

Marine Studies Initiative Building Site Selection



Site Selection Criteria



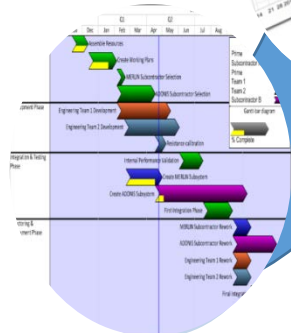
Life Safety: Seismic/Tsunami Impacts



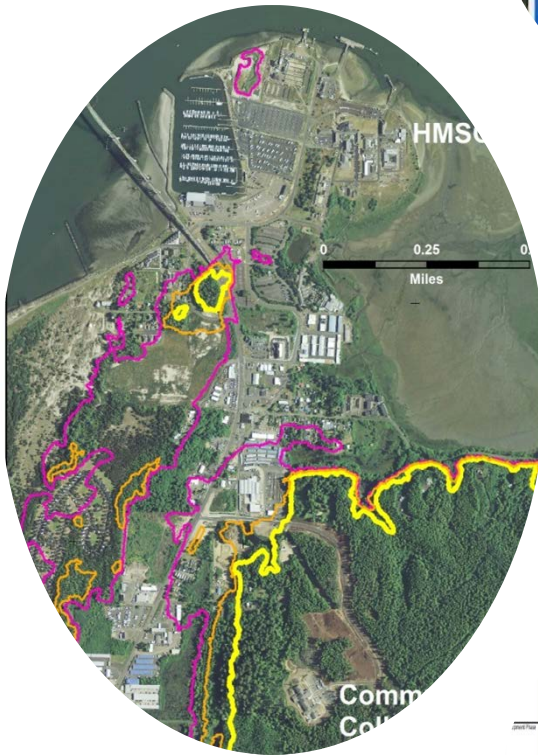
MSI Program Delivery: Education, Research, Engagement



