Threshold-Based Planning for Westport, Washington: a Case Study

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Abstract

As climate change increases sea-level rise and exacerbates natural hazard conditions, coastal flooding is becoming a more common-place hazard. Planning for this type of flood risk is challenging as it is expected but unpredictable in its timing, intensity, and magnitude. Mitigating flood risk by moving inland from the coast is not feasible for many communities as it ignores the complexities of community-coastal interactions. Using the city of Westport, Washington as a case study, the purpose of this thought experiment is to explore how cities with a strong sense-of-place can address flooding risks and the prospect of phased development through community-engaged planning practices. Though Westport has constructed Vertical Evacuation Structures (VES) to mitigate life safety risks posed by tsunamis, flooding damages from tidal, wave, and storm events have not been adequately addressed. These threats may necessitate either partial or full phased development of the Marina District to another location. However, the Marina District community lacks consensus on the causes of the threat, and actionable strategies to address flooding impacts. Our team proposes a three step process to initiate discussions and planning for future phased development needs: Engage, Envision, and Establish. This process should result in a comprehensive Threshold Planning Framework. Marina District business owners could use this plan for decision making when faced with increased instances of severe flooding. We expect that by engaging the business owners of Westport's Marina in long term development and flood adaptation goals they will feel more empowered and prepared during flood events. If effective, the Threshold Planning Framework would then be expanded to include the broader community of Westport.

Background

The Marina District in Westport, Washington is a collection of maritime businesses situated at the northernmost extent of Chehalis Point on the Pacific Coast. Westport's coastal geography and ocean access present inherent tradeoffs. Maritime focused businesses bolster Westport's economy, but ocean hazards also threaten these same businesses. The economy of Westport is fueled by the Marina Districts'

two ocean-based industries: fishing and tourism. Westport's climate is typical of coastal cities in Washington: fairly mild with precipitation averaging 76 inches per year, yet urban flooding is not a significant issue due to the high permeability of soils and adequate drainage of runoff to either side of the peninsula [1]. Additionally, riverine flooding does not pose significant risks to the marina because Westport is far from the mouth of the major rivers which drain into Grays Harbor. Instead, episodic hazards and chronic coastal flooding are primary concerns.

Tidal flooding, at current levels, has become normalized, and even incorporated into the tourist economy with king tide viewing platforms. However, chronic flooding is expected to pose problems as sea levels rise. In addition, rapid-onset, episodic hazards caused by earthquakes and tsunamis pose risks due to Westport's proximity to the Cascadia Subduction Zone. In the following sections we will introduce Westport's hazard background and elaborate upon our proposed Threshold Planning Framework as a solution to an uncertain future. Our closing remarks will briefly envisage the implementation of our proposals with local communities being empowered and inclusively engaged.

Rapid-Onset Hazards

Westport is vulnerable to two types of hazardous tsunamis; those caused by distant earthquakes along the Pacific Rim, and local tsunamis caused by earthquakes along the Cascadia Subduction Zone (CSZ) [2; 3]. Through Project Safe Haven, Westport has already mitigated much of the tsunami risk to life safety by building a Vertical Evacuation Structure (VES) at Ocosta Elementary School [2]. The city plans to build a second tower in the Marina District. These towers provide a place for people to take refuge during tsunamis, as they are taller than the predicted tsunami height. This added security could lead to more development interest in the Marina in the years to come, which would be both a welcome economic boost for the community and a complication to consider during risk mitigation efforts.

