



## Channel Migration: Planning & Implementation

Shorelands and Environmental Assistance Program  
Washington Department of Ecology

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# The Shoreline Management Administrative Code requires that SMP updates address channel migration

## Shoreline Master Programs WAC 173-26

WAC 173-26-201(3)(c)(vii)  
WAC 201(3)(d)(i)(D)

Inventory &  
Analysis

WAC 173-26-221(2)(c)(iv)(A):

Critical freshwater  
habitat

WAC 173-26-221(3)(b):

Flood Hazard  
Reduction

WAC 173-26-231(3):

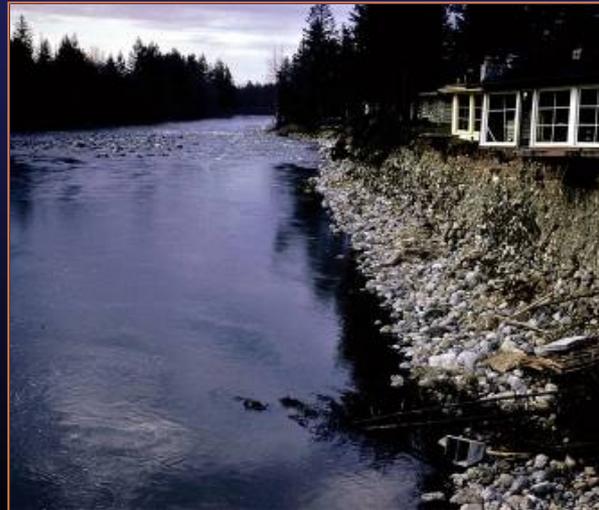
Modifications

# Channel migration zone: Preferred definition

**WAC 173-26-020(6):** "Channel migration zone (CMZ)" means the area along a river within which the channel(s) can be reasonably predicted to migrate over time as a result of natural and normally occurring hydrological and related processes when considered with the characteristics of the river and its surroundings."

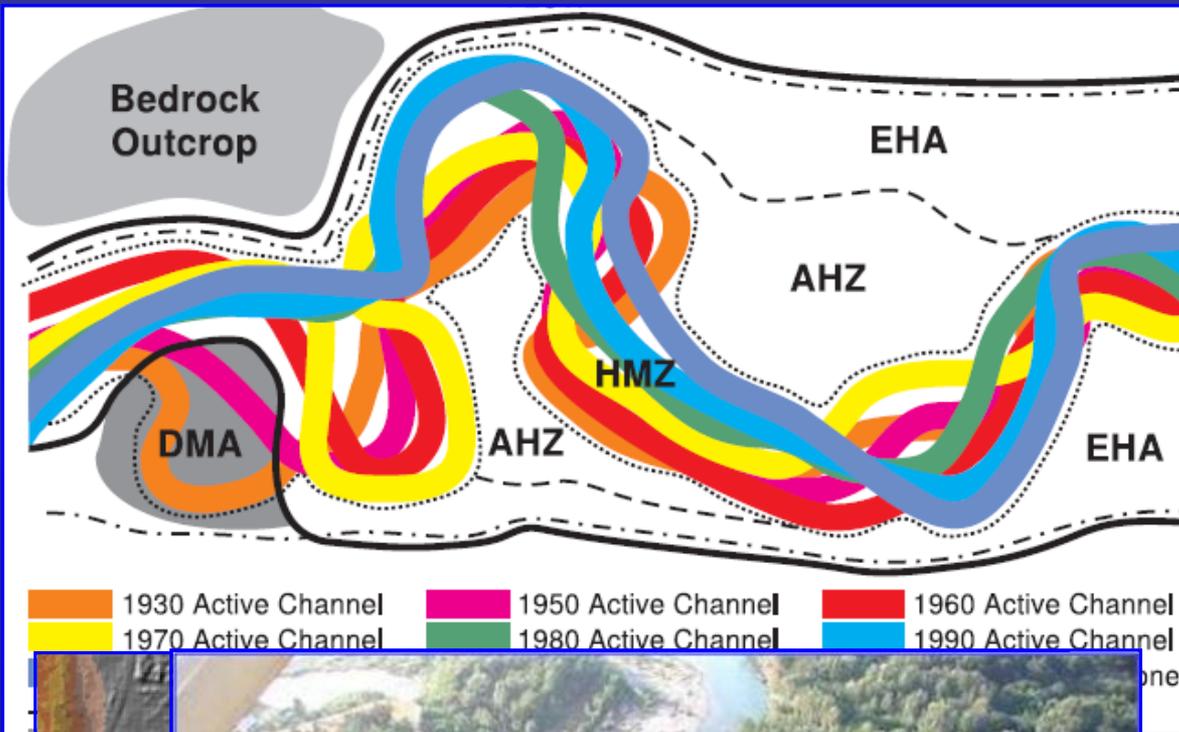


# What is channel migration?



Wolf Bauer





## Elements of CMZ

- HMZ= historic channel migration zone
- AHZ=Avulsion hazard zone
- EHA=Erosion hazard zone
  - CMZ=HMZ + AHZ + EHA
- DMA=Disconnected migration area



# CMZ: One of required inventory elements...

**WAC 173-26-201(3)(c):** Inventory shoreline conditions.

- Local governments shall, at a minimum, and to extent information is relevant and reasonably available, collect the following information:
  - (ii) Information on freshwater critical areas
  - (vii) General location of channel migration zones and
  - flood plains.

# What's reasonable and relevant?

- Existing GIS geology and soils data to evaluate erosion potential
  - WAC 173-26-221(3)(b): based on the historic record, geologic character and evidence of past migration over at least 100 years
- Information on channel characteristics such as channel gradient and confinement.
- 2 to 3 time series of aerial photographs, maps, LiDAR or whatever is available
  - ix) Already states that aerial photographs may be necessary to identify cumulative impacts

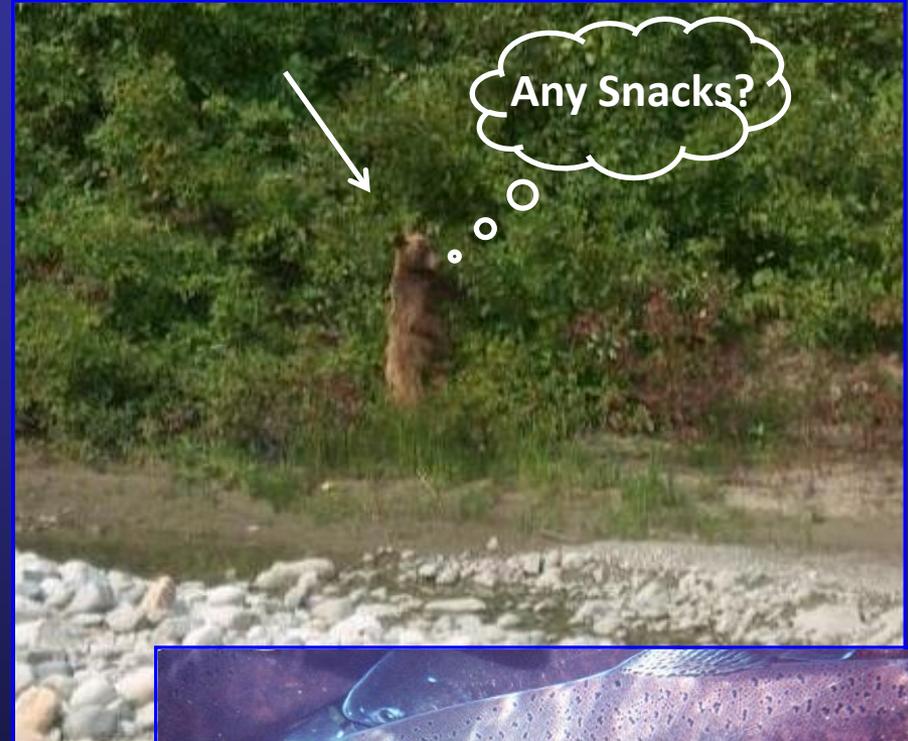
# Shoreline habitat, resources, critical areas

- WAC 173-26-201(3)(d)(i)(D): channel migration included as one of the ecosystem functions and processes of overall condition



# Shoreline habitat, resources, critical areas

- WAC 173-26-221(2)(c)(iv):
- Critical areas
  - CMZ included as a critical freshwater habitat
- New development in the CMZ limited to that which does not:
  - Cause net loss of ecological functions



