Appendices

Appendix A - Studio Materials

Urban Design Studio Syllabus

**Urban Design Studio: Urban Design for Community Resilience**

Urban Design and Planning 5081 (5.0) SLN 21149 • Winter 2016 • MTTh 1:30-5:20 • Gould 416

Instructor: Dan Abramson (PhD, Associate Professor)
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Doctoral TAs: Peter Dunn pdunn@uw.edu and Adnya Sarasmia aabrayan@uw.edu
Course discussion board: https://catalyst.uw.edu/gepost/board/abramson41718/

**STUDIO TOPIC – URBAN DESIGN FOR COMMUNITY RESILIENCE**

URBDP 508 satisfies the Studio requirement for the Master of Urban Planning, and especially the advanced 2nd studio for MUP students specializing in Urban Design, as well as the 2nd or 3rd studio for all students in the Certificate of Urban Design program (MUP, Master of Architecture, and Bachelor/Master of Landscape Architecture students). The 2016 Advanced Urban Design Studio is offered in conjunction with the National Science Foundation (NSF)-funded “M9” project to study how communities planning for resilience might make use of new probabilistic information about tsunami hazards associated with a Magnitude 9 (M9) Cascadia Subduction Zone (CSZ) earthquake.

- Learn how tribal communities on the Olympic Peninsula are leading the nation in adaptive community planning for coastal environmental change
- Work with UW M9 team, state and local agencies and community members to “plan with uncertainty”
- Organize and run a workshop with local staff and residents that combines asset-based community mapping techniques with hazard mapping using the latest scientific tsunami models and webTable interactive participatory GIS
- Develop a multi-phased adaptive urban design strategy for new settlement siting and forms based on local values and assets
- Explore how planning for long-term adaptation in the face of an infrequent, unpredictable but consequential change can help a community realize its short- and medium-term developmental and environmental goals

The studio centers on a workshop with local staff and residents that combines asset-based community mapping techniques with hazard mapping using the latest scientific models and interactive participatory GIS technology. The workshop includes a research component to compare how some participants use deterministic representations of the hazard with how other participants use representations that make uncertainty about the hazard more explicit. The studio will then use the workshop as part of a larger visioning exercise for new settlement siting and forms based on local values and assets, to explore how planning for long-term adaptation in the face of an infrequent, unpredictable but consequential change can help a community realize its short- and medium-term developmental and environmental goals.

**COMMUNITY SITE AND PARTNERS**

The site and community “client” is Aberdeen, WA. Quinault Tribe is also offering an introduction to their tsunami- and climate-change-adaptive planning process, and an option to assist with relocation planning for the tribal community of Queets.

1/18/2016

SYLLABUS
**Schedule**

**Weeks 1-3. Phase I – Initial Community Engagement, Asset Mapping, and Hazard Analysis (20%)**

In this phase, students develop background understanding of the project’s goals, gather basic site and community information, participate in community engagement, research relevant design principles and precedents, and undertake site analysis for design.

**Monday 1/4**  
First meeting:  
- Studio topic, sequence, class objectives, evaluation, format (overlap with Bob Freitag’s class, 4:30-6:30)  
- Students self-introduce, share backgrounds, goals for studio learning  
- Studio culture, media, environment and classroom logistics: keys, space, desks, etc.  
  - Discussion, esp. re media  
- Community and site engagement logistics: client (Aberdeen vs. Quinault?), dates, travel, accommodation, and communications  
- Overview of concept of resilience and relation to urban design

First assignment: Home Community Asset Map

**Thursday 1/6**  
1st Assignment due: Students present Home Community Asset Maps; brainstorm and assign themes for first (remote) pass at second assignment.

Second assignment: Aberdeen Community Asset Maps - Remote

**Friday 1/8**  
Quinault Tsunami Resilience Presentation  
2:15-3:30  
Gould 208J  
Charles Warsinske, Quinault Community Development and Planning Director

**Monday 1/11**  
2nd Assignment due: present remote efforts to map Aberdeen Community Assets  
Organize trip to Aberdeen and tasks for ground-truthing community assets and key site conditions.

**Thursday 1/14**  
Site Visit to Aberdeen  
All Day  
11:00am – 1:30pm: Lunch Meeting with Aberdeen key stakeholders in downtown Aberdeen, D & R Event Center, 111 South “I” Street.  
1:30pm – dark: windshield survey by van of key sites

**Friday 1/15**  
Optional Visit to Quinault Communities of Taholah and Queets  
Overnight stay in Aberdeen Thursday, 1/14; return to Seattle late Friday night.

1/18/2016  
SYLLABUS
**Urban Design Studio: Urban Design for Community Resilience**  
*Urban Design and Planning 508B (5.0) SLN 21149 • Winter 2016 • MTH 1:30-5:20 • Gould 416*

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
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<tbody>
<tr>
<td>Monday 1/18</td>
<td>NO CLASS – MARTIN LUTHER KING JR. DAY</td>
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<tr>
<td>Thursday 1/21</td>
<td><strong>3rd Assignment due:</strong> Present individual site visit impressions and overview of data gathered, using PowerPoint pechakucha format (20 slides in 20 seconds; see <a href="http://www.pechakucha.org/">http://www.pechakucha.org/</a>)</td>
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|          | Group brainstorm: Aberdeen SWOT analysis; what design precedents/reference prototypes would address the Strengths, Weaknesses, Opportunities and Threats we observed in Aberdeen?  
|          | - what further information-gathering from Aberdeen do we need to do?       |
|          | Work session:  
|          | - adopt workshop roles (community stakeholder; UW facilitator; UW note-taker; etc.? for role-playing with weTable  
|          | - revise and digitize asset map layers with ground-truthed data for use in ArcGIS and weTable |
| Weeks 4-6. Phase II – Prototype Design Ideas; Community Resilience Workshop (30%) |
| Monday 1/25 | **4th Assignment due:** Present digitized asset map layers. |
|          | Mini-Lectures:  
|          | - Methods of participant observation and note-taking for small group meetings  
|          | *input from modelers*  
|          | - introduce the hazards; deterministic vs. probabilistic scenarios; visualizing uncertainty |
|          | Work session: begin practicing map layer use in weTable? |
| Thursday 1/28 | Possible guest lecture topics:  
|          | - Cascadia Subduction Zone earthquake and earthquake-related hazards  
|          | - Tsunami vertical evacuation design |
|          | Work session and desk crits with TAs: develop prototype studies |
| Monday 2/1  | In-class charrette: use weTable and role-playing to brainstorm possible locations of prototype design solutions  
|          | Work session and desk crits with TAs:  
|          | - develop prototype studies  
|          | - prep workshop |

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**Thursday 2/4**  
*5th Assignment due:* Present precedent/reference prototype case PPTs; argue for their applicability based on Aberdeen site and community asset analysis

Work session: begin work on design precedent/reference prototype posters

**Monday 2/8**  
*6th Assignment due:* Bring design precedent/reference prototype posters to class

**Gould 007F**  
**Digital Commons**  
*Watch in advance:* one of the ARF or MP4 files for the 40-minute presentation on “HAZUS-20141127 0039-1” in the “FEMA” folder in “Resources” on the studio Google Drive.

Prep workshop

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**Wednesday - Thursday 2/10-11**  
**Community Resilience Workshop in Aberdeen**

**Friday 2/12**  
**Optional Second Ground-truthing Survey in Aberdeen**

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**Weeks 7-11 Phase III – Envisioning a New Post-Earthquake Normal: Adaptive Urban Design Strategy (50%)**

**Monday 2/15**  
NO CLASS – PRESIDENTS’ DAY

**Thursday 2/18**  
*7th Assignment due:* Present analysis of workshop proceedings

In-class charrette: use weTable and workshop participant input to begin work on “new normal” design schemes

**Monday 2/22**  
Work session; individual desk crits

**Thursday 2/25**  
Work session; individual desk crits

**Monday 2/29**  
Work session; individual desk crits

**Thursday 3/3**  
Work session; individual desk crits

**Monday 3/7**  
Work session; individual desk crits

**Thursday 3/10**  
Work session; individual desk crits

**Monday 3/14**  
Dry Run

1/18/2016  
SYLLABUS
Thursday 3/17  Final Review
Tsunami hazard mapping – R&D to improve hazard communication and resilience decision-making

**Background.** Deterministic Tsunami Hazard Maps are an important element of community emergency preparedness and response planning. Typically, most such maps present inundation zones delineated by a single, crisp line (Figure 1). Such maps lack any representation of the uncertainty in the science that underlies these maps—complex modeling of multiple factors, including spatial and temporal details of the tsunami source, tidal stage, variable bathymetry and topography, seismic uplift or subsidence of coastal land, etc.

Also, the conventional use of such maps in planning is as follows: first, the hazard map scenario and associated community vulnerabilities are presented; second, possible responses to the hazard are developed and discussed. In contrast, an “Asset-based” approach first has stakeholders create an inventory of built, natural, and social community assets, then examine the hazard scenarios and associated vulnerabilities and, finally, identify those assets that could facilitate planning that is adaptive—i.e., assets that could help achieve comprehensive community planning goals, enhance mitigation of the hazard, and recover from the disaster (Freetag et al., 2015).

Several important questions thus arise, regarding hazard uncertainty and community resilience planning. (1) Can adding uncertainty information to hazard maps improve their usefulness? (2) Will probabilistic or uncertainty information about a hazard influence community members to make more risk-taking or risk-averse (precautionary) decisions? Here, usefulness is defined in the context of whole community resilience—i.e., as collective decisions that consider and address a wider range of community values, capital or social, natural and built assets (Freetag et al., 2015). (3) Does starting discussions with a focus on community values and assets, as opposed to hazard scenarios and community vulnerabilities, make a difference in community planning?

**Goals.** To address questions (1) and (2), we will

- Develop tsunami hazard maps with and without representing uncertainties in the hazard assessment, and assess the influence of these maps in an asset-based approach to decision-making. If time and resources permit addressing question (3), we will also

- Test both versions of the tsunami hazard maps using a conventional hazard scenario approach to planning. This would be worthwhile because we are not aware of any previous research on whether including probabilistic or uncertainty information will itself prompt a more values-based discussion of the hazard and related adaptive strategies.

**Behavioral science background.** There has been little empirical study of how emergency managers, planners, the public at large, or even scientists from different disciplines, might understand and use representations of probabilities and/or uncertainty in various kinds of hazard maps, especially for rare events such as tsunamis. For frequent events such as icing, some research suggests that visual uncertainty information can reduce the quality of decisions, while also demonstrating that uncertainty information presented in other formats can improve decision-making (Savelli and Joslyn, 2013). Based on the literature and previous research by our team, we expect that:

1) Discussions of hazard response that invoke a greater diversity and number of different community assets and values as sources of resilience are likely to favor more precautionary courses of action, but also more creative strategies in contrast to conventional mitigation. Such strategies would include policies, investments and initiatives that meet a wide range of community developmental goals beyond the avoidance of damage to existing assets (Freetag et al., 2015).

2) A focus on a catastrophic, high-consequence, low-probability hazard (e.g. rare, extremely large tsunami) will prompt discussion of more precautionary courses of action than a representation that includes higher probability less extreme outcomes, according to Prospect Theory (Kahneman & Tversky, 2001; Sunstein 2015; Tversky & Kahneman 2001).

3) Fuzzier information (representations of uncertainty or probabilistic values) will also prompt discussion of more precautionary courses of action. In other words, representations of uncertainty associated with probabilistic hazard assessments (e.g. with fuzzy lines or areas representing probabilistic assessment of inundation—see Figure 2 and Thompson et al., 2015) may evoke different risk attitudes than do deterministic representations of expected inundation (i.e., sharp lines). In past studies showing confidence bounds on point estimates, some portion of message recipients focus on the riskiest estimates rather than the expected values (see discussion in Bostrom et al., 2015).
contrast, Savelli and Joslyn (2013) test a gradient representation of a predictive interval temperature forecast (i.e., an interval based on the probabilistic distribution of forecast temperatures); this gradient representation bears some visual resemblance to the type of fuzzy line that are also proposed in their study. They compare it experimentally to a deterministic temperature forecast — i.e., a single estimated temperature, and find that the gradient predictive interval improves risk decision-making over the deterministic forecast, although the gradient does not alleviate some known interpretation errors (e.g., the deterministic conjunctive error).

Recent research on probabilistic volcanic hazard maps finds that data classification, color scheme, content, and how the map key is expressed all influence how users engage with and interpret probabilistic volcanic hazard maps (Thompson et al. 2015), for which reason these elements would likely be kept as similar as possible across maps to be assessed.

Map Assessment Strategy – Community Workshops. The mechanism to achieve our goals will be community workshops with small-group interactions that are designed to inform ongoing planning efforts in partner communities, as well as to address broader questions of collective human response to different types of hazard information. For example, if conducted in Neha Bay, the workshop would follow up previous vertical evacuation planning efforts and ongoing new housing development and facilities site relocation siteing plans, with the coordination of Makah Tribe General Manager, Meredith Parker, and the Makah Emergency Management Program coordinator, Andrew Wisniewski.

Each community workshop will be similar to those that were held for the FEMA-funded project described in Freitag et al. (2015). Participants will characterize their community in terms of the goods and services that constitute its quality of life (values), and the sources and providers of those goods and services. Goods and services included material things and activities such as “water,” “exercise,” and “medicine”; non-material things like “information” and “cultural expression”; and combinations of material and non-material things such as “refugee services” and “social gathering over food.” Sources and providers will be specific to the community and could be located on a map, though they could also include spatially dispersed or mobile organizations or networks. In order to have a broad values-based discussion — i.e., identify all the assets that might help a community get through a disruptive event — it is important to hear from as diverse a representation of the community as possible. It is also important to bring an adequate number of participants (minimally 12; ideally 24) into the discussion to compare how people work with the two types of hazard information: deterministic and probabilistic/uncertain. Ideally, therefore, participants would include different ages of community members, residents of different locations within the community, owners and employees of different businesses, as well as emergency managers and other public officials.

Unlike the FEMA-funded workshop, however, the current proposed activity would take place in the context of a planning studio course at the UW, similar to those that took place for Project Safe Haven with coastal communities for tsunami vertical evacuation in 2010-2011. In other words, the workshops would be part of a student-community engagement over the course of one academic quarter (3 months) that would include a community asset- and values-mapping exercise, new hazard maps, and conclude with a more detailed, phased plan for new or relocated housing and facilities, vertical and horizontal evacuation structures, routes and trail systems, and/or other programs that might not involve land-use decisions.

To help stakeholder groups discuss data produced by the project and analyze opportunities to adapt settlement forms spatially, the workshop would (if possible) employ interactive touchable tables or wall surfaces, i.e., participatory GIS (Tanaka, et al., 2007; Tanaka, et al., 2009; PlaceMatters, 2010). The research team will train students and work with community members to document these activities by photography, and interview a sample of participants before and after the activities to elicit what lessons they learn are worth sharing from the experience, including what changes have taken place, if any, in their view of risk, change and planning, and the value of their community’s place on the coast. Once the community members have completed an inventory and map of values, assets and sources of resilience, they would divide into two groups to consider the hazard-change agent: one to work with a map representing a single, sharply defined deterministic scenario, the other to work with a map representing uncertainties in hazard assessments.

For both groups, the maps will be supplemented by (the same) qualitative descriptions of the experiences and damage forecast for these types of events, as well as likely long-term changes. Each group will be tasked to discuss which of the values and assets identified in the first phase of the exercise will be able or unable to withstand changes inflicted by the hazard, and which of those values and assets will enable the community to maintain its viability and identity through the changes. Finally, each group will be tasked to envision long-term strategies that, if adopted now or sometime before the change, would better enable the community to maintain its viability and identity through the changes.

Trained student observers, working under the supervision of M9 team members and UW doctoral students, will take note of the number and diversity of values and assets that workshop participants considered useful for long term adaptation in the face of the two different kinds of hazards in the two different communities. Other trained students will be
tasked with observing and recording indicators from the discussion that participants were either more or less precautionary or creative in their formulation of adaptive strategies. To what extent do participants tend to deny, ignore or de-emphasize risks posed by environmental change, or, alternatively, the risks posed by their own strategies? To what extent do they embrace or resist the notion of environmental change itself? To what extent do they envision strategies that accomplish multiple goals, that have lower external costs, or that can be reversed if necessary or involve multiple back-up systems in case of failure? Observations would be supplemented by short surveys at the end of the workshop(s), assessing participants’ understanding and the case-of-use of maps (e.g., uncertainties and inundation areas), their subjective risk assessments, and their preferences.

If the number and mix of local participants are adequate, we may also divide each of these two groups into two groups again, in order to test the difference that the asset- and values-based approach makes. One of each of the two “deterministic” groups and the two “uncertainty” groups would begin their discussion with the listing and mapping of assets and values (as described in Freitag et al., 2015), while the other group in each pair would begin discussion in the more conventional way, by describing the hazard and identifying vulnerability and risk.

Development of tsunami hazard maps that represent uncertainties. Uncertainties associated with Tsunami Hazard modeling can be categorized as: Source Specification, Model Physics, and Digital Elevation Model (DEM) quality issues. The relative importance of each category may be highly community- and source-specific; however, Source Specification is believed to be responsible for most of the uncertainty in near-field Tsunami Hazard Assessment (THA) studies – for example, studies conducted to assess Cascadia Subduction Zone (CSZ) tsunami hazards that threaten U.S. West Coast communities. In particular, results of such studies are highly sensitive to the detailed spatial distribution, on characteristic length scales of 10s of kilometers, of the near-field crustal deformation. Source Specification efforts must therefore address the very difficult (and frequently controversial) task of providing credible and scientifically defensible predictions of these detailed spatial distributions for future CSZ seismic events.

This important issue of THA Uncertainty is closely related to a goal of the Tsunami R&D component of the UW M9 Project (https://hazards.washington.edu/geomodulf9), namely

- Provide WA EMD/DNR with site-specific inundation studies, including supplementary probabilistic information to usefully inform decision-making.

Uncertainty and Probability are closely related concepts but, in the specific context of near-field THA, we make the following distinction. Given a credible and scientifically defensible suite of CSZ source models, a formal Probabilistic Tsunami Hazard Assessment (PTHA) modeling study requires that each of the multiple sources be assigned a numeric probability; this additional step can be significantly challenging. Thus the distinction that, if numeric probabilities are not utilized in a study, we may still have reasonable confidence that the occurrence of any of the scenarios is scientifically credible and possible. Even where there is scientific consensus on past and probable future events, there will always be some level of uncertainty regarding the probability of any given scenario.

We note that decisions to include or exclude numeric probabilities and/or to conduct formal Probabilistic Tsunami Hazard Assessment (PTHA) studies and/or to utilize PTHA products may be based on either scientific grounds (e.g., the numeric probabilities are not adequately defensible), or programmatic, policy, operational or other practical concerns. R&D will, of course, continue on PTHA that is aimed at producing “best available science” products and testing their impact on decision-making; whether or not these products are adopted for operational use, they may nonetheless prove valuable as additional guidance for decision-makers.