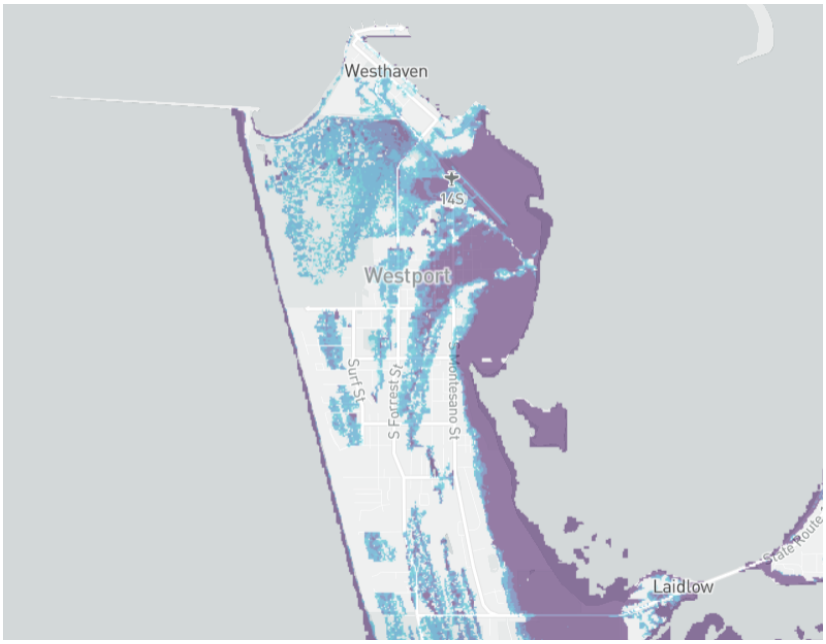

Fig 1. Map of Westport, Washington illustrating locations with a 0.2% chance of flooding this year. The shading indicates depth where the darkest purple displays roughly 3 ft deep flood water, and the lightest blue represents between 0 - 1 ft of flooding [Retrieved from: Flood Factor; 4].

Slow-Onset Hazards

Westport faces several chronic coastal flooding threats. King tides, storm surge, and normal wave action erode the coastline and damage infrastructure. These damages disrupt daily life and result in unplanned maintenance costs for businesses, homeowners, and the city. Climate change will exacerbate these impacts, as storms become more intense and more frequent, causing wave height and energy to increase [5; 6]. Westport's mean sea level is also predicted to rise by 0.85 - 2.5 feet by 2100 and will likely continue to rise over the following century (Figure 1) [5; 7]. This will raise overall coastal water levels, contribute to greater flooding, and may increase salinity of coastal groundwater which Westport relies on for drinking water [5; 8].

In addition to physical and climate-related uncertainties, planning must also account for community perspectives including sense-of-place, values, and consensus building among stakeholders [9]. Westport's Marina District has evolved from a physical space to a "representational space" with which people imbue emotional attachments and significance, transforming "space" into "place" [10; 11]. This

sense of place was communicated in 2019 community engagement sessions where it was noted that "many residents were not open to the idea of relocation" as a flood mitigation strategy in the short to mid-term, and "although safety is a high concern for residents, keeping the community identity and the place attachment residents have to Westport is also important"[1] [12]. We anticipate that community members hope to protect human life, continue operating profitable businesses, and to maintain and foster connections between the community, land, and sea.

In summary, coastal flooding and the impacts of climate change on flood events are of major concern for Westport. Using the city of Westport, Washington as a case study, the purpose of this thought experiment is to explore how cities with a strong sense-of-place can address flooding risks and the prospect of phased development through community-engaged planning practices[2]. Climate change increases flood risk and uncertainty for residents and infrastructure. Structural risk reduction strategies, like VES's, are necessary to mitigate life safety threats. Yet, they are made more beneficial when co-adopted with policy based, non-structural adaptation measures, for example community capacity building. Building capacity within the community will shift local risk perception from one of normalization to preparedness, and thus decreasing vulnerability to climate induced risks on the longer, chronic-hazard timescale [13]. Investments in non-structural adaptations are low at both the national and international levels with prioritization of short-term, hard infrastructure protection at the expense of long-term risk reduction [13]. A set of policy objectives that couple structural and social risk reduction strategies is beneficial for ensuring protection of the current Marina infrastructure, preventing loss of life, and for managing future growth.

Policy Goals

Policy goals should align with community values to ensure they are adequately addressed during

[1] Kevin Goodrich, Westport's Public Works director, echoed this sentiment, saying "who we are is where we are" (personal communication, November, 2021).
[2] This thought experiment was performed as part of the course URBDP 526: Floodplain Management and Planning for Coastal and River Communities taught by Robert Freitag in Fall of 2021. It should be noted that we had no outside contact with the community of Westport, Washington, but rather we relied on previous studies to provide information about Westport.

risk mitigation. For example, protecting human life, continuing to operate profitable businesses, and maintaining sense-of-place. Using an "If . . . When . . . Then . . ." format, community members would be aware of hazard uncertainties and encouraged to reflect on their personal risk thresholds associated with flooding impacts. An example of this thought-experiment can be found in Figure 2.