E.R. Keeley

# WAC 173-26-221: Flood Hazard Reduction

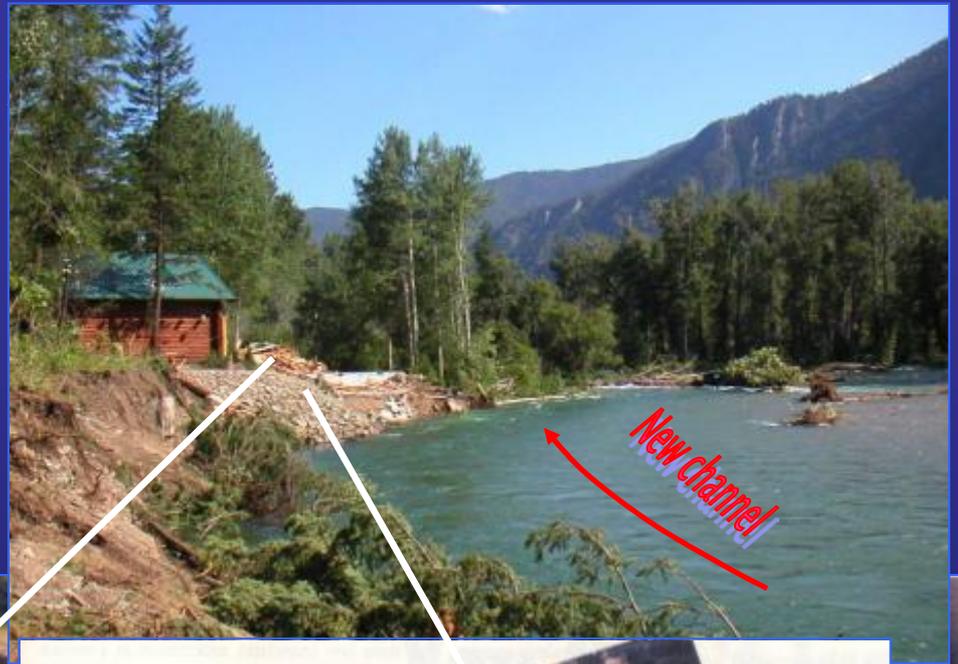
- **WAC 173-26-221(3)(b):** Failing to recognize the [channel migration] process often leads to damage to, or loss of, structures and threats to life safety



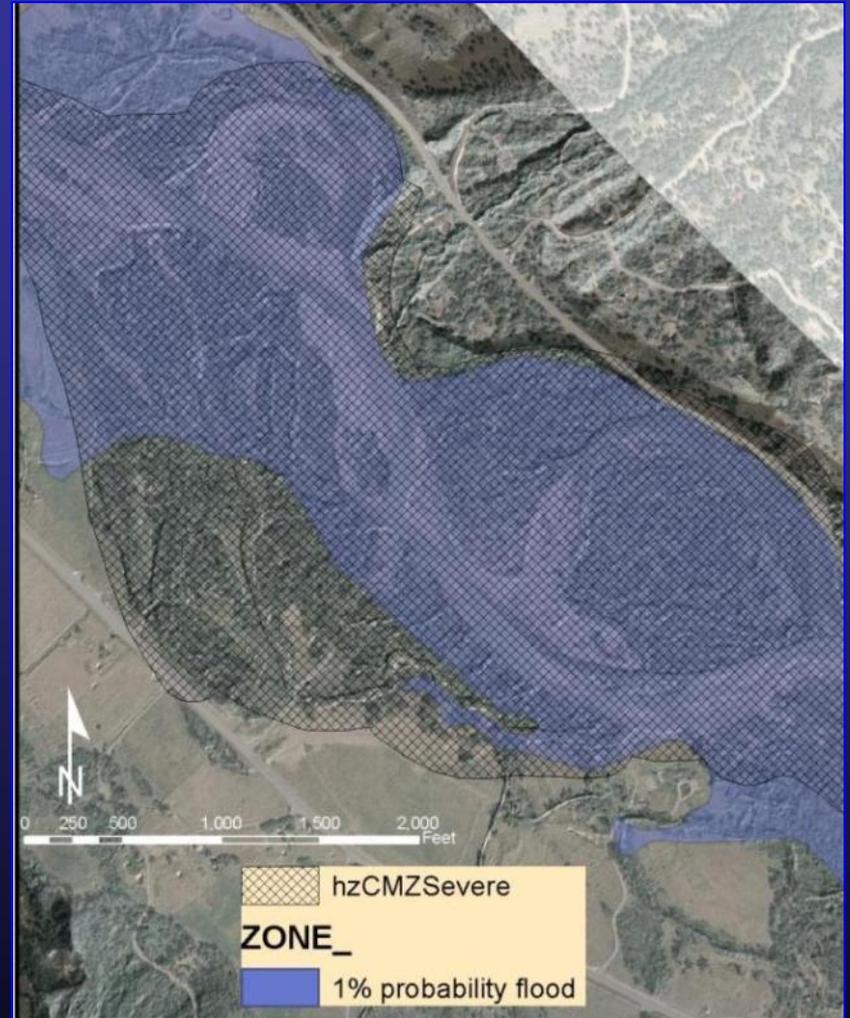
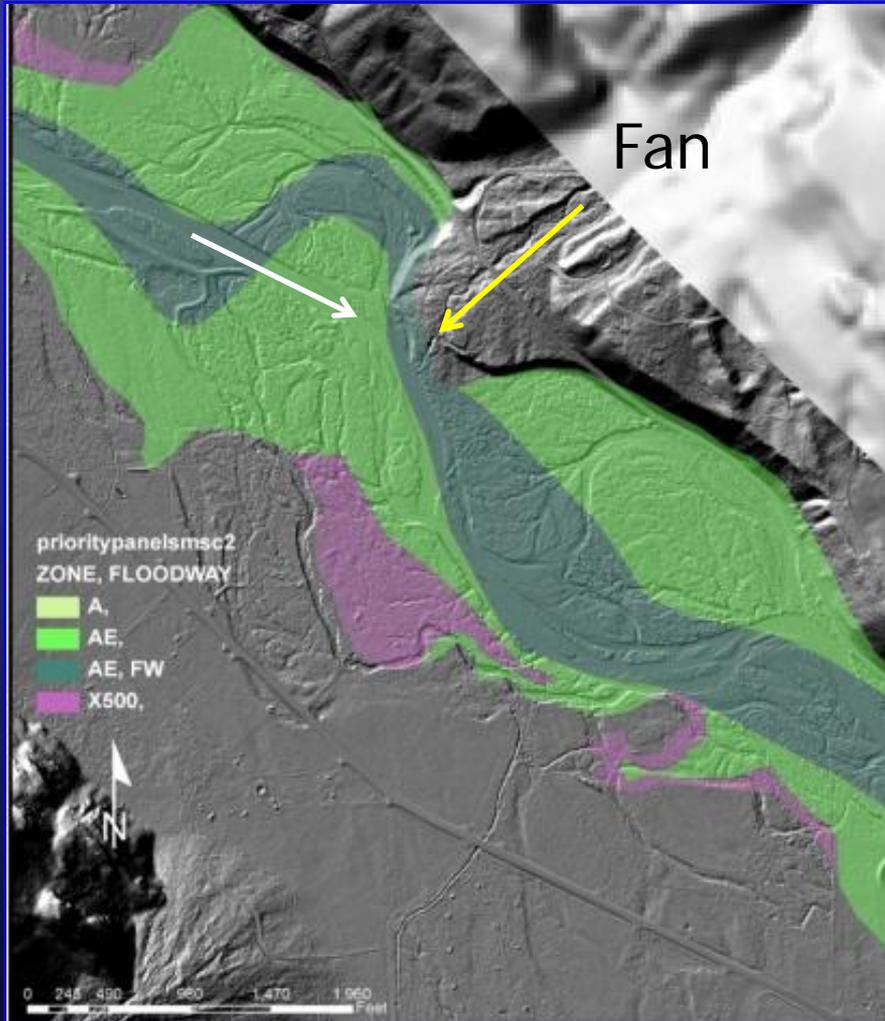
# WAC 173-26-221: Flood Hazard Reduction

- **WAC 173-26-221(3)(b-c):** limit development, shoreline modifications that may
  - interfere with the channel migration process
  - cause significant adverse impacts to property or public improvements and/or
  - result in a net loss of ecological functions





