



Sound Transit Climate Risk Reduction Project – Summary Findings

Lara Whitely Binder, UW Climate Impacts Group

Amy Shatzkin, Sound Transit

Carol Lee Roalkvam, WSDOT

September 9, 2014

PNW Climate Science Conference



What Is Sound Transit?

- Multi-modal public transit agency serving Tacoma-Seattle-Everett region
- 28 million riders (and growing)
- Services operated via contractual partnerships with King County Metro, Pierce Transit, Community Transit, Amtrak, and Burlington Northern Santa Fe (BNSF)



What is the Sound Transit Climate Change Risk Reduction Project?

- Funded by the FTA
- One of 7 climate *change adaptation pilot projects*
- A partnership between Sound Transit, the UW Climate Impacts Group, and WSDOT – **a first look for ST**



U.S. Department of Transportation
Federal Transit Administration

Other Pilots:



Metro



marta

METRO
Going Places



HART

Project Objectives

- Assess climate change risks to Sound Transit operations, assets, and long-term planning;
- Identify initial adaptation strategies and how to best integrate information into ST processes; and
- Provide a state-to-local testing ground for WSDOT's pilot of the FHWA's climate change vulnerability assessment methodology.

Projected Changes in PNW Climate



Increasing average temps, more extreme heat events

Projected increase in average temp by mid-century: +4.3°F to +5.8°F (range: +2° to 8.5°F) (Mote et al. 2013)



Increasing winter precip, more extreme precip events

24-hour storm events in Seattle-Tacoma area projected to increase 14-28% by 2050s, relative to 1970-2000. (Rosenberg et al 2010)

Projected Changes in PNW Climate



Increased flood risk west of the Cascades

More and larger fall/winter floods possible, compounded by sea level rise in coastal rivers and streams.

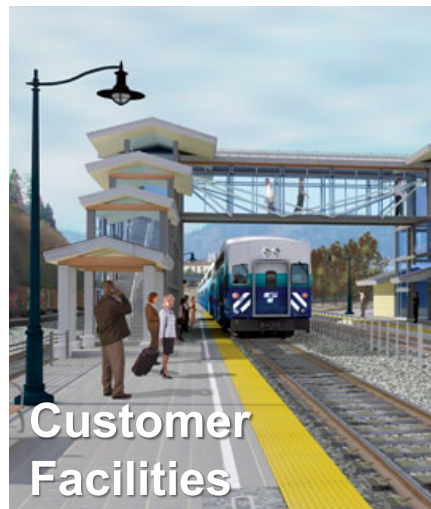


Rising sea level

Sea level in Seattle projected to rise +24.3 inches (range: +4 to +56 in.) by 2100. (NRC 2012)

Sound Transit Climate Change Risk Reduction Project

What Do These Changes Mean for ST?



Overarching Key Findings & Considerations

- Climate change exacerbates many existing issues already facing Sound Transit.
- The probability, timing, and degree to which climate change may affect Sound Transit will depend on many factors.
- Many climate change impacts on Sound Transit services will likely be minor to moderate, although more significant impacts are possible.
- Sound Transit already possesses some degree of climate resilience and capacity to address climate impacts.

Project Approach

- Drew on existing research for regional climate projections
- ST climate adaptation advisory group
- Staff survey for establishing baseline information on experience, perceptions about climate impacts on ST
- Facilitated workshops (~12):
 - Kick off events
 - Risk assessment & prioritization for facilities and modes
 - Identification of adaptation strategies (by mode)
 - Potential integration pathways (senior managers)
- Report development, Executive Team briefings, and dissemination

Potential Impacts Related to ST

Related to Temperature <i>Increased potential for...</i>	Related to Precipitation <i>Increased potential for...</i>	Related to Sea Level Rise <i>Increased potential for...</i>
• Rail buckling • Heat stress on electrical and safety equipment • Heat stress on overhead catenary system • Heat stress on pavement, structures • Heat stress on landscaping and environmental mitigation sites	• Mudslides and slope instability • Larger and/or more frequent river and stream flooding • Increased localized flooding due to more stormwater runoff or poor drainage • Seepage due to higher groundwater tables • Summer drought	• Temporary flooding of low-lying areas • Permanent inundation of low-lying areas • Higher tidal and storm surge reach • Erosion • Drainage problems • Corrosion from more frequent or prolonged exposure to saltwater

Prioritizing Potential Impacts and Services

Two questions assessed:

1. Which climate change impacts matter more across all services?
2. Which services may become higher (or lower) adaptation priorities?

Evaluation Criteria for Impacts Prioritization

- Expected and possible impacts to **service delivery**
- **Geographic distribution** of the impact
- **Potential cost** of managing or responding to the impact [qualitative only]
- **Probability of an impact** – Not a formal criteria, but estimated as an additional aid to decision making

Q1: Which climate change impacts matter more across all services?

