

Keeping Freight Moving: Enabling Disaster Resilient Transportation Networks

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“Our Shippers are looking at alternate modes of Transportation...” Marty Hettel, American Electric Power Co., River Operations



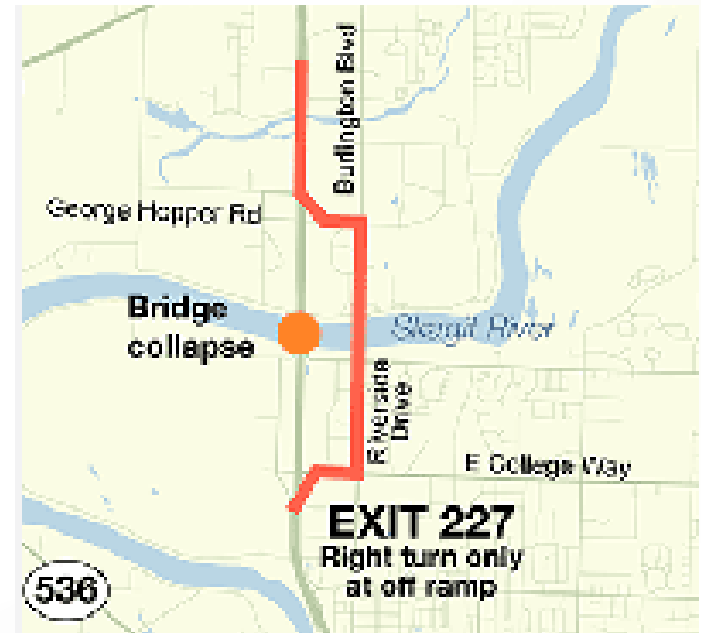
“But Katrina wasn't your ordinary hurricane...”
–Bloomberg Businessweek

U.S. energy production;

Devastation of a major urban center, New Orleans;

Disruption of a vital transportation artery, the
Mississippi River

Drivers can expect up to 30 minute delays during the peak commute times.



The Cost of Weather Related Closures in Washington:



Chronology of Events

I-5 Closure: December 2007

- Dec. 3 20-mile section of I-5 closed due to floodwaters.
Governor Gregoire declares State of Emergency.
- Dec. 4 SR 7 & US 12 detours opened to trucks with emergency supplies and perishable loads on a case-by-case basis.
- Dec. 6 One lane opened in each direction to commercial freight vehicles.
11-mile section opened to all traffic.
- Dec. 7 I-5 completely reopened to all traffic.

I-90 Closure: Jan. - Feb. 2008

- Jan. 29 I-90 at Snoqualmie Pass closed for avalanche control.
- Jan. 30 I-90 reopened for 4 hours.
I-90 closes again due to second avalanche.
- Jan. 31 Governor Gregoire declares State of Emergency.
- Feb. 2 I-90 reopened to all traffic.



Type of Economic Impact	I-5 Closure	I-90 Closure	Total Impacts Due to Closures
Total Lost Economic Output (\$ Million)	\$47.07	\$27.89	\$74.96
Employment Loss (Estimated Job Loss for One Year Following the Closures)	290	170	460
State Tax Revenue Loss (\$ Million)	\$2.39	\$1.42	\$3.81
Reduction in Personal Income (\$ Million)	\$14.55	\$8.60	\$23.15

