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Shared Vision Planning for Addressing Temperature TMDL's in the Willamette Basin

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Who

- Sandia National Laboratories
  - Thomas S Lowry
  - Vincent C Tidwell
  - et. al
- Army Corps of Engineers
  - Hal E. Cardwell - IWR Shared Vision Planning
- David Evans and Associates:
  - Terry Buchholz
  - Kim Seymour
  - et. al
- EcoTrust
  - Mike Mertens

- Willamette Partnership
  - David Primozich
- Army Corps of Engineers
  - Matt T. Rea - Portland Office
  - et. al

Technical Advisory Group
- Portland State University
  - Scott Wells
- USGS
  - Stewart Rounds
- ODEQ
  - James Bloom

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Motivation

GENTLEMAN, IT APPEARS TO BE UNANIMOUS

THAT WE CANNOT AGREE

-unattributed

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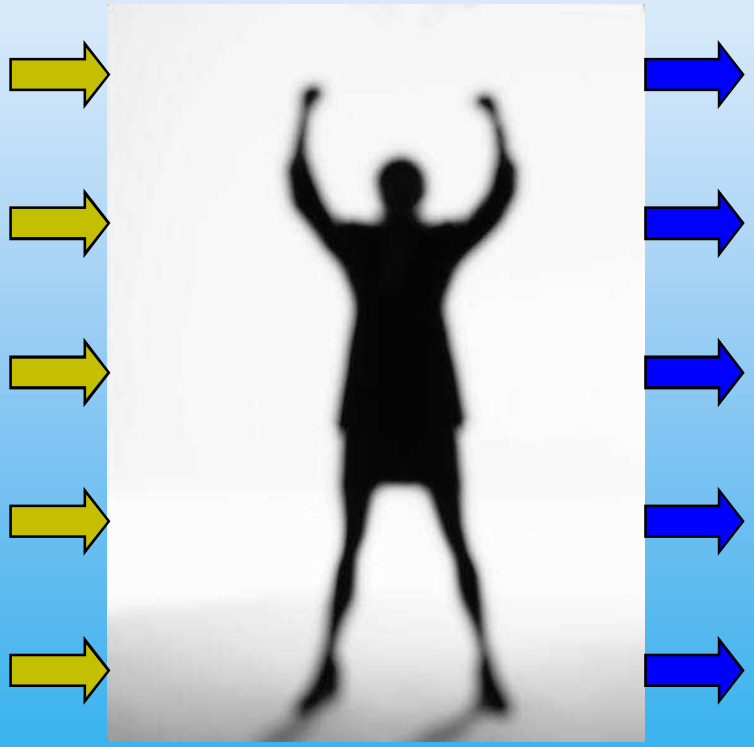
What is the Problem?

- Persistent conflict is becoming ‘the norm’ in water resources management
- Conflicts occur because of:
  - Complexity & uncertainty in natural systems
  - Lack of insight of cause and effect
  - Conflicting interests & values
- Need to integrate technical analysis into a public, multi-stakeholder decision process
- Previous efforts demonstrate the value of combining computer tools within collaborative processes

Motivation – 30,000 ft

To Turn Information into Insight

- **Understand cause and effect**
  - **Physical systems**
  - **Human systems**
- **Inform the decision making process**
- **Create an environment for consensus and agreement**



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Integrated Approach

- Understand basic hydrology, ecology, economics, etc
- Accurately represent the linkages between these areas

Technical tools

- Understand institutional setting
- Develop ways engage stakeholders
- Build trust

Process skills

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Collaborative Modeling

- Means involving stakeholders in
  - Data collection and/or analysis
  - Developing cause and effect relationships
  - Technical analysis

❖Builds understanding of the system

❖Builds confidence in the analysis

❖Builds trust between stakeholders

Shared Vision Planning

- **Integrates**
  - **Planning principles**
  - **Systems level analysis**
  - **Collaboration**
- **Addresses need for broad involvement**
- **Technical analysis is done collaboratively**