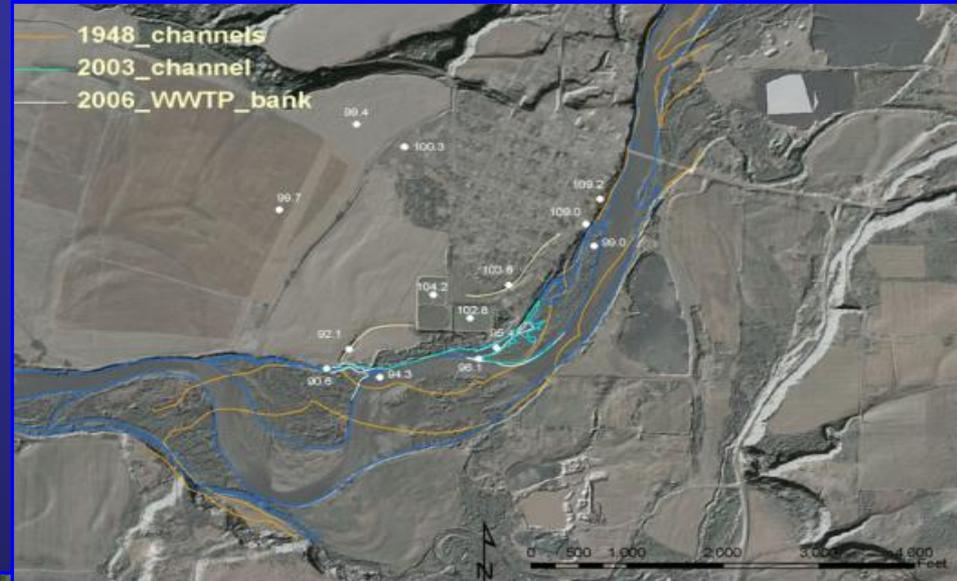
# Not in floodplain...



# Water Quality



Coal Creek



Toledo, WA  
WWTP site



Wilkeson Creek

## WAC 173-26-221(3)(b): Exemptions

The SMP guidelines recognize that previous human actions may deter channel migration. Areas may be removed from the channel migration area if:

- Within incorporated municipalities and urban growth areas, legally existing artificial channel constraints that limit channel movement
- All areas separated from the active channel by a legally existing artificial structure(s) that is likely to restrain channel migration, including transportation facilities, built above or constructed to remain intact through the 100 yr flood
- Outside incorporated municipalities and urban growth areas, only legally existing channel constraints built above the 100-year flood elevation

# Policy interpretations on exemptions

- Legally existing structures based on SMA floodway definition (RCW 90.58.030)
  - Exempted only where flood control devices are maintained by or maintained under license from government
    - Commitment to continue to maintain
- Transportation facilities that limit
  - Active railroads and public paved roads built above or maintained to withstand 100-yr flood with commitment to maintain
- Transportation facilities that are not considered limits
  - Private roads
  - Unpaved roads, whether public or private
  - Paved roads without a commitment to hold the line



Snack time?

Does experience show that policies make sense?

# Are all structures barriers?



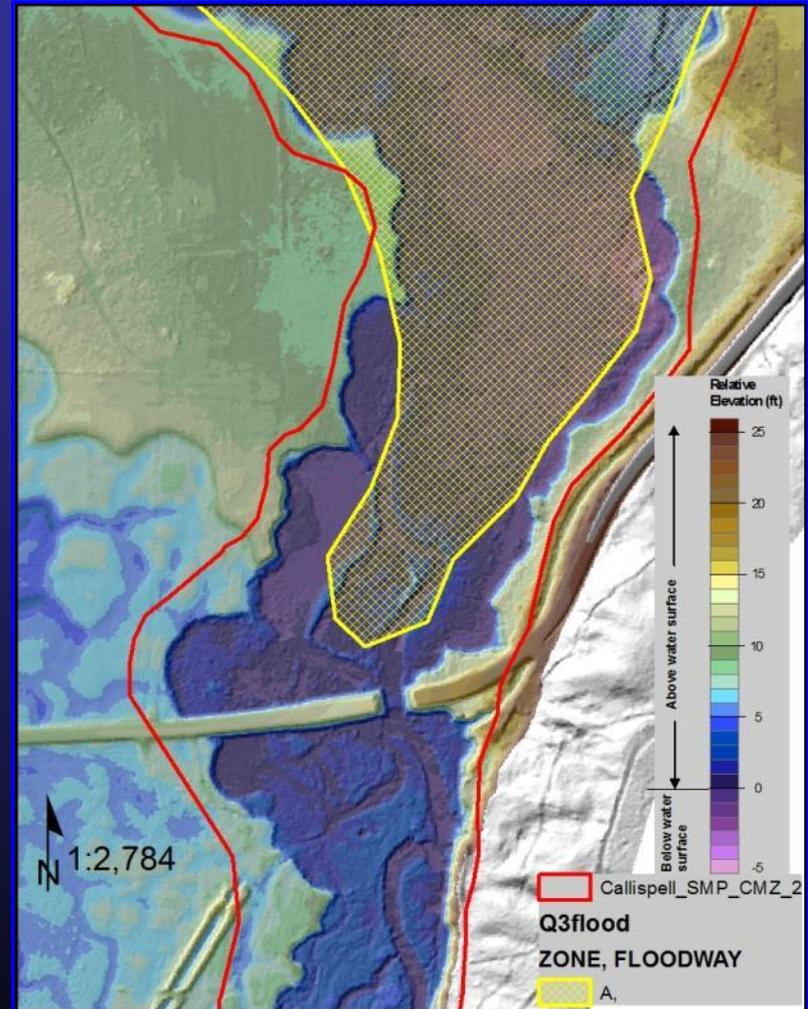
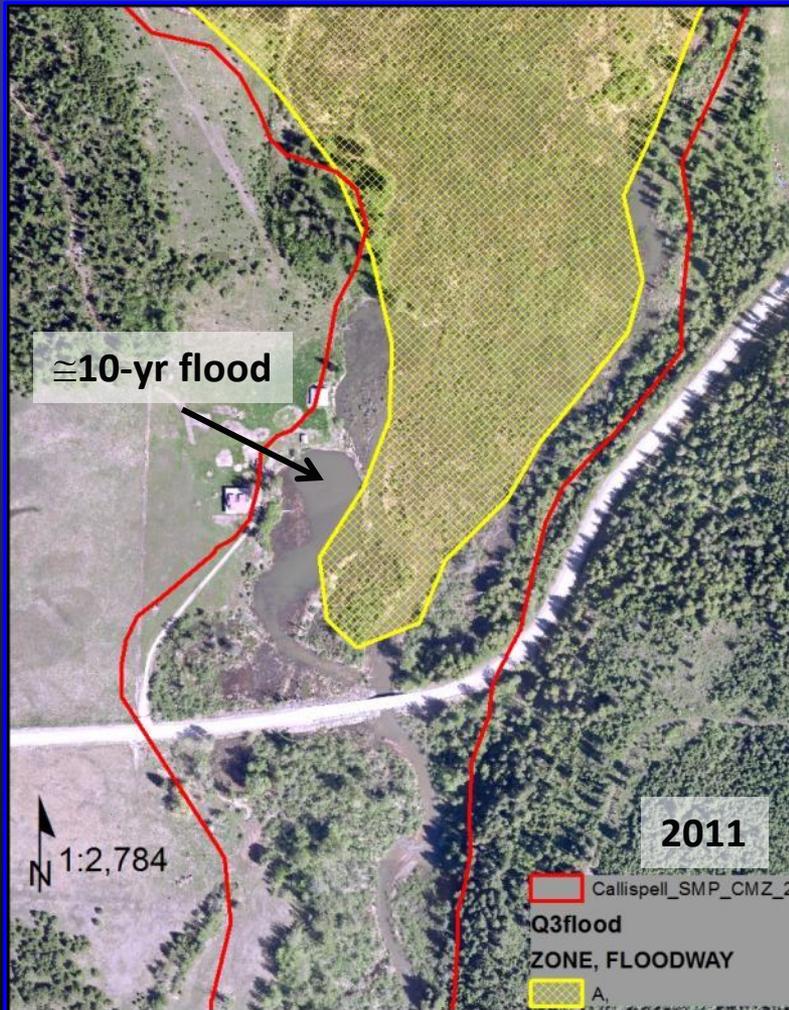
# Example transportation facilities that don't limit