Potentially Significant Impacts	Potentially Moderate Impacts	Potentially Minor Impacts
• Increased mudslide activity • Sea level rise and related impacts	• Larger and/or more frequent river and stream flooding • Increased localized flooding due to more stormwater runoff or poor drainage • Potential for rail buckling	• Increased heat stress on electrical equipment • Increased heat stress on the overhead catenary system • Increased heat stress on facility structures and landscaping • Increased heat stress on environmental mitigation sites • Increased tunnel seepage

** Assumes size of the projected impact is at the high end of what would be expected*

Q2: Which services may become higher adaptation priorities?

Potential high adaptation priority services:

- North Sounder
- Edmonds and Mukilteo Sounder Stations

Potential medium adaptation priority services:

- South Sounder; Tukwila and Kent Sounder stations
- At-grade or aboveground Link alignments

Potential low adaptation priority services:

- ST Express
- Environmental mitigation
- Other customer facilities
- Underground Link

Sound Transit has many options for adaptation...

Raise sensitive ground-level infrastructure

Build berms around sensitive ground-level infrastructure

Increase visual & electronic monitoring of infrastructure in vulnerable areas

Move or relocate infrastructure in hazard zones

Modify drainage patterns to re-direct flows, improve drainage

Add flexibility by building in capacity to relocation, raise, add higher capacity in future

Modify design standards to provide higher level of flood & stormwater management, seepage management, heat impacts

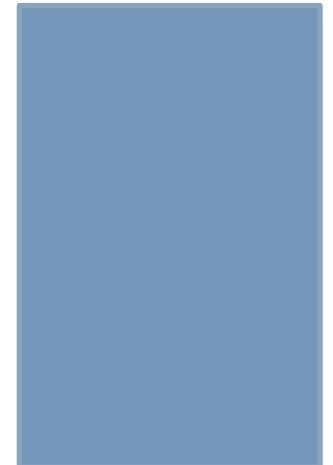
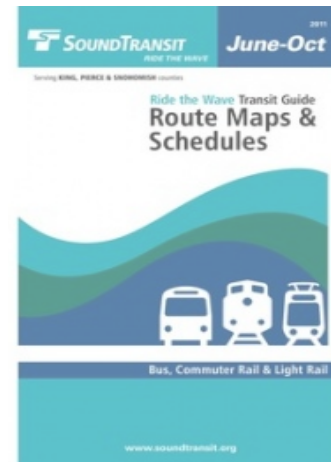
Partner with communities to target problem drains/drainages

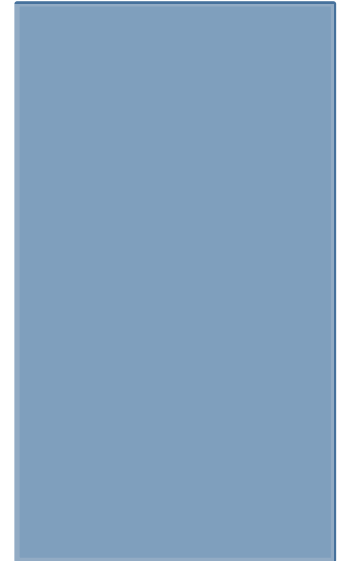
...And many opportunities for integrating climate change into agency processes

- Climate impacts *may* influence decisions including:
 - Policy setting
 - Environmental review
 - Strategic system planning
 - Preliminary engineering and final design
 - Operations and maintenance
 - Asset management
 - Intergovernmental relations

Next Steps: Prioritizing action

- Continue monitoring climate change impacts
- Continue working with regional partners to identify further areas of research ;
- Identify the climate adaptation considerations for near-term planning; and
- Provide guidance on developing a Climate Adaptation Plan.





Acknowledgements and Thank You's

- Leadership at Sound Transit, WSDOT, and CIG
- Amy Shatzkin (Sound Transit)
- Carol Lee Roalkvam (WSDOT)
- Mike Strong (Sound Transit GIS)
- Amy Snover, Ingrid Tohver, and Rob Norheim (CIG)
- The many Sound Transit directors, managers, and technical staff who participated in the workshops

A blurred photograph of a Sound Transit bus at night. The bus is white with a blue and yellow logo on the front. The destination sign above the windshield reads "DOWNTOWN SEATTLE" in orange. The bus is moving, as indicated by the motion blur in the background and the blurred lights on the bus itself. The background shows city lights and a street scene.

Questions?

Comments?

For more information:

- Lara Whitely Binder, CIG (lw123@uw.edu)
- Amy Shatzkin, ST (amy.shatzkin@soundtransit.org)