Chehalis Basin Strategy Local Actions Program Technical Advisory Group Meeting #2

November 9, 2020

Agenda

- Welcome and Purpose of Meeting
- Introductions (small groups again in breakout rooms)
- Summary of results from October 27 meeting
- Overview of Existing Hydraulic and Hydrologic Modeling for the Chehalis Basin Strategy
- Near-term Approach to Defining Future Floodplain
- Potential Priorities for Additional Modeling in the Long Term
- Input on Advisory Group Process
- Next Steps and Closing

Introductions (again)

- Breakout rooms of three members
- Introduce yourself (one minute each)
- Name and affiliation
- If you have been involved in basin flood issues
- Fun fact about yourself

Meeting Purpose

- Receive input on the October 27 Technical Advisory Group meeting and results
- Discuss approach for defining the future floodplain (in 2080) in the near term to identify planning-level local action program elements
- Discuss priority areas for additional modeling in the long term to support future project evaluation and design

Tech Group Questions for Meeting

- In the near term, are there other options for defining the late-century 100-year floodplain for the Chehalis River mainstem and tributaries? What are the pros/cons of options?

- Are there other hydrologic or hydraulic modeling options or approaches to evaluating the Chehalis River mainstem and tributary areas that should be considered for the longer term?

- What questions, suggestions, and/or feedback, do Technical Advisory Group members have for identifying and prioritizing areas for additional modeling in the longer term?

Tech Advisory Group Schedule

Meeting #3: November 13, 2020

Initial presentations and discussion:

- Potential to increase flood storage either through restoration or removing infrastructure
- Options for identifying floodplain extent from climate change and identifying at risk structures
- Potential local flood protection structural/non-structural actions
- Approaches to protect transportation routes and critical infrastructure

Summary of October 27 Mtg
and
Nov 4 Board Mtg Feedback

October 27 Meeting Feedback

- Provide understanding of how each topic fits into the larger Local Action Program outcomes
- Provide materials farther in advance for review, including technical memorandums and presentations
- Provide a roadmap regarding how advisory group input feeds into Board decision-making
- Include information on costs for near- and long-term studies

October 27 Meeting Feedback

- Importance of buy-in from local communities
- Concerned about future studies and costs without more information and Chehalis Board direction
- Use of survey to get initial viewpoints

Technical Group Questions on Climate Change Modeling

- Clarify average peak flows and whether models are only looking at the increase in the peak precipitations
- Consider the long-term development within the basin (not just the regulated floodplain)
- How does National Climate Change Information to Hydrologic and Coastal Design of Transportation Infrastructure fit into the Local Actions Program analysis?

Technical Group Feedback Near-term

- Acknowledge benefit of using 26% for “apples to apples” comparison
- Makes technical sense to using 50% increase for qualifying potential increase in floodplain and providing worst-case scenario
- Clarify how “uncertainty” in the GCM models would be characterized
- Clarify how increase in hydrology will be used to determine flood extents
- Some members not ready to recommend approach due to short time frame for review

Climate Change Modeling Options for Long-term Analyses

- Option 1: Explore range in climate projections by evaluating additional GCM projections in existing DHSVM model
- Option 2: Improve DHSVM model accuracy and calibration
- Option 3: Re-evaluate the approach to developing flow scalars

Technical Group Feedback Long-term

- Acknowledgment that more accurate climate change predictions needed in future
- Group members wanted more information about how the Board would use climate predictions in future decisions
  - For example: landowner outreach/education, project design, updated maps for application of existing or new regulations
- Needed more information and time to develop recommendations for long term

Board Approved Recommendation

- Near-term
  - Use 26%
  - Incorporate 50% increase in analysis for future floodplain
  - Complementary analysis based on precipitation for tributaries
- Long-term
  - Board provide additional guidance on how information will be used
  - Technical Group revisit information and provide recommendations

Erosion Hazard Options for Consideration

- Near-term: provide an initial evaluation of up to 100 miles based on GIS mapping of river channels (current and historic)
  - Focus first on areas with known or suspected high-risk of near-term damage to valuable structures and land uses

- Long-term: develop a more comprehensive approach to mapping erosion problems

Feedback from Technical Group

- Clarify intent of qualitative evaluation in the near term versus quantitative evaluation of risks and channel migration zone in the long term
- Clarify intent of mapping and what it will be used for
- Acknowledgment of the benefit to developing a focused effort in the near term
  - Use existing mapping in the basin, with updates as needed
  - Map areas with development potential that may pose a threat currently and in the near future

Feedback from Technical Group

- Consider use of change detection technology (e.g., LiDAR, aerial photography, and InSAR), which may be most appropriate for long term options
- Option 5 in the short-medium term and Option 6 in the long term should be explored further
  - Delineate risk zones, such as high, medium, and low channel migration risk
- For long-term options, comments regarding methodology will be further refined and scoped following State guidelines with input from the community, Advisory Groups, and Board