Given the scientific challenges, are there criteria that might provide guidance regarding the Source Specification issue? As a practical matter, the following factors might be considered.

1. Has the Source Specification work been vetted in the peer-reviewed scientific literature, and is there an adequate degree of scientific acceptance of the proposed sources?
2. Can the sources be considered conservative in some sense, i.e., do they likely err on the side of greater, rather than less, potential hazard?
3. Are the sources consistent with US National Seismic Hazard Mapping Program (NSHMP) recommendations?
4. Are the sources consistent with relevant programmatic policies and legislation (e.g., “best available science”, worst considered case, building codes, etc.)

Thus, Washington State has adopted the L1 earthquake scenario for most THA studies. It is one of 15 sources developed by Witter et al. (2013), and was chosen as a “worst case considered” scenario believed to be both conservative and have an estimated Average Recurrence Interval period acceptably close to a 2500-year building code horizon; in addition, portions of this work were adopted in the most recent US NSHMP recommendations. (Note that there are continuing efforts to improve CSZ source specification, most notably: the M9 Project R&D by Art Frankel; the
refinement and extension of the Witter, et al. (2013 Geosphere) work by several of the authors and M9 Tsunami team members; more general stochastic realization methodologies by LeVeque and other M9 tsunami team members.)

As a step toward the above M9 goal, we will present some ideas, for general discussion and feedback, on Hazard Map products that represent scientific uncertainties, as candidates for assessment at the community workshop. Such products will also serve as a natural intermediate step in the R&D to develop formal PTIA products that may be useful to WA State decision-makers.

At this point, in particular, a simple, two-map set is under consideration. The first map—a deterministic "Single Source Hazard Map"—would display the maximum inundation line associated with the scenario adopted by WA State, i.e., the Witter, et al. (2013) L1 source; the second map—a "Multiple Source Hazard Map" with additional scientific information—would display the L1 source plus additional selected sources from the remaining 14 sources developed by Witter, et al. (2013). For example, the five sources SM1, M1, L1, XL1 and XXL1 are each identified as the "most likely" in each of the 5 size categories (SMall, Medium, Large, eXtra Large and eXtra eXtra Large), with M1 being the most likely of all 15 sources; each is also the most conservative in its size category, because it is associated with maximum values of parameters that are indicative of potential hazard—i.e., peak slip, offshore uplift, offshore subsidence, shoreline wave height and inundation distance. The selection of sources, different possible representations of the inundation lines and the possible addition of information such as estimated average recurrence intervals will be topics for general discussion.

References


Final Review for Studio

University of Washington URBDP 508B - Advanced Urban Design Studio
Final Review - Gould Hall Room 100 - 17 March 2016

Urban Design for Community Resilience: Using Cascadia Earthquake and Tsunami Scenarios to Envision a Sustainable Aberdeen, WA
Dan Abramson, Instructor, abramson@uw.edu
Peter Dunn and Adnya Sarasmita, Doctoral Teaching Assistants

Schedule

2:00 - 2:10  Welcome & Introductions by Dan Abramson

2:10 - 2:30  Studio Process Overview and Master Plan by Ashley Bennis

2:30 - 2:40  Gallery Walk of Posters

2:40 - 4:20  Break out into Parallel Presentation and Discussion Sessions

Session I – Reviewers: Bob Freitag, Director, UW Institute of Hazards Mitigation;
   Cynthia McCoy, FEMA Region X Risk Analyst GIS/Hazus;
   Susmita Rishi, UW Urban Design & Planning PhD candidate.
   Students and topics:
   Ashley Bennis – Overview of the Studio Approach
   Max Baker – Bike Plan Aberdeen: Enhance, Evolve, Evacuate
   Lizzie Moll – Division Street Berm: Protect, Preserve, and Play
   Jingchen Liu – Collage City: Intensifying and Revitalizing Downtown
   Ru’a Al-Abweh – Resilience in the Public Realm: Recreation & Refuge
   Ziqin Pu – Moving Up To Safety

Session II – Reviewers: Manish Chalana, Associate Prof., UW Urban Design & Planning;
   Himanshu Grover, Assistant Prof., UW Urban Design & Planning;
   Sara Jacobs, UW Built Environments PhD candidate;
   Leann Andrews, UW Built Environments PhD candidate.
   Students and topics:
   Michelle Caponigro – Looking to Nature: Shoreline Design for Flood and Tsunami Mitigation
   Ze Wang – Downtown Waterfront Levee as Public Amenity
   Stevie Koepf - Imagine Fry Creek: Building the Confluence of Forest, City and Estuary
   Jialing Liu – Living with Water: Flood-Accommodating Neighborhood Design for West Aberdeen
   Colin Poff – Resort to Refuge: Uphill Relocation Possibilities

4:20 – 4:30  Coffee break and 2nd gallery walk

4:30 – 5:00  Wrap-up Roundtable Discussion
   Some questions for consideration:
   • Did the studio succeed in showing how thinking about a disaster can help with long-range planning for the community generally?
   • Did the studio succeed in showing how thinking about community developmental goals can help with disaster preparedness?
How can this approach better demonstrate the value of "resilience thinking" to long-term planning and hazards mitigation?
ABERDEEN COMMUNITY PROFILE AND STUDIO INTRODUCTION

Aberdeen: Overview | Ashley Bennis

The 2016 Advanced Urban Design Studio in Aberdeen actualized the research phase in a National Science Foundation (NSF)-funded project to study how communities might make use of new probabilistic information about tsunami hazards associated with a Magnitude 9 (M9) Cascadia Subduction Zone (CSZ) earthquake. The university team, known as M9, that carried out the research is a multidisciplinary group of specialists seeking to address scientific and engineering challenges that come with reducing risk while also learning how to convey complex information to communities involved in resilience planning. The first step in the process involved brainstorming which community along the Washington coast would be ideal for implementing the pilot project as the eruption of the CSZ fault would be felt all along the western coast from Cape Mendocino California, through Oregon and Washington up to Vancouver Island in Canada. The Washington State Emergency Management Division (EMD) works closely with local emergency managers who drive the outreach and projects within their communities and through this the state EMD connected with the Director of Emergency Management in Grays Harbor. The cities within Grays-Harbor have a long history of community outreach efforts steeped in their struggles with natural hazards. The city of Aberdeen has the largest coastal population, is the economic and commercial hub of the county and, is very conscious of the threat of an earthquake tsunami event. The students explored how planning for long-term adaptation in the face of an event of high consequence and low probability can help Aberdeen realize its developmental and environmental goals. The following report is a culmination of a larger visioning exercise for new settlement siting and forms inspired by the local values and assets of the community.
BACKGROUND

The city of Aberdeen is situated 35 miles past the capital city of Olympia, along I-5 as it branches to the west and becomes Highway 101, nestled between the Pacific Ocean to the west and lush forest to the north east. The Wishkah and the Chehalis rivers converge at this point contributing to the topography characteristics of the land, a result from centuries of sediment deposits. Incorporated in 1888, Aberdeen fulfills the role of the residential and commercial core in Grays Harbor. Consequently the city maintains the only deep-water port on the west coast of Washington with the port of Grays Harbor being the largest coastal shipping port north of California. Settlement in the region grew out of successful ventures in timber and fishing due to the buoys of natural resources and proximity to the ocean and rivers as avenues for transporting goods. The success soon brought in new industries such as mills, canneries, and shipbuilding that continued to contribute to the economy of the region well into the twentieth century. By 1970 the timber industry began to slow due to over logging and by the 1990s most of the mills closed down culminating in an economic downturn for the region and a general shift away from natural resource industries to be replaced by education, health care services and retail industries. It has maintained a modest increase in population since the 1980’s but has yet to recoup the 35.1 percent loss of population from 1950 to 1990.

Tourist from all over Washington are drawn to the region for the opportunity to pass through the gateway to the Pacific coast, the Olympic National Park and the gorgeous beaches along the coast. Calling South Aberdeen home, the Grays Harbor Historical Seaport provides many opportunities for tourist attraction through their procurement of the vessels the Lady Washington and Hawaiian Chieftain. This nonprofit organization engages tourist with educational programs, public sailing excursions, public walk-on tours as well as battle sails that provide a taste of 18th century maritime life. The national popularity of the band Nirvana also continues to contribute to the tourist traffic through the region with the Kurt Cobain Memorial Park and welcome sign emblazoned with their most infamous lyrics as well as a multitude of nostalgic options that allows individuals to be immersed in nature.

DEMOGRAPHICS

The city harbors a population of over 15,000 at a density of 1,599 per square mile, making it the largest city on the west coast. When combined with Hoquiam and Cosmopolis, the three cities are the basis of the economic hub and location of half the population for the county of Grays Harbor.

The population however throughout the day as only 3,185 or 55% of citizens who work in Aberdeen live within the city limits. The other 2,496 or 45% of workers commute from outside the city.

LAND USE

Much of the industrial uses in Aberdeen are located on the waterfront that is shared by larger commercial uses located near the Wishkah river. The historic downtown core is located at the southeast region of city along Highway 101. Around 80% of the land is zoned as some level of residential and covers a wide range of economic roles.

ASSETS

Aside from natural amenities Aberdeen boasts a wide range of built and social capital providing a quality of life for all stages of life. A robust education system complete with four elementary schools, two high schools, two colleges and a much anticipated STEM school provide opportunities to the younger residents of the town. Aberdeen is the medical hub for the coastal region with the newly built Grays Harbor Community College and wide array of specialized clinics that can address most medical ailments. A strong Public Utilities network has provided unobstructed power to the residents and businesses of Aberdeen throughout countless natural disruptions. Not to mention a thriving farming community, home to a wide variety of businesses that provide jobs and economic opportunities to both Aberdeen and Hoquiam. Though a small town by Seattle standards, Aberdeen provides an inimitable amount of amenities for its citizens to grow up, raise a family, work and retire while maintaining a small town feel that contributes to the strong social ties that characterize the town.
HAZARDS

FLOODING

According to a Sea Level Rise in the Coastal Waters of Washington State report by the University of Washington Climate Impact Group and the Washington Department of Ecology, the sea level rise in the west coast of Washington is less than the global average due to the amount of tectonic uplift. The International Panel on Climate Change estimates that the Olympic Peninsula can expect to see 35 cm of sea level rise by 2050 and 88 cm by 2100. Aberdeen’s strategic location at the confluence of the Wishkah and Chehalis River also create substantial flooding issues, especially in the historic downtown core. During the winter and spring time, when snowpack melt is high, the city can experience devastating floods. It is estimated that Aberdeen residents pay some of the highest premiums for flood insurance in the state.

LANDSLIDES

Aberdeen has always enjoyed a milder climate with a high prevalence of rainfall which can cause the soil to liquefy and flow. As a result Aberdeen has a high prevalence of landslides along the bluffs that designate upper and lower Aberdeen.

STORMS AND STRONG WINDS

The coast of the Pacific Northwest experiences several low pressure systems which can produce winds as strong as 60 mph from the months of October to March. Winds have been known to cause downed power lines, tree branches, and external damage to houses.

FIRES

The Olympic National Park is one of the wettest places on earth but an unusually dry winter prevented the formation of snow in 2015 causing a devasting fire to overtake the forest. The fire lasted for more than 3 months and burned through over 1,000 acres of forest before it was extinguished. Changing climate conditions will continue to bring unusual events that are not often seen such as the Paradise Fire in Washington. Along with that the older median household age in Aberdeen means that homes are constructed from wood and possess older electrical systems that have caused many fires for a city of its size in the past.

CASCADE SUBDUCTION ZONE

Not only is Aberdeen located in geologic hot spot known as the Ring of Fire, a region where earthquakes and volcanoes occur at a very rapid rate, but the tectonic activity is frequent. The sediment contribution of the Wishkah and Chehalis does not provide a stable foundation on which to build. The county of Grays Harbor is located at the confluence of the Pacific plate, the Juan de Fuca Plate and the North American Plate. The fault line created from these plates is known as the Cascadia Subduction Zone named for the volcanic mountain range that runs parallel 300 miles inland, and can potentially cause a substantial amount of damage to the built, social and natural environment. Any amount of ground shaking endangers the entire region to liquefaction of the soil, a phenomenon in which water saturated layers of soil take on properties of a liquid due to the pressures created by the earthquake. The Juan de Fuca Plate is currently sliding underneath the North American Plate causing the land plate to bulge upwards at a rate of about 3 to 4 millimeters a year and compress eastward at a rate of 30 to 40 millimeters.

If this tension, that has been building up for the past 300 years, is released, an earthquake at a magnitude of 8.7 to 9.2 could be felt all along the western coast from Cape Mendocino California, through Oregon and Washington up to Vancouver Island in Canada. An event of this magnitude would create enough damage alone but as the fault is located on the ocean floor offshore, the implications for subsequent, damaging tsunami waves are high. Various models implicate that millions of people will be affected by such an event with exact numbers impossible to predict.

HAZARD MITIGATION

Flooding is an expensive issue that affects many communities all over the United States. As a way to keep damage associated costs at a reasonable level the United States Congress implemented the National Flood Insurance Program in 1968. The basic role of the NFIP is to help FEMA to identify flood hazards, assesses flood risks and partner with states and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. The Floodplain maps are the basis for the NFIP regulations and flood insurance requirements displayed in the Flood Insurance Rate Maps (FIRMs). FIRMs include statistical information about data such as river flow, storm tides, hydrologic/hydraulic analyses and rainfall and topographic surveys using best available technical data.

NORTH SHORE LEVEE PROJECT

The susceptibility of the Housman and Wishkah River to flooding has created extensive issues for the citizens of Aberdeen that are both disruptive and costly. Currently flood insurance rates in Aberdeen are aggressively expensive due to a lack of flood protection measures in the city. In an effort to protect the cities of Aberdeen and Hoquiam the North Shore Levee project has been proposed to decrease the risk of annual flooding and insurance rates for citizens and business owners. Generating business growth has proven to be difficult not only because of the high insurance rates but both cities downtown cores are located in the worst flooded regions of the city.

The Levee project is the combination of many previous proj...
PROJECT SCHEDULE

July 2016 – Alignment Analysis & Concept Design
October 2016 – 60% of plans complete.

February 2017 – QL/QM Submittal & FEMA Review

Aberdeen-North Shore Levee Project

MARGARET STREET DIKE

Status: Project is getting prepared to hire design engineering consultant.

Purpose: This project will protect Aberdeen and Hoquiam from coastal flooding. It is aimed at removing Aberdeen and Hoquiam from the National Flood Insurance Program (NFIP) for mortgages while also providing comprehensive protection to frequently flooded areas. Projected to protect 2,700+ homes, properties and private property annual flood insurance savings ($1M-$1.5M).

SOUTHSIDE DIKE/LEEVE CERTIFICATION

Status: Certification is about 60% complete.

Purpose: The levee was designed by the Army Corps of Engineers and built to protect south Aberdeen. This project currently needs a complete certification process. Certifying the Southside Dike will ensure compliance with USACE standards and the effectiveness of the Dike to protect south Aberdeen. It will protect a residential population (approx. 4,000 people), an elementary school, junior high school, major shopping centers and various commercial businesses.

ORGANIZATIONS ACTIVELY ENGAGING

M9 PROJECT AND UNIVERSITY OF WASHINGTON

Anchors conducted on the Cascade Subduction Zone by researchers in the UW geology and forestry department inspired an interdisciplinary project, funded by a grant from the National Science Foundation. This UW-led effort, known as the M9 Project, is working to address the scientific and engineering challenges that come with reducing risk by employing a suite of 3D state-of-the-art simulations of fault rupture and ground motions produced by Cascadia megathrust earthquakes. The goal, along with reducing risk to citizens, is to acquire deeper insight into the phenomena of earthquakes and tsunami and improve estimates of these effects by considering factors that have previously not been addressed such as:

- Distribution and timing of energy release on the fault;
- The inherent variation of frequency content of fault motion and depth;
- The 3D effects of the deep base along Puget Sound;
- The coastal scenarios of tsunami deformation;
- Estimating the tsunami run-up.

The researchers have been confronted with a wide range of challenges including understanding the ways current science can be conveyed in public forums to a degree that generates creative, resilient planning solutions. The interdisciplinary project is seeing expertise from a variety of specialties including geology, engineering, urban design and planning, earth and space sciences, statistics and applied mathematics making the project. The involvement of so many specialties creates a holistic analysis that looks at the phenomena of earthquake tsunami from many angles as processes and consequences.

The passion of the citizens of Grays Harbor and proximity to such a variety of natural resources has also inspired a number of collaborative efforts in the region, including FORTEBRA.

Citizens in the city of Aberdeen are passionate about their shipping past and have been collaborating on their Coastal Resilience and Shoreline Master Plan to reconnect the city with the waterfront. Forthras, one of the largest conservation and community building groups in the northwest, has hired the Grays Harbor Historical Seaport Authority to assist with grant writing and fundraising from public and private corporations, and government. This work is part of Forthras’ Olympic Agenda, an organization that focuses on developing economies in rural communities in ways that are sensitive to the environment. Forthras has also helped facilitate community planning sessions to engage residents in planning efforts to redevelop the historic downtown area.

WASHINGTON SEA GRANT

The Washington Sea Grant is part of a national network of Sea Grant Programs, administered by the National Oceanic and Atmospheric Administration. Building off of the University of Washington’s academic strengths in marine science, engineering and policy the WSG supports marine research, education and works with communities to strengthen under-standing and sustainable use of ocean and coastal resources. WSG is currently a part of the state team commissioned by the Washington Legislature to develop a Marine Spatial Plan for Washington’s Pacific Coast. The WSG is trying to find a balance between the variety of users (shipping, recreational, fishing, habitat conservation) by creating a spatial plan grounded in public participation and science-based decision making. WSG is working with Aberdeen and other coastal communities to help them understand these implications and facilitate information sharing between state planners, federal partners, tribes and other stakeholders (WSG). As Aberdeen is located within the Marine Spatial Planning study area boundary WSG is looking at a variety of factors from energy sustainability, possibilities for recreational activities, habitat conservation, water quality, infrastructure and human use.

Details: Photo by Michelle Casagrande

THE STUDIO

The 2016 Master of Urban Planning class in an Urban Design focused studio project working in conjunction with the "MIR" project to study how communities planning for resilience might make use of new probabilistic information about tsunami hazards associated with a Magnitude 9 Mw Cascadia Subduction Zone (CSZ) earthquake. Through the focus of the studio are solutions centered around design the three month class was so much more than that.

GOAL

Through comprehensive community collaboration the students of the studio tried understanding how framing an issue can contribute to planning in a creative and resilient way. Students created 9 design-based planning solutions and through these varying levels of feasibility, the students recognized the importance of trying out a variety of approaches to find a solution that fits.