Source: WSDOT Freight Systems Division IMPLAN Modeling, 2008

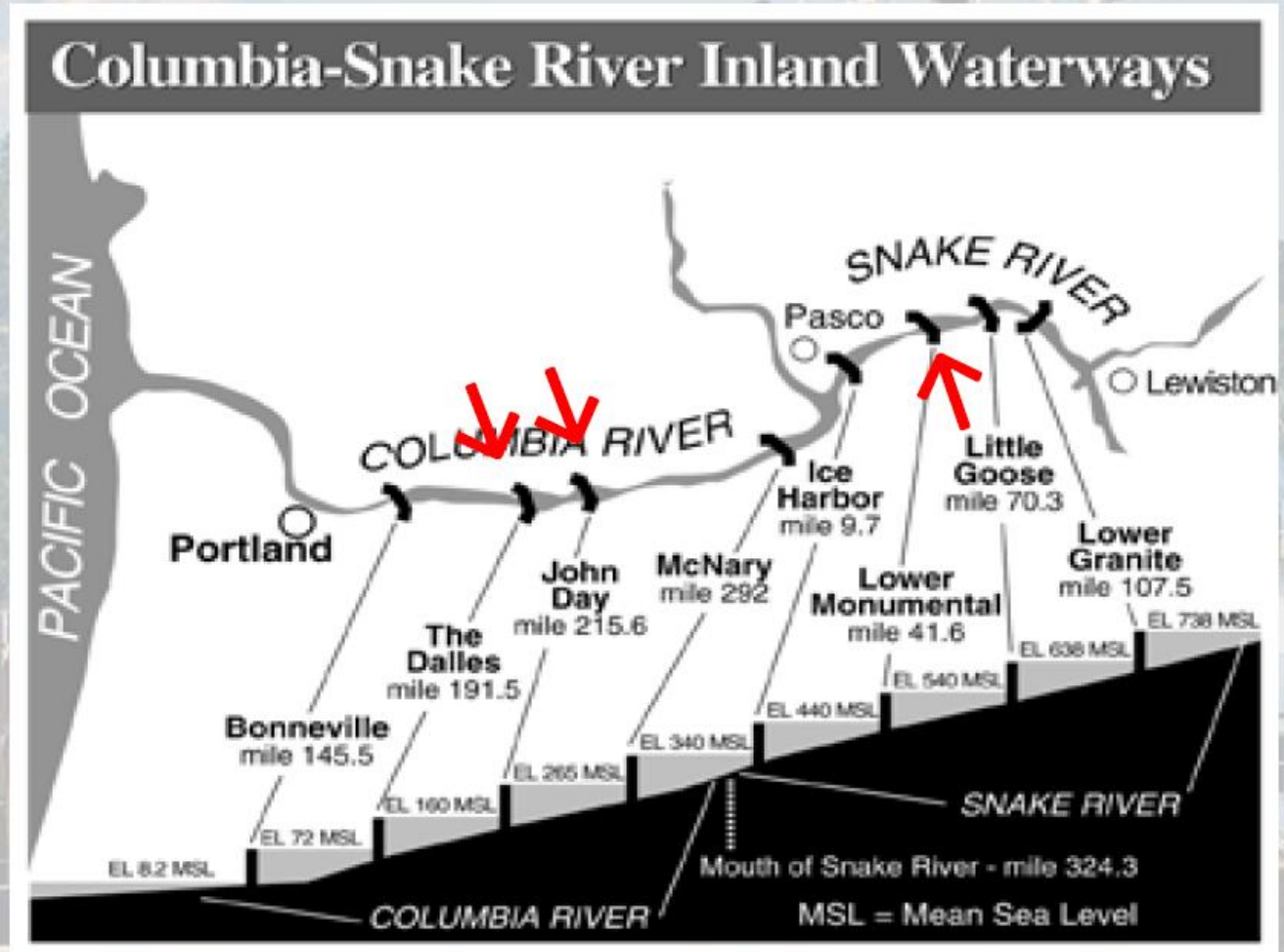
We will witness economic shocks to the freight network...

But the question becomes, how do we develop a system that is resilient 'enough'?

We can learn a bit from planned disruptions to networks.

The Issue

- 15 weeks
- December 2010 to March 2011
- Replace and rehabilitate an aging infrastructure
- Replaced downstream gates for three locks

