maps show the data sources depicted, including "2002 LIDAR topography (Puget Sound LIDAR Consortium)". The Appendix C method for identifying reaches also notes the Puget Sound LIDAR Consortium data source and provides a web link.

However, Chapter 4.3 also notes that where LiDAR was unavailable, USGS 10m DEMs and topo were used.

2015 LiDAR was not available at the time the reports were created, so USGS 10m DEMs were used as the best available data for areas such as the middle reach of the Sol Duc River. Because LiDAR has starkly sharper resolution, the difference between the two elevation datasets is easily differentiated on the maps. As an example, please see the RWSE Map 10 for the Sol Duc River. There is a distinct difference between the LiDAR and USGS DEM datasets that are both used on this map.

**Please provide a response to public comments related to Ecology's CMZ mapping received by the County:**

- A. Public Comment: "Channel Migration Zone designation (CMZ) and delineation based on four reports (studies) provided by Department of Ecology - A product of General Studies not supportable of a property taking."

Ecology Response: The planning-level channel migration assessments completed for Clallam County are not based on a regional model or mathematical calculations that extrapolate across geographies. Rather, the method reflects a geomorphic evaluation at the reach-scale conducted by licensed professionals, as described in both reports and the QAPP. The comment's general premise regarding general studies and takings is correct. Like any other element of the SMP, the application of these pCMZ maps in the regulation of private property may not result in a taking of constitutionally protected private property rights. The Draft SMP includes measures to ensure regulations do not result in takings, including the incorporation of mandatory "safety valves" such as allowances for reasonable use through the shoreline variance process. The provisions in chapters 1, 2 and 8 are examples of how private property rights are to be protected from unconstitutional regulatory takings.

- B. Public Comment: "Figure 4.1 - Single reach, single stream (Sooes) assessed for WRIA 20. By delineating regional areas in this figure, there is no supporting evidence if the analysis depends also on using conclusions in other regional areas to support the model's hypothesis. If such dependency

is a tool. In the analysis, that relationship and validation is imperative to reach a confidence level that goes beyond general details or looking at things from a 'high altitude'."

Ecology Response: A regional delineation approach was not used. If the reader is asking about the RWSE method's REM (relative elevation model), the maps are derived from LiDAR data that shows elevations of the land surface adjacent to a stream, relative to the elevation of the approximate water surface of the stream. This model was produced specifically and individually for each reach or river segment analyzed. The pCMZs are general delineations depicted as preliminary maps, as described in the Pacific Streams CMA report at Sections 1.2 and 4.1 and now depicted in Appendix E.

The 2011 Report included a single Sooes River reach as an outlier, even though not a Puget Sound watershed. In the subsequent Pacific Streams CMA, the Sooes River was again included due to its location in WRIA 20.

The referenced Figure 4.1 map serves as an index to illustrate the project scope that is described in the text. This figure has been corrected to show the ~170 miles assessed for WRIA 20, rather than the WRIA 18 – 19 areas from the previous CMA.

- C. Public Comment: "Section 4.3 - Stated LIDAR as the primary source, with dependence on DEM in the absence of LIDAR. The report does not address that condition, the extent of the difference, and the effects on the model due to the amount of difference occurring, especially in consideration of WRIA 20 if inferences are occurring in the report that rely on conclusions reached in other regional areas (Figure 4 1) that don't have a similar amount of disparity."

Ecology Response: As noted above, all REM's produced in this effort were derived from LiDAR as the source DEM. No REM's were produced from regional scale DEM's such as USGS 10 meter DEM.

- D. Public Comment: "Tables 4.2 and 4.3 - Data types listed in tables 4.2 and 4.3 are considered for the purpose they serve in particular aspects of CMZs, how that is captured in the model has the potential for flaw if the weight of those factors in relation to the primary LIDAR/DEM components is not specified. If this has been accomplished, the report does not speak to the weighting of the different factors relied upon to be satisfied solely by the data available in the Hoko. There has to be validation to build a level of confidence in the model in this case, to extrapolate solely is a flaw. (But I propose that if such comparison between high/low available data was used between the Sooes and Big Rivers, then the confidence level is even more questionable)"

Ecology Response: All REM's were derived solely from LiDAR topographic data. No weight was given to any other GIS data types.

- E. Public Comment: "Table 4.4 - Logically, table 4 4 captures data that meets a qualified standard for GIS:

- |                                                 |                                                      |
|-------------------------------------------------|------------------------------------------------------|
| - National Hydrography Data                     | - Light Detection and Ranging (LiDAR) elevation data |
| - Shoreline Management Act (SMA) Suggested Arcs | - OEM 10 m                                           |
| - SSURGO soil data                              | - DEM 10 meter hillshade                             |
| - Washington State Geology                      | - 2006, 2009 NAIP Orthophotos                        |
| - Landslides (OGER)                             | - DOQQ                                               |
|                                                 | - Washington State 24K DRG Image Library             |

- FEMA Flood Hazard Zones
- Railroads

- Washington State Routes
- Washington State Local Roads

The three tables, and the primary/alternate tools used to draw the conclusions of the report do not incorporate locally derived data. Unfortunately in many cases the local data would probably not fit neatly in any one of these tables (GIS quality or a specific labeled aspect) and it does not appear the model used (as spoken to in the report) or has the means to incorporate these variables or even considered a factor. And most likely even such data is unpublished or lack of being peer reviewed to establish confidence: but due to a lack of ground truthing by the study on those areas that are so dependent on where direct analysis was conducted, it is only reasonable to provide legitimacy in being relied upon to set new restrictions on private property (as described above)."