Budgetary:
Total Capital & Operating Costs

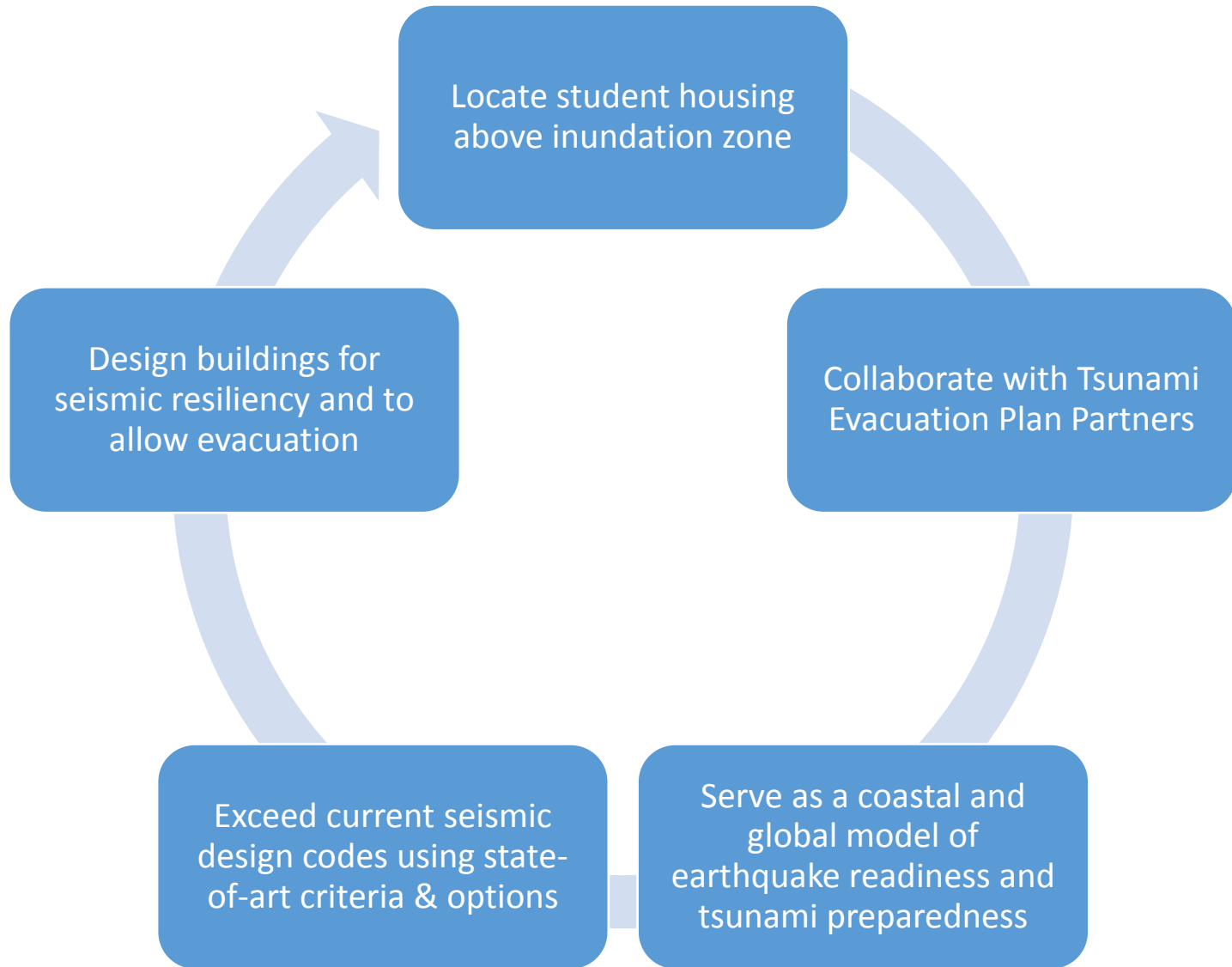


Schedule:
Capital Fund Raising → Building Opening



Possible site locations

Building Principles



Site Selection Process Overview

2015 – January 2016

Chris Poland's Work on
Earthquake & Tsunami
Considerations

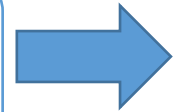
February 2016 – May 2016

Third Party Evaluation
of HMSC & Two
Alternative Sites

May 2016

Recommendation to
President Ray

Outreach Plan: Engage and Receive Input from Faculty, Coastal
Community Stakeholders, State and Federal Agencies & Commissions



Marine Studies Initiative Building Earthquake & Tsunami Considerations



Chris D. Poland, Consulting Engineer
Member of the National
Academy of Engineering

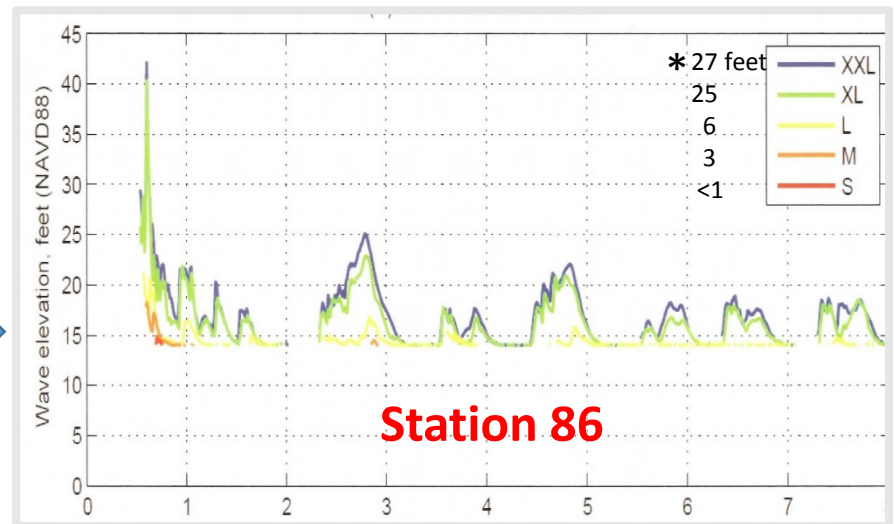
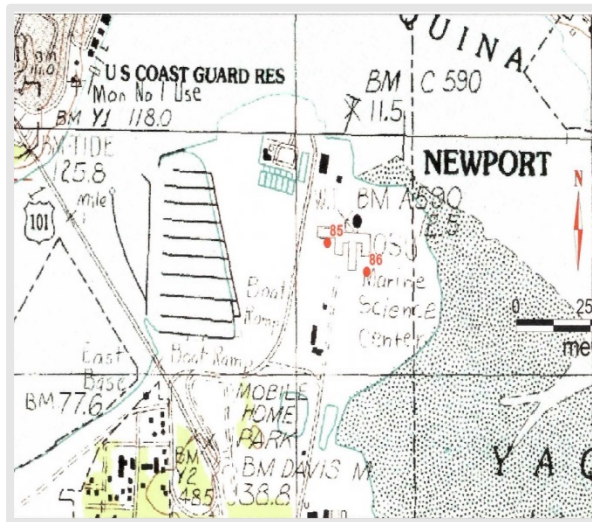
Roz Estime'
Estime' Science & Technology
Facilities Planners