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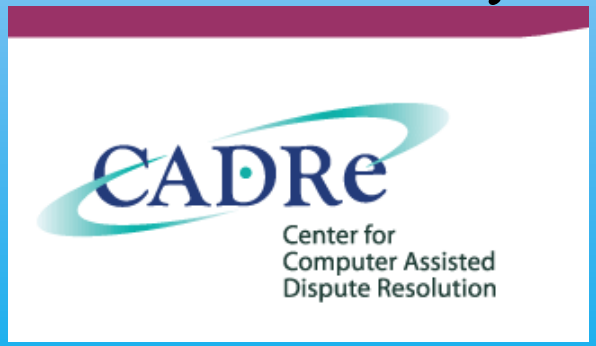

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Shared Vision Planning

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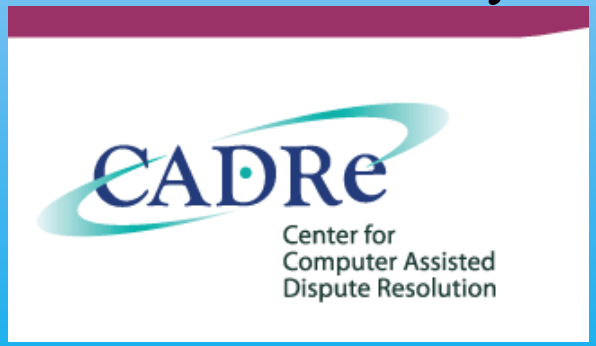

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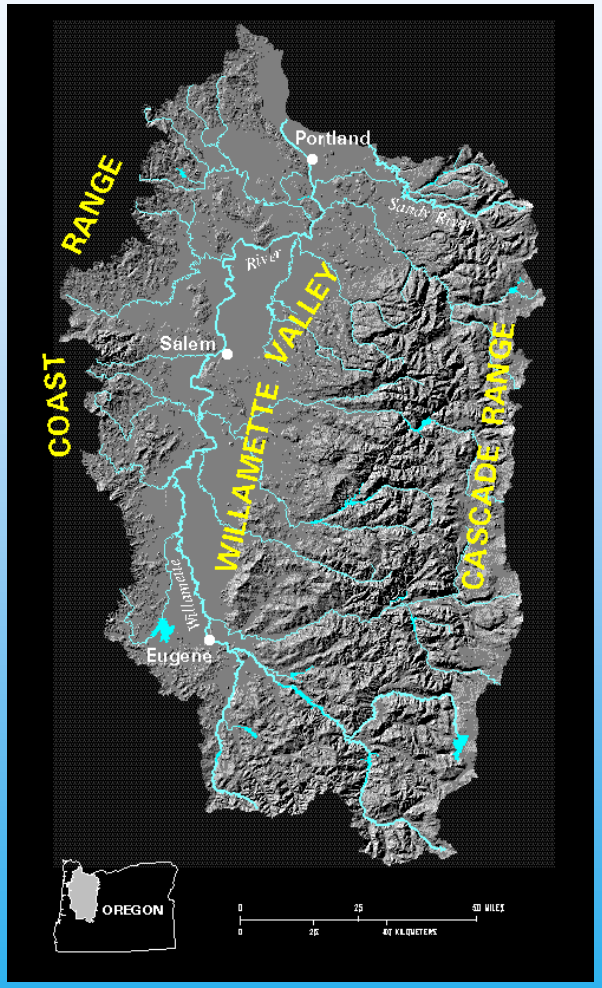
Willamette Basin



- 28750 km^2
- 300 km long
- 68% of Oregon's Population
- Flow at mouth:
  - 225 to 2000 m^3/s
  - 13th largest in the US
  - Most runoff per unit land area of any other river