PROCESSES

The studio centers on a workshop with local staff and residents that combines asset-based community mapping techniques with hazard mapping using existing scientific models and interactive participatory GIS technology. The workshop as part of a larger visioning exercise for new settlement sites and forms based on local values and assets, to explore how planning for long-term adaptation in the face of an infrequent, unpredictable but consequential change can help a community realize its short- and medium-term developmental and environmental goals.

ASSET V. HAZARDS

How does a community begin to understand how it might cope with a specific tsunami hazard? The students worked to understand what actions a community might take to enhance its resilience?

The workshop organized participants into small group discussions. The students not only completing the hazard mitigation and resilience in community planning but also identifying communities to the asset focus or hazard focus. The students engaged with the participants to describe the city of Aberdeen's in terms of what makes it a good city to live in and to what extent does certain goods and services contribute to that. Groups that began with a hazard and were asked to assess the extent that a hazard could negatively affect their city form field before contemplating the providers of goods and services.

The "asset-based" approach aims to apply the stakeholders to creating an inventory of built, natural, and social community assets that examine disaster scenarios and associated vulnerabilities and, finally, identify those assets that could facilitate planning that is adaptive i.e., assets

that could help achieve comprehensive community planning goals, enhance mitigation of the hazard, and recover from the disaster (Freitag, et al., 2015). The "asset-based" approach emphasizes vulnerabilities of the city and is the most common approach taken in hazard mitigation and community collaboration efforts.

PROBABLISTIC V. DETERMINISTIC

The studio also explored how different visual representations of hazard information can inspire different understanding and solutions in resiliency community planning.

Maps that represent earthquake tsunami hazards are commonly employed by the regional government to inform decision-making. These maps are complex and based on the science that underlies them, including spatiotemporal models of the tsunami source, seafloor bathymetry, and topography, oceanic and coastal inundation, etc. (Freitag, et al.).

The workshop hoped to demonstrate how difficult it can be to reveal the conventional procedure of presenting hazard maps to community members using the hazard map scenario, presenting identified vulnerabilities in their urban areas to the community and discussing possible responses to the hazard could spur more resilient solutions.

WE TABLE

Employing modeling provided to us by researchers from the MIR team the students employed new technology never before used in Washington to incorporate community participation with GIS technology to create an interactive interface on any desktop or laptop. Participants were able to interact with the technology with very little instruction.

Through the studio process of collecting background information on Aberdeen, conducting the workshop, speaking directly with citizens about their community and learning about the scenario problems, an urban design and planning solution was presented.
proposed levee project, the students were influenced and went to work coming up with creative urban design solutions to complement what was already there. The levee project represents an interesting challenge for good urban design and ecologically sensitive hazard mitigation in the cities of Hoquiam and Aberdeen. The students, playing off of this, felt that there could be another layer added to the levee project that incorporated the long range vision for Aberdeen and protect areas of the city not only from frequent storm flooding, but also from the river but highly consequential Cascadia earthquake subsidence and tsunami hazards that threaten it.

RETRIEVE, ACOMMODATE, PROTECT

One general concept of the studio is to illustrate how three different responses to both frequent flooding and storms, as well as rare more severe flooding from earthquake-related subsidence and tsunami, could either work together or separately. The students employed a variety of design solutions; in some cases they worked on creating solutions for crucial protection of important assets like the historic downtown from all these hazards. In other cases, the students designed for the surrounding development and to moreigorously functioning streams, wetlands and shorelines but they also considered designs for the resilience of development and wetland. The variety of students’ work illustrates how resilience can be achieved through designs and programs that meet short-term development goals while providing for a more secure future in the face of long-term threats. Complex issues require complex solutions, for example, Aberdeen has strong economi- cally and demographically in recent decades; perhaps one of it could be given back to nature, while some of it becomes denser and more intensely protected, more lively but with a smaller footprint.

WORKSHOP CONTRIBUTION

The students of the University of Washington Studio visited the city of Aberdeen on two separate occasions. The first was a part of a ground truthing exercise or a form of fact checking the background research students conducted earlier in the process. On both occasions the students were able to meet with citizens of Aberdeen, ask them questions and hear them speak passionately about their city. Apart from the opportunity to give the students an idea, cultural dimension, students were also able to frame their knowledge of design solutions with the desire of the citizens to produce thoughtful solutions.

Many things were abundantly clear to the students for one thing employed by the City of Aberdeen and Lazy Harbor are thoroughly passionate about the future of their community and the citizens they serve, and the residents value the wellbeing of their neighbors as high as they value their own. The city experienced a devastating flood event in 2021 but the community spirit could not be deterred as the citizens of Aberdeen felt a commitment to their neighbors which will be above all else, the most important event in the event of a C50 earthquake-tsunami event. By visiting the city and sitting down with the community at the workshop the students were able to gauge what was truly important to them rather than what the students felt were important from their experience conducting background research and studying maps.

The thirteenth individuals that participated in the community workshop at the Log Pavillon in Aberdeen on February 11th 2022 provided a wide variety of information to the students including assets, vulnerabilities, goals, services and the providers of goods and services. The goods, services and providers were mapped using the Vizsyn technology as shown in example maps. There were noticeable differences between the four groups but there were also universal similarities that the students took note of. The value with which the natural resources and recreational amenities offered was indispensable to the residents. The city grew because of the natural prosperity of the region and, even though the city no longer relies on these resources for economic purposes as much, it still continues to define the character. The proposed bike path by student Max Beiler endeavors to bring the residents and tourist closer to nature by utilizing a network of roads and trails that extend from the height of the loggin industry but have since been utilized. The Olympic Peninsula already possesses a vast trail network and the bike path would not only add to this but also provide citizens with alternative scenic routes to the super regions of the city or disaster struck. The network would include a 1/2 portion along division street in Aberdeen which would provide a beacon to residence in the lower region in the case of a total blackout.

Participants also expressed pride in their thriving port and extensive waterfront. A waterfront park and bike path run along the northern banks for the Chehalis River but for the most part the waterfront has been largely utilized for commercial and industrial purposes. The first visit as well as the workshop gave the students the impression of a strong desire for the city to be reconnected with the waterfront, a feat that could be met with Michalina’s natural form design and Zola’s natural levies and floodplain. Flooding exists issues from both directions of the Aberdeen and Hoquiam. Michalina’s natural form would provide protection for the residents and commercial core of Hoquiam, activate underutilized land and provide an opportunity for tourist and residents to reconnect with the water while enjoying a forested, natural environment. Zoé’s levee and seawall would protect the commercial core of Aberdeen from flooding caused by
Projects on Map

North Shore Levee Project – The combination of many previous projects aimed at flood mitigation and has been narrowed down to two major implementations: a dike along market street and a South Side Dike/Levee Certification.

Max – Master Bike plan for Aberdeen that would increase recreational biking options in Grays Harbor and provide an evacuation route during a Cascadia event.

Zijn – Vertical Evacuations and that also function as community sites outside of natural hazards.

Ria – Shows how sites in Aberdeen can function as new public amenities and refuge sites as a part of Zijn’s vertical evacuation and Max’s bike plan to create community networks.

 Mickie – A forested, bermed barrier would be an extension of the levee plan for West Aberdeen and East Hoquiam. This project would provide a more biologically and recreationally functioning waterfront than a conventional levee, and would also absorb energy from an incoming tsunami.

Steve – Proposes widening Fry Creek and restoration of estuarine wetlands in West Aberdeen, making it more resilient to storm flooding as well as change in the coastline.

Lizzie – A bermed levee along Division Street, separating West Aberdeen from Downtown, would be the waterfront levee back to higher ground, and complete the protection of the historic center. It would also be used to withstand inundation from both subsidence and tsunamis following a Cascadia event, as well as serve as a back-up protection of Downtown Aberdeen in the event that storm flooding continues to affect West Aberdeen.

Joe – This robust levee and floodwall system along the Chehalis and Wishkah riverfronts of Downtown Aberdeen would protect the historic center of Aberdeen from both frequent storm flooding as well as subsidence and tsunamis following a Cascadia earthquake.

Odel – Up-Hill Resort/Refuge illustrates how sites at higher elevations could develop low impact infrastructure for new markets of homeowners and/or vacationers, as well as serve as a long-term viability relocation site for people displaced by changes in the coastal flatlands.

Legend – Shows how a transfer of development rights program could assist property owners and residents to transition from areas being “surrendered” to wetland to redevelop and re-inhabit the historic center, enhancing the urbanity of downtown.

Jalling – Flood accommodating neighborhood design shows how West Aberdeen might evolve into a smaller neighborhood of new infrastructure and building types that live with a water environment.
02 INDIVIDUAL DESIGN WORKS

Bike Plan Aberdeen: Enhance, Evolve, Evacuate | Max Baker
Creating a resilient transportation network for all situations.
BIKES AS A GOOD RETURN ON INVESTMENT

Bicycle riding has been steadily increasing across the United States, with the Pacific Northwest being perhaps one of the most significant outliers. Not only is bike commuting in cities becoming more popular, but recreational riding in the less congested areas outside of major metropolitan areas is as well. The Olympic Peninsula is one of those areas, with many new cycling infrastructure projects being pushed forward in areas such as Port Angeles, Sequim and Olympic National Park.

The Ilwaco-Hoquiam trail in northern Oregon is an example of a successful rail trail project completed in the past few years. Constructed for a cost of $1.4 million, this rail trail runs for 21 miles between the towns of Banks and Vernonia through a section of I. Stibb Stewart State Park. It now attracts nearly 20,000 visitors each year to this remote section of the state.

Bicycle infrastructure is also an incredibly sound investment for cities to make. According to one research study completed in 2010, the city of Portland experienced a 53% total return on every dollar invested in bike infrastructure, compared to just 3.3% for every dollar spent on road paving and maintenance. This takes into account every net positive benefit, be it from reduced infrastructure needs, residents' improved health, fewer vehicle accidents, less dependence on automobiles, etc. By taking those small steps, great returns can be experienced by all.

BIKE PATH AS ATTRACTION/EVACUATION ROUTES

In the city of Eindhoven, Netherlands there exists a path that doubles as a work of art, an ode to the hometown of Van Gogh. What makes this pathway unique is the fact that it is able to emulate the painting that inspired it in a way that no other path could. Using a combination of solar-powered LEDs and glow-in-the-dark materials, the path depicts Van Gogh's famous Starry Night, a work that is best viewed in low light. After the pathway was completed in 2014, visitors have flocked to the attraction by the thousands. It is one section of a larger regional network that is used to bring visitors to the less-visited areas of northern Holland.

Such a pathway could act as both a tourist attraction as well as a safety route for evacuators when the lights go out. Considering that the Pacific Northwest coast can be shrouded in darkness for nearly 36 hours a day during the winter months, such a feature would be well-suited for Aberdeen. Artwork could be integrated in the system to celebrate the city's stored history, with the depicted Salmon run to the right being one such example. If the power were to go out during an earthquake, the evacuation route could provide an evacuation route north to higher ground. This pathway could be located in either the downtown core along Broadway or at the top of the proposed Division Street levee. It should also be located in an area that is easy for pedestrians to navigate to during moments of chaos, providing a safe pathway to the rest of the pedestrian evacuation network. Such a path would only need to run between 1/4 to 1/3 of a mile from end to end, minimizing costs and reducing maintenance needs.

A NATURE TRAIL THAT DOUBLES AS AN ALTERNATIVE EMERGENCY ACCESS ROUTE

During the open house with Aberdeen residents and decision makers, it became clear that major access points to the city would likely be compromised in the event of a major earthquake. As it is due to landslides along the Olympic Highway or the collapse of any one of the century-old car bridges, Aberdeen would be effectively severed from outside resources. Logging roads were identified as a potential asset that could be utilized in an emergency, many of which terminate just outside the northern edge of the city.

By enhancing and connecting a series of existing logging roads and transforming them into a five-mile nature pathway, the city could simultaneously ensure connections with neighboring cities while providing residents with a valuable recreational attraction. A pedestrian bridge over the Wishkah could be constructed connecting the northern sections of the city for a fraction of the cost of a similar vehicular structure. This nature trail would travel to a number of points of interest, including Lake Aberdeen, the Wishkah river, city water tanks (which could potentially be used in an emergency), new hilltop housing developments and Faye Creek.
A NETWORK TO CONNECT

While Aberdeen has a robust car evacuation network, it is lacking streets that are designated and designed to facilitate evacuation on foot. This is incredibly important when one considers that most emergency agencies suggest leaving vehicles when attempting to make way to higher ground during a tsunami.

By developing a network that works to route foot and bicycle traffic away from busy car corridors like Summer and Simpson Ave., the city could ensure more corridors will remain safe and accessible during an emergency. Design improvements would help to make bicycle travel safer at any time and will have minimal impact on adjacent properties. Alternative connections would be made between neighborhoods and city points of interest such as downtown, Kurt Cobain Memorial Park, the proposed Aberdeen nature trail and the waterfront. It would also provide students with safe travel routes to and from school on streets that have been reoriented to favor alternative modes of transportation.

Cherry Street improvements with a bike lane on either side. This layout allows for easier transitions between Cherry Street and perpendicular roads.

Cherry Street improvements with a bike lane on the northern edge. The southern edge is narrow, allowing homeowners greater flexibility.

Cherry Street’s role in the Aberdeen bike network is vital, connecting Aberdeen, the Division-St. Lewis and western neighborhoods to the nature trail evacuation route.

WISHKAH STREET PLAN

Wishkah Street would be converted from a three lane one-way road into a narrow, two-lane road with bike lanes and parallel parking on either side. Locating the parked cars between the sidewalk and travel lanes will help to keep any fallen debris out of the roadway during an earthquake.

DOWNTOWN PEDESTRIAN REDEVELOPMENT PLAN

The Aberdeen Conceptual Master Plan that was developed in May of 2014 provides a solid foundation for the creation of new pedestrian-oriented realms in the downtown core. By removing westbound Highway 101 traffic from to Market Street, Wishkah Street is given the opportunity to act as a main street for Aberdeen. This allows for a new, more functional Wishkah to be developed, with bike lanes and slower two-way traffic allowing for the creation of a quieter and more enjoyable pedestrian realm.

Vehicular traffic to and from 101 would be rerouted to provide better pedestrian and bicycle access to the proposed waterfront and Gateway Center Project from downtown, limiting unnecessary maintenance on lesser traveled streets in the process. The bicycle network would be integrated into this new realm in a way that would encourage residents from throughout the city to enter the downtown core without their car.

ENHANCED CONNECTIONS TO WATERFRONT

With the discontinuation of vehicular traffic along the northbound lane of Broadway, E. State Street’s role in the network is reduced significantly. This allows for the creation of a pedestrian/bike trail that could travel from the downtown core to the redeveloped waterfront.
**BROADWAY PEDESTRIAN PLAZA**

Broadway Street’s boulevard design lends itself nicely to the creation of a two to three block pedestrian plaza along the northeastern half of the street. By removing vehicles on the one side of the street, a two-way bike lane can be introduced that would run the entire length of Broadway. The southbound traffic lane of Broadway could remain intact to allow families and senior citizens convenient access to the pedestrian core. Traffic from Wishkah would also be allowed to exit using this street, reducing the number of cars within the downtown realm.

In the downtown core the former angled parking spaces could be converted into a sizable pedestrian plaza, with businesses able to set up dining and seating areas. This section of Broadway is also attractive in the downtown core due to the fact that many of the historic buildings are still standing and in good condition. This area is also located close to the proposed Gateway Center Project and Waterfront Park, a mere two blocks away. By reorganizing and connecting the downtown core of Aberdeen, the city will create a safe and enjoyable atmosphere for residents and tourists alike.

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**BROADWAY AND WISHKAH PEDESTRIAN CENTER**

The intersection of Broadway and Wishkah is an obvious center point for the city of Aberdeen. The new Wishkah pedestrian plan would connect conveniently to the greater bike network, while Broadway itself demarcates where many streets transition from an east to west directional convention.

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**BROADWAY STREET PLAN**

Broadway traffic would be reduced down to one lane southbound, with angled parking to help keep speeds to a manageable level. The northbound lane would be turned into an entirely pedestrian oriented realm, with the traffic lane turned into a two-way bike path. This median acts as an existing protective barrier between the two environments, with the remaining northbound parking transformed into a pedestrian plaza.

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**Moving Up To Safety: A Vertical Evacuation Strategy**

Ziqin Pu

According to some previous studies, the first tsunami wave is predicted to arrive at our study area approximately 25 min after a Cascadia Subduction Zone earthquake, and most of the low-lying areas in Aberdeen requires fewer than 25 min of pedestrian travel time to the near natural high ground, with travel time up to 49 min in waterfront areas. This means the majority of the city’s population has enough evacuation time before the arrival of tsunami. However, Aberdeen has the highest number of population exposure to the tsunami hazard in Grays Harbor County, when considering the slow travel speed of children, elderly residents, and people with disabilities, travel time needed to get up to the high ground would increase. Also, the changed post-earthquake landscape, such as the debris and broken roads, could block people’s evacuation. Psychological and sociological factors could also lengthen people’s evacuation time.

Considering those factors that might lengthen people’s evacuation time, we propose to build some artificial vertical evacuation structures in the city as backup for the natural high ground. These structures would provide safe places for refugees who could not get up to the hills when tsunami waves come. And they are designed to combine with communities’ daily activities to increase their functionality, but not only the structures for evacuation.
WHAT IS TSUNAMI VERTICAL EVACUATION?

Typically, when tsunami waves attack coastal communities, people evacuate to high ground outside of the inundation zone. However, in areas that lack natural high ground, or the time is not enough to allow people to evacuate, the horizontal evacuation may not be a adequate strategy. Thus, a vertical evacuation strategy is necessary.

Vertical evacuation structures (VES) are refuges that lead people to safety by moving them above the hazard during a tsunami. Typically, a tsunami vertical evacuation structure could be a tower, building, or earthen mound that has sufficient elevation above the maximum level of tsunami inundation. It could also be an evacuation trail that allows people move up to the natural high ground. A tsunami vertical evacuation structure should be designed and constructed with the strength to withstand ground shaking and water flow.

A tsunami evacuation tower is a tower or structure built to provide a safe place to wait out a tsunami. It typically includes features such as stairs or ramps, a roof to protect from debris, and a strong foundation to withstand the force of the water. The evacuation trail provides a safe, elevated route to higher ground where people can wait until the tsunami passes.