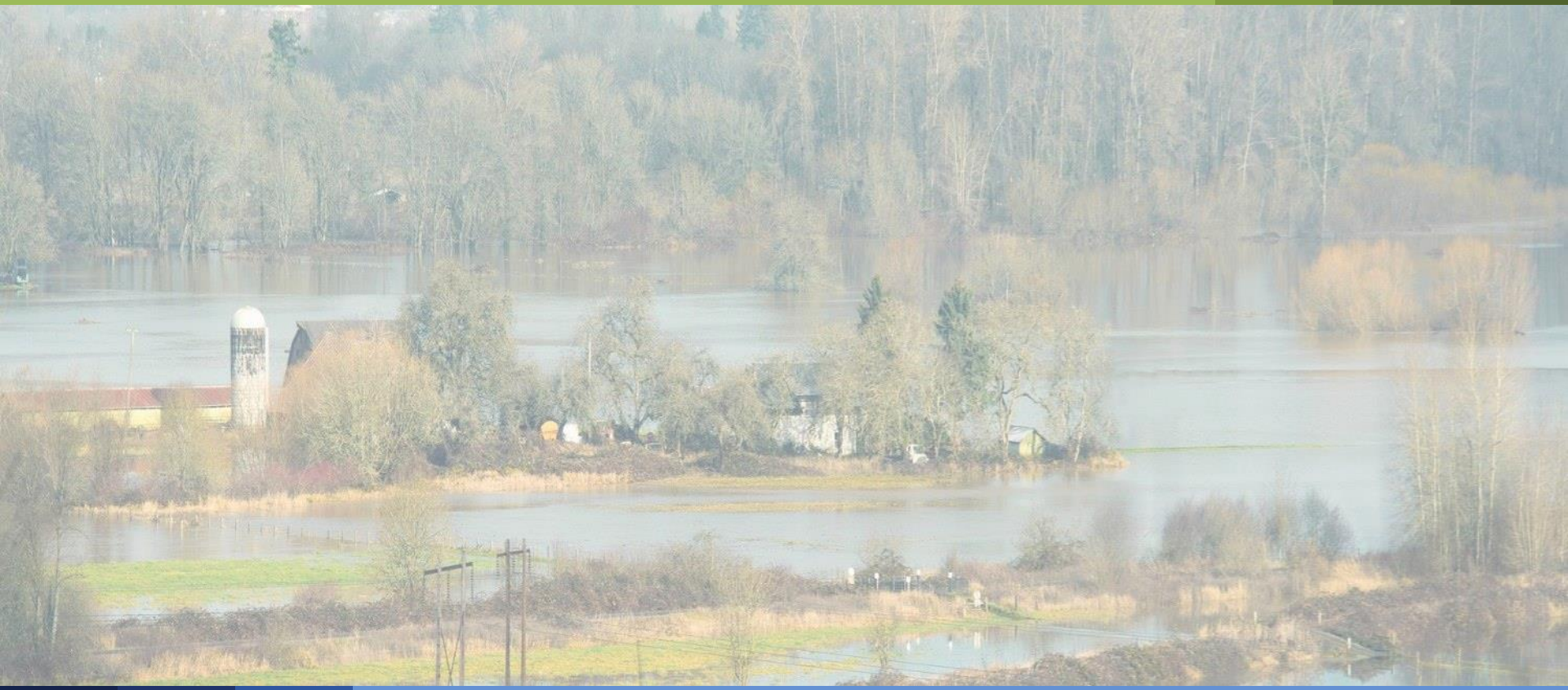
Board Approved Recommendation

- Near-term: use local knowledge to focus areas, identify high-priority erosion hazards in up to 100 miles of basin

- Long-term: continued discussion of options with the Technical Group

Today and Friday Issues

- Today - how to define future floodplain, priority areas and modeling
- Friday – Overview of high damage areas, potential for storage, infrastructure and erosion



Feedback on Our Process

What feedback to you have regarding the way we have provided information, opportunities for your input and learning from other TAG Members?

Chehalis Basin Strategy Local Actions Program

Technical Advisory Committee Meeting #2

November 9, 2020

Overview of Presentation

- Board Planning Assumptions
- Board Desired Outcomes
- Hydrologic and Hydraulic Modeling and Analysis To Date
- Methodology for Current Evaluation
- Summary and Ranking of Flood Damage Potential
- Near-term Option for Floodplain Delineation
- Long-term Options for Additional H&H Modeling

Board Planning Assumptions for

- **Plan for the 100-year flood conditions that are predicted for 2080 when considering outcomes and actions**
- *Consider a timeframe of up to 30 years to implement the actions*
- *Projects funded through the program will be designed, implemented, and mitigated to avoid making flood damage worse in other areas*

These planning assumptions provide the foundation for all the outcome measures agreed to by the Chehalis Basin Board

