Chehalis Basin Board

June 1, 2023

CHEHALIS BASIN STRATEGY

DEPARTMENT OF ECOLOGY
State of Washington
OFFICE OF CHEHALIS BASIN

CHEHALIS BASIN STRATEGY

CLIMATE CHANGE CONSIDERATIONS FOR THE CHEHALIS BASIN STRATEGY

June 1, 2023

PRESENTATION OVERVIEW

- Recap the process used to estimate climate change impacts in the Chehalis Basin
- Preview results from recent simulation and analysis of Global Climate Model (GCM) ensemble
- Understand how other organizations have approached similar issues
- Board discussion with panel members on key considerations for the future use of climate modeling to support long-term strategy decision-making

PRESENTATION SUMMARY

- Climate models are constantly evolving, *uncertainty* is to be expected
- A wide range of climate change methodologies and results have informed decision-making to date
- Climate change methodologies and assumptions are not used consistently across Strategy elements
- A “best practices” approach may be emerging among organizations / initiatives that are considering climate change
- The Board needs to determine what scale of protection and level of risk are acceptable when using climate modeling to support long-term strategy decisions

RELATIONSHIP TO LONG-TERM STRATEGY

- Board will need to agree on how to approach assumptions regarding climate change – including potential new modeling of packages (combination of elements) for comparative evaluation

- Revised assumptions will likely require new hydraulic/hydrologic modeling and fish modeling (EDT and/or NOAA life cycle) of packages of Strategy (e.g., FRE, LAND, ASRP)

- Any new modeling will take time which may impact the timing of the Board's decision-making process

QUESTIONS FACING THE BOARD

Recognizing the inherent uncertainty in climate modeling, do you want to:

1) Use the prior data and prior modeling outputs?
2) Update some of the prior modeling outputs with 2023 data?
3) Update all the prior modeling outputs with the 2023 data?
4) Wait for the next major data and/or modeling update?

If you choose to update any prior modeling, do you want to be consistent across all elements or assigned based on useful life of infrastructure/project (i.e., low, med, high & mid- or late-century)?

OVERVIEW OF CLIMATE CHANGE MODELS FOR CHEHALIS BASIN STRATEGY

CONSIDERING CLIMATE CHANGE IN THE BASIN

- Strategy has done more to consider climate change in the Chehalis Basin than most watersheds in the state

- Three main factors have changed over time relative to climate modeling in the Basin:
  - Updated data and understanding of climate impacts
  - More sophisticated modeling approaches
  - Use of modeling results for different purposes (e.g., planning, design, etc.)

- Our understanding of projected climate change is constantly evolving, *uncertainty* is to be expected

LAYERS OF UNCERTAINTY

- Representative Concentration Pathway (RCP) Uncertainty
  - Criticism of RCP 8.5 as "business as usual"
  - Doesn't specify the "why" – Purpose of SSPs (Shared Socioeconomic Pathways)
- Global Climate Model (GCM) Uncertainty
  - Natural variability (e.g. La Niña and El Niño)
  - Process uncertainty (numerous models and constant updates)
    - Increased number of GCMs used in modeling = Higher Certainty
- A Cascading Effect: RCP + GCM + Downscaling + Hydrologic Modeling
  - Creates uncertainties
  - Without this modeling, no ability to estimate localized climate change impacts

CLIMATE CHANGE MODELING USED FOR PLANNING

STRATEGY ELEMENT	YEAR(S) OF PUBLICATION
Programmatic SEPA EIS	2017
Phase 1 Aquatic Species Restoration Plan	2019
Project-level Draft SEPA EIS	2020
Project-level Draft NEPA EIS (climate variability considered without modeling)	2020
Local Actions Program	2020-2021
Project-level Final SEPA EIS	2021-Present
Chehalis River Basin Comprehensive Flood Hazard Management Plan Update	2021
Skookumchuck dam evaluation	2021-Present
LAND	2022-Present

CLIMATE CHANGE CONSIDERED FOR DESIGN

STRATEGY ELEMENT	YEAR(S)	HOW WAS CLIMATE CHANGE CONSIDERED
North Shore Levee and North Shore Levee West Segment	2020-Present	Used FEMA's mapped Special Flood Hazard Area and considered sea level rise
CFAR	2020-Present	Accounts for climate effects in 3' freeboard standard
On-the-ground Aquatic Species Restoration Projects	2017-Present	Considers future climate change conditions based on previous modeling
Flood Authority Local Projects	2017-Present	Considers FEMA's mapped Special Flood Hazard Area