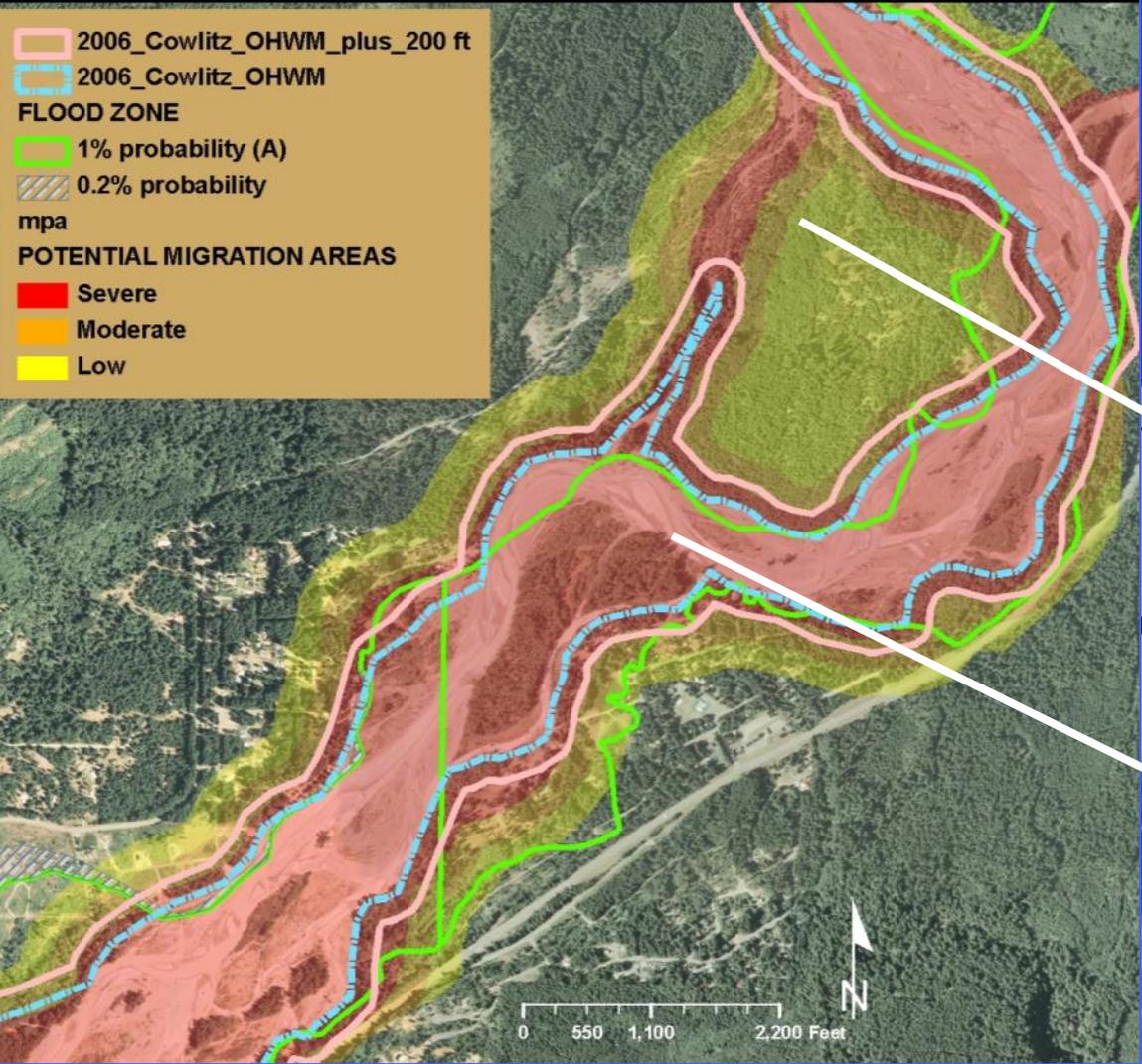
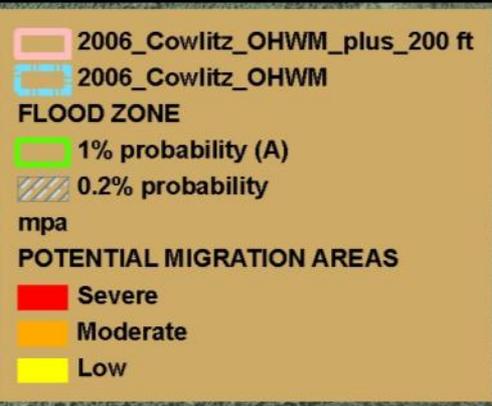


# Lessons on what not to assume

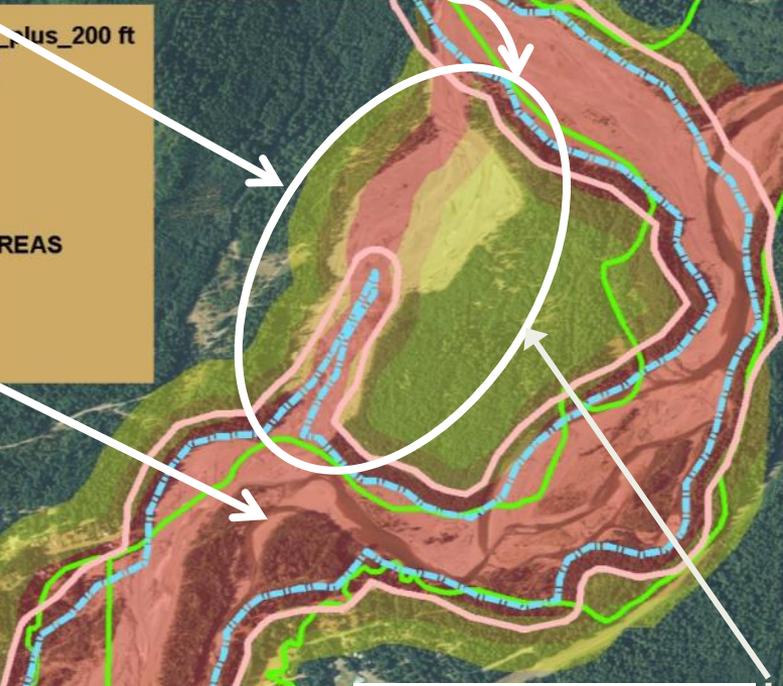


# Assuming the FEMA floodplain and CMZ are synonymous





Outside jurisdiction



Assuming that minimum jurisdiction is sufficient to reduce flood/geologic hazards

Possible buffer area based on historic CMZ, AHZ & overflow paths



# Assuming that minimum jurisdiction is sufficient to reduce flood/geologic hazards

- Think about critical area buffers
  - **RCW 90.58.030 (SMA):** Any city or county may also include in its master program land necessary for buffers for critical areas
- Jefferson County: “...the limits of the floodplain, floodway, and channel migration zones...along with site-specific information on the location of the ordinary high water mark and associated wetlands, to determine the lateral extent of shoreline jurisdiction on a parcel-by-parcel basis.”
  - **Increased Buffers:** An increase in buffer width shall be required upon determination that the development would be:
    - ii. Susceptible to health and safety risks caused by ... channel migration;
    - iv. On steeply sloped (> 25%) land adjacent to the ordinary high water mark

# Assuming small streams don't migrate...



Wilkeson Creek



Little Creek  
(Franklin Co.)