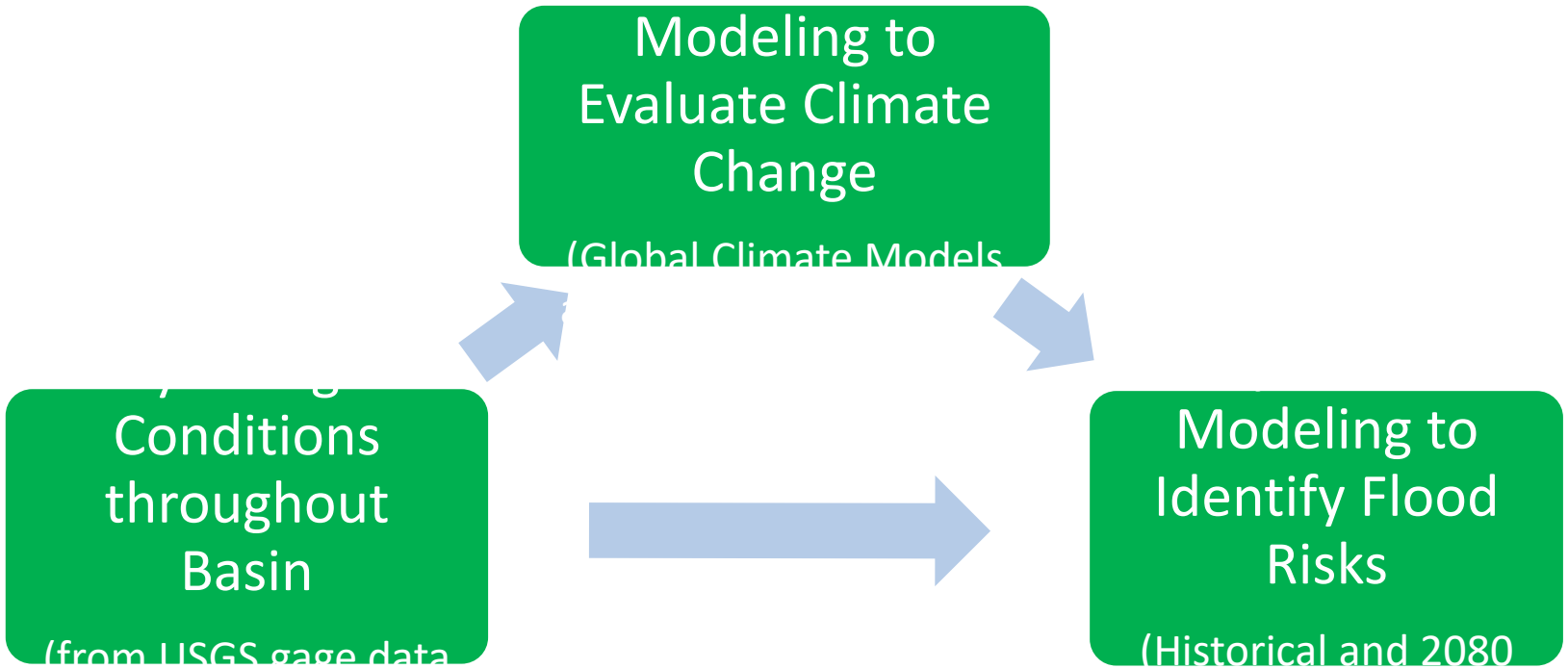
Board Desired Outcomes

- Valuable Structures Protected From Catastrophic Flooding
- Homes & Businesses Protected From Seasonal Urban Flooding
- Farmland & Rural Structures Protected
- Critical Facilities Protected
- Transportation Routes Protected
- Prevent New At-risk Development

Questions from Technical Memorandum

- In the near term, are there other options for defining the late-century 100-year floodplain for the Chehalis River mainstem and tributaries? What recommendations do you have?
- Are there other hydrologic or hydraulic modeling options or approaches to evaluating the Chehalis River mainstem and tributary areas that should be considered for the longer term? What recommendations do you have?
- What questions, suggestions, feedback, or recommendations do Technical Advisory Group members have for identifying and prioritizing areas for additional modeling in the longer term?