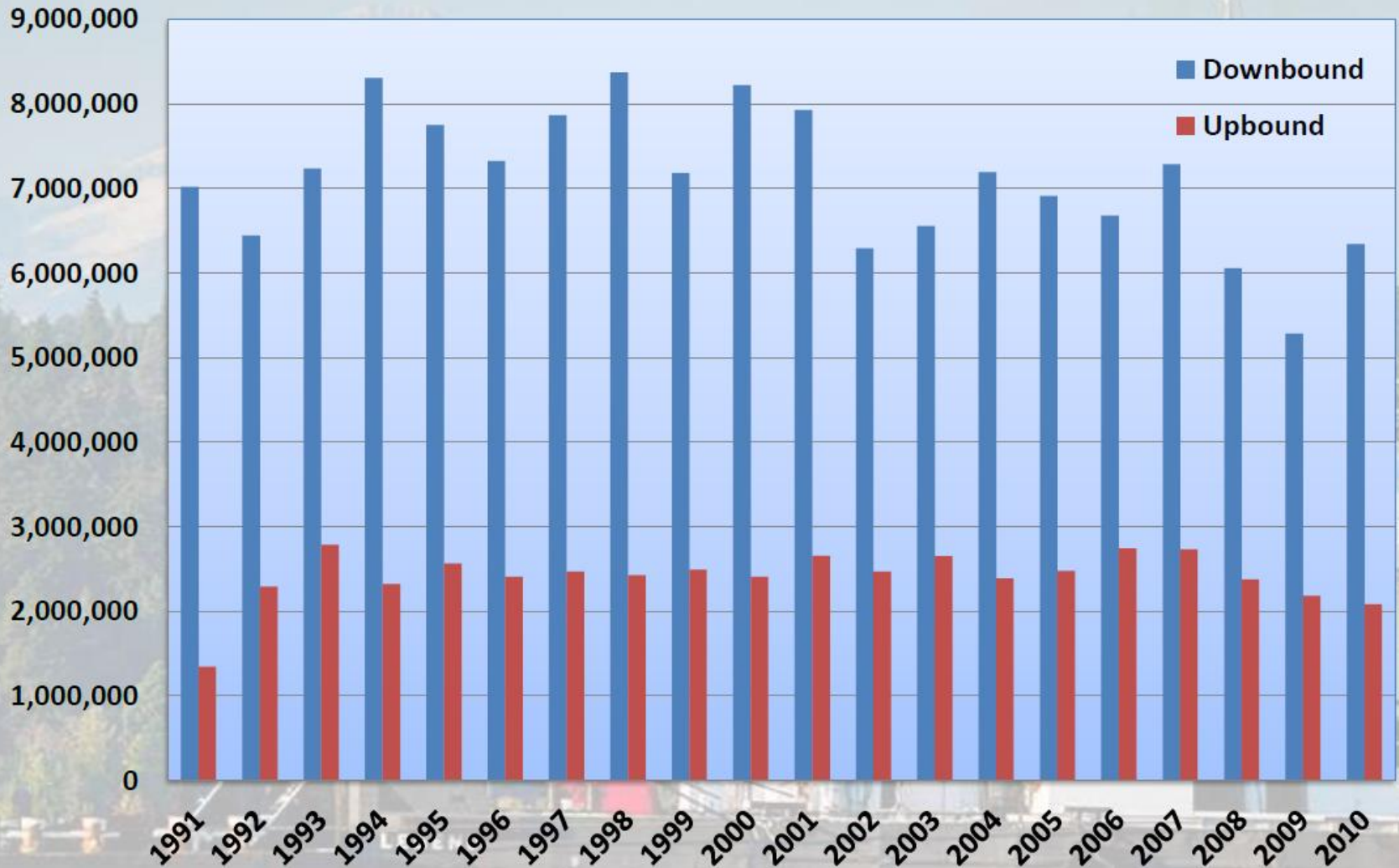


Transportation Study and Approach

- Purpose and Phases
 - Determine
 - Historical use of the river system (Phase I)
 - Preparations of shippers, industries and governments (Phase II)
 - Impacts of the outage (Phase III)
 - Return of traffic to the river system (Phase IV)
 - Evaluate the economic and environmental impacts (Phase V)