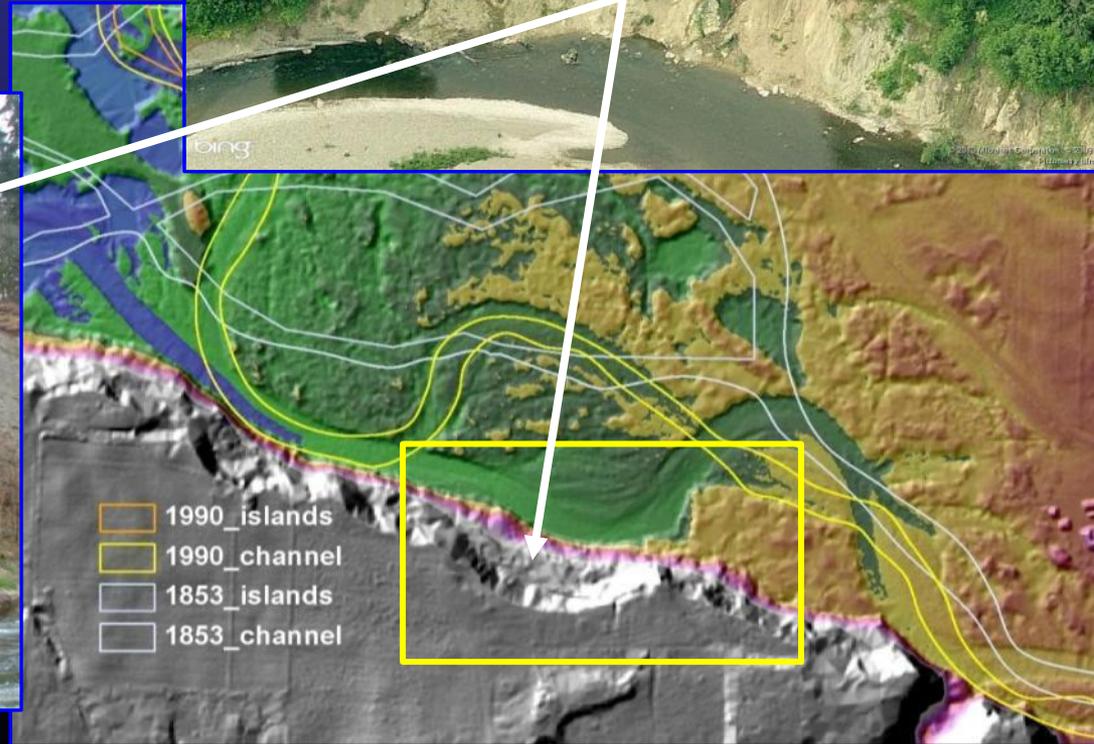
Big Beef Creek



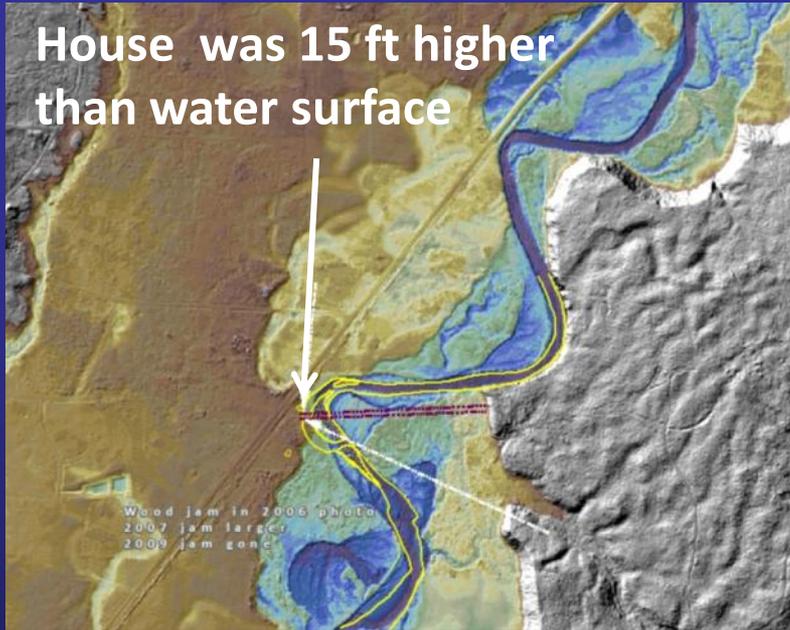
Coal Creek

# And More...

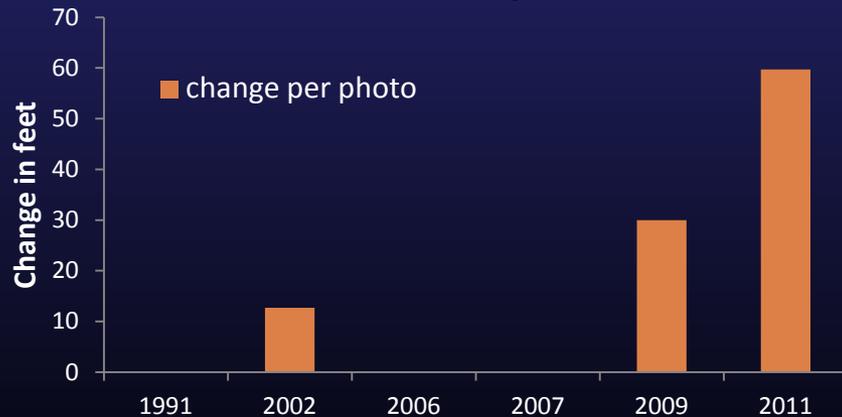
- Assuming that all artificial structure(s) limits channel migration
- Assuming that all bedrock stops channel migration



Assuming that streams don't move because not in photo record or local knowledge



House ne corner to bank change between air photos



Never been here before....



House had been 300 feet  
from river for 80+ years

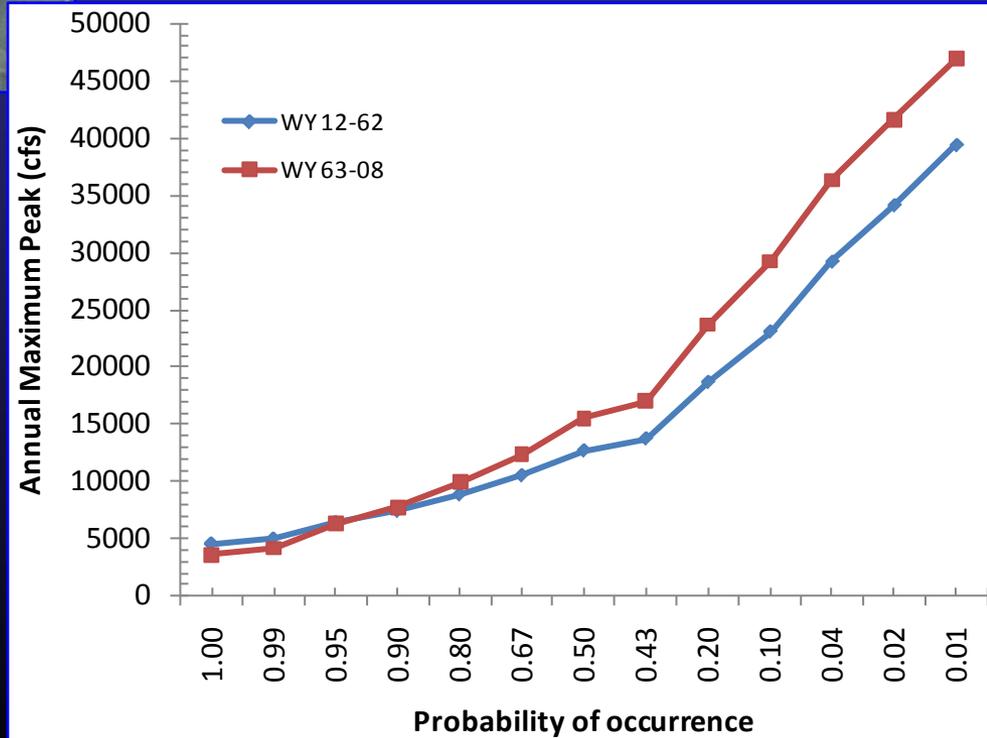


## Other considerations

- Identify the general location of CMZ doesn't provide much information on processes and response
  - *“As a general rule, the less known about existing resources, the more protective shoreline master program provisions should be to avoid unanticipated impacts to shoreline resources.” (WAC 173-26-201(3)(g))*
- Will likely require more detailed evaluations where contended
  - Evaluations should be done by a licensed geologist or engineer with at least 5 years on the ground experience in fluvial geomorphology and channel response



Climate change adaptations:  
 Past channel migration  
 controlling regimes may not  
 equal future regimes



# Ecology's Role

- Review and approve SMP update documents
- Provide funding where available—SMP updates, FCAAP
- Provide technical assistance by developing tools to:
  - Make decisions on need for CMZ assessment
  - Determine approach, level of analysis and appropriate methods
  - Outline minimal acceptable standards of analysis
- Provide technical assistance for:
  - Implementing shoreland regulations where there are CMZs

# Local government roles

- Incorporate assessment costs into shoreline grant applications
- Identify and map general location of channel migration zones in characterization
- Appropriate environmental designations
- Development standards
- Regulate actions in CMZs based on WAC language
  - SMP jurisdiction or CAO



# Channel Migration Mapping To Support Shoreline Master Program Updates in Washington State

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Mary Ann Reinhart, LG, LEG, GeoEngineers

# CMZ Mapping for SMPs

- Washington State Shoreline Master Program (SMP) requires identifying the “general location” of CMZs in characterization
- Challenges
  - No information in SMP guidelines on how to identify the “general location” of CMZs
  - Guidelines say to use reasonably available and relevant data
- Provide CMZ maps for communities required to update their SMP by 2012

# EPA Scientific and Technical Investigation Grant

- EPA funding fills a critical need at the Puget Sound and community levels
- Funding provides scientific and technical support so Ecology's Shorelands and Floodplain Programs can:
  - Identify and map channel migration zones for within the Puget Sound communities updating their Shoreline Master Programs (SMP)
  - Update scientific literature
  - Evaluate existing channel migration assessments
  - Identify possible future hazards due to development and changing hydrologic and sediment regimes
  - Identify restoration/protection strategies and opportunities

# Products to date

- Developed SMP planning level CMZ delineation methodology
- Delineated CMZs for 626 miles in PS region
  - Kitsap (14), Skagit (220), Mason (296), and Clallam (80) Counties (614 miles)
  - 9 smaller cities (12 miles)
- Senior level QA/QC
- Provided draft work products to local communities
  - CMZ maps
  - Supporting technical reports and GIS data
  - Met with Skagit and Clallam Counties (so far)