Hydrologic and Hydraulic Modeling

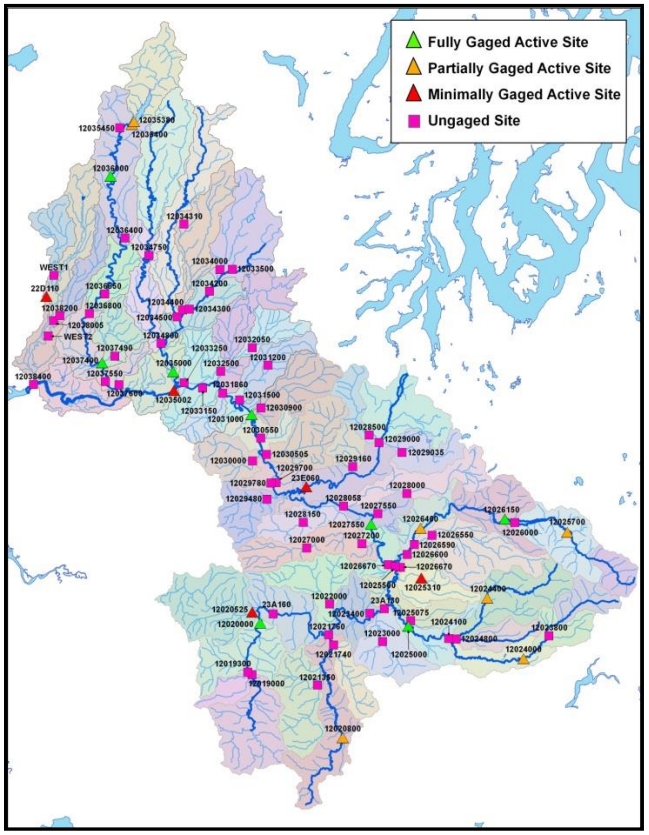


Hydrologic and Hydraulic Modeling and Analysis To Date

Basinwide Hydrology (WEST Consultants under contract to USACE, 2014)

- New Flood Frequency Analyses
  - 17 gaged sites
  - 66 ungaged sites
- Historical Data for February 1996, Dec 2007, and Jan 2009 Calibration Events
- Design Flood Hydrology (peaks, timing, and volumes) for 1.5- through 500-year events

*Hydrology was peer reviewed by USACE, State Agencies, and ITR Team



Hydrologic and Hydraulic Modeling and Analysis To Date

- **DHSVM Modeling including Climate Change Simulations** (WSE, 2019)
  - Developed and calibrated hydrologic model for the entire Chehalis River Basin. Evaluated climate change projections for two GCMs/RCPs.
  - Key Findings: model difficult to calibrate, cannot replace historical data; but acceptable for comparative evaluations. Estimated increase in peak flows due to climate change is 12% to 26% (or 50% with corrected climate data).

MEMORANDUM

Date: February 28, 2019
To: Bob Montgomery, Anchor QEA
From: Larry Karpack, P.E. and Colin Butler, EIT, WSE
Re: Chehalis River Basin Hydrologic Modeling

1.0 Introduction

This technical memorandum summarizes work performed by Watershed Science and Engineering (WSE) to develop and calibrate a hydrologic model of the Chehalis River Basin. The model extends from the headwaters of the Chehalis River upstream of Pe Ell to the mouth of the river at Grays Harbor including all tributaries to the Chehalis River. The model also includes other river basins which drain directly to Grays Harbor, including the Wishkah, Hoquiam, and Humptulips River basins. Together, the area covered by the hydrologic model comprises Water Resource Inventory Areas (WRIAs) 22 and 23 (DOE, 2018). Figure 1 shows the aerial extent of the hydrologic model.

The Chehalis River Basin hydrologic model was configured using the Distributed Hydrologic Soil Vegetation Model (DHSVM) software (Wigmosta et al, 1994). DHSVM is a gridded, physically based, distributed parameter model that provides an integrated representation of watershed processes at a user defined spatial resolution. Key data inputs to the DHSVM model include topographic, soils, land cover, and meteorological data. Development of the DHSVM model is described below in Section 3.

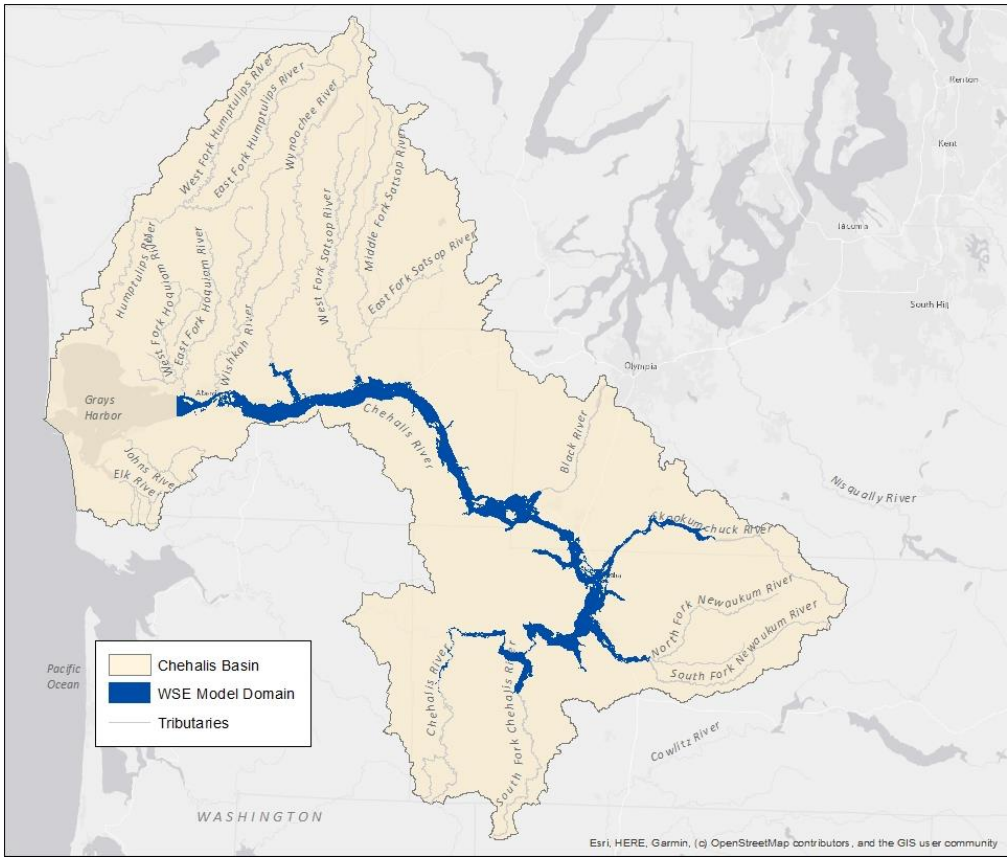
Meteorological inputs for the hydrologic model were provided by the University of Washington's Climate Impacts Group (CIG) and include a physically based historical data set spanning January 1981 through December 2015, as well as two long term historical/future data sets based on Global Climate Model (GCM) predictions. The meteorological data sets used in this study are described in Section 4.