Phase I



Total Annual Downriver and Upriver Tonnage, 1991-2010

Source: U.S. Army Corps of Engineers Monthly Lock Tonnage Reports



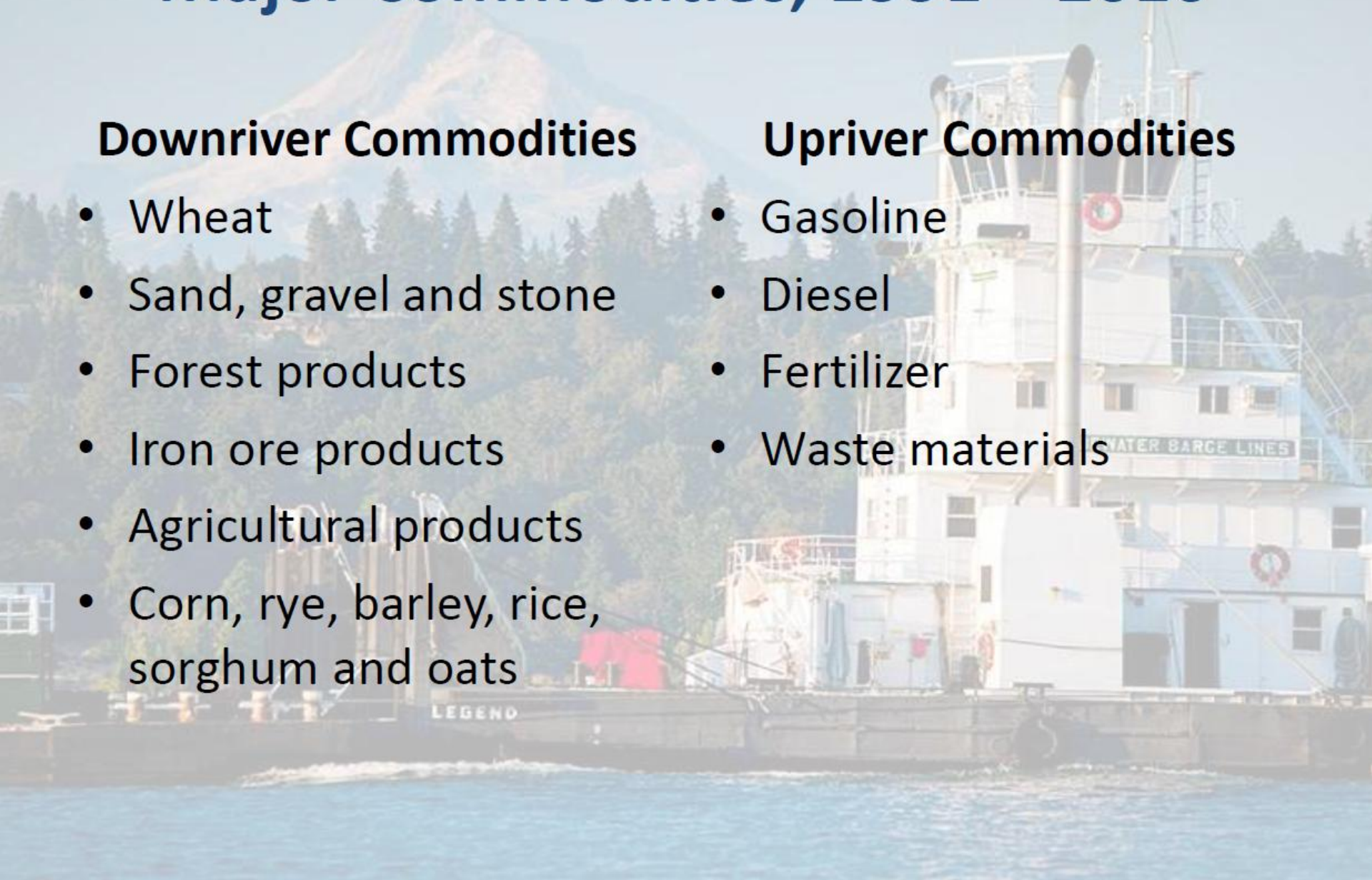
Major Commodities, 1991 – 2010

Downriver Commodities

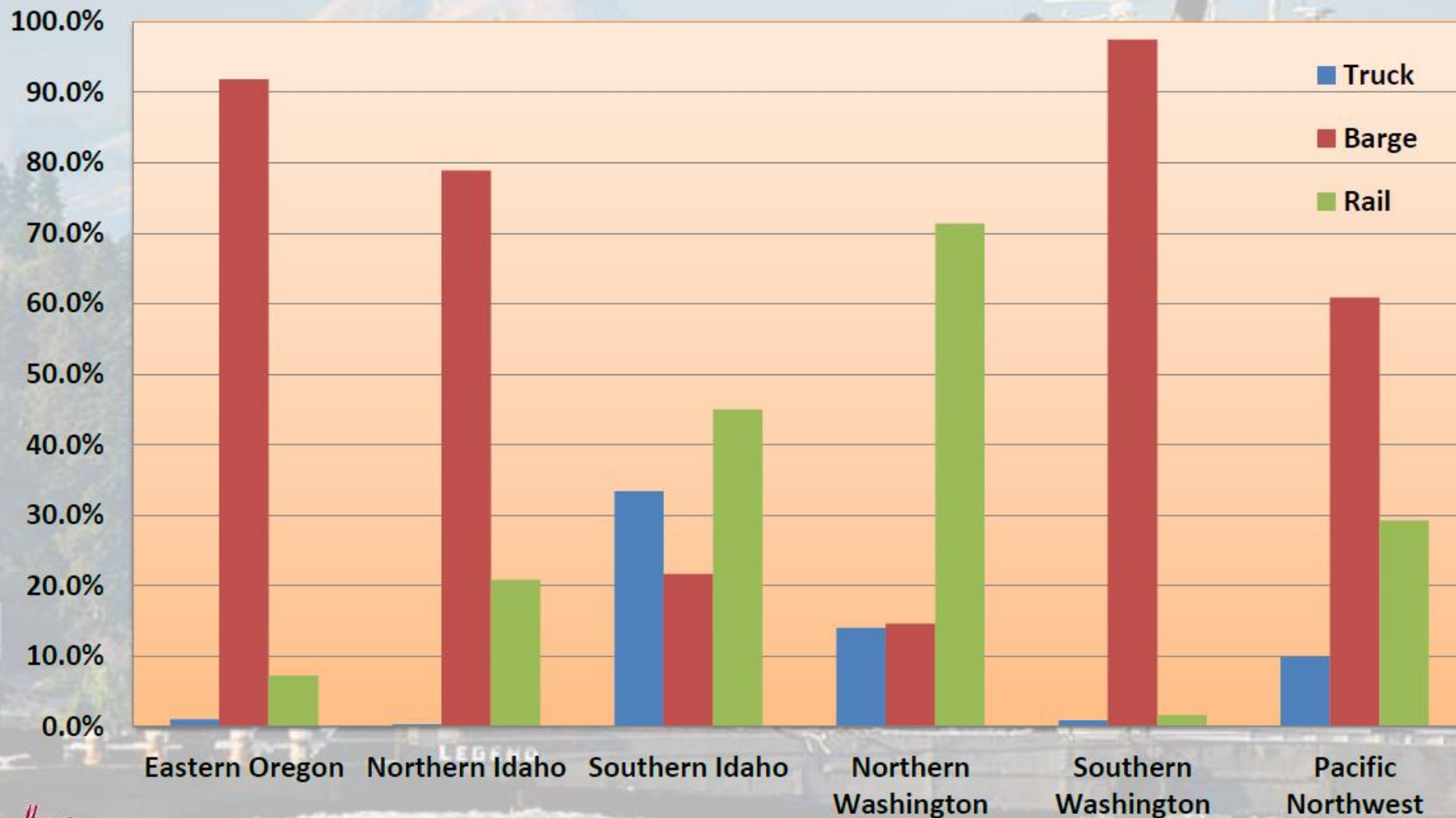
- Wheat
- Sand, gravel and stone
- Forest products
- Iron ore products
- Agricultural products
- Corn, rye, barley, rice, sorghum and oats