Ecology Response: It is not clear specifically what locally derived data the reader feels was omitted. As described above, a regional delineation model was not applied across all streams; each stream reach was evaluated individually.

- F. Public Comment: "My recommendation, my need, the plan needs to be edited to reflect that all streams that were not specifically a function of the model using the primary data source and supported by other viable data sources are limited in scope for those delineations and are "advisory" only for those changes that "exceed" the current county designations."

Ecology Response: As described above, a regional delineation model was not applied across all streams; each stream reach was evaluated individually. SMP revisions may be made by the BoCC prior to local approval. County has discretion in codifying the pCMZ maps or relying on them as 'advisory' technical information for eventual SMP implementation at the project level.

- G. Public Comment: "If my government does not see fit to make this edit, or something similar regarding "advisory" as used in regards to Tsunami zoning, then at a minimum the need for language is essential to identify and address the burden on the landowner (the "Onus" concept used by the DCD director on several occasions with the public and also before the BOCC, resulting in a taking in the form of a burden to limit the landowner they must determine essentially a proportionate measure of mitigation) along with the application of such burden (specifying what that is, but this piece might not be needed if the language is there, just at this point in the process I don't have readily available/known) and allowed exceptions. Otherwise it is my opinion well-crosses the line in being respectful of due process and being subject to an uncompensated taking of property."

Ecology Response: Mapping of habitat and hazard areas is a fundamental step in informing regulations for shoreline development. Ecology believes the pCMZ maps provide a sound basis for planning-level decisions. As noted in our response to A. above, the comment correctly observes that the SMP must be applied within the bounds of 'nexus & proportionality' as established by state and federal constitutions, in order to avoid uncompensated taking of private property. Ultimately, only the courts can say definitively when a taking has occurred. During SMP updates and subsequent implementation, local governments need to pay attention to the "warning signals" as described in the WA Attorney General's [2015 advisory memo on takings of private property](#). The County has discretion to revise the Draft SMP prior to local approval to address concerns about the process for

requiring site-specific or detailed evaluations, establishing burdens on landowners, or clarifying procedures. See also Chapter 2 and Appendix B of the Pacific Streams (WRIA 20) report for regulatory considerations related to pCMZs.

### *Policy & Regulatory Implementation*

**How should the County address review of new development within the Ecology's potential mapped CMZ's based on the examples above in terms of site evaluation and when a report by a qualified professional should be required?**

Ecology Response: Chapters 1 and 2, and Appendix B of both the Puget Sound Streams and Pacific Streams reports include discussion of SMP requirements including a) the general location of CMZs; b) critical areas, c) flood hazard reduction, d) shoreline modification, and e) conditional use standards. Beyond meeting these requirements, the County has discretion as to if/what additional CMZ policy and regulatory provisions to include in their updated SMP. Ecology does not require regulatory buffers of any particular distance but has approved such provisions in some SMPs. The County's September '17 Draft SMP proposal, including pending BoCC revisions for a 'three-step' strategy (similar to Skamania County), appears to be a reasonable and acceptable approach. Locating development outside the area of potential risk will be effective in most locations, some projects in some locations will need more detailed CMZ delineations to help avoid/minimize adverse impacts to life-safety and shoreline resources.

### *Future Mapping Efforts*

**Clallam County is interested in improving CMZ mapping, especially from a risk potential. To assist with estimating CMZ mapping costs, what was the cost (e.g., average per river mile) of Ecology CMZ mapping for WRIA 20 rivers. In addition, any information Ecology can provide to assist with recommended CMZ mapping methodology and cost estimates for more detailed CMZ mapping, especially based on "risk potential" would be appreciated.**

Ecology Response: The approximate 2013 cost for pCMZ mapping some 170 miles of Clallam west-end streams was in the range of ~\$150 - \$175 per stream mile. Ecology has several publications on both the planning-level and detailed CMZ delineation methods (including hazard ratings), related GIS tools, and other guidance on the website:

<https://ecology.wa.gov/Water-Shorelines/Shoreline-coastal-management/Hazards/Stream-channel-migration-zones>

Other local governments have done detailed CMZ assessments and may provide useful information and cost estimates; Pierce County is one example.

The final Channel Migration Assessment reports provided with this memo are intended for use by Clallam County to identify the "general location of channel migration zones" as required during the comprehensive SMP update process. These planning-level assessments delineate the approximate location of the pCMZ based on a professional geomorphic assessment prepared in accordance with standard practice. The boundaries should be refined for project level development activities to more

accurately reflect the risk on a site scale. Should the County pursue detailed CMZ mapping on a broader scale, Ecology can assist by providing technical guidance (e.g. use of online resources, project scoping, consultant requirements, etc.).