DOWNTOWN ABERDEEN AND EAST ABERDEEN

These two neighborhoods are both close to the waterfront and thus are most likely to be affected by tsunamis. Downtown Aberdeen is a commercial area that contains businesses, parks, and other communal spaces. However, the tsunami evacuation structures are rare in this area. East Aberdeen is a residential neighborhood that contains homes and other residential buildings. This neighborhood is more likely to have tsunami evacuation structures, such as community parks and evacuation trails.
WEST ABERDEEN AND NORTH ABERDEEN

These two neighborhoods are located at the hinterland of the City of Aberdeen and they have relatively long distance to the waterfront. But when medium to large tsunamis attack the study area, these two neighborhoods are still at high risk and will be inundated. Site 5 is now a vacant land and next to a school district. The school complex includes preschools and high schools, and many children are at risk if a tsunami comes. The design idea is to develop this vacant land and elevate the ground to be a playground above the inundation height. This elevated playground could both serve for the kids at schools and evacuees from the neighboring areas. And it will be used as a normal open space when there is no hazard event. Site 7 is designed as a combination form-tower structure with a playground on the ground. This retains the function of the original West End Playground and then provides safe haven for evacuation. The design also considers that if the Fry Creek near the site developed to be a wetland, then the tower and form could become a observation place to sightseeing. Site 6 is two small pieces of unused land, and two vertical evacuation towers are proposed to build there.

The North Aberdeen neighborhood is not planned to build any new VES. Because this area is close to the natural high ground and most of the area is out of the inundation zone when the level of tsunami is small to medium. Many evacuation routes are also available in this neighborhood, and people live here can walk up to high ground when hazard happen. Besides, the vertical evacuation sites 3 and 5 are located at the border of the neighborhood and they can both serve for this neighborhood.

EAST HOQUIAM AND THE PORT

East Hoquiam is an area that has high level of exposure. Any level of tsunami attacks this area will heavily affect this neighborhood for its low elevation and close location to the waterfront. East Hoquiam is a major residential area and over 2000 residents live there. When a tsunami coming, people in the area can choose to evacuate to the hill or move into the inland of the City of Aberdeen, but considering the large number of residents at risk, the vertical evacuation structures are still required in this area. One of the VES is the Washington School. The roof of the two-story concrete building can be used as an evacuation place. The school facility can both satisfy the evacuation need of students and other evacuees from the neighborhood. The other two vertical evacuation locations are the Hoquiam Fire Department and the Washington State Patrol, Hoquiam Detachment. Both of the two places have patch of land that can be used to build VES, and vertical evacuation towers could be the choice. On the other hand, the departments can maintain the structures when they are not in use and the staff can provide help for evacuees when there is a tsunami event.

The port is an industrial area, and most people here are factory workers. This area has relatively higher elevation than other neighborhoods on the low-lying ground, and some of the area in the port could even out of inundation under all the levels of tsunami hazard. Since there is no possibility to use the land in the port to build a term under the current land use, and existing buildings in this area are not reliable for evacuation, towers could be built to serve the region. Several towers could be placed in the port, and close to daily gathering places. They can also be used for observation when the tsunami waves coming.
OVERLAPPING WITH OTHER PROPOSED PROJECT

The previous analysis is based on the status quo of our study area, and all the sites are chosen to locate on the available land. Except the vertical evacuation strategy, members in our team also develop other planning strategies to improve the resilience of this area, and their plans may affect the location and necessity of the VES. The map above shows some of the plans that may overlap with the vertical evacuation strategy. As you can see, if levels are proposed to develop on the Division Street and along the waterfront, then sites 2 and 4 near the levee at the waterfront, and site 5 next to the Division Street will all be affected. Because a levee can serve as a vertical evacuation structure and it has a large capacity to provide safety for people. The sites 2 and 4 are not necessary and site 5 will be replaced. The levee along the waterfront would be a VES serving the communities close to it. The levee along the Division Street will be used as a recreation place in daily life, and served as a safe haven when a tsunami coming.

The proposed wetland along Fry Creek will not affect the use of the two sites (Sites 7 and 8) VES close to it. Since site 7 is designed as a combination berm-tower structure, the berm and tower can be used as observation platforms for visitors, and when tsunami comes, it can be used for evacuation. Site 8 is out of the inundation area of the wetland and it can still serve as a VES. The structures in the East Hoquiam (Sites 9 and 10) could still be useful, because the berm along the waterfront can not totally neutralize the force of a tsunami, and people in the neighborhood still need vertical evacuation structures as backup for evacuation.

Resilience in the Public Realm: Recreation & Refuge | Ru’a Al-Abweh

Resilience in the Public Realm explores public space as a tool for community resilience. This idea developed after conversations with the community in Aberdeen about people’s natural tendency to come together in difficult situations, such as the flood in 2015. While the community bond is generally strong, Aberdeen seems to have a few different social groups that remain relatively disconnected on a daily basis. It also lacks public spaces for events, activities, and gatherings where these different groups could interact. Resilience in the Public Realm attempts to enhance and improve these existing social ties by imagining the activities that could happen in public space, both on a regular day (“Recreation”) and in the event of an earthquake and tsunami (“Refuge”).

Overall, this design concept was inspired by the city of Christchurch, New Zealand and their use of informal public spaces, activities, and events as a main pillar of community resilience and as a tool for recovery after the 2010 and 2011 earthquakes. A core element of their approach is incrementalism, which involves making the best use of existing infrastructure, assets, and spaces to build back the city over time (both figuratively and literally). They have also concentrated many of their developments around an important axis, the Avon River, enhancing its importance.
Through their lens of informality, transformation, and existing assets (whether physical structures or intangible characteristics of Aberdeen), Resilience in the Public Realm proposes uses of different public spaces and attempts to visualize the situations pre- and post-disaster. It also links with three other projects developed in this studio - Division Street Barn, Bike Plan Aberdeen, and Moving Up to Safety. This design concept assumes that the barn and bike path/evacuation route are in place, furthermore, the outcome of the analyses carried out in Moving Up to Safety helped determine one of the zones examined more closely in this project. Resilience in the Public Realm examines public space on three different levels. Firstly, vacant public plots of land (including parking lots) were mapped, focusing on areas around two main axes - the proposed bike/evacuation route and the barn. This included assessing which spaces would be in “danger” (i.e. in the inundation zone) and which would be “safe” (i.e. outside the inundation zone). Furthermore, it was important to analyze how an open space network could serve as a “wayfinding” tool and strengthen people’s familiarity with the barn and bike path/evacuation route, which would be critical destinations during an earthquake and tsunami.

Secondly, three “zones” - UP, OVER, and THROUGH - were selected to take a closer look at different micro-systems of public space, focusing on how the spaces within these systems would function together and which plots of land would be activated pre- and post-disaster. Thirdly, a section of each of the three zones was examined more closely, showing a more human-scale visualization of three different scenarios in a state of “recreation” (before a natural disaster) and “refuge” (after a natural disaster). While the scenarios for this design concept are situated and contextual, similar concepts could be applied to other spaces around Aberdeen or even other cities.
Located in southwest Rambler, this area is mostly residential with some commercial activities. It is relatively safe from the evacuation needs, higher ground, and the threat. Therefore, this scenario presents a unique platform to expand the community's emergency preparedness strategies. It serves as a vertical evacuation structure connected to Grocery Outlet to the west and the freeway leading to the north through a pedestrian bridge raised above the highway. Both buildings would house residents during evacuations, centralizing the community's ability to higher ground. From this area, one can access the vertical evacuation structure through the existing roadways.

This zone contains the proposed Division Street barns, which act as a spine down the middle of Rambler and integrate with the proposed Bike Path, Rainier. Raising the site's height above the inundation level, the barns would act as a critical community space for shelter during evacuations and for gathering points to higher ground and for emergency medical services. This scenario would serve as a nuclei of a larger part of the area, including improving existing building, temporary housing, and a series of parks. Existing homes along Fresh Pond Road would remain in place, while a new public space is provided with a regular fire and rail service to evacuate residents in the event of a disaster, including using the sink guidelines to evacuate and the barn and the barn as a rescue area and shelter space.

Resilience in the Public Realm: Recreation & Refuge | AIA Biennial

Urban Design for Coastal Community Resilience in Rambler, WA | Winter 2018
Looking to Nature: Shoreline Design for Flood and Tsunami Mitigation | Michelle Caponigro

RESPECTING NATURE:

With intensified media coverage on tsunamis and natural disasters, increased awareness has caused coastal cities to choose to armor their shorelines with seawalls or hardened structures. As demonstrated in the 2011 Japan tsunami, seawalls are overcome by natural forces time after time. Not only do seawalls cause damage to the natural ecosystems native to the shoreline, but they also serve as a physical barrier for community members to connect to the waterfront. Instead of fighting nature, we should look to work in harmony with biological forms to counter tsunami and flooding. Natural berms constructed of waving topography will serve as a natural barrier, trees along the berm serve to dissipate wave energy, and the berms will be enjoyed in non-emergency situations as a public greenbelt. The greenbelt will connect two existing highpoints, the port of Aberdeen and East Hoquiam, and in return, the most vulnerable areas of West Aberdeen and East Hoquiam will be protected.
VISION

Create a greenbelt that works with nature to mitigate flooding and tsunami threats. The greenbelt park serves not only to protect the community, but also creates a place for people of all ages to gather and enjoy nature. The park will honor the rich logging history of Aberdeen through the planting of new trees, and by reusing an abandoned pulp plant.

CONNECTION TO THE HARBOR

Forests and native plants thrive along the shoreline, while walking trails allow the community to enjoy the waterfront from the berms and along the shore.

Reconnect the citizens to their beautiful waterfront; create a series of outdoor places for social gathering and recreation.

Reutilize abandoned pulp plant for outdoor event center and community viewpoint.

RESILIENCE AND FLOOD REDUCTION

Natural berms constructed with varying topography, serve as a natural barrier for flooding. The design works with natural elements and ties into existing highpoints.

Land currently is vacant and not being used to its full potential. Remediating shoreline, and properly demolish existing abandoned pulp plant.

Natural shoreline and trees dissipate wave energy versus causing large wave revereations from seawalls.

PROGRESSION FROM STRUCTURED TO BIOLOGICAL SPACES

A defined entry welcomes the community to the park, while enticing visitors to come in and discover what is within.

A community event center reclames existing pulp plant structures, while demonstrating the transition from a structured environment to natural formed berms.

A biological shoreline is restored. Piles, bulkheads, and the dock will be removed. Native plants and soil replaced.

DEFINED ENTRY

The entry is created by combining the organic form of the berm with the rigid form of structural concrete. A series of tiered planters with native plants create contrasting textures and colors against the concrete forms. The entry is flanked with two sets of stairs, which welcomes visitors to explore on the berms. Beyond the entry, a series of trails meanders through a valley of pools, gardens, and play areas for children.
COMMUNITY EVENT CENTER

The existing Harbor Paper pulp plant is on high ground, and creates a strong anchor point within the greenbelt park. The site is currently owned by private investors, and has ongoing clean up requirements. Existing retention ponds will be properly remediated and cleaned. The four circular ponds will be reutilized as a series of fountains. The largest pond will be excavated and an outdoor amphitheater will support community concerts and gatherings. A viewpoint will be constructed with an additional deck, which will overlook the city of Roanoke, Hopkinton, and Grays Harbor. Throughout the space, there will be restrooms demonstrating the rich logging history that was so important in creating the pride and social fabric of the community.

RESTORED SHORELINE

Grays Harbor is one of the largest concentration points for shorebirds along the west coast. The shoreline along the greenbelt park will return to its biological state. All piles, bulkheads, and docks will be demolished. Native plants, stones, and sand fill will be used to naturally harden the shoreline, without fixed manmade structures that sever adjacencies of upland and aquatic areas. Native shrubs and trees will be planted upland to encourage native birds to return to the site. The benefits include a more natural appearance along the shore, increased habitat for birds and fish, water filtration, and recreation.
A COMMUNITY PARK FOR ALL

The greenbelt park will provide playful opportunities for people of all ages. The primary gathering space of the park will be an open-air amphitheater constructed of a series of concrete steps and grass planes within the revitalized pulp plant’s retention pond. A series of steps and slides will be cut into the entry berm, providing a playful area for children to experience the changing topography of the berm. Native plants, shrubs, and trees will be planted adjacent to play areas, along with informational displays to demonstrate the biological diversity of the greenbelt park.

RESILIENCE THROUGH NATURE

Meandering trails along the berm, on top of the berms, and along the shoreline allow visitors to experience multiple ecological zones, and provide dramatic views of the surrounding city and harbor. The greenbelt park becomes a refuge within the city, and creates a destination place for community members and tourists. The park demonstrates the revitalization of the environment and the communities, all while making the city of Aberdeen and Hoquiam resilient against flooding and tsunami inundation.

Imagine Fry Creek: Building the Confluence of Forest, City and Estuary | Stevie Koepp

This project intends to spur discussion negotiating short-term needs of Aberdeen with long-term goals of hazard mitigation. The ecology, history, and social context of Fry Creek set the stage for a creative approach to redefining the city by improving access to its unique natural resources and hydrology.

FOREST: Fry Creek begins in the forest where a mixed hardwood trees stabilize steep slopes and increase the evapotranspiration of frequent rains. As the stream collects, palustrine and estuarine wetlands provide valuable ecosystem services. Phase one of planning aims to incorporate the highlands with the lowlands and realize the impact of upstream development.

CITY: West Aberdeen and East Hoquiam must reestablish their relationship to each respective urban center. First and foremost, flooding of what is primarily residential must be mitigated. Second, incentives and planning initiatives should plan to rebuild aging and deteriorating housing stock more densely, out of the way of less frequent but dangerous hazards (tsunami, earthquake, and landslides). Phase 2 finds potential in the transition and relocation of homes in the way of hazard.

ESTUARY: As an envisioning exercise, this project turns towards the Chehalis estuary as a major opportunity for development in all phases of design. Plans to better incorporate the waterfront into the city of Aberdeen have thus far focused on shipping and retail potential. Starting with Fry Creek and reimagining new waterfront post-disaster and subsidence, the economic, social, and environmental amenities offered by the waterfront are stressed.
"For thousands of years the Lower Chilkoots have lived among Days Harbor and in the river valleys that feed into the bay. Bands of the Tlingit-speaking communities moved between a series of villages along the shore near the salmon rivers where they gathered to hunt and fish. In the winter months, they traveled to cabin and camping sites in the mountains for gathering plants and berries, harvesting trees for winter use and other items, and hunting."

"In June 1876, John Doele settled at Sykes Creek, at what would become Days Harbor, just east of the small, delta of the bay from the mouth of the Chilkoot. He built a small log cabin and started hunting and fishing for the summer. By 1880 he had increased production to 10,000 square feet per day, which is the equivalent of nearly 3,000 of today's 2 x 4-inch studs."

"In a short article from 1993, Jene Stewart, an early settler, tells her version of the town's naming: "I wrote a letter to one of the leaders suggesting that the name Days Harbor be given to the river mouth, to the river, and to the town across the bay."

"Completed in 1957, the railroad provided an extended connection to cities on Puget Sound and to Portland, offering access to those markets for the region's lumber and agricultural products."

"Considering its small size, with just under 4,000 people, Aberdeen has a diverse population. Many of the native, African, European, and farmers who lived in Aberdeen lived from foreign sources in Europe and Asia."

"A serious downtown fire in 1993 was followed the following year, on October 18, 1994, with a configuration that destroyed some 300 acres of Aberdeen's downtown. Many of the buildings were gone in an instant, thus creating a feelings of loss for the town."

"In 1998 the city began filling the fire area. Much of the (R) Rev. Pitts from a new levels in that where Aberdeen High School stands."

"In 2004 a new milestone for annual lumber production was reached when the saw mill's log of timber was 18 acres from Aberdeen, earning the town the title of "Lumber Capital of the World.""

"Another change in the logging industry invited the town's landscape. Beginning in the 1980s, local leaders began to question what was called "railroading" that brought so many high into Aberdeen to the mill."

"On October 9, 1993, a second at the Days Harbor Pottery and a record for the nearest site development. In just 23 days and 14 months they built the Aberdeen, a 4,000-ton vessel site on two separate trucks."

[From Washington History Link.org]
FIRST PHASE

The restoration and daylighting (at Hwy 101) of Fry Creek will provide vital community and natural resources, along with flood mitigation, to the cities of Aberdeen and Hoquiam in the immediate future. North to South continuity between forest and waterfront is stressed to promote environmental literacy and connect residents and businesses to water resources.

Primary objectives:

- Flexible, connected open space development (urban agriculture, park amenities, community engagement)
- Clear Pedestrian evacuation route
- Stream restoration and increased wildlife habitat
- Space for community and tourism development
- Natural park and educational opportunities
- Community health and well-being

SECOND PHASE

This is an intermediary step towards hazard mitigation in the case of an major earthquake event. Flooding has been reduced in Phase 1, but housing is relocated to higher ground in this long term planning initiative. The city’s relationship to the waterfront is developed.

Primary objectives:

- Relocate water treatment facilities, build municipal artificial wetlands and connected green way (case study: Tidewater- Courthouse, OR)
- Relocate households to higher ground, utilize FEMA funding in both cities
- Salt marsh wetland development for natural amenity and wildlife function
- Urban aquaculture - algae (biomass) and eelgrass plant species

+25-50 Years: Housing Relocation and Open Space Development
PHASE 1, 2 OR 3

This plan projects a future post-earthquake event or alternatively, in favor of major waterfront improvements following housing relocation. Fry Creek persists as a physical and symbolic connection to the past despite major shifts in mean high water level and changes to its hydrology.

Primary objectives:
- Establish waterfront destination accessible by highway
- 101 Project for Public Spaces "Powers of Ten"
- Houseboat communities, amphibious housing development
- Biomass (breakwater)
- Carbon offsetting through mitigation projects
- Critical wildlife reclamation projects

+1 - 250 Years: Rebuilding a Waterfront

Division Street Berm: Protect, Preserve, and Play | Lizzie Moll

Division Street in Aberdeen is an important street for many reasons. It runs north-south and the street where the street grid changes. It is in the middle of town and divides the west end of Aberdeen from the downtown core. There is also an east-west change in elevation by four feet from Williams Street to Division Street. Creating a berm on one block between Williams Street and Division Street would help to protect the downtown core of Aberdeen during a tsunami. The blocks from east to west are 300 feet wide. Accounting for the ground subsiding with a major earthquake, the berm would have to be ten feet tall in order to protect the downtown from the waves that would arrive with the tsunami. The slope would not need to be very dramatic in order to be effective. In the short term the berm would provide opportunities for community green space and for adjacent buildings and housing to be built on the inside of the berm. It would also include a passive recreation trail along the top of the berm. In the event of a tsunami, the trail could then be used as an evacuation path and as a vertical evacuation option. Other neighboring structures can also be used for vertical evacuation. The mass and height of the berm would keep the water from reaching downtown Aberdeen.
CASE STUDIES

Lucca, Italy is a medieval city that has incorporated their Renaissance-era walls into their urban fabric. These walls are now a pedestrian promenade called the Passeggiata delle Mura Urbane. These tree-lined walkways and bicycle pathways encircle the ancient city center and serve both as a tourist destination and a public space for passive recreation by residents of the city.

Suwon, Korea is a walled city in the Gyeonggi Province. The city has grown outside of the walls built in 1796 and are now a designated UNESCO World Heritage site. There is a path around the walls that tourists and locals alike walk along. There are different structures, observation towers, and pavilions along the wall that are points of interest with panoramic views of the city.