The Earthquake and Tsunami Threats

OPEN-FILE REPORT O-13-19

TSUNAMI INUNDATION SCENARIOS FOR OREGON

by George R. Priest¹, Robert C. Witter², Y. Joseph Zhang³, Kelin Wang⁴, Chris Goldfinger⁵, Laura L. Stimely¹,
John T. English⁶, Sean G. Pickner⁷, Kaleena L.B. Hughes⁷, Taylore E. Wille⁷, and Rachel L. Smith⁷



Chris Goldfinger reported that the probability of a Tsunami at the MSI site is 39% to 58% over the next 100 Years

Initiate Expanded Horizontal Evacuation Planning

- Plan for DOGAMI “XXL” event
- Include City of Newport representatives & South Beach businesses and residents
- Improve efficiency and completeness through new technology and with ADA input
- Seek a path to safety for every occupant
 - Determine routes to Safe Haven Hill and Community College using OSU modeling
 - Consider vertical evacuation structures
- Seek state & local funding for route improvements
- Develop & implement South Beach-wide evacuation plan

Initiate the Design Process

- Model cost/schedule for relocating HSMC to high ground
- Commission site specific studies of:
 - strong shaking
 - liquefaction, subsidence and lateral spreading potential
 - tsunami inundation potential,
 - identification of debris sources and the potential for large ship impacts at the HSMC site
- Determine MSI activities that can be accomplished on high ground
- Develop design alternatives for MSI facilities at HMSC
 - Minimum seismic code
 - Repairable after “L” level inundation
- Determine feasibility and cost to provide vertical evacuation
- Use triple-bottom line analysis
- Design and construct the selected solution

Panel Discussion

Moderator

- Dean Scott Ashford, Dean of the College of Engineering

Panelists

- Jack Barth, MSI Co-Chair & CEOAS Professor and Associate Dean for Research
- Chris Goldfinger, Professor of Geology and Geophysics, CEOAS
- Dan Cox, Professor of Civil and Construction Engineering, COE
- David Gomberg, Oregon State Representative, District 10

OSU's Marine Studies Initiative

Jack Barth and Bob Cowen, Co-Leads

Opportunity – Develop a World-Class Marine Studies Program

Vision

Through its *Marine Studies Initiative*, Oregon State will be recognized as a global leader in 21st century transdisciplinary education and research and lead the development of inclusive strategies for successful stewardship of our ocean and planet for today and the future.

Mission

The mission of the *Marine Studies Initiative* is to create a healthy future for our oceans and the planet through transdisciplinary research and teaching that emphasizes collaboration, experiential learning and problem solving.