Upriver Commodities

- Gasoline
- Diesel
- Fertilizer
- Waste materials



Typical Percentage of Wheat Shipped via Various Modes



Industrial and Regional Preparations

Barge Line Preparations

- Expected to take the brunt of the economical impact
- Implementation of a “business interruption surcharge”
- Prepared customers and employees

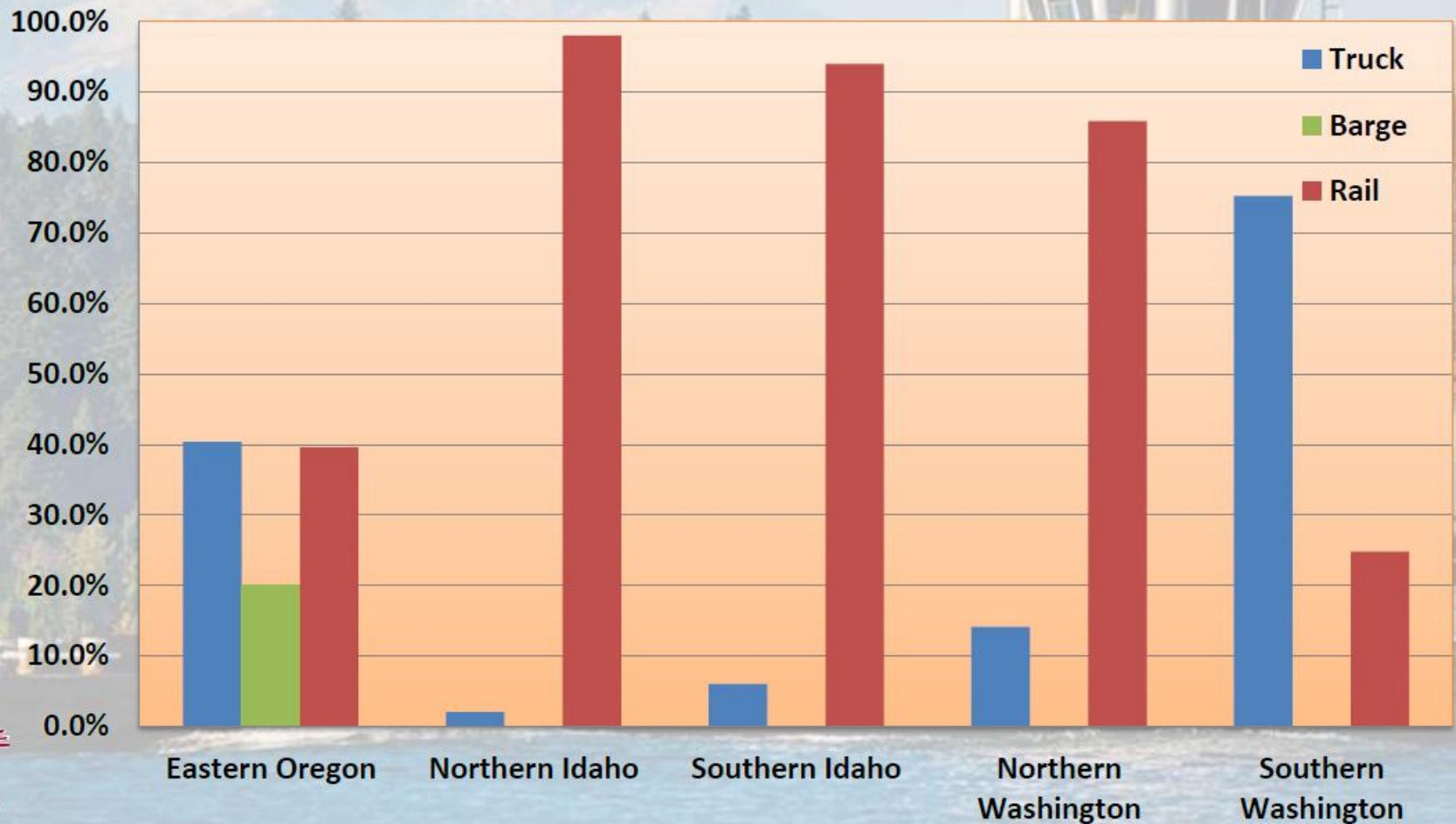
Rail Line Preparations

- Prepared for an increase in cargo loads and locomotives
- Helped industries in continuing shipments through the outage
- Advertised, identified inland markets and partnered with local ports to aid in the movement of products