The South Park Blocks in Portland, Oregon is an linear twelve block park in downtown Portland that is 100 feet wide. It is treated as the heart of the city's cultural life with public art and flexible spaces for festivals. The park has walkways down the center with automobile streets around the periphery. This is an important case study because it does not divide the city itself - it unifies it.

BEHIND THE BERM

Tsunami's are a result of water rushing in to replace subducted land after an earthquake happens and tectonic plates shift. Often the tsunami will continue over multiple high tide and low tide cycles. This means that it is not safe to immediately return home after an earthquake. Although the water rushes in - it does not suddenly appear like a massive wall of water. Instead it will often look like a rapidly rising high tide.

A berm will provide extra elevation in the land in order to protect structures and stop the flow from entering Aberdeen’s downtown core at the time of the event.

Climate change has also meant an increase in sea level rise and changes in precipitation which could lead to a need for extra fortifications from seasonal flooding.

The engineering firm kpf is in the process of creating a system of levees and sea walls in order to protect Aberdeen and neighboring Hoquiam from tsunamis and flooding. They had initially proposed a wall at Division Street when their client was the City of Aberdeen. Since their first plan, the city of Aberdeen and the city of Hoquiam have joined together to create a larger strategy for maintaining their cities from tsunamis and flooding. This means that the Division Street wall was abandoned in their plans. We are still proposing a berm at Division Street. In resiliency strategy is important because sometimes the first option fails and the berm could be pivotal in protecting downtown historic Aberdeen. By creating a green belt through the city instead of a wall, Aberdeen will have a unifying park instead of a divisive structure.
This proposal impacts 173 parcels of land. Based on 2015 Tax Assessor Data, the average building value is $50,575.39 and the average land value is $23,284.29 within the area with the green border representing the berm. The map to the left shows building values by parcel in the area of Aberdeen around Division Street. The blocks between Williams Street and Division Street have comparatively less value than the buildings in the downtown core to the east of Division Street.

View of Division Street looking south - Image by Mark Moreland.

View of Pacific Ave from intersection with Division Street looking west - Image by Mark Moreland.

The berm along Division Street serves multiple purposes. It serves the community as a linear park with multiple points of interest. Designing the park blocks with community gardens, providing new housing options that are protected by the berm, and a new school will give the berm some programmed, active spaces.

This is a huge opportunity to invest in the community with educational facilities and gathering spaces for the residents and a point of interest and novelty for tourists.

Roads

U.S. Route 101 goes through Aberdeen and will go directly over the berm. Route 101 is used by many tourists who are on their way to Olympic National Park and Aberdeen could have more opportunities to take advantage of the tourism money that drives through the city. By creating an interesting linear park, it might encourage drivers to stop, get out of their car, go for a walk, and maybe spend some money. All of the connecting roads will go over the berm in order to preserve the structural integrity and emergency purpose of the berm. This plan keeps most of the major street connects but integrates the odd shaped blocks into the berm.

Blocks

This plan creates larger blocks. This provides some opportunities to create community spaces larger than the current 300 foot blocks. It also helps to incorporate the switch in grid and leaves room for complementary uses. For example, across from the community garden is space for new housing units at different scales that can use the garden space. They are also inside the berm making them better investments.

52 Division Street Brem: Pictoral, Preserve, and Play | Lisa Wall
BERM BENEFITS DAY-TO-DAY

In the short term, the berm can be a vehicle for a network of community gathering spaces. It is at the geographic center of Aberdeen, but it also has the opportunity to be a cultural center as well.

A new high school and community garden will invigorate the area and keep the park space active. It will encourage use of the green belt berm by multiple generations. It will also provide new infrastructure in the form of a new school and more local food options.

People want to live near parks, so by creating this linear park that is potentially part of a larger trail and park system we are creating a desire and also an option to live downtown. Residents can be near community members and open space, but also be protected from a tsunami. This will lead to increased land values and reinvestment in the downtown core. There is a potential for more economic investment in the town with the reduced flood insurance cost and more security from disasters.

With the berm there are opportunities for new housing options at different scales. Cottage housing or town houses could be alternative options to single family houses if more people would like to live nearer to the berm or on the east side of the berm in case of inundation from a tsunami.

This berm is part of a park and trail green belt system that can be used by residents and tourists alike for active and passive recreation.

BERM BENEFITS DURING THE DISASTER

In the long term, the berm will be the most useful for easing the impact of the tsunami. Even if the berm is only useful for one catastrophic event, it will have protected downtown Aberdeen. By creating a ten foot tall berm, the water will not be able to penetrate the downtown core of Aberdeen.

The trail at the top of the berm can be used as a trail towards higher ground at the time of the event. The sides of the berm will not be too steep in order for people to climb the berm. Every side will be a slope angle that is ADA compliant.

The pathway itself is high enough that, if need be, it can be used as a vertical evacuation structure at the time of the event. It will be a form that people can recognize because of its park-like distinctive appearance day or night.

The berm also provides options for other vertical evacuation structures to be built along side the berm. These structures could serve dual purposes. For example, the new school could also be built to be a safe building to be on top of during an earthquake and tsunami.
Downtown Waterfront Levee as Public Amenity | Zoe Wang

Aberdeen is located at the eastern end of Grays Harbor, near the mouth of the Chihah River and southwest of the Olympic Mountains. Grays Harbor is notable as the northernmost ria on the Pacific coast of North America because it has remained free of glaciers throughout the Quaternary due to unfavorable topography and warm temperatures. Waterfront here is mostly owned by the Port of Grays Harbor, a leading export port and the No. 1 seafood landing point for Washington State. The city was once prosperous with its great natural resources and stable economic development. However, it experiences economic decline and faces the threats from tsunami and flood these days. Solutions are called for to neutralize the city.

One way to deal with the issue is by establishing a park and levee system, along the Levee serves as a barrier, preventing water from pouring into downtown and residential areas; park aims to offer more opportunities for recreational and commercial uses, activating downtown development. With careful design and planning, the park and levee system could make Aberdeen a more resilient and vibrant city.
ASSETS AND ISSUES

Urban structures and nature resources are both assets and obstacles to the development of the city. Waterfront along Willamette and Chehalis river is left naturally developed, could be better utilized. Land adjacent to the waterfront is mainly for commercial and institutional uses, with some abandoned buildings at some places. There are some commercial development already exist along Willamette river. Railway is a big issue for the area. It cuts the connections between downtown and waterfront, leaving only two entrances, one of which goes under the flyover while the other one goes under the elevated rail lines.

The entrance and export way of the flyover impedes local traffic circulation. However, the heavy traffic brought by both flyover and bridges make the waterfront a gateway of the city. According to FEMA Data report, all of the area is under the threat of tsunami. In terms of flood, all downtown area and some land on the waterfront are below the water surface. The average flooding depth is less than 30 feet.

VISION

- Promote a resilient and vibrant Aberdeen

GOALS

- Prevent hazards from tsunami and floods
- Provide diverse waterfront activities
- Promote downtown development

STRATEGIES

A hybrid levee along the waterfront, preventing water from pouring in as well as serving as connections between downtown and waterfront, increasing the accessibility of the waterfront.

A multi-functional waterfront, divided into Data Zone, Commercial Zone, Water Zone, Activity Zone, and Natural Landscape Zone, facilitating diverse activities involving fishing, boating, and waterfront catering.

A pedestrian-friendly street system, both inside and outside the waterfront area, promoting bicycling and walking, connecting with evacuation routes, and activating the downtown development.
MULTIPLE ZONES

A multi-functional waterfront, divided into Gate Zone, Commercial Zone, Water Zone, Activity Zone, and Natural Landscape Zone, facilitating diverse activities involving fishing, boating, and waterfront catering.

The different functional of the five zones are determined by the water conditions and its relationship with surrounding areas. Each of them matched with different infrastructures.

Gate Zone consists of sculpture park, gallery, and waterfront restaurants; Commercial Zone is facilitated with waterfront restaurant, waterfront commerce, and 2nd floor decks; Water Zone has port, terraced area, and water promenade; Activity Zone includes gallery, terraced area, flexible plaza, water promenade and terrace; Natural Landscape Zone is characterized by grass slope, ecological island, water terraces and promenade.

MULTIPLE FUNCTIONS

A hybrid levee along the waterfront, preventing water from pouring in as well as serving as connections between downtown and waterfront, increasing the accessibility of the waterfront.

To protect the inside areas, levee should be around 10 feet in height at least. Stoopots are involved at the entrances of the two bridges. Railway should be elevated a little bit more at the crossing to the levee.

The structure of the levee could be adjusted to offer adaptivity to the functional use of waterfront. For Gate zone, the levee is merged into grass slope; for Commercial Zone, the levee is connected with two-story buildings and their decks; for Water Zone and Activity Zone, terraces are added to offer activity platform; for Natural Landscape Zone, levee is more naturally looked as grass slope.
Collage City: Intensifying and Revitalizing Downtown Aberdeen | Jingchen Liu |

This project focuses on the area that will be protected by proposed levees (see Figure 1-2 and Figure 1-3), which is mainly downtown Aberdeen. My vision of this project is to intensify and revitalize downtown Aberdeen by using “collage” as an approach.

According to our class’s vision and arrangement, in future, my research area will be responsible for accommodating relocated residents from west Aberdeen. It makes my project different from general urban infill or revitalization proposals, because I need to consider both where new residents come from and where they could be relocated. Therefore, I try to use “collage” as the core concept in this design, which means picking up elements in west Aberdeen and collage them into my research area (as can be better demonstrated in Figure 1-2). For downtown Aberdeen, it can also be intensified and revitalized through this “collage”.

To realize this concept, I am going to work on three steps, from large scale to small scale: 1) calculate maximum collage capacity in my research area; 2) arrange 3 redevelopment phases in future; 3) propose detailed urban design strategies.
MAXIMUM COLLAGE CAPACITY

Maximum collage capacity in my research area is calculated first based on current zoning’s regulation. All parcels with potential residential use are divided into two parts: major residential area and auxiliary residential area (See Figure 2-2 and Figure 2-3). These two area’s residential capacity are calculated separately.

According to calculations, research area’s maximum units capacity is 4122 units, and its maximum population capacity is 8202 people.
URBAN DESIGN STRATEGIES

CURRENT SITUATION (Figure 4-1)

Nine blocks in downtown Aberdeen are designated for proposing detailed urban design strategies. These blocks are chosen based on two reasons:

1. There are four historical buildings in this area, which can be sacred places for future’s community resilience (see Figure 4-3).

2. At the center of downtown, this area has potential to be redeveloped as a gathering place for both residents in Aberdeen and visitors from outside in the future.

By using “collapse” as an urban design approach, I am going to demonstrate how redevelopment could happen in general and also how specific properties can be redeveloped or adaptively reused.

PHASE 1 (Figure 4-2)

This phase will primarily focus on infilling current vacant land, and there are two options for developing these lands:

Option 1: Redevelop current vacant land into community’s pocket park or gathering space.

When choosing parcels for this development, we should try to make them evenly distributed in different blocks.

Option 2: Redevelop current vacant land for new mixed-use buildings, with retail, restaurant, apartment, small office and other uses.

When conducting this option, we should give higher priorities and intensify parcels at four corners of each block. Because these parcels have higher accessibility to people on streets, and they are more important to this area’s vitality in the future.

PHASE 2 & 3 (Figure 5-1)

After vacant land being infilled, parcels with lower and medium property value will be redeveloped. There are also two options for these parcels redevelopment.

Option 1: Conserve existing buildings and intensify their structure systems, and then build new buildings with separate structures above existing buildings.

Properties with historical value or considered as sacred places to community may use this option.

Option 2: Remove existing constructions and build new mixed-use buildings.

Properties with no specific value to community may use this option for redevelopment.

Adaptive use of parking lots: Figure 5-2 and 5-3.
From Resort to Refuge: Uphill Relocation Possibilities | Colin Poff

A tsunami caused by a Cascadia subduction zone earthquake could potentially lead to the temporary or permanent displacement of Aberdeen residents. In such an event, the need for relocation is a given. However, thinking about relocation now can be a resilient strategy for the City of Aberdeen by meeting current needs and simultaneously preparing for relief in the immediate aftermath of a disaster, and permanent residence in this new area.

A current evacuation and gathering area north of Gray's Harbor Community Hospital is one potential site that is suitable for uphill development. This section of the report illustrates the sites capacity, design concepts, and readiness to other proposed projects (such as Fry Creek daylighting and a regional nature trail network). It also discusses how the site can adapt to accommodate people in time of crisis.

**POSSIBILITIES FOR RELOCATION:**

1. Area could have capacity to assist temporarily displaced in the event of tsunami or flooding
2. Innovative design outside of flood and tsunami prone areas could attract new investment
3. Duplication or relocation of city infrastructure and assets would increase resiliency
4. Careful site planning could accommodate a variety of models of near-term development, as well as adaptable enough to be a long-term resettlement option.
SCHEMATIC DESIGN

SITE ECOLOGY: The natural conditions on the site pose some challenges, as well as opportunities. Aberdeen receives 84 inches of rainfall every year, creating the need for storm water management strategies. The wet conditions have caused standstills in the area adjacent to the site. The site ecology diagram below shows steep slopes, which development will need to avoid. However, there is a large flat area suitable for dense building. The steep slopes are also a benefit, as they provide views of the city below, and the streams that they support can be a public amenity, as they are located in the area that used to be the site. The site layout is shown in the site ecology diagram. The site contains a large open space, which connects the steep ravines and streams with trails, and orientates the development toward the great natural surroundings.

PUBLIC AND PRIVATE: This diagram shows "districts" on the site. The darkest area is a central area near Basich Boulevard, and it is a gateway to the site. Retail, commercial, and civic uses can be clustered here to service the site as well as the surrounding area, and would be a highly public area. The medium sized area mimics the green space corridor shown in the site ecology diagram. The corridor connects regional trails, public parks, and wooded areas, and acts as a public amenity and connection with some more exclusive uses for residents. The lightest shade shows more private areas, but still well connected with the surrounding context, where different housing types can be located.

THE EXPERIENCE: The final diagram shows the overall experience of the site with connections, nodes, and landmarks. Vehicular circulation hierarchy is shown in black. The local and regional paths shown in red are for biking and walking and interact with open space on the site. The major node of the site would be along Basich Boulevard, where mixed use activity is most intense, and other nodes are made up of public, and semi-public parks. Landmarks include a multi-functional building near the entrance, a municipal service building, an outdoor education center, and a view tower. Surrounding open space corridors lead to bike paths, other regional interurban mountain bike trails, open space corridors, walk/biking paths mixed with public space.

NEAR-TERM DEVELOPMENT

The relocation site lends itself to many possibilities beyond just raffage. A large area is a public, wooded location with access to recreation, close proximity to Grays Harbor Hospital, and a short trip to Aberdeen's historic downtown. In the near term, the site could be best used to attract new markets, as well as existing residents to this part of Aberdeen. There is also a strong case to be made for connecting this development with recreation; open space corridors, new commercial uses, educational services, civic buildings, and relocation of municipal services. The site plan on the right shows one conceptual build out of the relocation site. It has two main purposes, to show the full capacity of the site, and to show potential programming and amenities.

A GROWING MARKET: Most resorts in the western coast of Washington and Oregon are built on sandy sites and don't experience forested landscapes and a full variety of recreational opportunities that the region has to offer. The compact, new urban development pattern is in demand, but is short supply. An innovative design such as this can attract a new housing market in Aberdeen, that offers affordable permanent dwellings, as well as multiple options for daily and weekly rentals. The success of nearby resort communities on the coast signify a possible latent demand for innovative and coherent neighborhood development in Aberdeen. This site could be the location for new and existing residents, ecotourism, outdoor education, and more.

SITE LAYOUT: The design of this site is largely based on design precedents shown on the next page, as well as local context. It includes a variety of open space typologies, such as large community parks, semi-private shared courtyards, and an integrated open space trail system. Long, narrow lot sizes (around 30x40) and a grid/crunilinm hybrid street network support a walkable community with homes built to fit lines and atway access to parks. Design is sensitive to steep slopes, and private lots maximize views at high elevations, while a public and visible mixed-use area is concentrated near Basich Boulevard.

SITEx PHOTOs

- An old rugged road cuts through the site and can be covered by new pedestrian boulevard.
- During heavy rains, open space areas such as this can turn into gardens that utilize rainwater collection and other water-sensitive features.
- Near Basich Boulevard is a small area for commercial and civic uses, while the wooded areas to the west are better for residential use.

AMENITIES FOR RESORT:
- Integrated local and regional bike/walking paths as well as mountain biking trail system and bike shop.
- Community Garden
- Seasonal retail
- Views
- Public Parks with sports courts and semi-private parks
- Bed and Breakfast
- View Tower Structure
- Aberdeen lodge w/ private event space, bistros, and rental office.

PUBLIC USE OF ON-SITE AMENITIES:
- Commercial uses near main arterials, such as community bike rental/repair shop.
- Aberdeen lodge with multifunctional space.
- Regional and local bike/walking paths through open space corridors.
- Outdoor education center used for field trips to pro motte hands on learning about Aberdeen's ecology, timber industry history, recreation, and more.
- Municipal Service Building. Fire and Police service duplicated until outside of inundation area. Also serves as additional storage place for emergency supplies.
DESIGN PRECEDENTS

The conceptual site plan could include many possibilities. The developments described below exemplify innovative and sustainable elements that would be appropriate in an uphill location area in Aberdeen. These elements include their site layout, housing types, sustainable design features, open space, and overall programming. The three examples are built in a similar wet and hilly western Washington landscape. The building typology to the right are small to show how an area can be dense and walkable, but diverse enough to support many different preferences.

All of these examples illustrate low impact design principles. Low impact design includes techniques for storm water management, natural infrastructure, and minimizing paved surfaces to minimize flood risk while promoting sustainability. Along with that, these design features double as amenities.

SEABROOK, WA
• A growing development only 30 miles from Aberdeen built in the new urbanist style.
• 280 privately owned homes, with half designated as cottage rentals.
• Resort amenities attract temporary and seasonal residents, but the percent age of permanent residents is expected to grow as it becomes more self-sufficient.
• Dense, walkable design in a heavily wooded environment (similar to sites in Aberdeen).
• Permeable surface along streets consisting of sea shells absorbed storm water and is a unique, attractive feature.
• Storm water is discharged into rain gardens, or retained behind houses.

“ISLANDWOOD,” BAINBRIDGE ISLAND, WA
• 255 acre outdoor learning center to foster stewardship of natural environment.
• Multipurpose event center houses weddings, dining, retreats, adult education and lodging.
• Numerous sustainable features such as roof rainwater reuse, locally sourced building materials, natural ventilation, and solar power.

DANIELSON GRVE., KIRKLAND, WA
• Lot sizes between 2,400 and 3,000 square feet.
• Clustered housing to preserve existing old growth trees and native vegetation.
• Cottage housing types surrounding shared semi-private courtyard (shown in building typology above.)