CLIMATE CHANGE PROJECTIONS OVER TIME

Year	Project	Method	100-year flow (late-century)	Uses	Notes
2014	Chehalis River Basin Flood Hazard Mitigation	Literature Review (mostly CIG State of the Science Report)	18% Increase	Flood reduction alternatives analysis	All return periods scaled by same amount
2014	Chehalis River Basin Flood Hazard Mitigation	Discussions with Alan Hamlet at UW CIG on forthcoming research	90% Increase	Bracket a potential high-end projection	Detailed analysis not available, simply Alan's guesstimate based on his research
2016	Chehalis Basin Strategy	UW Climate Impacts Group, VIC hydrologic modeling, 10 MACA statistically downscaled data sets, bias corrected, averaged across basin	66% Increase	Programmatic EIS, Flood retention facility evaluation	2-year: 16% increase 10-year: 35% increase 20-year: 45% increase 100-year: 66% increase 500-year: 94% increase
2018	Chehalis Basin Strategy	UW CIG provided 2 dynamically downscaled Global Climate Model meteorological projections, WSE used DHSVM hydrologic model to estimate flow increases	26% Increase	Draft SEPA EIS, Phase 1 ASRP (for EDT)	Averaged across all return periods and locations, termed a median climate change projection
2019	Chehalis Basin Strategy	UW CIG provided corrected GFDL dynamically downscaled Global Climate Model projection, WSE used DHSVM hydrologic model to estimate flow increases	50% Increase (averaged across all locations)	Informational Only	Averaged across all return periods and locations. Not used for analysis but used to put the 26% climate change projection in context as median.
2021	Chehalis Basin Strategy	WSE and CIG evaluated spatial variations in precipitation estimates for numerous GCMs, and results of DHSVM hydrologic modeling of corrected GFDL to estimate flow increases throughout the basin	Spatially Varied Increase ranging from 40% to 65%	Preliminary Final SEPA and NEPA EISs, ASRP, LAND, late century floodplain mapping	Averaged across all return periods but varied by location in the basin

RECENT ANALYSIS OF GLOBAL CLIMATE MODEL ENSEMBLE

- Previous (2018 – 2021) climate analyses in Basin used data available from two Global Climate Models (GCMs).

- Recent (2023) analysis by UW CIG and WSE modeled and analyzed 12 GCMs, referred to as an ensemble. Determined median and range of projected peak flow increases.

- Results do not show consistent spatial patterns in the projected peak flow increases across the full ensemble of models.

COMPARISON OF PRIOR AND RECENT CLIMATE MODELING

Climate Change Scenario	Peak Flow Increase (2021)	Peak Flow Increase (2023 Ensemble)	Summer Flow Change (2021)	Summer Flow Change (2023 Ensemble)
Mid-Century Median / Average	12%	10%	-11%	+4%
Mid-Century High-End	23-37% (spatially varied)	40%	-22%	-11%
Late-Century Median / Average	26%	22%	-16%	-5%
Late-Century High-End	40-65% (spatially varied)	55%	-30%	-17%

COMPARISON OF PEAK FLOW ESTIMATES

Strategy Element	MID Century (2021)	*MID century (2023 ensemble)*	Late century (2021)	*Late century (2023 ensemble)*
Phase 1 Aquatic Species Restoration Plan (2019)	+12%	*+10% (basin-wide)*	+26%	*+4% to +55% (+22% median)*
Project-level Draft SEPA EIS (2020)	+12%	*+10% (basin-wide)*	+26%	*+4% to +55% (+22% median)*
LAND (2022-Present)	---*	*N.A.**	+26%	*+4% to +55% (+22% median)*
Skookumchuck dam evaluation (2021-Present)	N.A.*	*N.A.**	+60%**	*+4% to +55% (+22% median)*
Project-level Final SEPA EIS (2021-Present)	TBD	*TBD*	TBD	*TBD*

*LAND and Skookumchuck analysis did not include mid-century modeling
**Based on 2021 spatially varied high-end analysis, 60% was the scalar for the Skookumchuck Basin

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HOW OTHER ORGANIZATIONS / INITIATIVES ARE CONSIDERING CLIMATE CHANGE

CLIMATE PROJECTION USE IN ENVIRONMENTAL ASSESSMENTS

- Major infrastructure requires Environmental Impact Assessments (EIAs; often at both state and federal level)
- Methodologies to determine effects of climate change on the project are not established and vary by agency
- Lots of uncertainty of addressing climate change in EIAs

CLIMATE CHANGE PROJECTIONS IN LAND USE PLANNING

- American Planning Association Climate Change Policy Guide
  - Assistance for planners to create locally and regionally tailored climate plans
  - Provides very high-level policy guidance

- Use of Vulnerability Risk Assessments to make more in-depth decision-making and planning

SCENARIOS PLANNING AND ADAPTIVE MANAGEMENT

- Many grapple with uncertainty by developing plans for multiple scenarios for mid- and high-range climate change projections

- Scenarios planning – prepare for multiple future possibilities allowing for adaptive management over time

- Adaptive management - adjust to changing factors consider risk tolerance, tradeoffs, and costs of climate adaptation

EMERGING BEST PRACTICES FOR ADDRESSING UNCERTAINTY

- Accept and embrace uncertainty
- Reject use of low-range estimates (e.g., RCP 4.5) because we are already past that point
- Design/construct infrastructure to meet mid-range estimates and include Scenarios Planning and Adaptive Management in the event high-range estimates (e.g., RCP 8.5) become more probable
- Consider political, social, regulatory, and budgetary landscape