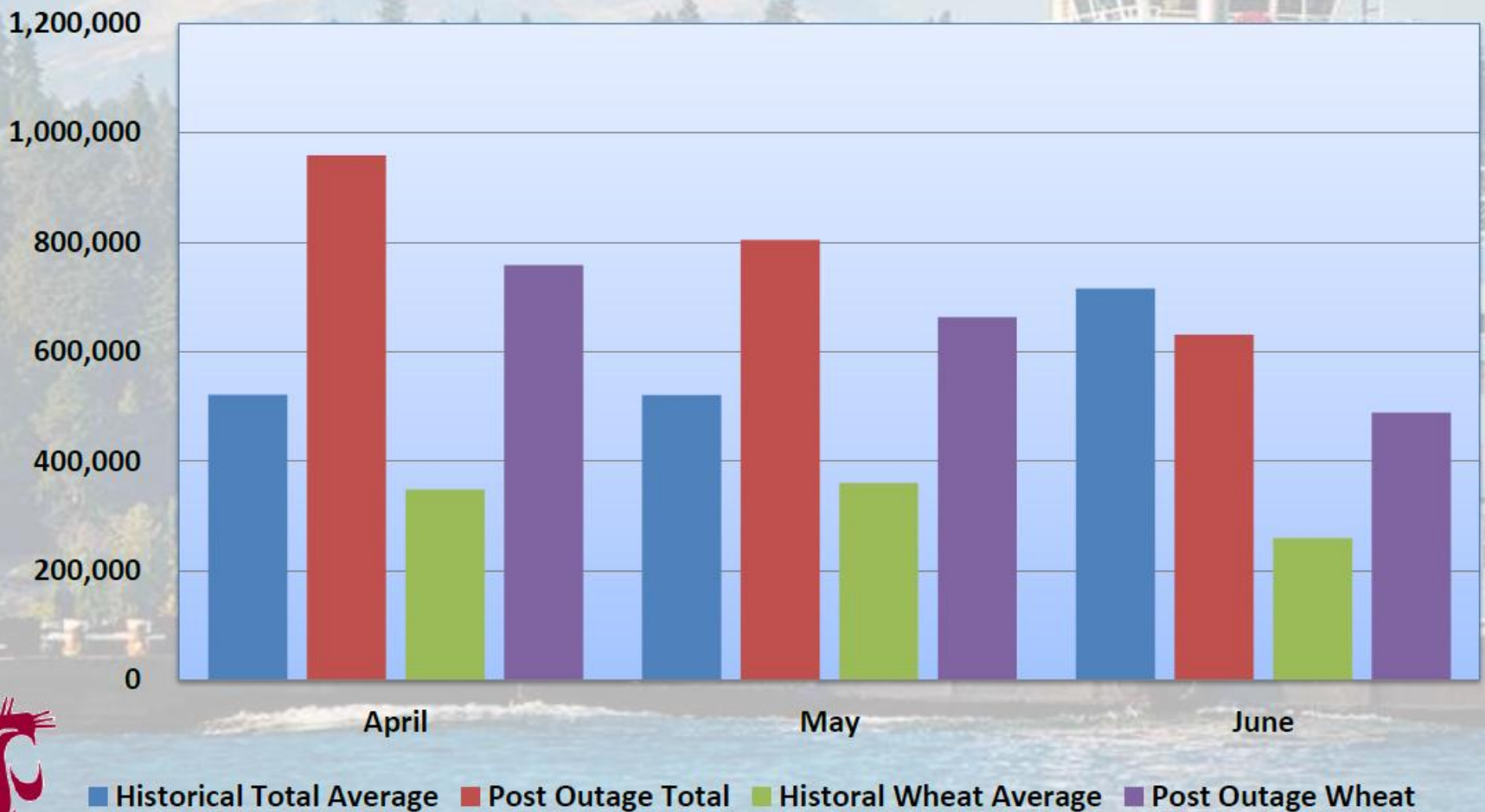
Phase III

Percentage of Wheat Shipped via Various Modes, Dec 2010 – Mar 2011



Phase IV

Monthly Tonnage Shipped Downriver Post Lock Outage



Conclusions

- Stakeholders were well prepared
- Prior to outage, commodities moved in large and above average quantities
 - Forest products, iron ore, wheat, vegetables and processed grains
- Barge lines increased rates to capture additional revenue
- Rail lines prepared for possible increases in carloads and advertized to barge customers



Conclusions, Cont.