THE REFUGE

Because of previous experiences with flooding in Aberdeen, it is not difficult to imagine a scenario where the low-lying west end is covered in water. In the event of a cascading subduction earthquake, subsidence of the land and water rushing in from a tsunami would cause long-term inundation and cause residents to be temporarily, or even permanently displaced. Because of this, a resilient strategy would include imagining the possibility for reuse of uphill development in a time of crisis. The site plan described in the previous pages does not only provide amenities, but also supports adaptive reuse. The important aspects of adaptability are in the overall form of the neighborhood, as well as the changing functions of the land uses and buildings. This section describes how the amenities listed on page 3 can be imagined as something different both as providing relief during a disaster, but also evolving into a viable, permanent residence in the following years.

PREPAREDNESS AND IMMEDIATE RELIEF

Uphill development can be a place for infrastructure and services to be duplicated. This will create a better preparedness for the city as a whole to assist during a crisis, and to resume normal functions afterwards. Because this area is already on major evacuation routes, it serves as a good option for a gathering area that provides comfort and relief for evacuees. The area is flat compared to its surroundings, making it safe from landslides that commonly happen in Aberdeen and would be possible during shaking. Currently existing on the site are uses that could serve during a major evacuation, such as a large cleared field exists along the Basich Boulevard, which could act as a gathering space. Nearby is Cities Harbor Community Hospital, a hospital that can provide medical assistance. To the north are water storage tanks. Important city services that are currently in inundation area could be reproduced on this site, such as fire and police services. These buildings could also provide storage of emergency supplies and food, as well as backup power sources. New uses in the development, such as a community garden, could provide a source for fresh food.

A variety of temporary housing would be needed to house displaced people, appropriate for families, the elderly, and other groups. The resort site plan shown earlier features an inn that could house many people for a short period of time. Civic buildings such as the Aberdeen lodge could also be converted into shelter, and temporary rental units would likely be vacant and available for use. Cluster housing, such as the typology shown in the last page, may be appropriate as a temporary shelter center. A community workshop on February 11, 2016 elucidated the fact that a disaster could create the need for Aberdeen residents to be self-sufficient for weeks or months, so a relocation site will need to have infrastructure to support that reality. In addition to emergency supplies and services, adaptable housing creates needed safe and sanitary housing that has not been present in many post-disaster scenarios. Thoughtful site planning can encourage social interaction and perpetuate the ethic of helping neighbors that has long existed in Aberdeen.

RESETTLEMENT

The reality is that a tsunami could cause long-term displacement for many residents. The challenge would then be for facilities, services and amenities to reach a level that meets residents needs. To create a community that incorporates those needs, Aberdeen’s assets and values as well as local culture, it would take a community-driven vision. The site plan above is just one of many possible layouts, but some long term adaptation strategies for this site could be translated to a similar site. For example, what is a small commercial area in the plan, consisting of boutiques, seasonal shops, could intensify into a mixed-use center. In this center, local business could find support and help build the economic base needed for long-term recovery. As local retailers begin to increase, and other everyday need providers are established, the percentage of permanent residents would be likely to increase. The Aberdeen lodge, which is a proposed multi-functional public building in the site plan housing private events, a bistro, and a rental office, could evolve into a fundamental civic center. Renting out the outdoor education center could incorporate its former purpose with a new use as a fully functional school. While the site is currently programmed for a more temporary, resort community, it is well connected to the existing Aberdeen community. A series of converted logging roads provide mountain biking recreation or bike/pedestrian access to the downtown area. Open spaces which is primarily used by resort guests could become more public, and their immediate connection to the surrounding wooded landscape could create a strong connection to Aberdeen’s existing identity.

[Image of people standing outside a building with the words “Aberdeen flooding during the 2016 flood. This site has many values for neighborhoods throughout the area. Uphill development should be designed in a way to encourage and accommodate this type of community-based resilience.” Source: Jesse Poteat - Historical Collection.]

Urban Design for Coasted Community Resilience in Aberdeen, WA | Winter 2016
CONCLUSION
The National Oceanic and Atmospheric Administration (NOAA) describes the resilience process in 5 steps: identify the problem, determine liabilities, investigate options, evaluate risks and costs, and take action. However, resiliency planning in Aberdeen offers an opportunity to think more creatively and holistically than what is offered in that process, and this is exemplified throughout the proposals in this report. The relocation possibilities identified in this section present not just the potential to make Aberdeen safer, but to add vitality as well. The conceptual site plan illustrates new development patterns that can attract existing residents, as well as new markets. The site can programming benefits the public as a whole, and can make Aberdeen more resilient by offering outdoor education programs, and relocation of municipal services. Finally, the site is adaptable to the needs of immediately displaced residents in the immediate aftermath of a crisis, and to evolve into a permanent, resilient and sustainable development in the long term. A community-driven vision for the future should include consideration of uphill development. Out of the inundation area, it offers potential for redundancy of infrastructure and services, new uses that connect people with Aberdeen’s wooded landscape, innovative new development patterns, and self-sufficiency in the event of a disaster.
VULNERABILITY AND THREATS

West Aberdeen sits on the low and plain lands and suffer from flooding annually caused by heavy storm in the rain season. The inundated area can be up to 5-6 feet under water, leading to great private and public property losses. Moreover, because of subsidence after a GSA earthquake, it is 60% possible that the area will be inundated during high tide. The depth of water ranges from 3-10 feet depending on the magnitude of this earthquake. However, houses, streets, and public spaces in West Aberdeen are not fully designed to face all these everyday and future risks: regular flooding, earthquake, tsunami, and subsidence.

ASSETS AND OPPORTUNITIES

West Aberdeen is home to over 1200 households and many hearted places, such as local businesses, parks, schools, and churches. These places are mostly clustered along 105th, while single-family homes spread south to the Port. The residents are no strangers to flooding. They have helped each other out and cleaned up after yet another storm. There is great opportunity for West Aberdeen to recall their nautical spirit and rethink how their neighborhood can adapt to future changes through self-generated actions. Moreover, some flood-proofing projects will alleviate flood insurance burden, leading to opportunity to reinvent the neighborhood.

INTERVENTIONS AND PHASES

Flood-accommodating neighborhood design is a strategy to better prepare for the everyday emergency of flooding, the risk of major earthquake and tsunami, and the new normal that would change the landscape and lifestyle of West Aberdeen. The general concept is that by adapting to more regular and familiar disaster scenario, residents may start to provide support and redesign their neighborhood, so that there is opportunity to recover from disasters in the future. For now and the future, the actions taken should benefit the built environment improvement and social relationships enhancement of the neighborhood, and be feasible and promising economic wise.

Based on research and case studies, a series of interventions are selected. These interventions are adaptable to West Aberdeen either in a short term or long term. The main focus is on the built environment improvement, but with evaluations on the costs, time spent, flexibility, and effectiveness. The 17 interventions are grouped into two, serving respectively the adaptation to everyday emergency and the recovery to the new normal.

The timeline of flood-accommodating neighborhood design is divided in to four phases. Phase 1 & 2 show how West Aberdeen can gradually adapt to a neighborhood better prepared for regular flooding, what might the neighborhood be like if certain interventions are applied where suitable. Phase 3 & 4 show how the landscape of West Aberdeen would change, and how it may recover from disaster based on the assets from previous phases.
**PHASE 1:** Short-term adaptation to regular flooding and future risks

In this phase, the Fry Creek wetland restoration project and the Division Street levee project have started. There are bridges connecting east-west traffic. Vertical evacuation facilities (I-20) will be built adjacent to the projects. Investments to elevate buildings (I-02) or build new elevated buildings are encouraged along the 101 commercial corridor and the levee. The buildings can have mixed uses (retail, office, or parking on the first floor, with living spaces above) and use waterproof materials and furniture on the first floor. For other part of West Aberdeen, residents may choose to abandon their properties with compensation and move to uphill and downtown area (I-01). The vacant lands can be acquired by public sectors to build floodable parks or gardens for local agriculture (I-08). For residents who decide to stay, small-scale and incremental interventions can be adopted to their property to adapt to regular floods, such as rooftop water retention (I-05) and dry flood proofing (I-03).

**PHASE 2:** Long-term adaptation to regular flooding and future risks

Interventions adopted in Phase 1 are still applicable in Phase 2. The bridge connecting east-west traffic on 101 will be extended to better prepare for regular floods. More houses will be adapted into elevated houses (I-02), or even into new terraces (I-09) that can survive earthquake shaking and tsunami waves when people have enough money and confident to invest. Meanwhile, more houses will adopt the incremental changes to their properties (I-03 and I-05). In addition, emphasis can be placed on reengineering streets into stormwater retention infrastructures (I-06). The axle system in West Aberdeen can be turned into green infrastructures as well (I-07). Compared to phase 1, the Fry Creek estuarial wetland will expand to achieve better performance in stormwater management. As a result, more residents will be moving out of West Aberdeen. If residents living within the wetland area do not want to move, they can rebuild their houses into amphibious ones (I-04).

**PHASE 3:** Short-term recovery responding to major CSE earthquake

After a major CSE earthquake and tsunami have struck West Aberdeen, the most possible scenario is that most buildings are destroyed and will be in water for most time of the day because of subsidence. Residents may choose to move to uphill and downtown areas (I-01). However, the vertical evacuation facilities and buildings that are elevated or reinforced will survive. The survived buildings can be adapted to new uses (I-05), leaving first floor vacant because there be water most of the time. In Phase 3, the bridge on 101 can be extended to connect downtown and Hoquiam (I-02). Based on this bridge, by moving first floor businesses to the bridge level (I-01), the 101 commercial corridor can be brought to life in the long run. New bridge can also be built based on the evacuation route. Jetties can be built as well to connect survived buildings to bridges and the levee, or in places that are identified as potential area for economic recovery.

**PHASE 4:** Long-term recovery to new normal

This a long-term recovery process that will not only involve rebuilding of the physical environment, but also that of social networks and economic vitality. The survived and adapted buildings (I-01), and the bridges and jetties (I-02) provide opportunities to rebuild neighborhood and social relationship with a different form. The new water-based developments can incorporate several forms of living with the water, such as floating houses, amphibious houses, and houses that stand free of the water on mounds, levee or other otherwise situations (I-03). Based on the floating neighborhood, there can be opportunities of economic recovery utilizing the new geography and landscape for tourism. The new neighborhood can provide accommodation for tourists coming for leisure, sport fishing and recreational racoon clamming (I-06, I-07, I-08). Besides tourism, there can be water-based light industry development adjacent to the Port (I-04).
FEASIBILITY

The images to the left show the evolution of urban landscaping and how different interventions can be applied to sites. However, they are not deterministic images of future West Aberdeen, but one alternative as a result of certain choices made by individuals and the community. There are more questions to ask before taking action. The interventions should be further evaluated by cost-benefit analysis, availability of technology, and community discussion. There should also be analyses on how these implementations would need adjustment of code and plan. It should also be taken into consideration what policies would encourage such self-generated improvement by the residents, and if there is funding resources available. The purpose of these analyses and consideration is to find out the low hanging fruits that are more acceptable and cost less to implement. Moreover, for the other interventions, under what circumstances will they be feasible to implement.

The scenario of regular flooding is more familiar to West Aberdeen residents, while how a CSL earthquake and tsunami would change the neighborhood is unknown. By dealing with the worst case scenario, residents can start to imagine what if it is possible to revolve West Aberdeen on the water. “Living with water” provides one possible vision where the relationship between water and the neighborhood is reconciled, and where there is an opportunity of economic recovery. However, this is not the only vision that is possible. By asking more questions about the future, there will be more thinking about what are the existing assets and how to create more assets to support the future.
Appendix B- Workshop Materials

Coastal Resilience Workshop Flyer

COASTAL RESILIENCE WORKSHOP
CITY OF ABERDEEN
COMMUNITY DEVELOPMENT
AND
THE UNIVERSITY OF WASHINGTON
FEB 11, 2016
6 PM TO 9 PM
ROTTERY LOG PAVILION
COMMUNITY OUT REACH MEETING
WITH ABERDEEN STAKEHOLDERS,
LOCAL OFFICIALS, BUSINESS
OWNERS AND RESIDENTS

MAKE A DIFFERENCE
JOIN US FOR A WORKSHOP CREATING A PLAN.....
RSVP: RENEE REYNOLDS - reynolds@ aberdeenwa.gov

The staff and students of
URBDP 508 B (Advanced
Planning Studio) taught by
Associate Professor Daniel
Abramson at the University
of Washington will facilitate
a 3-hour community outreach

resilience is the capacity of
the community to maintain
function after a shock or
disturbance. State and
county emergency
managers are interested to
know how local communities

The point of contact between the students and staff of
the UW studio is the City of Aberdeen’s Director of
Community Development, Lisa Scott. In consultation
with UW faculty, Lisa reached out to stakeholders, city
council and community members to invite them to
participate.

The community meeting will be organized into small-group
discussions, allowing comparison of how stakeholders
approach hazard mitigation and resilience in community

meeting with stakeholders,
local officials and residents
of Aberdeen Washington,
to discuss and map
community assets and
values, and scenarios of
Cascadia Subduction Zone
(CSZ) earthquake and
tsunami hazards, to inform
Aberdeen’s planning for
resilience and conducting
research on new methods
of conducting such
planning. Community

can use new models of
earthquake and tsunami
hazards for immediate life
safety as well as long-term
land use planning. Students
will use the information
generated in the meeting to
inform their own attempts at
design and policy strategy
which they will present to
community leaders at the
end of the quarter.
M9 Mapping Workshop Syllabus

UW M9 Project Student Workshop: Mapping Hazard Information with uncertainties
September 1 - September 4, 2015
Data Science Studio, Physics Astronomy Tower, 6th Floor, University of Washington Seattle
UW M9 Project (NSF Grant 1331412)
Lead instructors: D. Abramson, A. Bostrom, F. Gonzalez, R. LeVeque

Background: This workshop for M9 graduate students is part of an NSF-funded research project (M9) on Cascadia subduction zone (CSZ) events and related hazards. The vision of the M9 project is to reduce the catastrophic potential of a CSZ Magnitude 9 (M9) event through integrated research advances in prediction, warning and adaptive planning across the social, built and natural environments. Specifically, M9 research aims to advance hazard sciences by moving away from generalized scenarios toward probabilistic predictions of M9 seismic events and the subsequent hazards, with the objective of integrating these into community resilience planning and advancing the state of earthquake early warning systems. M9 Cascadia earthquakes provide an integrative focus for interdisciplinary hazards and risk research that is relevant to a broad range of hazards and extreme events. This interdisciplinary endeavor also informs the structure of the workshop, which builds on the disciplinary expertise of the students to support team problem solving.

The workshop aims to begin to engage M9 graduate students in interdisciplinary research relevant for the development of maps for community planning that convey probabilistic hazard information. The workshop will include an introduction to the development of probabilistic models of tsunami and other earthquake-related hazards, and to scientific methods of testing the applicability of those models and their products to the development of maps for planning for community resilience. Maps of tsunami inundation zones are already an important element of community emergency preparedness and response planning. However, these maps are simplified, deterministic representations of hazards that are best understood scientifically as non-linear, probabilistic phenomena that are inherently uncertain in their outcomes. Risk analysts and scientists have begun developing Probabilistic Tsunami Hazard Assessment (PTHA), which from a geoscience perspective will support the production of more complete, transparent, and thus honest and useful maps and other hazard representations, but there is little to no evidence regarding whether PTHA products—i.e. probabilistic representations—are ready for operational applications. To date there has been little empirical study of how different stakeholders—e.g. emergency managers, planners, the public at large, or even scientists from different disciplines—might understand and use representations of probabilities and uncertainties in various kinds of hazard maps, especially for rare events such as tsunamis. For more frequent events (e.g., storms or icing) some research shows that communicating uncertainty information visually can reduce the quality of decisions, while other research suggests that conveying uncertainty information can be helpful for decision-making. This workshop will contribute to the small body of research on the effects of representing probability and uncertainty information in maps, especially for tsunami hazards.

Goals: The immediate goals of the workshop are to:

a. Introduce students to research on the representation and interpretation of probability and uncertainty information on maps
b. Teach the students basic PTHA concepts that are needed to develop candidate hazard maps that represent uncertainty,
c. Explore different ways of representing probability and uncertainty information about tsunami hazards on maps,
d. Develop and pilot test a format for testing those candidate maps in other situations, for example in community planning meetings.

Ultimately, the goal is to derive deeper insight on how to communicate the best scientific knowledge (including probability and uncertainty information) so that communities can better plan for hazardous events. While “best” and “better” are moving targets, we will proceed on the assumption that individuals and groups need to be able to make decisions and act on information they have now, even as they know that the best information will change, and that the specifics of some phenomena are inherently unpredictable. Part of our goal, therefore, is to enhance public understanding of the evolutionary nature of hazards science,
and to foster a higher level of trust in scientific knowledge and comfort with probabilities and uncertainty that can improve decision-making.

Activities: M9 faculty and M9 stakeholders (including state officials John Schelling and Tim Walsh) will contribute short lectures and be available for Q&A. The purpose of this workshop will be to provide a transdisciplinary educational and research experience for the M9 students, in which they will, as a team:

- Develop candidate probabilistic tsunami hazard maps
- Design experiments to assess the utility of the candidate maps
- Conduct an initial evaluation of the candidate hazard maps.

Workshop Agenda

Prior to workshop: Please familiarize yourselves with the Gonzalez et al. Crescent City report sections, and the National Tsunami Hazard Mitigation Program guidance document on evacuation mapping before the workshop.

Day 1, September 1st (4 hours) 10am to 2pm, including lunch and teamwork

- 10am to 10:30am: Introductions, workshop overview, purpose and goals. (John Vidale, all)
- 10:30am to 11:15am: Existing tsunami hazard maps, how maps are produced and used. What would you like to see in the next generation of hazard maps? (Tim Walsh, John Schelling)
- 11:15am to 12pm: Overview and summary of PTHA: Crescent City results and different kinds of maps (Randy, Loyce, Frank)
- 12pm to 12:10pm: Break
- 12:10pm to 12:45pm: Discussion over lunch (lunch will be brought in) of current and future maps of tsunami hazard risk
- 12:45pm-2pm: Hands-on notebook work (Randy), Tsunami modeling issues; map construction (Randy, Frank)

Teamwork: Read MacEachren et al. 2012, Joslyn and LeClerc 2013, Bostrom et al. 2008 and Tanaka et al. 2009 for the September 2nd session. If you have time, the additional papers will be helpful as well. For each paper, please identify a couple of you to take the lead on preparing questions and discussion points.

Day 2, September 2nd (2.5 hours) 10am to 12:30pm, followed by lunch (brought in) and teamwork

- 10am to 10:30am: Map design, designing evaluations of risk communications – criteria, candidate experimental and survey designs (Ann)
- 10:30am to 11am: Community context, effects of de-emphasizing boundaries (Dan)
- 11am to 11:30am: Representation of uncertainty in decision making under uncertainty (Susan Joslyn)
- 11:30am to 12pm: Visualizing risk and uncertainty (Jessica Hullman)
- 12pm to 12:15pm: Break
- 12:15pm to 1pm: Lunch discussion of ideas for map representations of risk and uncertainty, including MacEachren’s paper, different approaches and possible future products; Vulnerability maps, diverse types of risk maps.