The hydrologic model was calibrated and verified by comparing simulated flows against data from five USGS stream gaging stations in the basin, depicted in Figure 1 and listed in Table 1. Collectively these gages cover approximately 70% of the model domain. Preliminary calibration was conducted using an automated model parameter optimization routine to best match daily observed flows at these gaging stations for October 2006 through September 2009. Long term runs of the model were then completed and peak annual flow data for 1981 through 2015 were extracted and compared to USGS observed peak flows. Additional adjustments to model inputs were made to best match observed flows at each of the gage locations. The model calibration process and results are fully described in Section 5. The calibrated DHSVM model was then run using long term meteorological data sets to provide data for evaluation of potential climate change impacts on Chehalis River basin hydrology. This evaluation is described in Section 6.

Chehalis Basin Strategy: Reducing Flood Damage and Restoring Aquatic Species Habitat 1

Hydrologic and Hydraulic Modeling and Analysis To Date

- **RiverFlow2D Hydraulic Model** (WSE, 2019)
  - Includes 108 miles of Chehalis River and significant portions of many tributaries
  - 2012 – 2019 LiDAR and bathymetry for mainstem
  - Older topo and bathymetry for most tributaries



Hydrologic and Hydraulic Modeling and Analysis To Date

- In addition to mainstem RiverFlow2D model there are numerous other models available for portions of the basin – See Appendix C in memo
- These need to be obtained and reviewed to determine the extent to which they meet the needs for the current work

APPENDIX C
DRAFT HYDRAULIC MODELS IN CHEHALIS BASIN

Appendix C provides a preliminary summary of hydraulic models within Lewis, Thurston, and Grays Harbor counties for the Chehalis Basin Strategy. Most are detailed models using 1D HEC-RAS or 2D models. These are current or fairly recent models that could be available to use for further analysis. It is important to note that this document does not provide an exhaustive list of potential hydraulic models throughout the basin. This information will be reviewed and revised in consultation with local officials and other experts.

Question

- Are there other hydrologic or hydraulic models, data, or information available that should be considered?

Methodology for Flood Risk Evaluation

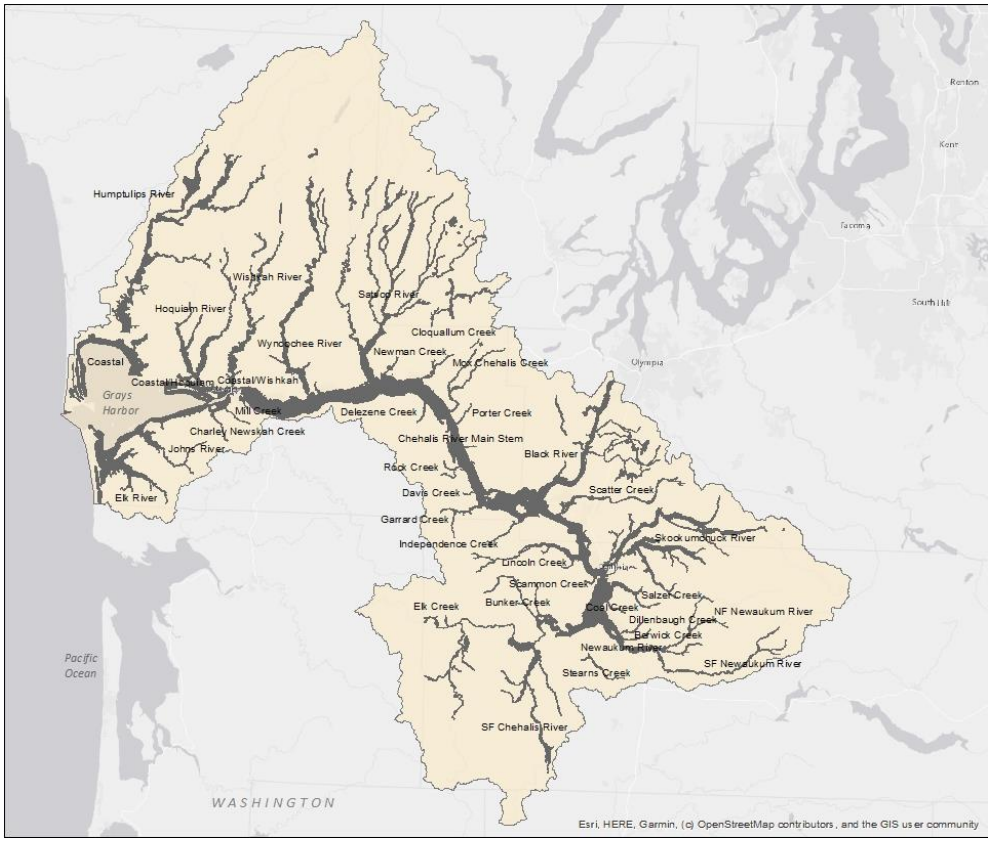
- Coordinate with floodplain managers and public works staff from local communities to determine:
  - Existing or anticipated future locations of significant flood damage, including areas of urban flooding
  - Available data or hydraulic models for rivers, creeks, or urban areas known to flood or expected to see increased flooding in the future
- Obtain delineations of all FEMA floodplain boundaries in the Chehalis Basin.
- Overlay floodplain delineations with:
  - Existing structure locations to identify existing structures at risk of flooding.
  - Zoning data to identify areas with greatest potential for future development and increased flood risk.
  - Agricultural zoned properties to identify areas of potential agricultural flood impacts.
- Identify areas with the greatest overall potential for flood damage from overlays.
- Prioritize near-term and long-term options for additional hydraulic modeling.
- Discuss options for additional hydraulic modeling to evaluate flood risks in priority areas and estimate potential costs.