CLIMATE RESILIENCE STRATEGY UPDATE (E2SHB 1170)

- Ecology will lead an update to the statewide climate resilience strategy in partnership with state agencies and UW CIG (RCW 70A.05)
- Engage a wide array of interested parties in process
- Develop state actions and leads for addressing climate resilience gaps on key climate change impacts
- UW CIG legislative report due June 2024 about best practices for measuring and evaluating climate change resilience
- Updated climate resilience strategy due Sep. 2024 – then updated on 4-year cycle

KEY CONSIDERATIONS FOR CLIMATE CHANGE AND BOARD DECISION MAKING ON LONG-TERM STRATEGY

RELATIONSHIP TO LONG-TERM STRATEGY

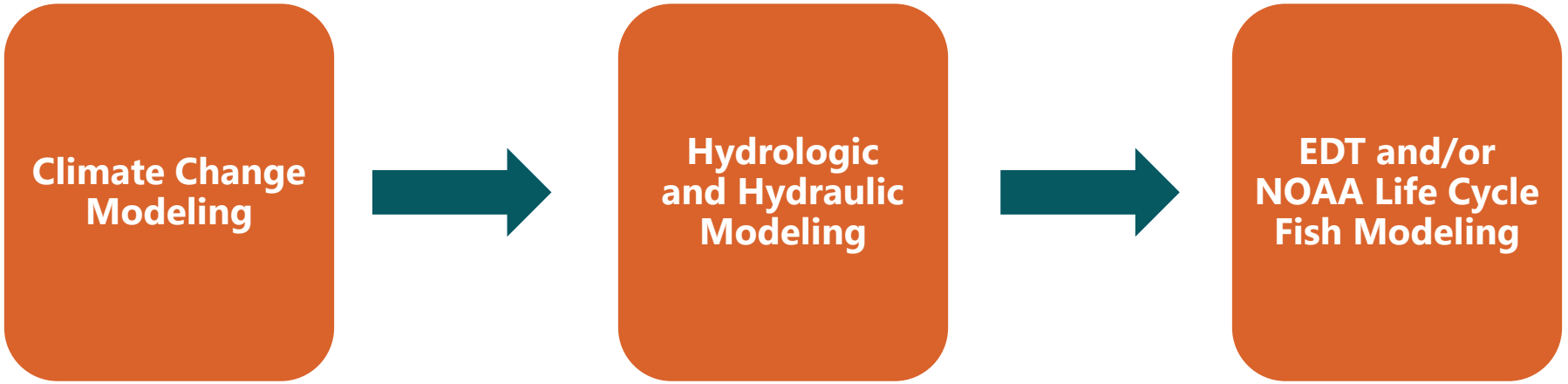
- Board will need to agree on how to approach assumptions regarding climate change for the Strategy – including potential new modeling for the comparative evaluation

- Revised climate change assumptions would require new hydraulic/hydrologic modeling and fish modeling (EDT and/or NOAA life cycle) of packages of Strategy elements (FRE, LAND, ASRP)

- Any new modeling will take time and needs to be factored into the broader Board decision-making process

MODELING APPROACH FOR COMPARATIVE EVALUATION

Potential modeling approach for a comparative evaluation of packages that include combinations of FRE, LAND, ASRP, Skookumchuck dam, CFAR, etc.



QUESTIONS FACING BOARD ON INDIVIDUAL STRATEGY ELEMENTS

Recognizing the inherent uncertainty in climate modeling, do you want to:

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CONSIDERATIONS FOR BOARD MEMBERS: ELEMENTS

Advantages/disadvantages of:

- Completing new climate change modeling that incorporates new ensemble results for one or more of the individual elements of the Strategy (e.g., FRE, LAND, ASRP, Skookumchuck dam, CFAR, etc.)?
- Using the median and scenarios planning/adaptive management best practice?
- Using the same median or each Strategy element, or using different assumptions based on the Strategy element's impact, risk, and longevity?

QUESTIONS FOR BOARD ON PACKAGES FOR COMPARATIVE EVALUATION

Recognizing the inherent uncertainty in climate modeling, do you want to:

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If you choose to update any prior modeling, do you want to be consistent across all elements or assigned based on useful life of infrastructure/project (i.e., low, med, high & mid- or late-century)?

CONSIDERATIONS FOR BOARD MEMBERS: PACKAGES

Advantages/disadvantages of:

- Completing new climate change modeling that incorporates new ensemble results to support your comparative evaluation of packages that include combinations of FRE, LAND, ASRP, Skookumchuck dam, CFAR, etc.?
- Using the mid-range estimates and scenarios planning/adaptive management best practice?
- Using the same mid-range assumptions for each Strategy element, or using different assumptions based on the Strategy element's impact, risk, and longevity?

BOARD AND PANEL MEMBER DISCUSSION

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THANK YOU!

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