- During the outage, wheat producers shipped wheat heavily by truck even though rates increased
- Barge lines temporarily laid off 1/3 – 2/3 of staff
- Rail lines incurred additional costs
- Traffic returned to barge in above average levels
 - Especially wheat



Conclusions, Cont.

- Transportation costs increased 37.4%
 - Tonnage increased
 - Global demand for wheat increased
 - Modal shifts
- Truck and rail rates increased 4% and 2%
- Energy consumption increased 10%, but Btu's per ton decreased 5% due to heavy use of rail, which is more energy efficient
- Emissions production increased as well
- Result: "fears not realized"



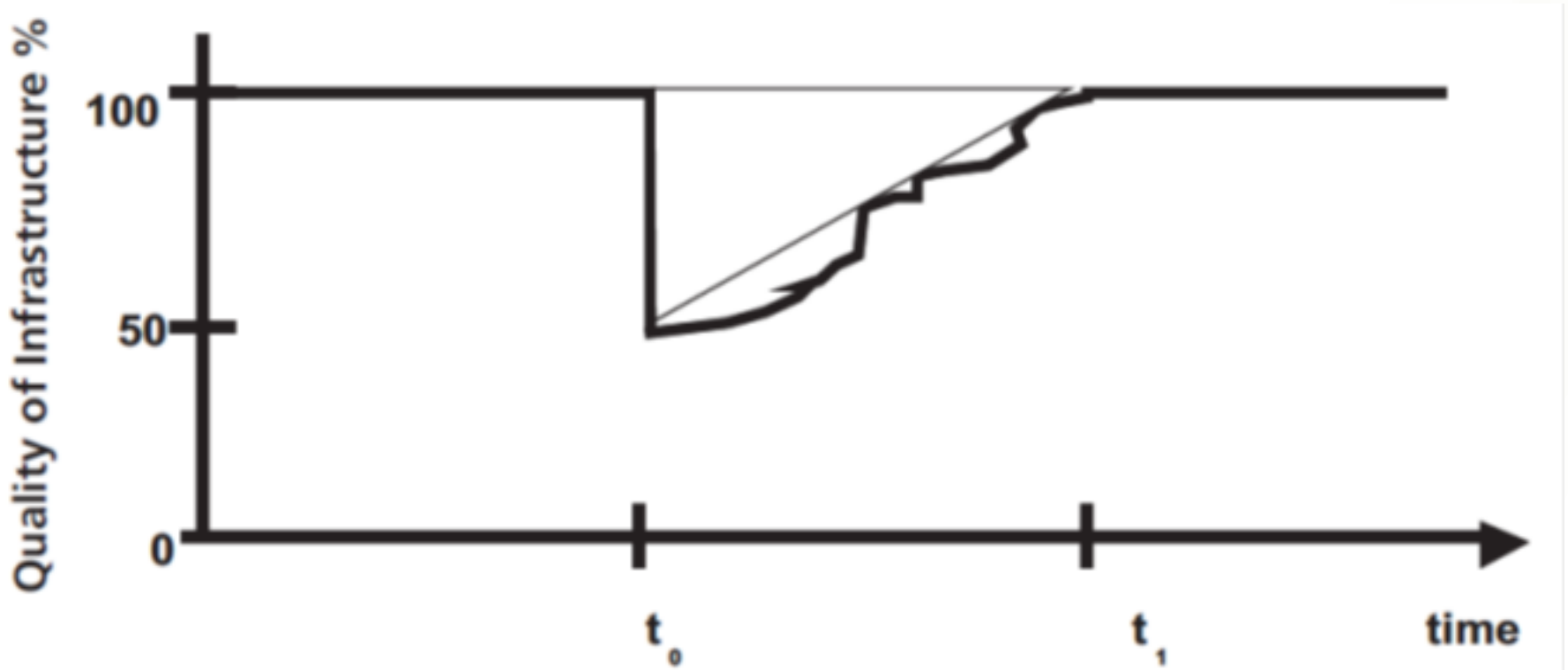
While the Snake River Example was ‘planned’, we can take home some important lessons:

Robustness – The ability of systems and other analytical units to withstand disaster forces without significant degradation or loss of performance;