Summary of Community Input

- WSE contacted public works officials or floodplain managers at Lewis County, Thurston County, Grays Harbor County, and the cities of Aberdeen, Bucoda, Centralia, Chehalis, Cosmopolis, Elma, Hoquiam, Montesano, and Napavine. Lewis, Thurston, and Grays Harbor Conservation District staff were also contacted.
- The intent of these conversations was to better understand where significant flood or erosion issues exist and where future development might be at risk of flooding and erosion.
- A summary of key feedback is provided in Appendix B to the memorandum.
- Placeholder for input from TAG experience (Jamboard)

Methodology for Current Evaluation

FEMA Special Flood Hazard Areas (i.e., 100-year floodplain)



Summary and Ranking of Flood Damage Potential

- Using the FEMA Floodplain Three Overlays were Made and Ranked (from 1 to 36):
  - Number of Structures in the FEMA 100-year floodplain
  - Acreage of Higher Density Zoning in the FEMA 100-year floodplain
  - Acreage of Agricultural Zoning in the FEMA 100-year floodplain
- These were then weighted and an overall ranking was determined

Summary and Ranking of Flood Damage Potential

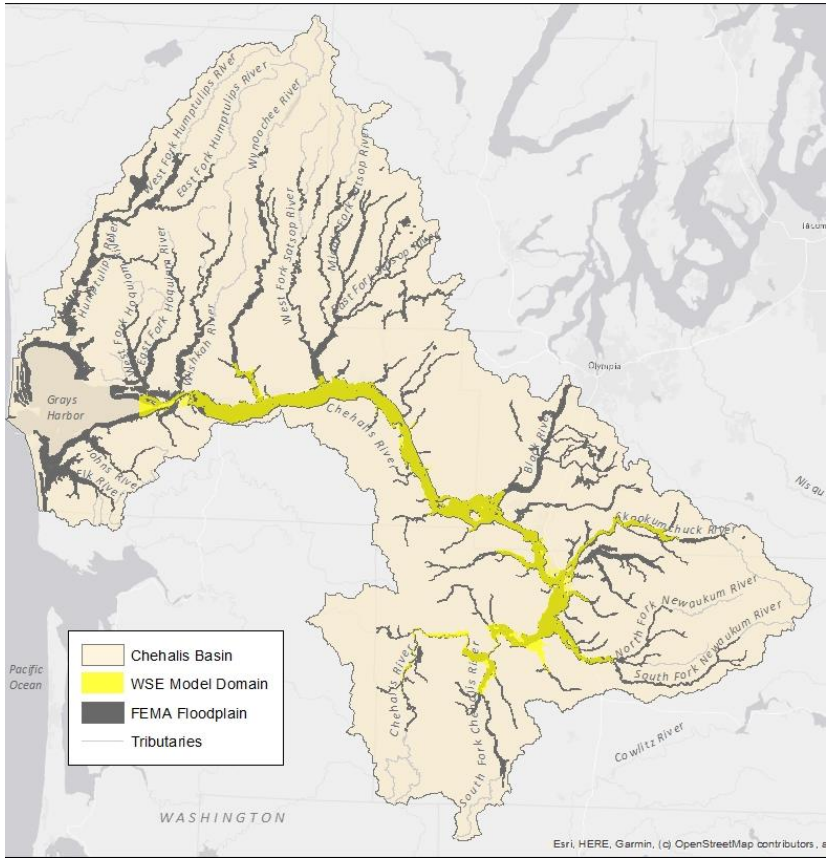
- Structures, Developable Acreage, Agricultural Acreage ranked
- Weighted rankings 50%, 33%, 17% to get overall rank