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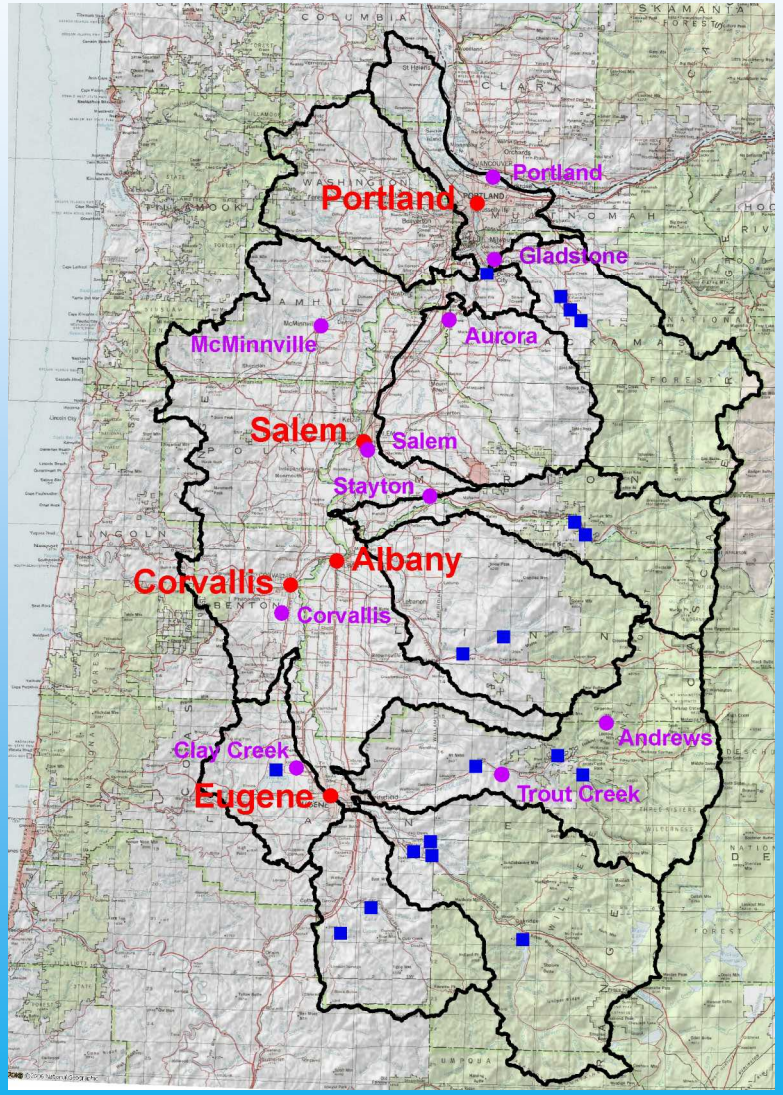
Willamette Basin



- Ten Sub-basins
  - Willamette
    - Coast Fork
    - Middle Fork
    - Main stem
  - Santiam
    - North
    - South
  - McKenzie
  - Long Tom
  - Tualatin
  - Clackamas
  - Pudding
- 13 Reservoirs

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Motivation – Ground Level

- Oregon Department of Environmental Quality - TMDL
  - Protect aquatic ecosystems from anthropogenic heating and cooling
    - Salmonids, bull trout
  - 7 day average of maximum daily temperature (7dADM)
  - Developed through detailed modeling using CE-QUAL-W2
- Key Players
  - USACE reservoir operations
  - Point sources
    - Municipal
    - Industrial
  - Near stream land cover
  - Stream morphology
  - Willamette Partnership
    - Coordinated approach
    - Leverage conservation expenditures
    - Ecosystem marketplace