1pm to 2pm Teamwork: Discuss additional readings, design three candidate maps and propose a map evaluation scheme (Gould Hall or Data Science Studio) [Faculty will prepare this session by discussing some map production approaches and providing materials]
Day 3 September 3\textsuperscript{rd} (including lunch, which will be brought in)

- Teamwork to develop maps
  Teamwork: develop and refine candidate maps, conduct and analyze preliminary evaluation (possibly as an online voluntary exercise for M9 project members and others at UW)

Day 4 September 4\textsuperscript{th} (2 hours) Note earlier start and finish: 9am to 11am closing session

- Team presentation of proposed mapping approaches, proposed evaluation scheme and results of any preliminary evaluation
- Discussants: Michael Lindell and Ian Miller
- Discussion of follow-up (all) and adjourn

Readings

To access the readings, go to https://catalog.tw.edu/go/post/conversation/aframson/391681/post/3163485/3163485

(*recommended optional reading) Abramson, D., L. Manzo and J. Hou. “From Ethnic Enclave to Multi-ethnic Translocal Community: Constructed Identities and Urban Design in Seattle’s Chinatown-International District,” Journal of Architectural and Planning Research, Vol. 23, No. 4 (Winter 2006): 341-360. (Read this article specifically to understand some implications of mapped boundaries for community planning; key point is in the 4th full paragraph on p. 354; just skim the rest of the article.)


Leveque, Randall, Jupyter notebooks. PLEASE NOTE: We plan to use SageMathCloud (SMC) to simplify doing some computing and plotting during the workshop, and to make it easy to distribute some files to everyone. You can create a free account on this cloud computing platform at: https://cloud.sagemath.com. It only takes a minute to create an account. If you do this and want to be added to the group who will receive materials, please email this info to Professor Leveque (rlj@uw.edu) before the workshop. He can then add you as a "student". This means a new "project" will appear on your SMC account with the relevant files. Projects are simply virtual machines running linux that you can log into and do anything you'd do on other linux machines, but more easily and through any web browser. For more info, see https://cloud.sagemath.com/help.


National Tsunami Hazard Mitigation Program guidance document on evacuation brochures. Please familiarize yourselves with this material before the workshop:


Participants, including guest speakers:

**UW graduate students working with M9 faculty**
Alicia Ahn
Peter Dunn
Michael Greenfield
Alex Grant
Nasser Marafi
Jacob Ortega-Girnich
Johnny Paige
Donusim Rim
Ian Stone
Mika Thompson
Andrew Winter

**UW Postdoctoral researchers**
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Erin Wirth-Moriarty

**UW Faculty and Researchers**
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Loyce Adams
Cecilia Aragon
Ann Bostrom
Frank Gonzalez
Jessica Hullman
Susan Joslyn
Randall Leveque
Michael Lindell
John Vidale

**Washington State Department of Natural Resources**
Recep (Ray) Cakir
Tim Walsh

**Washington Emergency Management Division**
John Schelling

**Washington Sea Grant**
Ian Miller
Protocol for Aberdeen Community Meeting

Draft Protocol for Aberdeen Community Meeting: February 11th, 2016

On Thursday February 11th, 2016 the staff and students of URBDP 508 B (Advanced Planning Studio) taught by Associate Professor Daniel Abramson at the University of Washington will facilitate a 3-hour community outreach meeting with stakeholders, local officials and residents of Aberdeen Washington, to discuss and map community assets and values, and scenarios of Cascadia Subduction Zone (CSZ) earthquake and tsunami hazards, to inform Aberdeen’s planning for resilience and conducting research on new methods of conducting such planning. Community resilience is the capacity of the community to maintain function after a shock or disturbance. State and county emergency managers are interested to know how local communities can use new models of earthquake and tsunami hazards for immediate life safety as well as long-term land use planning. Students will use the information generated in the meeting to inform their own attempts at design and policy strategy which they will present to community leaders at the end of the quarter.

The point of contact between the students and staff of the UW studio is the City of Aberdeen’s Director of Community Development, Lisa Scott. In consultation with UW faculty, Lisa reached out to stakeholders, city council and community members through mailings and face-to-face interactions to invite them to participate. The 24-32 participants are attending of their own accord and have expressed interest to be a part of these planning efforts, and comprise a diverse group of stakeholders representing different perspectives on the community. Some of the participants will hold elected positions, including the mayor and up to 12 members of the city council; local government staff from the school district, hospital, police and fire departments, and municipal water and sewage; business and community leaders including representatives of the Aberdeen Revitalization Movement, the Port of Grays Harbor, and the Aberdeen Historical Seaport Society; and independent residents and business owners.

The community meeting will be organized into small-group discussions, allowing comparison of how stakeholders approach hazard mitigation and resilience in community planning, depending on whether they are working with a single, deterministically represented scenario of tsunami hazard as opposed to a set of probabilistic scenarios, and also whether they are beginning their conversation with a consideration of community assets and values (sources of quality of life), or with a consideration of vulnerability and risk. Dependent variables of particular interest are the extent to which these different combinations of discussion conditions prompt participants to: (1) list more or fewer types of assets and values as important to community resilience; (2) imagine strategies that are either more risk-taking or more precautionary (i.e. involving multiple back-up plans, redundancy in the systems they would put in place, etc.); and (3) take positions that either reflect particular individual
interests with respect to the hazard, or reflect a desire for consensus among all community members.

Participating stakeholders will join one of four small groups, A, B, C and D, each to work with a different combination of these types of information and discussion sequences, as shown in the diagram below:

<table>
<thead>
<tr>
<th>HAZARD MAP REPRESENTATION TYPE:</th>
<th>SEQUENCE: Begin conversation by describing, mapping and listing sources of quality of life, before discussing hazard and vulnerability</th>
<th>SEQUENCE: Begin conversation by describing, mapping and listing hazard and vulnerability before discussing quality of life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deterministic (e.g. single scenario with a sharply bounded hazard area)</td>
<td>Group A</td>
<td>Group C</td>
</tr>
<tr>
<td>Probabilistic (e.g. multiple scenarios associated with different probabilities, represented by variously shaded area)</td>
<td>Group B</td>
<td>Group D</td>
</tr>
</tbody>
</table>

Each group will sit at its own table and be assisted by four UV students: 1 group dynamics facilitator, 1 mapping facilitator, and 2 observer note-takers. Group dynamics facilitators will be responsible primarily for keeping conversation flowing, within time, and on topic, and all participants in each group have opportunities to speak. Mapping facilitators will ensure that as many items mentioned by participants that have spatial/locational properties are mapped. Student observers will take notes with quotes from participants and observations regarding how and how often they talk about assets and values, risk, precaution and hazard, consensus or agreement versus their own differing or independent position, and expressions of uncertainty (with reference to coding scheme). Student observers will also note participants’ facial expressions, focus, and affect/emotion.

The meeting will consist of two or three rounds of discussion, depending on the different sequences outlined above, according to the draft agenda below:

| 6:00-6:30 | Introduction by Lisa Scott and UVW lead faculty Dan Abramson, outlining the background and objectives of the meeting as described in the first paragraph above. The introduction will be neutral with respect to the different kinds and |
sequence of information being used by the different groups. Participants grab pizza, and form into the four groups. (They will be pre-assigned, so that each group has a balanced number of elected officials, municipal staff with some expertise in emergency management, and other community stakeholders.)

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:30-7:00</td>
<td><strong>Round 1 Discussion</strong></td>
</tr>
<tr>
<td></td>
<td>In the first 5 minutes, student facilitators present to Groups A and B a brief definition of “quality of life” based on the Millennium Ecosystem Assessment, and explain the distinction between the goods and services necessary for quality of life (basic material, health, security, and good social relations), and the local providers of those goods and services. Groups A and B discuss three questions: $(1)$ What generally makes Aberdeen a good place to live? $(2)$ “What specific goods and services contribute to quality of life in general?” $(3)$ “What/who specifically in Aberdeen provides those goods and services?” To the extent these providers can be mapped, participants or student note-takers will mark them on maps. Non-mappable providers will just be listed on a chart. Facilitators encourage participants to be broad and inclusive in listing these providers, considering built, natural and socio-economic, but avoid</td>
</tr>
<tr>
<td></td>
<td>In the first 5 minutes, student facilitators present to Groups C and D a definition of “hazard”, “vulnerability” and “risk”, and a summary explanation of CSZ hazards facing the community, shown on maps (deterministic for Group C and probabilistic for Group D), and supplemented by analysis using FEMA’s HAZUS software and local data from the existing hazard mitigation plan. Groups C and D discuss three questions: $(1)$ “What would happen in Aberdeen during and after a CSZ earthquake and tsunami?” $(2)$ “What/who in Aberdeen would be at risk during a CSZ earthquake and tsunami?” $(3)$ “How would a CSZ earthquake and tsunami affect quality of life (as defined by basic material, health, security and good social relations) in Aberdeen?” To the extent that at-risk items (people and things) in Aberdeen can be mapped, participants or student note-takers will mark them on maps. Non-mappable risks will just be listed on a chart. For the last five minutes of the round, stakeholders select the 3-5 most important at-risk items.</td>
</tr>
</tbody>
</table>
suggested specific possible answers.
For the last five minutes, stakeholders select the 3-5 most important providers.

<table>
<thead>
<tr>
<th>7:00-7:30</th>
<th><strong>Round 2 Discussion</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>In the first 5 minutes, student facilitators present to Groups A and B a definition of “hazard”, “vulnerability” and “risk”, and a summary explanation of CSZ hazards facing the community, shown on maps (deterministic for Group C and probabilistic for Group D), and supplemented by analysis using FEMA’s HAZUS software and local data from the existing hazard mitigation plan. Groups A and B discuss “Immediately after a CSZ event, what/who would provide the goods and services you identified in the first round as contributing to quality of life? Which of the providers identified in Round 1 will be able or unable to withstand changes inflicted by the hazard, and which will enable the community to maintain its viability and identity through the changes?” As above, student facilitators list participants’ answers to this question on a chart, and map as many items as can be mapped. Participants are free to add any new goods and services to the initial list.</td>
<td></td>
</tr>
<tr>
<td>In the first 5 minutes, student facilitators present to Groups C and D a brief definition of “quality of life” based on the Millennium Ecosystem Assessment, and explain the distinction between the goods and services necessary for quality of life (basic material, health, security, and good social relations), and the local providers of those goods and services. Groups C and D discuss “Immediately after a CSZ event, what/who would provide the goods and services you need for quality of life? In addition to the providers identified in Round 1, what other providers will be able to withstand changes inflicted by the hazard, and which will enable the community to maintain its viability and identity through the changes?” As above, student facilitators list participants’ answers to this question on a chart, and map as many items as can be mapped. Participants are free to add any new goods and services to the initial list.</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Activity</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>7:30-8:00</td>
<td><strong>Round 3 Discussion</strong></td>
</tr>
<tr>
<td></td>
<td>All groups (separately) discuss &quot;In the months and years following a CSZ event, what/who from round 1 (column 2) and round 2 (column 3) provides the goods and services that would do ALL of the following: (1) best help the community adapt to the &quot;new normal&quot; and recover over the long term; (2) put the community in better position should another disruption occur; and (3) provide a better quality of life.&quot;</td>
</tr>
<tr>
<td>8:00-8:05</td>
<td><strong>Break</strong></td>
</tr>
<tr>
<td>8:05-8:40</td>
<td><strong>Report Back and Full Group Discussion</strong></td>
</tr>
<tr>
<td></td>
<td>Each group then elects a spokesperson to summarize for the whole gathering the results his/her group’s discussions in each round. The UW faculty explains to the whole gathering the different types of information and sequences of discussion each group worked with, and the rationale for dividing the activities in that way. The whole gathering then reflects on what was learned.</td>
</tr>
<tr>
<td>8:40-8:50</td>
<td>Students set up easels with posters of preliminarily researched potential design and policy strategies, while community participants fill out a questionnaire with questions as listed below.</td>
</tr>
<tr>
<td>8:50-9:00</td>
<td><strong>Community participants’ give feedback on posters by writing on post-it notes.</strong></td>
</tr>
<tr>
<td>9:00-10:00</td>
<td><strong>Community participants adjourn. Students stay to write up field notes on their group discussions, and go through their notes to clarify them.</strong></td>
</tr>
</tbody>
</table>

Please answer the Questions below using a 1 to 7 scale (1= not at all to 7= extremely). Provide further explanation where necessary.

1) How concerned are you about a Cascadia Subduction Zone earthquake and tsunami risk?

2) Did your concern about the CSZ and tsunami risk change after viewing the map[s]? In what way?

3) How much do you trust the information on the map[s] provided? Please explain.
4) What is your level of confidence in the accuracy of the map[s]?

Please select which of the two maps below you prefer and briefly explain your choice.
### Community Exercise Sheet: Asset-based

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset 1</td>
<td>Vulnerability 1</td>
<td>Value 1</td>
<td>Category 1</td>
</tr>
<tr>
<td>Asset 2</td>
<td>Vulnerability 2</td>
<td>Value 2</td>
<td>Category 2</td>
</tr>
<tr>
<td>Asset 3</td>
<td>Vulnerability 3</td>
<td>Value 3</td>
<td>Category 3</td>
</tr>
</tbody>
</table>

### Vulnerability-Based

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vulnerability 1</td>
<td>Probability 1</td>
<td>Impact 1</td>
<td>Score 1</td>
<td>Risk 1</td>
</tr>
<tr>
<td>Vulnerability 2</td>
<td>Probability 2</td>
<td>Impact 2</td>
<td>Score 2</td>
<td>Risk 2</td>
</tr>
<tr>
<td>Vulnerability 3</td>
<td>Probability 3</td>
<td>Impact 3</td>
<td>Score 3</td>
<td>Risk 3</td>
</tr>
</tbody>
</table>
As the note takers you are tasked with the job of capturing meaningful dialogue to obtain insight into how the community of Aberdeen uses earthquake and tsunami models for safety and long-term land use planning. You’re focus throughout the meeting will be the participants’ responses to the questions, body language and facial inflections indicating personal feelings (disagreement, discomfort, animated) and whether or not the participants converse with one another.

One of the first things you will note is which of the groups you are assigned during the meeting (A, B, C or D). In the table below I have identified the themes that you will be listening for throughout the discussion in the far left column. Examples of the keywords and phrases that you might hear are listed in the far right column as taken from our first visit to Aberdeen.

<table>
<thead>
<tr>
<th>Theme</th>
<th>What You’re looking for</th>
<th>Phrase/keyword</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk/Disaster/Hazard</td>
<td>Reference to Flooding/Earthquake/Damage</td>
<td>“If it happens…” “The Wishkah always floods.”</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>Aspects of event that are unknown</td>
<td>“They don't even know what will happen” “It’s impossible to know what will happen”</td>
</tr>
<tr>
<td>Probability</td>
<td>The chance or likelihood that something will happen</td>
<td>“Likely”, “unlikely”,</td>
</tr>
<tr>
<td>Recovery/Resilience</td>
<td>Positive references to actions or state of community after the storm</td>
<td>“After an earthquake..” “strong social networks” “we wouldn’t make it without…”</td>
</tr>
<tr>
<td>Loss</td>
<td>Destruction of social/built/natural capital</td>
<td>“destroyed” “damaged” “lose” “finished” “loss”</td>
</tr>
<tr>
<td>Assets</td>
<td>The providers/sources of goods/services that contribute to Quality of Life</td>
<td>“The port provides us with..” “Aberdeen Revitalization Movement is a great organization”</td>
</tr>
<tr>
<td>Values</td>
<td>What people consider important; what they consider to be a good life</td>
<td>“Strong community” “Family/neighborly ties” “wildlife…”</td>
</tr>
<tr>
<td>Preparation</td>
<td>reference to plans in the case of an event/disaster</td>
<td>“If it happens I will..” “evacuation route”</td>
</tr>
<tr>
<td>Precaution</td>
<td>Measures that take risk into account and avoid it</td>
<td>“I wouldn’t live there…” “This would be good in case of…”</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Trust</td>
<td>belief or disbelief in the contents of the maps or questioning of source credibility</td>
<td>“How do they know this will happen?” “Where did they get this information?”</td>
</tr>
<tr>
<td>Truth</td>
<td>Reference to helplessness or vulnerable aspects of the community in the instance of an event</td>
<td>“if the bridge goes out we will be on our own” “we are an island”</td>
</tr>
</tbody>
</table>

It will be helpful to organize your notes into separate columns (seen below) as well as also having a blank sheet handy for scratch notes that do not fit within the columns. Your notes should be broken up by rounds so that you will be able to tell the context the phrases were mentioned within without having to take the time to write it out. I want you to use a format that it most comfortable for you as the pace will be very fast. I have provided different ways that you can organize your notes but using some kind of table format will be the easiest. Notice how I try to keep rows separated by who said what and how they said it making sure not to line up phrases with someone else’s body language or vice versa. Doing this will make typing up your notes later much easier as you will better recall how the conversation flowed. The participants will be given codes to protect their identity but it would be helpful if you are able to note who is saying what and how they are saying it (are they talking about the bridges in a negative way? Do they mention the waterfront as a positive asset?). Using a simple (+) or (-) symbol is an easy way to record this. The numbers in parenthesis in the second table below are examples of how you might link responses with a stakeholder without the use of names.
<table>
<thead>
<tr>
<th>What was said?</th>
<th>How? (body language)</th>
<th>Did they talk with each other?</th>
</tr>
</thead>
<tbody>
<tr>
<td>we are not a producing area, we are a consuming area (=)</td>
<td>Crossed Arms</td>
<td>Side talk with neighbor</td>
</tr>
<tr>
<td>“Everyone gathers at the community center every week to check in” (+)</td>
<td>Shaking Head (-)</td>
<td>Another person agrees</td>
</tr>
<tr>
<td>A lot of people cannot access the upper region (-)</td>
<td>Nodding in Agreement</td>
<td>Looking to neighbor</td>
</tr>
<tr>
<td>“Don’t you think that would be the best route to take?” (+)</td>
<td></td>
<td>Looking around table for consensus</td>
</tr>
<tr>
<td>“We have the highest fundraising pop/capita” (+)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

You could also forgo the columns and use free style on blank paper to record using a system such as:

<table>
<thead>
<tr>
<th>What was said? Who said it? (Participants coded by group and number, e.g. A3)</th>
<th>Did they talk to someone else at the table?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 → “The hospital is protected on the hill” (+)</td>
<td>A1/C6 private convo / crossed arms, everyone responds with a nod in agreement</td>
</tr>
<tr>
<td>D3 → “we would be an island” (-)</td>
<td>frowning/shaking head</td>
</tr>
<tr>
<td>All --&gt;silence</td>
<td></td>
</tr>
<tr>
<td>B2/C4 → “bridges” (-)</td>
<td></td>
</tr>
</tbody>
</table>
Appendix C- Survey Materials

Aberdeen Community Meeting: February 11th 2016
Post Meeting Questionnaire

Please circle which discussion group you belonged to:  A  B  C  D

Please answer the Questions below using a 1 to 7 scale (1= not at all to 7= extremely) and providing further explanation where necessary.