Programmatic Goals and Requirements

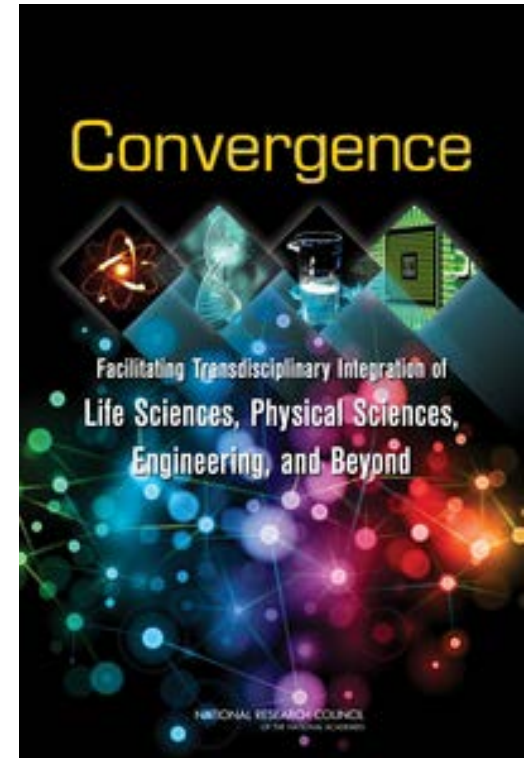
- Extend OSU's education, research, and outreach mission to the coast
- 500 full-time equivalent students annually in Newport by 2025: 400 undergraduate, 100 graduate
 - Classroom, laboratory, innovation and collaboration spaces
 - Housing (will be outside tsunami inundation zone)
- Maximize OSU's past and future investments in marine-related education, research, and outreach and engagement at the coast
 - Hatfield Marine Science Center
 - Guin Library
 - Visitor's Center (free-choice learning laboratory)
 - Ship Operations docks
 - Community partnerships
- Enhance researchers and students "access to sea" in all its forms: estuarine and coastal waters; boats; agency scientists; adjacent classrooms and seawater facilities; etc.)



Programmatic Goals and Requirements

Goal: Build a collaborative environment that fosters synergy

- Convergence and collaboration
 - “Researchers from centers with unbroken, co-located office and laboratory space reported an ‘innovation outcome’ measure higher than researchers from centers occupying split spaces” (*NRC, 2014)
 - Degree of collaboration, including enhanced research grant success and innovation, directly proportional to distance (**Kabo et al. 2015)
- Examples of collaboration include
 - Sea Grant Visitors Center as a free-choice laboratory
 - Marine mammal research and underwater acoustics
 - Renewable energy and ecological impacts
 - Conservation biology and genomics



Goal: Demonstrate how to build safety in a seismically active region; opportunity for public education through high visitation numbers at HMSC visitors center

* National Research Council. 2014. *Convergence: Facilitating Transdisciplinary Integration of Life Sciences, Physical Sciences, Engineering, and Beyond*. Washington, DC: The National Academies Press.

** Kabo et al. 2015. Shared paths to the lab: A sociospatial network analysis of collaboration. *Environ. and Behavior*, 47:57-84.

The coming Cascadia Great Earthquake: How did we get here?