Highest Ranked Systems

FLOODING SOURCE	AGRICULTURAL ZONING IN SFHA (ACRES)		DEVELOPABLE ZONING IN SFHA (ACRES)		STRUCTURES IN SFHA (COUNT)		
TOTAL	55,755	RANK	54,213	RANK	14,548	RANK	OVERALL RANK
Chehalis Mainstem	31,387	1	14,094	1	3,860	1	1
Coastal Flood Zone	651	10	8,391	2	3,094	2	2
Skookumchuck River	1,655	6	3,812	5	1,863	4	3
Satsop River	4,378	3	1,675	9	589	5	4
Humptulips River	5,898	2	6,564	3	183	11	5
Wynoochee River	4,280	4	2,537	7	241	8	6
Black River	53	20	2,740	6	234	9	7
Newaukum River	758	9	539	16	295	6	7
Coastal/Hoquiam	0	28	1,147	12	2,193	3	9
Hoquiam River	0	28	3,928	4	205	10	10
Wishkah River	1,538	7	2,053	8	83	20	11
Coastal/Wishkah	0	28	341	17	251	7	11
Mox Chehalis Creek	213	13	697	15	96	18	13
Charley and Newskah Creeks	0	28	801	14	141	14	14
Cloquallum Creek	59	19	334	18	125	15	15
Scatter Creek	15	25	912	13	108	17	16
South Fork Newaukum River	322	12	25	29	144	13	17
Salzer Creek	15	26	88	25	163	12	18

H&H Option for Near-term

- Define Late-century (2080) 100-year floodplain throughout basin
  - Use hydraulic models wherever they are available
    - Update hydrology to reflect climate change (26% and/or 50% increase)
  - Estimate floodplain for locations without hydraulic models
    - Compile/combine best available topographic data
    - Define or estimate current FEMA Base Flood Elevations
    - Increase BFEs by some amount to account for Climate Change
    - Re-delineate floodplain at higher elevation

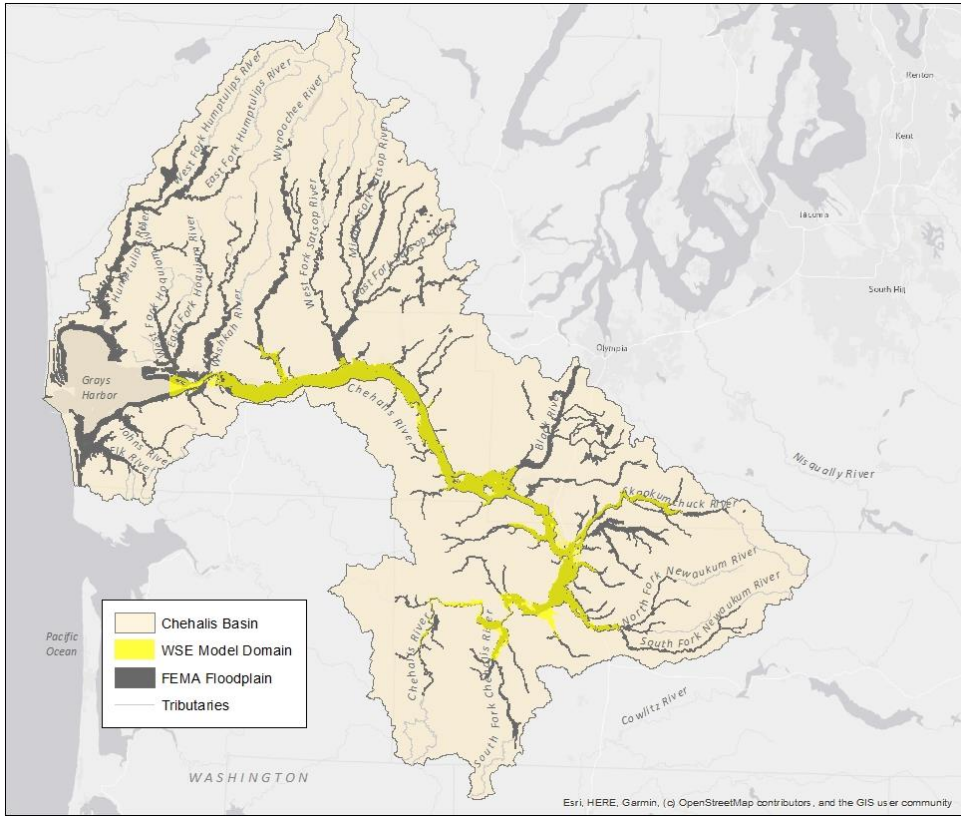


Question

- In the near term, are there other options for defining the late-century 100-year floodplain for the Chehalis River mainstem and tributaries? What recommendations do you have?