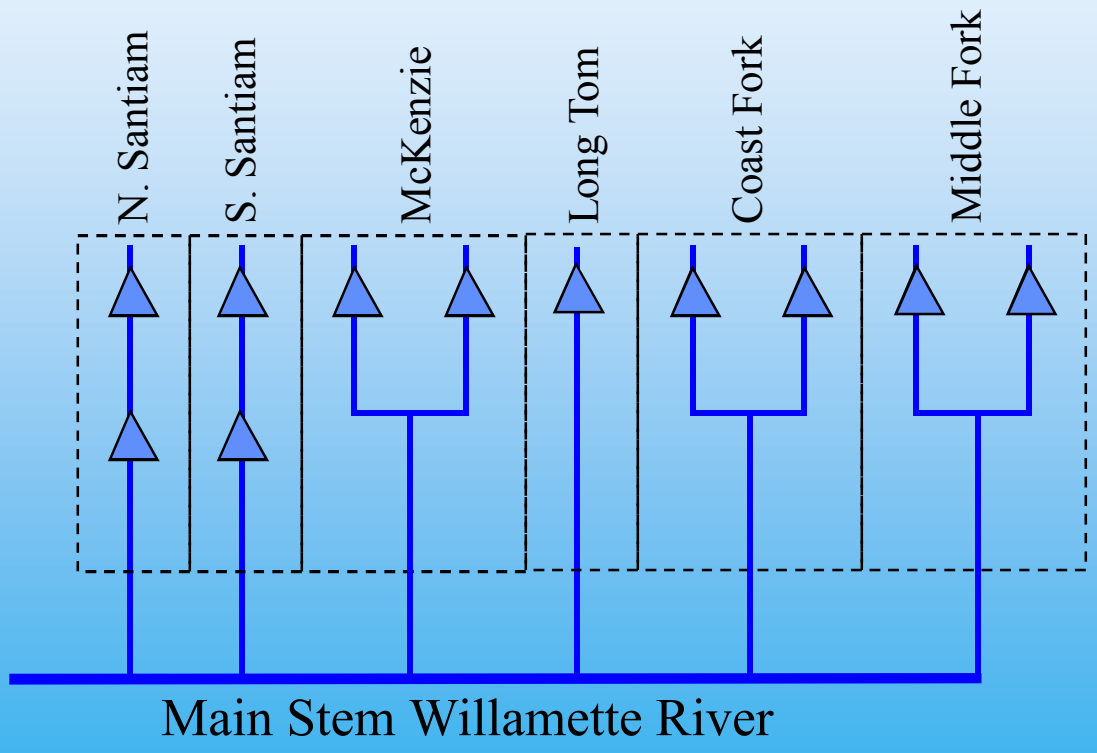
Shared Vision Planning

- Met with Willamette Partnership
  - Liked the idea
  - Wanted to use the tool when it was done
  - Didn't have the resources to consistently engage
  - Model Objectives
- Technical Advisory Group (TAG)
  - Group of local experts
  - Trusted by stakeholders

Model Objectives

- Temperature dynamics for the entire basin
  - Reservoirs
  - Streams
  - Riparian shading
  - Point source discharges
- Reservoir Operations
- Impacts on fish ‘habitat’
- Impacts on recreational opportunities
- Impacts on power generation
- Economic considerations - Recreation
- Test viability of ecosystem marketplace
- Fast execution for rapid scenario screening

Model Domain



- **Willamette**
  - Coast Fork
  - Middle Fork
  - Main stem
- **Santiam**
  - North
  - South
- **McKenzie**
- **Long Tom**
- **11 Reservoirs**