Chris Goldfinger

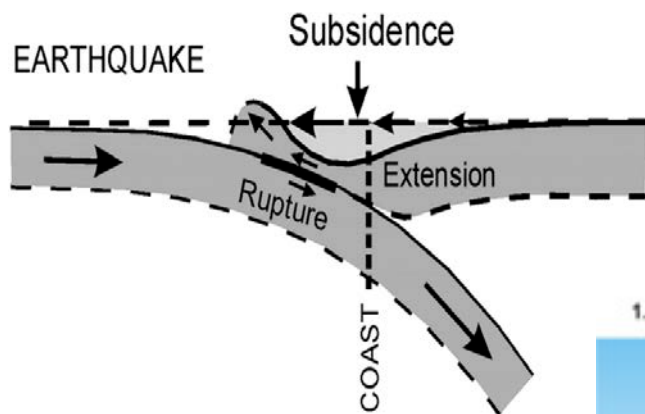
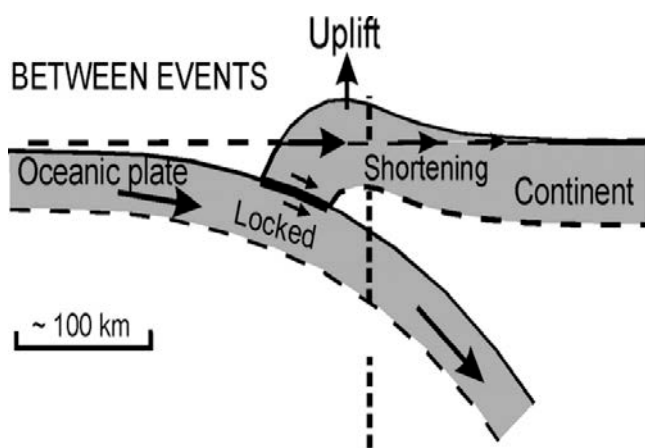
College of Oceanic and Atmospheric Sciences, Oregon State University

Active Tectonics Group, Ocean Admin Bldg 104, Corvallis OR 97333

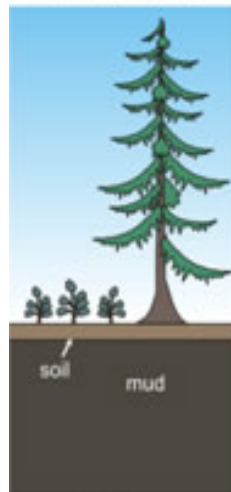
gold@coas.oregonstate.edu

C. Hans Nelson[†], Joel E. Johnson^{*}, Steve Galer, Jeffrey Beeson, Bran Black, Ann E. Morey^{*}, Julia Gutiérrez-Pastor[†], Eugene Karabanov^{**}, Andrew T. Eriksson^{*°}, Rob Witter and George Priest^σ, Eulàlia Gràcia^{****}, Kelin Wang^{***}, Joseph Zhang^Σ, Gita Dunhill^{††}, Jason Patton^{*}, Randy Enkin^{***}, Audrey Dallimore^{***}, Tracy Vallier[§], and the Shipboard Scientific Parties (52 students, colleagues, technicians)



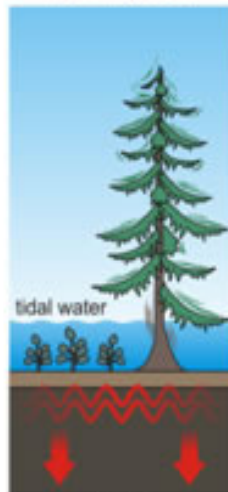


1. Coastal forest



*prior to
earthquake*

2. Great earthquake.
Land sinks
flooding forest.



*during
earthquake*

3. Within an hour
tsunami rushes
ashore.



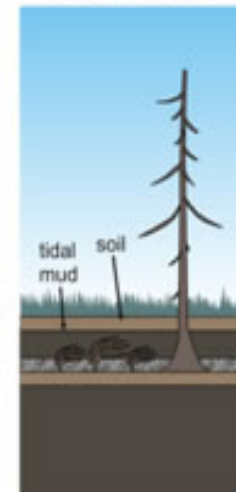
tsunami

4. Dead forest
in a tidal flat.



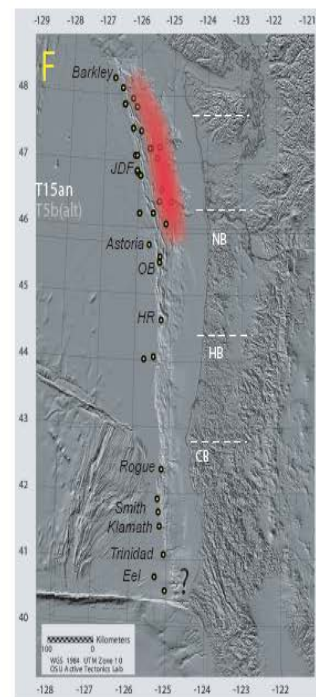
*following
earthquake*

5. "Ghost" forest



*years
later*

(Goldfinger et al. in revision 2016)





This is what success looks like in a Great Earthquake. Japan lost ~ 20,000 on 3/11/11.