1. How concerned were you before this workshop about the Cascadia Subduction Zone earthquake and tsunami risk? (please circle one)

   1 2 3 4 5 6 7

2. How concerned about the Cascadia Subduction Zone earthquake and tsunami risk are you now? (please circle one)

   1 2 3 4 5 6 7

Do you have any comments about how your concern about the CSZ and tsunami risk changed after viewing the hazard maps?

3. Please consider the main tsunami hazard map your group used in the workshop discussion; what is your level of confidence in the accuracy of the hazard maps (please circle one, where 1 is least confident and 7 is most confident)?

   1 2 3 4 5 6 7
Appendix D - Result Tables

Each of the Participants responses were separated according to a pre-determined set of themes to determine if different topics were discussed in the Asset-based groups versus the Hazard-based Groups. A snapshot of a larger table is separated along the theme and groups. Each page will display the Asset-based responses compared to the hazard-based responses.

A-B- Risk/Disaster

<table>
<thead>
<tr>
<th>Risk/Disaster</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Round 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Round 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

H-B-Risk/Disaster

<table>
<thead>
<tr>
<th>Risk/Disaster</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Round 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Round 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## A-B-Uncertainty

<table>
<thead>
<tr>
<th>Uncertainty</th>
<th>Round 1</th>
<th>Round 2</th>
<th>Round 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>&quot;What if the town is built on fill—the entire area—a lot of woodside fill and then timber fill? how do they know that one dot is different from another?&quot;</td>
<td>&quot;So the new normal is that undersea at high tide? If we going to say it's going to rebuild, is that possible?&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;I don’t know that (about electricity). The BPA lines come from north, not sure about the redundancy.&quot;</td>
<td>&quot;Access is going to be a huge issue for us. Are they going to take precedence on 1-5? Where do we fall in? Would FEMA say we are not going to help you rebuild? Looking at Japan—large concrete sea walls—maybe that’s a solution for us but if the ground is going to drop is that a feasible solution? That’s a question to all of us...&quot;</td>
</tr>
</tbody>
</table>
|             |         | "We don’t have anything on the hill. Refers to Japan and relocation of villages on hills. "Idk if we have that ability but it should be looked at and considered."
|             |         | "I need a reference point to envision where the water will be after an earthquake."
|             |         | "Idk how you plan for it. Doing the best we can until state and federal assets come in. All of our main utilities are in the inundation area."
|             |         | "What happens when they get up? There is nothing up there. It will have to rely on neighbors helping neighbors." |

## H-B-Uncertainty

<table>
<thead>
<tr>
<th>Uncertainty</th>
<th>Round 1</th>
<th>Round 2</th>
<th>Round 3</th>
</tr>
</thead>
</table>
|             |         | "How big is an event? It’s a 0.7?"
|             |         | "It’s interesting because you can go to a half a dozen different agencies and get a half a dozen different answers."
|             |         | "The port is one of the main economic drivers for the county—if we lose that "do they task the rights back on? "why would they?"
|             |         | "Whoever the president is would have to declare a national emergency right?"
|             |         | "I want to know the statistics of people who live and work in Aberdeen because a lot of people who work here do not live here. How do we deal with those transients?"
|             |         | "An event will affect everything from here to Olympia so when you talk about what to do afterwards, that’s pretty hard to figure out because it is a regional issue." |
### A-B-Probability

<table>
<thead>
<tr>
<th>Round</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All of our services in the inundation zone. Water treatment is north, it may stay intact but I do not know that.</td>
</tr>
<tr>
<td>2</td>
<td>“So if it’s dark people it is over your head? (yeah) huh, I’m glad I live up here [points to map].” “The fire station will probably not exist.” “The main electrical line comes in from Central park and Cosmopolis. We might have some electrical options.”</td>
</tr>
<tr>
<td>3</td>
<td>“Let’s say some of this remains, people might try to remain because there is dwelling there so we will have to think of how to service these people.” “If the medical survives it would be the key to repopulating if we lose it that would be the final blow.”</td>
</tr>
</tbody>
</table>

### H-B-Probability

<table>
<thead>
<tr>
<th>Round</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>“The 13.3 main office, their gear may be in the higher ground (according to blue map).” “Chances are [balloons] it could come down in an event or extreme snowing.” “The logging roads may be a way out once the lodges are gone which would lead up north. Some of them will not be accessible.” “Water storage tanks—never shed tarts—could possibly be a source of water after.”</td>
</tr>
<tr>
<td>2</td>
<td>“Brown shaking map [4/19/01] all this data is +/- 50% could be more could be less.” “The weather will play a role (water)” “Outhouses possibly [lost refuge], but they are all old brick buildings according to the shaking map will probably be heavily damaged.” “The railroad will be damaged—there is a lot of debate about the Port and how much of it will survive.”</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
### A-B- Recovery

<table>
<thead>
<tr>
<th>Round 1</th>
<th>Recovery</th>
</tr>
</thead>
</table>

| Round 2 | We can restart, build a town square. |

| Round 3 | New infrastructure at the port is now and should be seismically sound. Businesses and amenities will be what brings back the citizens. All existing infrastructure will not cease to exist. We are a deep water shipping port closest to the pacific rim, it will come back for that. |

| Round 3 | Is it an opportunity to start over [for us]? Build earthquake resistant structures. Vertical evacuation center, make everything shiny and new. You could say it's a rebirth. We have significant fire issues in older houses with shotty electrical work. Central Park might become the new center in SH. It has room for growth. It is actually one of the sites that we are looking at for the new transfer station...that may be the new Aberdeen. |

### H-B- Recovery

<table>
<thead>
<tr>
<th>Round 1</th>
<th>Recovery</th>
</tr>
</thead>
</table>

| Round 2 | The public works area—that will be important in recovery. |

| Round 3 | Area north of town is undeveloped. Housing development has lots set aside but none of it has been developed yet be the economy is horrible here. It is all really nice, really taxable property. But if there is nothing left it falls back on industry and maybe there will be residential for the workers. They do not have the continuity to rebuild. If we lose part of it, just like in FOLI, and they did not have a plan the government can just come and take it. If Aberdeen has a plan than maybe it will come back. Care 29 runs out of town—if you can restore water—would have a community. |

| Round 3 | These are state highways so the state would have to be involved in rebuilding some of the infrastructure. I could see the port rebuilding. (In the question) “would you rebuild in the same location?” If I lost my buildings in an earthquake I’m not sure I’d rebuild them. |

| Round 3 | Think they need better codes for where and what to build. Buildings should be more structurally sound. |
### A-B- Resilience

<table>
<thead>
<tr>
<th>Resilience</th>
<th>Round 1</th>
<th>Round 2</th>
<th>Round 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- "There is a sense of resiliency. People step forward—volunteers with ARM.
- The city of Aberdeen is bare bones, down to essential services. Volunteers make a difference in the Town."
- "[After the floods in 2016] we don’t have vacant homes because we act at a local level."

### H-B- Resilience & Loss

<table>
<thead>
<tr>
<th>Resilience</th>
<th>Round 1</th>
<th>Round 2</th>
<th>Round 3</th>
</tr>
</thead>
<tbody>
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</table>

- "Economic resilience because of the port and industries."

<table>
<thead>
<tr>
<th>Loss</th>
<th>Round 1</th>
<th>Round 2</th>
<th>Round 3</th>
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</thead>
<tbody>
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</table>

- "These are state highways so the state would have to be involved in rebuilding some of the infrastructure."

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### A-B - Loss & Asset/Values

<table>
<thead>
<tr>
<th>Round 1</th>
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<tbody>
<tr>
<td><strong>Loss</strong></td>
<td></td>
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<tr>
<td>Round 2</td>
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<tr>
<td>Round 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Assets/Values</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Round 1</td>
<td>Flat, lot’s of water access to the coast. Small town feel but it’s the biggest in the country, could own a bigger house for cheaper, good quality amenities (food, water, activities). Trails, kayaking, canoeing, healthcare hub, city own safety and security</td>
<td>&quot;Economic draw—got the city life but also the recreational life&quot; &quot;Quiet, Smaller city—less traffic—great place to retire The outdoors—great resources&quot; &quot;Medical Hub for the area&quot; &quot;Great Port—Infrastructure&quot;</td>
</tr>
<tr>
<td>Round 2</td>
<td></td>
<td></td>
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<tr>
<td>Round 3</td>
<td>&quot;There is a sense of resiliency—there is a lot of pride in the town. Volunteers make a difference in the town and people notice it.&quot; &quot;There is a sense of resiliency—there is a lot of pride in the town. Volunteers make a difference in the town and people notice it.&quot;</td>
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### H-B - Asset/Value

<table>
<thead>
<tr>
<th>Round 1</th>
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<tbody>
<tr>
<td><strong>Assets/Values</strong></td>
<td></td>
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<tr>
<td>Round 2</td>
<td></td>
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<tr>
<td>Round 3</td>
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</tbody>
</table>
### A-B- Preparation

<table>
<thead>
<tr>
<th>Round 1</th>
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<tbody>
<tr>
<td>“Chances are we will be on our own for a bit of time. Need to take time to educate people to get to higher ground.” “Survival kits for employees so that they can take care of themselves to help other people.” “St. Joseph may serve as an alternative hospital. Sam Benn park is an evacuation zone. College may serve as a triage center.”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Round 2</th>
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<tbody>
<tr>
<td>“I think the high school is elevated 20-30 feet and could provide an evacuation location. The hospital is in a safe area that would be an okay spot there.” “If you showed them this map everyone would agree that the hospital would be the gathering place for any kind of service.” “East campus and Sam Benn park that is an evacuation route so that could be an option.”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Round 3</th>
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<tbody>
<tr>
<td>“Saltair Park. The army has a plan for a big event and Saltair would be where the base is located.”</td>
</tr>
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</table>
### A-B- Precaution & Trust

<table>
<thead>
<tr>
<th>Precaution</th>
<th>Round 1</th>
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**Round 2**

"We are moving our operations out, replacement transformers, trying to consider where to put things that make the most sense. Once they're gone we won't have anything left."

"Everyone needs to have a 3-day kit, or more like 7-14 day kit, because much of it will be a matter of self-reliance. Because there is no way that city services can support 10,000 people."

**Round 3**

"We do have a plan for moving infrastructure. Long term plan is to move the main operation service center out of Aberdeen."

<table>
<thead>
<tr>
<th>Trust</th>
<th>Round 1</th>
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</table>

**Round 2**

"We were told you will not be able to move over the bridges or get to I-5. You have to assume all the relief efforts will go to population centers first and then us, maybe a month or so later."

### H-B- Precaution & Loss

<table>
<thead>
<tr>
<th>Precaution</th>
<th>Round 1</th>
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<tbody>
<tr>
<td></td>
<td>&quot;If we have some sort of catastrophic event the only way we can get to the hospital is over the river.&quot;</td>
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</table>

**Round 2**

"GH is looking at staging equipment out of inundation zone on high ground. Public works has a concrete building for generators, vehicles and any kind of rescue equipment we don't use everyday. They will hopefully be available during another disaster."

**Round 3**

"The departments have been trying to consider how to get equipment to a location it will actually be usable but for now almost all of it is in the low lying areas."

<table>
<thead>
<tr>
<th>Trust</th>
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**Round 2**

|       |         |   |

**Round 3**

|       |         |   |
### A-B- Vulnerability

| Round 1 | Vehicular (ambulances) are in the inundation zone. *We'd cease to exist.* "We would lose everything, there are a few places that do not show up on our critical areas map."
| Round 2 | "Ships are tied up at the terminal those could all be sitting in downtown Aberdeen."
| Round 3 |  |

### H-B- Vulnerability

| Round 1 | Pretty much everything would be vulnerable. *All of our businesses and services are within this red area, the port is within this red area. Everything except the infrastructure. Bridges are key to getting out, otherwise isolated. There is no alternative that don't exist within that red area.*
| Round 2 | "Treatment plant is definitely in the inundation zone.* *There is some likelihood it will not, does that give you confidence? This whole area is low elevation this whole area we use to be tidelands—sandblast and fill. We've got the worst red in the states.*
| Round 3 | "The bridge is vulnerable to collapse, the one that spans on it centers is no longer usable.*
|  | "There will be a lot of isolated regions that will not be able to have access to emergency supplies. There will be no electricity or refrigeration.*
|  | "Hospitals on top of hill—chance are it could come down in an event or extreme rain.*
|  | "There is no evacuation route if they do not have a bridge. The bridge always comes down and will most likely during an event.*
|  | "Concrete covered seawall—shaking they would be gone."

- [Image]
MacEachren Typologies (2005)

The following table outlines the nine typologies adapted from MacEachren (2005) which are discussed in the methodology section. Any response during the workshop that pertained specifically to the information of this map was organized into this table. The colors designate different groups: red, asset-based, deterministic information, green designates asset-based, probabilistic information, gold is Hazard-based Deterministic and purple is hazard-based, probabilistic. An extra row was added at the bottom to include a response mentioning the WeTable technology specifically.

<table>
<thead>
<tr>
<th>Survey Response- Group D</th>
<th>“I think it will be much worse that your map predicted many areas your map shows as minimally impacted are areas of poor soils and low elevations”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset-Based, Deterministic</td>
<td>“What of the town is built on fill--the entire area--a lot of woodside fill--and then timber fill  Showing the shaking map--questions “how do they know that one dot is different from another?”</td>
</tr>
<tr>
<td>Asset-Based, Deterministic</td>
<td>“Is this liquidation or liquefaction” --&gt; no, no, just the inundation zone --&gt; “Oh, inundation, okay”</td>
</tr>
<tr>
<td>Hazard-Based, Deterministic</td>
<td>“This must be an old map because it does not show any of the port infrastructure in here.”</td>
</tr>
<tr>
<td>Asset-Based, Probabilistic</td>
<td>“if we put in a dike...maybe thats a solution for us but if the ground is going to drop is that a feasible solution? Thats a question to all of you”</td>
</tr>
<tr>
<td>Asset-Based, Probabilistic</td>
<td>“Higher ground--dont know what kind of earthquake damage they might have”  “So the new normal map--does that mean that that's underwater at high tide?”</td>
</tr>
<tr>
<td>Hazard-Based, Probabilistic</td>
<td>“There is a fair amount of the town that will have mild damage due to shaking  All this data is +/- 30%--could be more could be less”</td>
</tr>
<tr>
<td>Hazard-Based, Probabilistic</td>
<td>“So these areas are 100% inundation zones and these areas are not?”  “Is that based on elevations or how the wave moves up the channel?”</td>
</tr>
<tr>
<td>Hazard-Based, Deterministic</td>
<td>&quot;What's the elevation at this point? Above sea level?&quot; [shows the DEM layer]  “So this is 11-9, is that what is represents”</td>
</tr>
<tr>
<td>Hazard-Based, Deterministic</td>
<td>“I dont think it would affect the high school’ → do you think it would withstand a tsunami Wave?”  “I think The high school is elevated 20-30 feet and could provide an evacuation location”</td>
</tr>
<tr>
<td>Survey Responses- Group B</td>
<td>impact a CSZ would/could have on Aberdeen. The exercise was very beneficial due to the probabilistic mapping showing the scientific modeling for subsidence and inundation.</td>
</tr>
<tr>
<td>Asset-Based, Probabilistic</td>
<td>“So if it’s dark purple it is over your head→ huh…(some laughter)”</td>
</tr>
<tr>
<td>Hazard-Based, Deterministic</td>
<td>“How big of an event?” “Like a 9.0?”</td>
</tr>
</tbody>
</table>
| Hazard-Based, Deterministic | “I want to know the statistics of people who live and/or work in Aberdeen because a lot of
<table>
<thead>
<tr>
<th>Consistency</th>
<th>Hazard-Based, Deterministic</th>
<th>“Would this area be affected or are you not considering that?” --we didn’t consider that</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lineage</td>
<td>Hazard-Based, Deterministic</td>
<td>“How big of an event is this predicated on? Like a 9.0? That’s the figures I’ve heard”</td>
</tr>
<tr>
<td></td>
<td>Hazard-Based, Deterministic</td>
<td>“So if this does happen we’re talking a, what, 1 in 300 year event?” “So like, what’s the risk?” “so that would get into a whole planning thing. Develop plans that you can create areas where basic necessities could be distributed”</td>
</tr>
<tr>
<td></td>
<td>Asset-Based, Probabilistic</td>
<td>“We’ve done a lot of outreach--we are a tsunami and stormready prepared city, we bring it up. I’m curious to know if we did a random poll if the citizens would be aware--“how do you get the word out?”</td>
</tr>
<tr>
<td></td>
<td>Hazard-Based, Deterministic</td>
<td>“An event will affect everything from here to Olympia so when you talk about what to do afterwards, that’s pretty hard to figure out because it is a regional issue.”</td>
</tr>
<tr>
<td></td>
<td>Hazard-Based, Deterministic</td>
<td>“Centered on this landscape here, in the event of an earthquake this size, will affect everything here to Olympia. It’s a regional issue and will be hard to figure out what to happen next.”</td>
</tr>
<tr>
<td>Currency</td>
<td>Hazard-Based, Deterministic</td>
<td>“The weather will play a role (winter time)” “Most likely if the event happens outside of work hours many workers won’t be there--won’t be able to access the town.”</td>
</tr>
<tr>
<td>Credibility</td>
<td>Survey Response-Group A</td>
<td>“I believe the maps are accurate based on the BAS and from what we have learned from world disasters Subjectivity Interrelatedness”</td>
</tr>
<tr>
<td>Subjectivity</td>
<td>Asset-Based, Probabilistic</td>
<td>“So if I were going to say “I’m going to fill and rebuild, is that possible?” I would say most of town is 1 ft underwater.”</td>
</tr>
<tr>
<td></td>
<td>Hazard-Based, Probabilistic</td>
<td>“there is a lot of debate about the Port and how much of it will survive”</td>
</tr>
<tr>
<td></td>
<td>Hazard-Based, Deterministic</td>
<td>“It’s interesting because you can go to a half a dozen different agencies and get a half a dozen different answers”</td>
</tr>
<tr>
<td>Interrelatedness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of WeTable</td>
<td>Asset-Based, Probabilistic</td>
<td>“Were we supposed to stay inside one area or if it’s on the map it’s fair game? --”it’s fair game “this map isn’t static, if you want to talk about the Wishkah we can go there. This is just the general framework but we want to talk about your community (whatever that entails)”</td>
</tr>
</tbody>
</table>