# Skagit, Mason, Clallam, and Kitsap Counties



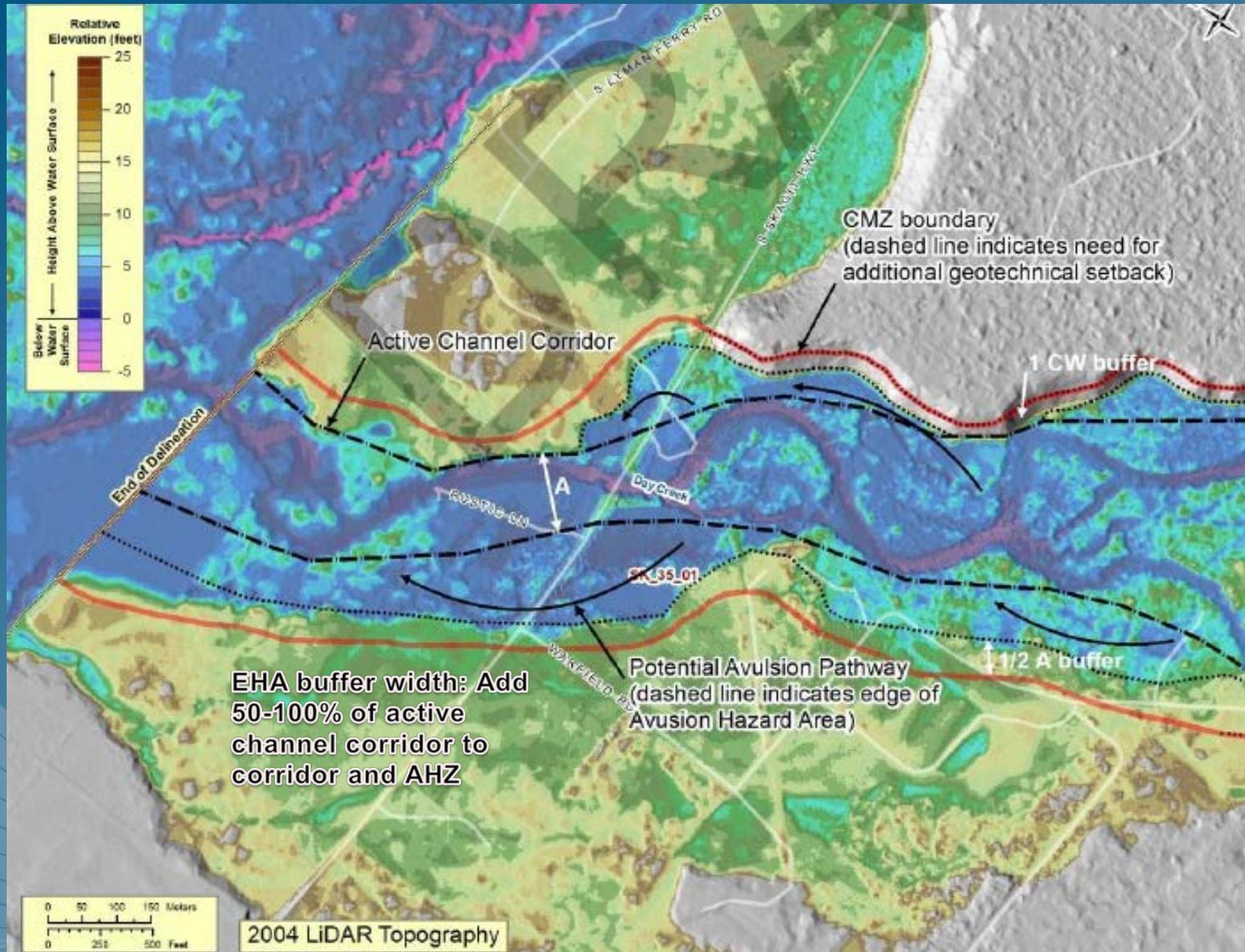
# Develop New Methodology

- Relies on a geomorphic assessment of reach-scale fluvial processes based on available GIS and other digital data sources
  - Reasonably available as specified in the SMP guidelines
  - Geology, soils, orthophotos, maps, and LiDAR where available
- Geomorphic interpretation of varied and complex geomorphic conditions
- Additional senior level QA/QC was required
  - Resulted in improvements to the methodology
  - Modification of CMZ boundaries
  - Necessary professional judgment

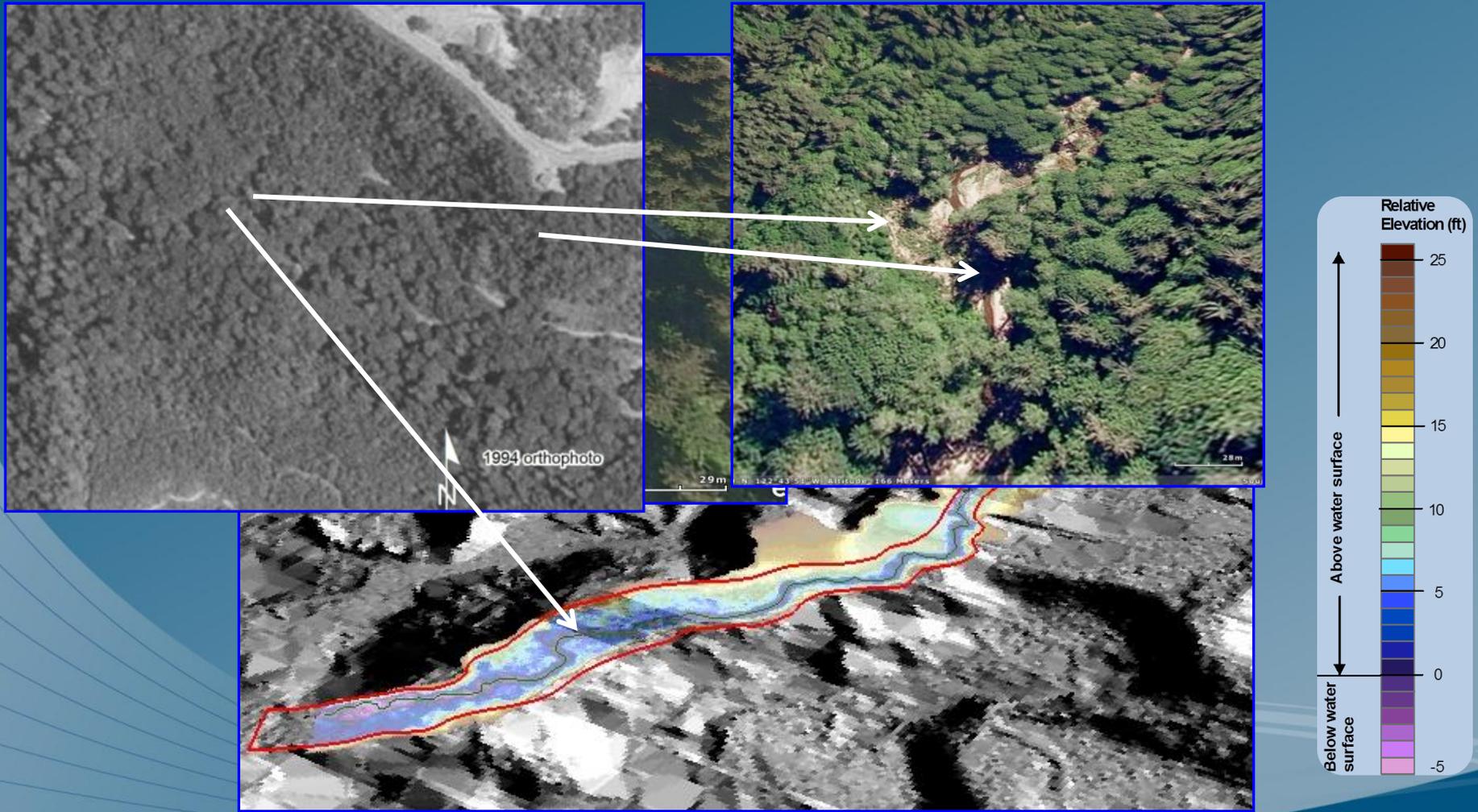
# Examples of CMZ maps

- Decision rules with special conditions and features addressing variability in geomorphic terrain
  - CMZ components—Active channel corridor (HMZ), AHZ, EHA, DMA
  - Small heavily canopied streams
  - Terrace erosion, valley widening and alluvial fans
  - Avulsion potential
  - Underfit streams in large glacial valleys
  - Channel response to sediment loading