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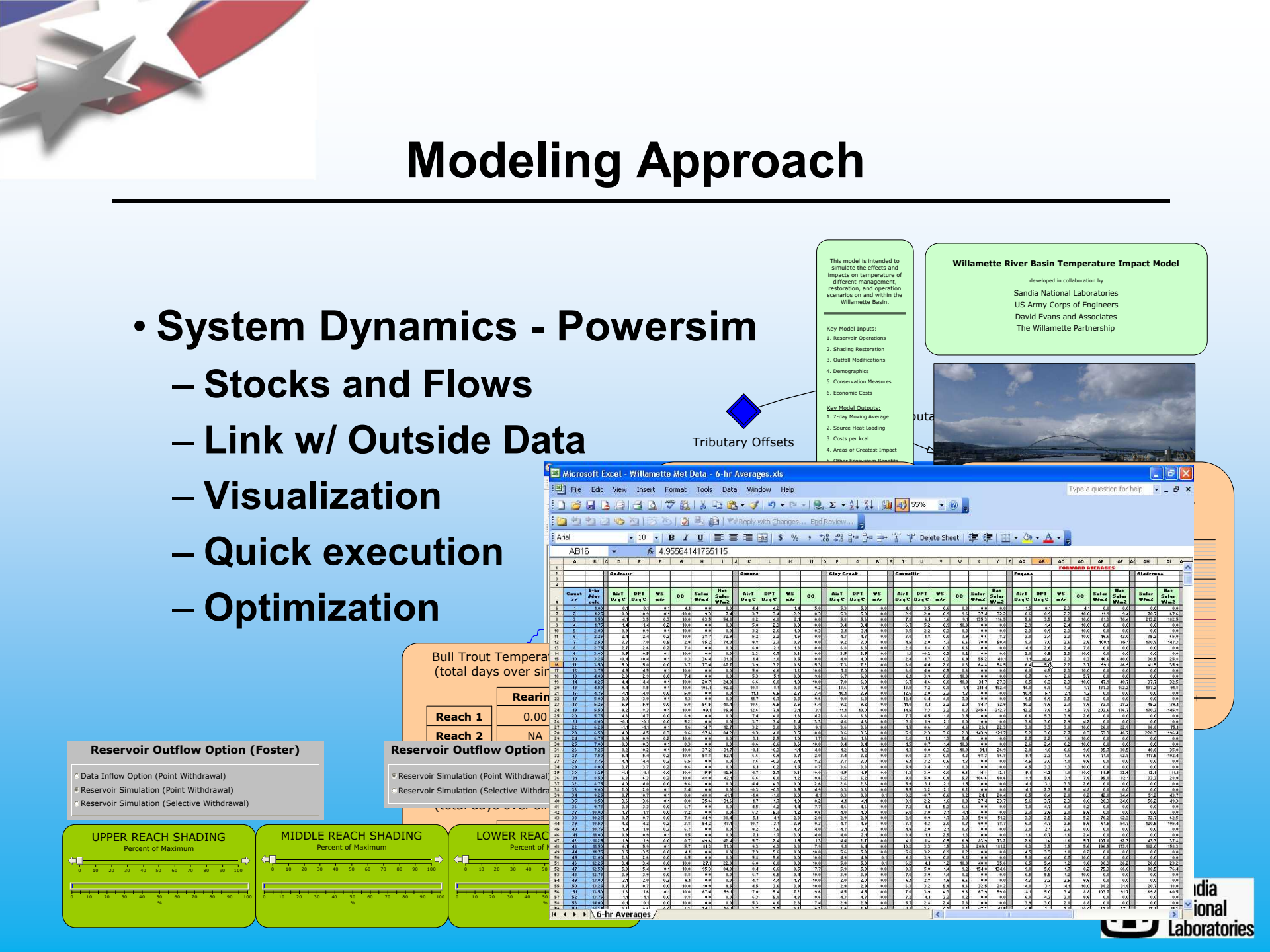