It could have been 230,000 as in Sumatra 2004.



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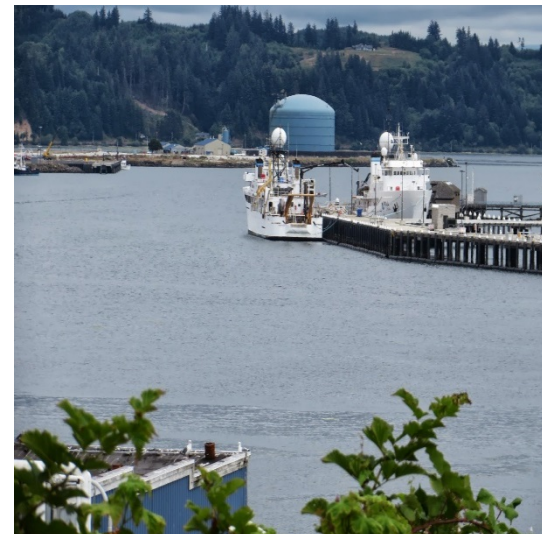
The Hatfield site is a liquefiable sandbar, with 2m of fill on top. It's barely above high tide.

We can't say what size tsunami will be next, it could be 6-10 ft, or it could be >30 ft as in Tohoku.

The land will likely subside 3-6 ft during the earthquake.



What would Mayor Sato do?



Daniel Cox

Professor, School of Civil and Construction Engineering

Tsunami Life Safety; Tsunami Engineering and Resilience

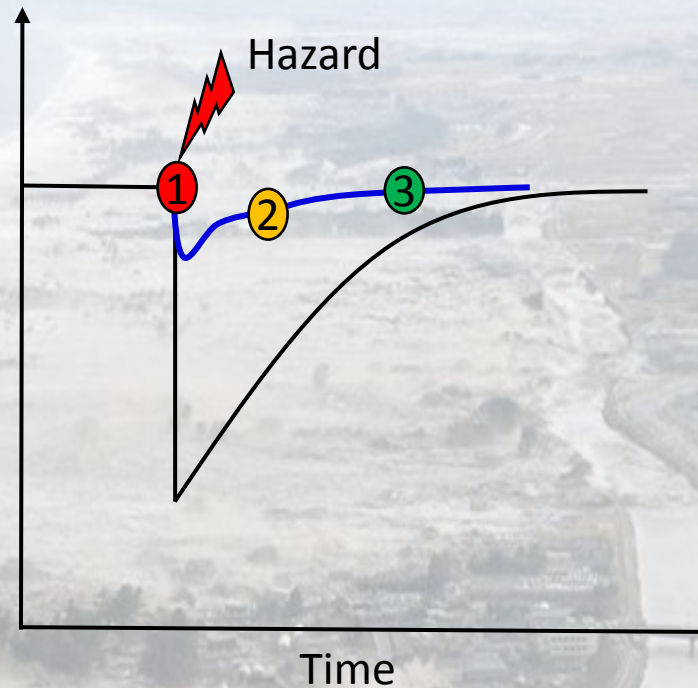
Tsunami Life Safety and CSZ Event

1. Survive anticipated earthquake
2. Evacuate to high ground
 - Tsunami arrives at HMSC in 30 minutes
 - Education to reduce “milling time”
 - Safe Haven Hill on foot as first option
 - Evacuees stay in place for 24 hours
 - Consideration for assisting disabled
 - Vertical evacuation as unplanned alternative