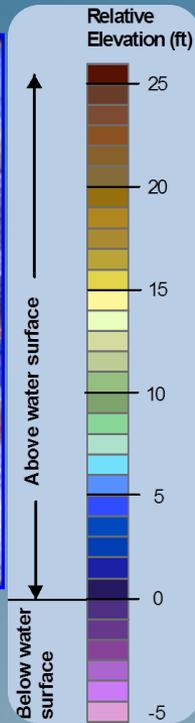
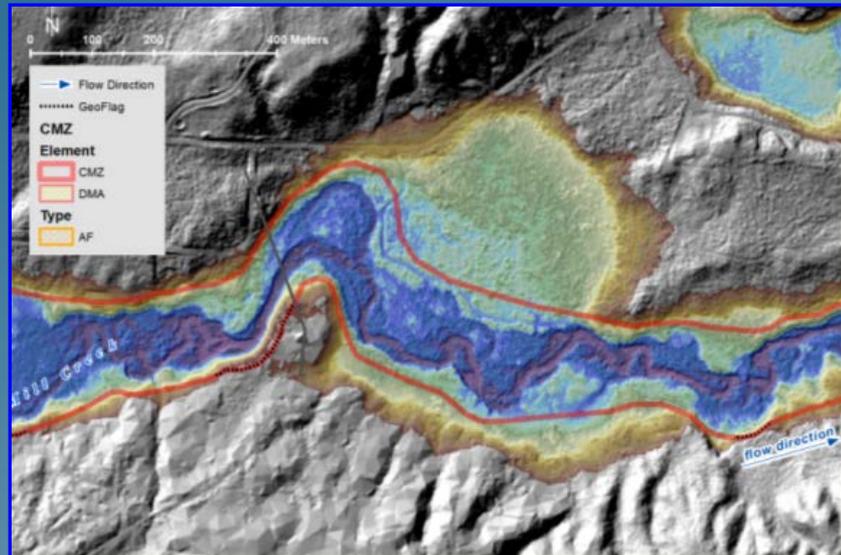
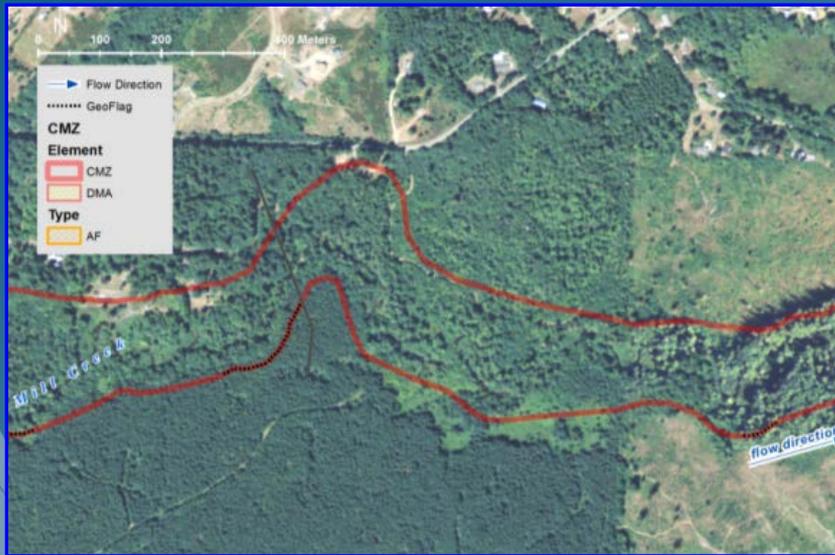
# Planning Level SMP: Elements



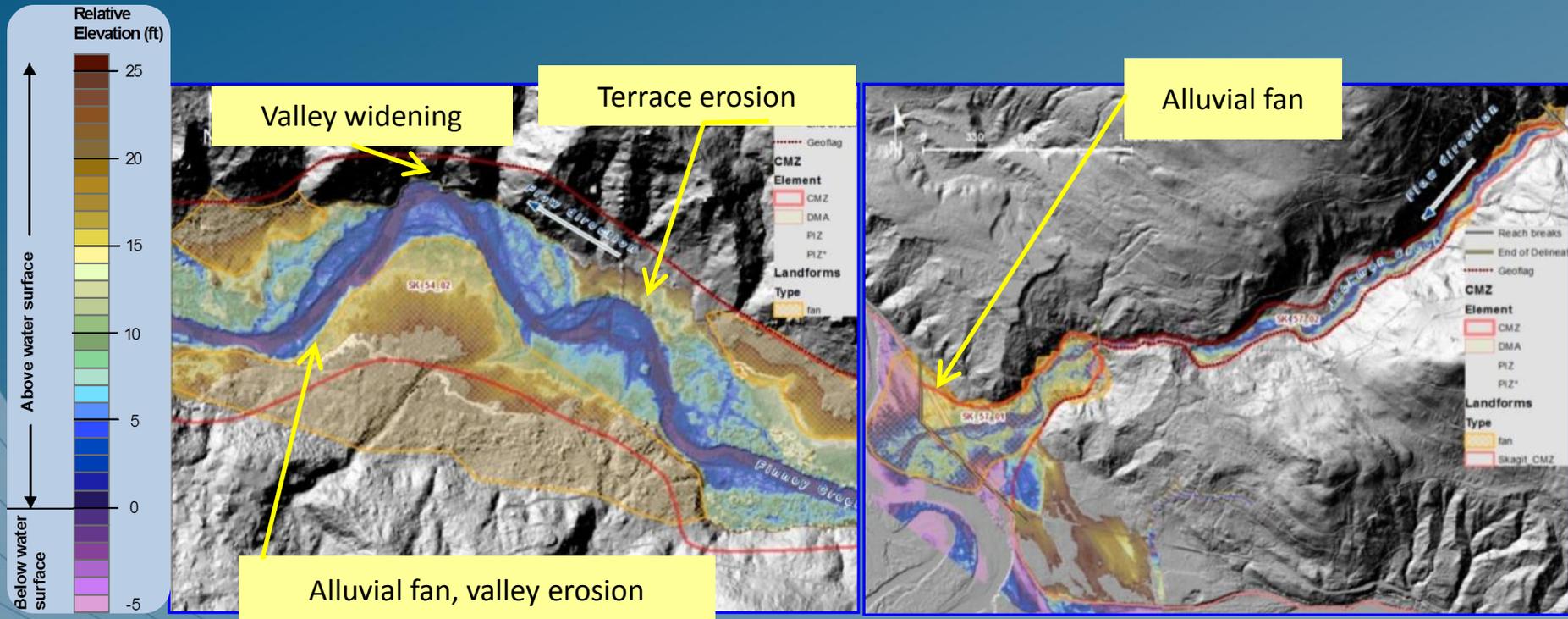
# Kitsap County: Underfit stream, canopy cover, eroding valley walls, sediment and wood loading, channel widening



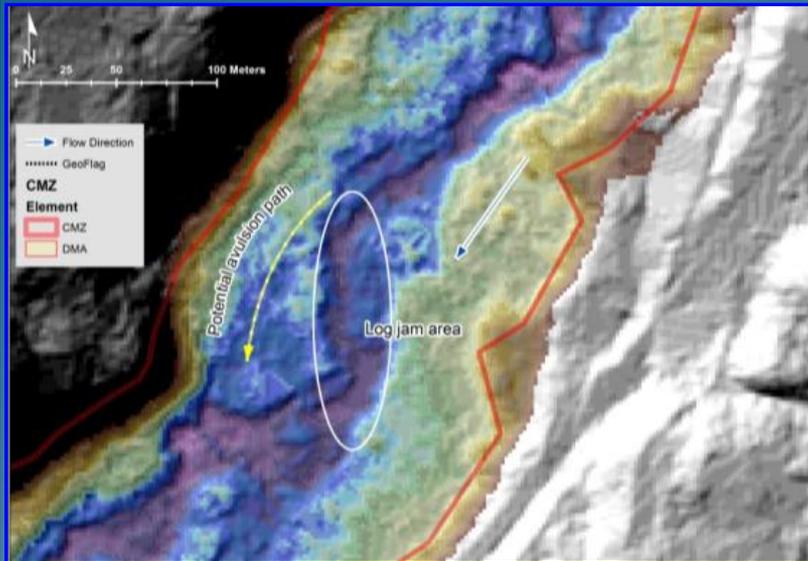
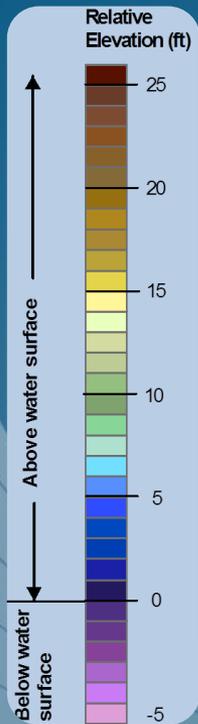
# CMZ Delineation of a Stream Obscured by Tree Canopy