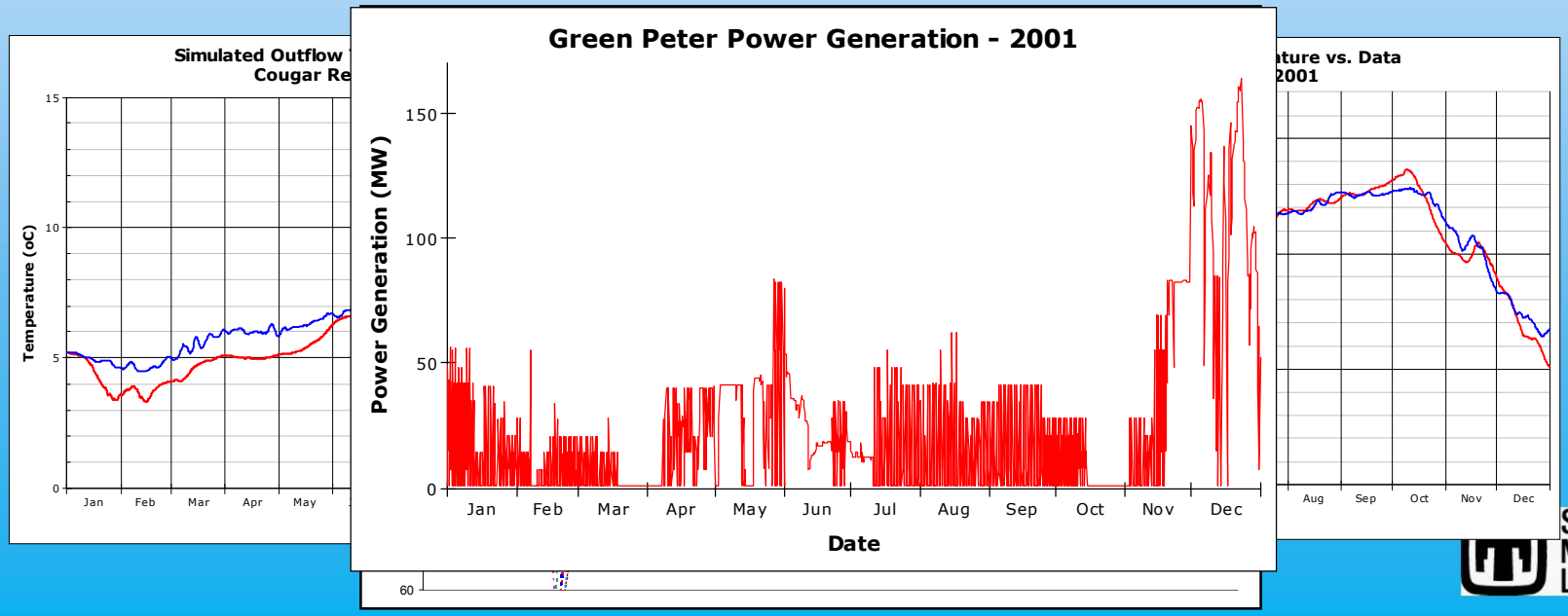
Modeling Approach