Disaster Resilience

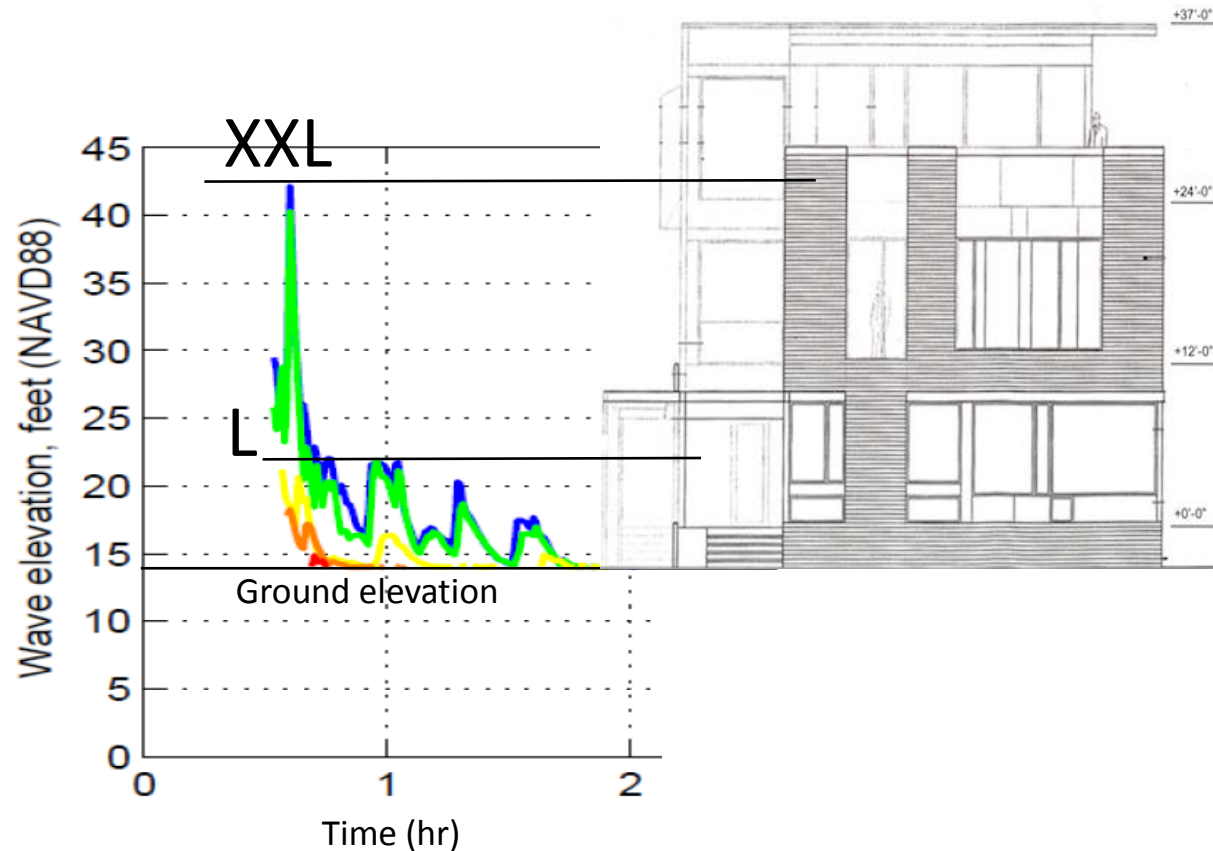
What we care about

1. People
2. Infrastructure
 - a. Buildings
 - b. Transportation
 - c. Power
 - d. Communication
 - e. Water



This combination of three photos taken over a six month period shows the March 11 tsunami and its aftermath at Sendai Airport in Sendai, Miyagi prefecture, northern Japan. The top photo taken March 11, 2011 shows the tsunami engulfing the airport immediately after an earthquake. The middle photo, taken June 3, 2011 and the bottom photo, taken Sept. 6, 2011 show the restored and reopened airport. AP / Kyodo News

Tsunami Depth at HMSC for Life Safety (XXL) and Resilience (L)



- ❖ *Important technical challenges to reduce risk for life safety and to increase resilience*

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