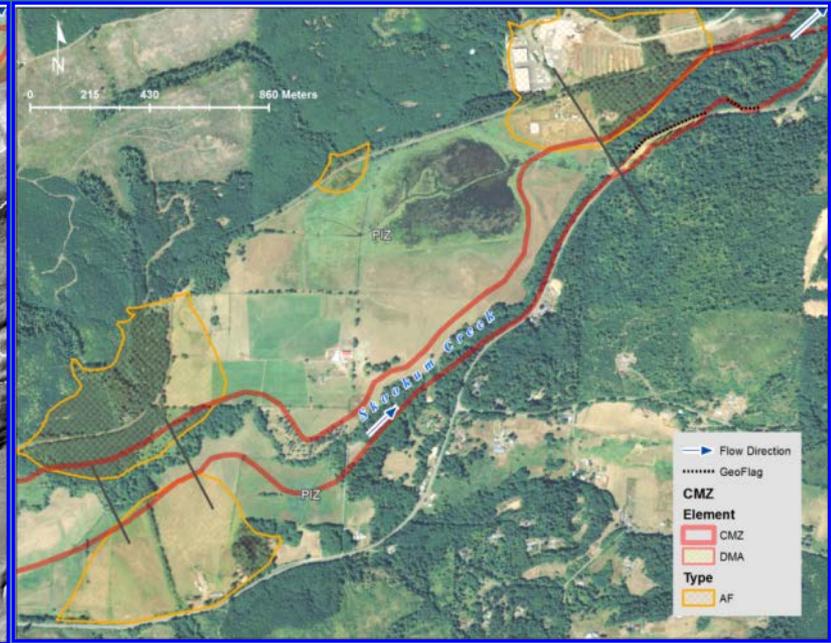
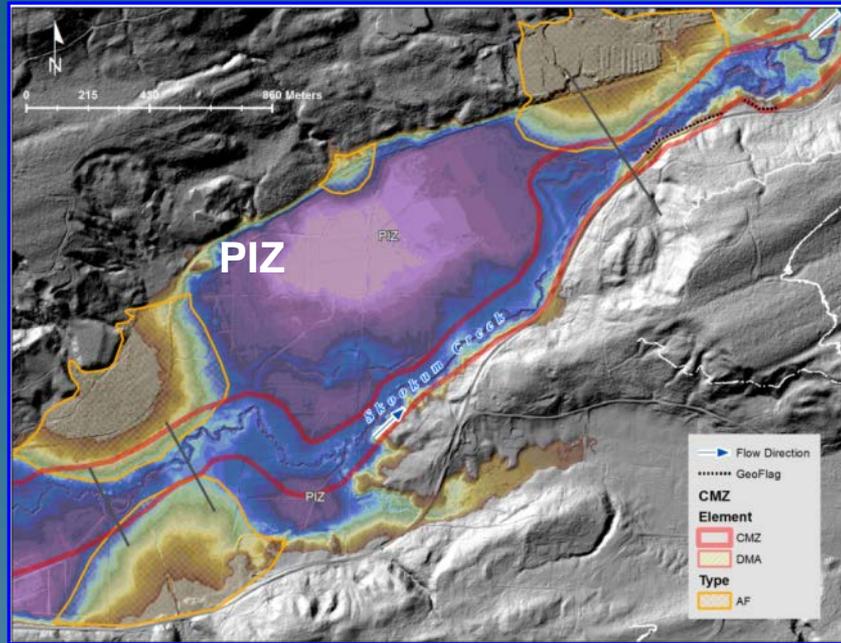
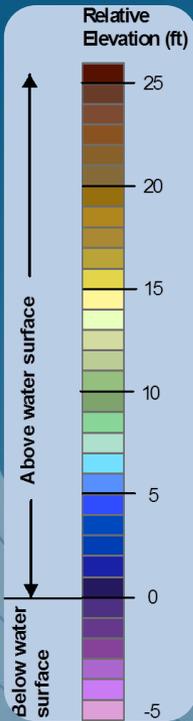
# CMZ Delineation: Considering Terrace Erosion, Valley Widening and Alluvial Fans



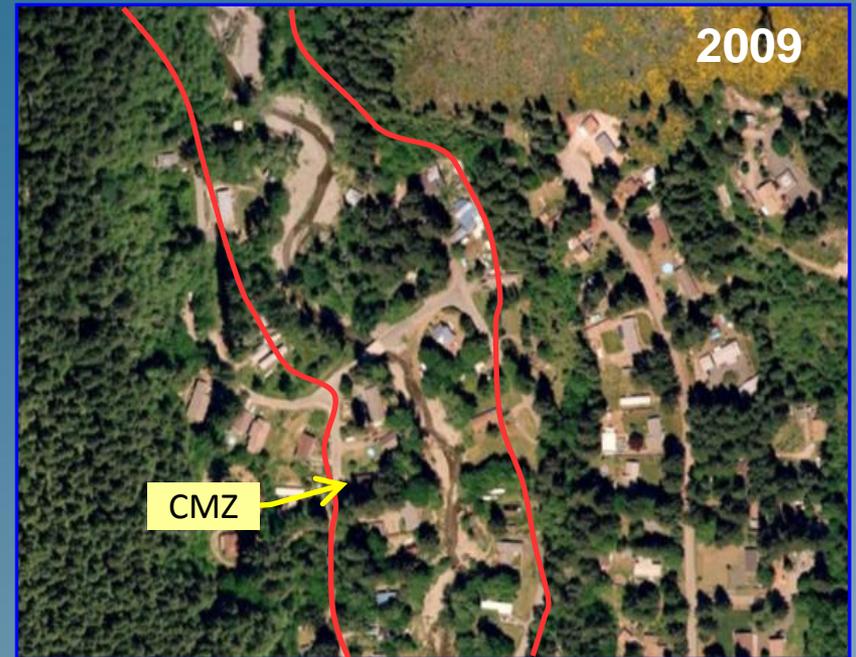
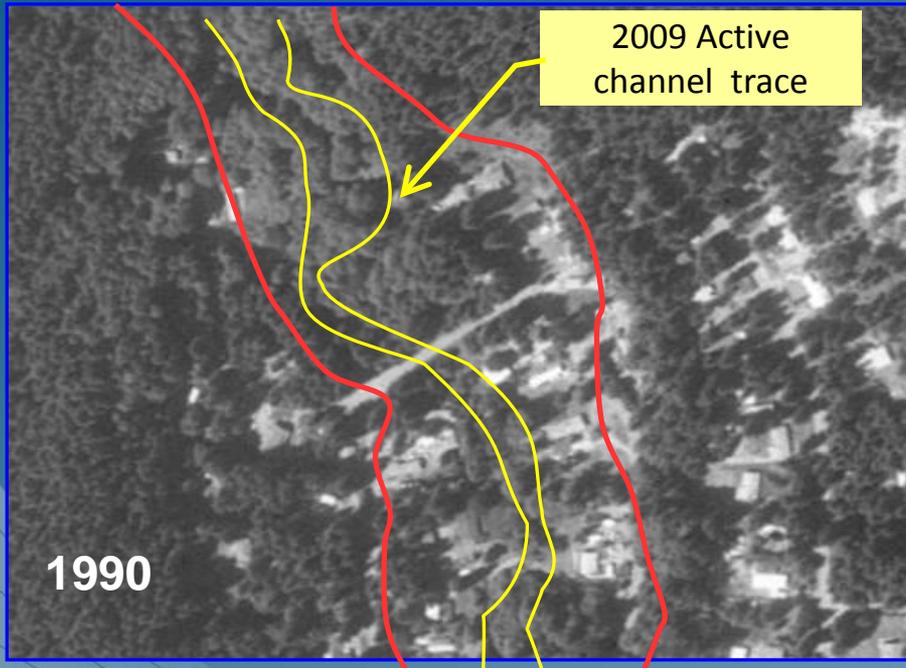
# CMZ Delineation: Considering Potential Avulsion Pathways



# CMZ Delineation: Underfit Stream



# CMZ Delineation: Considering Potential Sediment Loading



# Phase 1 Conclusions

- The planning level CMZ approach
  - Provides reasonable general location CMZ maps for SMP planning purposes
  - Does not substitute for more intensive CMZ investigations.
- Detailed CMZ mapping should be used to guide site-specific management actions
- Even planning level interpretation requires individuals experienced in interpreting fluvial geomorphic features and processes