H&H Modeling Options for Long-term

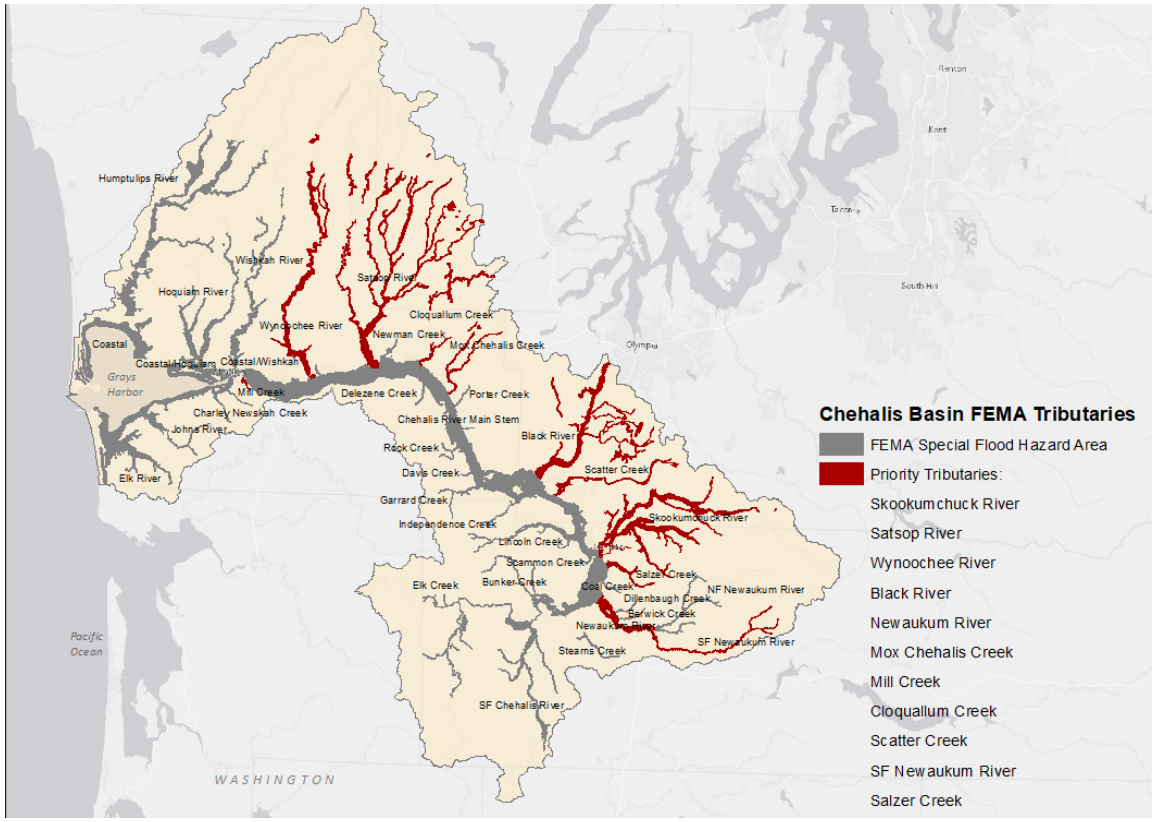
- Chehalis River floodplain and portions of tributaries and coastal floodplain in Aberdeen and Hoquiam are not recommended for new modeling
- Considered ranking of flood damage potential in addition to community input
- Identified 11 high ranked systems for additional modeling



H&H Modeling Options for Long-term

TRIBUTARY (IN ORDER OF PRIORITY FOR MODELING)	NOTES
Skookumchuck River	From mouth to existing dam, high flood damage potential, high community concerns, requires new bathymetric data
Satsop River	Model Satsop Riviera reach and specific locations of bank erosion
Wynoochee River	Model WWTP reach and specific locations of bank erosion
Black River	More research and feedback from Thurston County needed
Newaukum River	From mouth to the North Fork/South Fork confluence, high flood damage potential, requires new bathymetric data
Mox Chehalis Creek	There is not enough information currently available to define modeling needs
Alder and Mill Creeks	Need modeling of creeks and the downstream flood ponding area near the South Aberdeen levee, community concerns and observed problems
Cloquallum Creek	From mouth to Stamper Road, not identified as high priority by community, needs channel survey data
Scatter Creek	More research and feedback from Thurston County needed
South Fork Newaukum River	Significant structures and agricultural property in SFHA, Conservation District identified this area as a priority, NSD RiverFlow2D model available
Salzer Creek	Significant number of structures in SFHA, community identified priority, potential flood storage

H&H Modeling Options for Long-term



TAG Questions

- Are there other hydrologic or hydraulic modeling options or approaches to evaluating the Chehalis River mainstem and tributary areas that should be considered for the longer term?
- What questions, suggestions, and/or feedback do Technical Advisory Group members have for identifying and prioritizing areas for additional modeling in the longer term?