- System Dynamics - Powersim
  - Stocks and Flows
  - Link w/ Outside Data
  - Visualization
  - Quick execution
  - Optimization



Reservoir Modeling

- Model
  - 1-d vertical
  - Inflows and outflows from data
  - Selective vs. point Withdrawal
  - Power generation
  - Reservoir operations
- Calibration
  - Outflow temperature
  - Vertical temperature profiles



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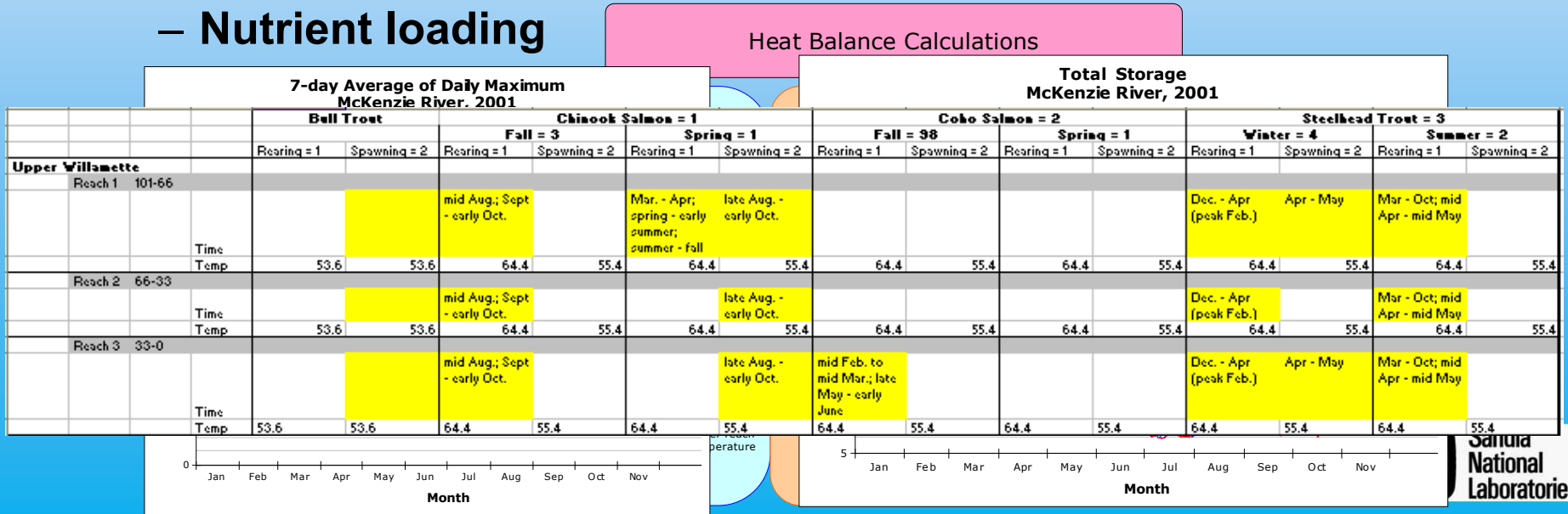
River Modeling

- Model
  - Lumped Parameter
    - 1 to 3 stream reaches
  - Inflows and outflows from data
  - Shading
  - Fish windows
  - Nutrient loading
- Calibration
  - Stream storage
  - W2 7dADM



			Bull Trout		Chinook Salmon = 1				Coho Salmon = 2				Steelhead Trout = 3			
					Fall = 3		Spring = 1		Fall = 98		Spring = 1		Winter = 4		Summer = 2	
			Rearing = 1	Spawning = 2	Rearing = 1	Spawning = 2	Rearing = 1	Spawning = 2	Rearing = 1	Spawning = 2	Rearing = 1	Spawning = 2	Rearing = 1	Spawning = 2	Rearing = 1	Spawning = 2
Upper Willamette																
Reach 1	101-66															
		Time			mid Aug.; Sept - early Oct.		Mar. - Apr; spring - early summer; summer - fall	late Aug. - early Oct.					Dec. - Apr (peak Feb.)	Apr - May	Mar - Oct; mid Apr - mid May	
		Temp	53.6	53.6	64.4	55.4	64.4	55.4	64.4	55.4	64.4	55.4	64.4	55.4	64.4	55.4
Reach 2	66-33															
		Time			mid Aug.; Sept - early Oct.			late Aug. - early Oct.					Dec. - Apr (peak Feb.)		Mar - Oct; mid Apr - mid May	
		Temp	53.6	53.6	64.4	55.4	64.4	55.4	64.4	55.4	64.4	55.4	64.4	55.4	64.4	55.4
Reach 3	33-0															
		Time			mid Aug.; Sept - early Oct.			late Aug. - early Oct.	mid Feb. to mid Mar.; late May - early June				Dec. - Apr (peak Feb.)	Apr - May	Mar - Oct; mid Apr - mid May	
		Temp	53.6	53.6	64.4	55.4	64.4	55.4	64.4	55.4	64.4	55.4	64.4	55.4	64.4	55.4

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Status

- Santiam and McKenzie basin models complete
- Balance of river models complete
- Reservoir data compiled for balance of basins

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Next Steps

- Develop the rest of the sub-basin models
- Link models - GUI

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THANK YOU

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