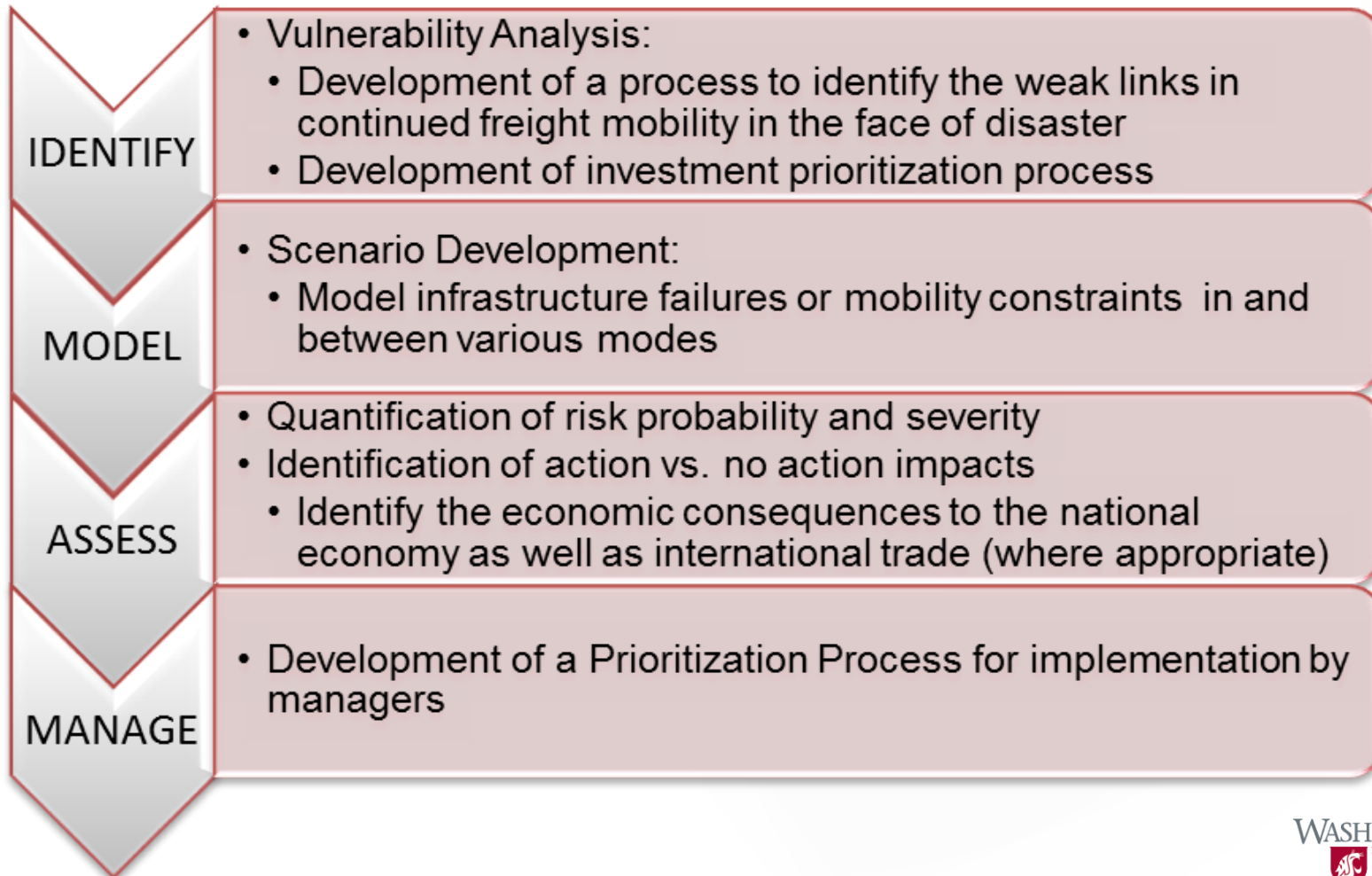
Redundancy – The substitutability of system elements that permits the satisfaction of functional requirements where complete or partial loss of functionality has occurred;

Resourcefulness – The capacity to identify problems, establish priorities, and mobilize resources (monetary, physical, technological, and human) under the threat of disruption.

The Resilience Triangle



When Extreme Weather Strikes Transportation Systems— Implications and Opportunities for Data Before, During, and After



Why Are these actions *Necessary*?

- Massive losses can ripple through the economy with only days of interruption.
- Waiting often entails substantial costs as perishable items lose value, delivery dates are missed, and market contracts are not renewed.
 - As the likelihood of recurring interruptions increases, the willingness of shippers/carriers to use the network decreases.
 - Reduces the economic competitiveness of a region....risk assessment.

For more Information:

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