If… the street is no longer passable	When . . . flooding reaches x feet for more than y amount of days	Then . . . I will take z action

Fig. 2: Example If-When-Then format for a Threshold Planning Framework

We propose that a Threshold Planning Framework should follow three guiding principles to initiate discussions and planning for phased development needs: Engage, Envision, and Establish.

- Engage Westport's business owners and residents in conversations about increased flooding risks regularly.
- Envision flood-based thresholds that could prompt phased development, and identify opportunities to utilize policy and planning tools.
- Establish actions that can support phased development processes.

Flood-based thresholds are scenarios, i.e., a range of plausible outcomes that account for critical uncertainties, which would require business owners to take action to protect themselves and their businesses [14]. These thresholds should be defined by impacts that business owners perceive, such as days of closure, damage to property as a percent of total value, or their personal health, including mental health and wellbeing. Encouraging stakeholders to discern their thresholds based on given scenarios would prompt discussion about flood-management adaptations. Potential actions could include establishment of planning tools to redirect growth and aid in phased development or the initiation of further planning policies.

Further, an essential component of a proposed Threshold Plan is to provide space for the community to be the experts. Local people must be active in preparing for disasters, and threshold-based programs prompt community members to share their lived experiences, and come to collective consensus on a policy plan regardless of their perception of flooding causes [15]. Rather than focusing solely on the

problem, such an approach engages the community in establishing solutions. We contend the best approach to due-diligence is to encourage participation and contribution from those affected by the hazard. Business owners should feel empowered to outline strategies that would benefit the community and protect their assets, and we also contend that their contributed local knowledge is acclaimed to be essential in adapting to threats from disasters [16].

Additionally, as Javeline et al (2019) found, whether or not people believed climate change was occurring did not have a significant impact on their intention to act on flooding. Mitigation efforts targeted toward increasing climate change literacy are ineffective at promoting action among community members [17]. Instead, focusing on solutions to the risks through a mock cost-benefit analysis done by the community themselves may be more effective at preventing damages from worst-case-scenario flooding [17]. This type of collective decision-making will propel them towards resiliency. Climate change is predicted to increase the frequency and intensity of the tidal, wave, and storm events that Westport already experiences. Providing opportunities for the public to participate in decision making will allow for a smoother response during worst-case-scenario flooding.

Conclusions & Future Work

Threshold Planning could be a useful component for improving community resilience, however we acknowledge this solution only works if thresholds are accompanied by a plan for gradual development away from the floodplain when threshold conditions are met. This can only be accomplished if another viable location is sited, particularly for critical infrastructure. The nearest upland area that could provide protection from coastal flooding is several miles away from the current marina and encroaches on other towns. Also, any new additions to the Marina (docks and breakwater) would still be vulnerable to tsunami. A move this significant could damage the community's sense-of-place and the livelihoods of many people who rely on the ocean. Therefore, any discussion around phased development should take into consideration the needs of the community and look into more complex scenarios like partial relocation, where the marina and sea-based businesses stay, in addition to full relocation. Threshold planning should also be an iterative process, one that is updated periodically and regularly seeks

community insights into improving the relevance and effectiveness of the framework.

Collaboration among planners and the community is necessary for producing threshold-defining hazard scenarios and supporting Westport's decision-making at every step. It should be emphasized that scenarios are not predictions, rather they serve to communicate scientists' assumed range of plausible future conditions to the public [18]. Scenarios can be conceptualized as a "boundary object" that "bridge" researchers on one side and the empowered public on the other [19]. Scenario-based community engagement accounts for complexity and uncertainties, embodies scientific advice (a key input for informed decisions), and forges trust and a collaborative atmosphere among stakeholders. This leads to more credible, salient, and legitimate outputs.

The tradeoffs of structural risk reduction strategies are relevant for other coastal communities, particularly along the Pacific Coast, who are experiencing unprecedented tidal, wave, and storm events. A Threshold Planning Framework could help maintain or promote economic development while also managing the inherent risks of building within a floodplain. Climate change is increasing mean sea-level and exacerbating natural hazard conditions. Planning for climate change requires structural and non-structural solutions to boost community-capacity. By exploring how communities with a strong sense-of-place can address flooding risks and the prospect of phased development, we find that self-determined and community-engaged Threshold Planning may be a viable approach for Westport and comparable communities to establish a proactive plan despite an uncertain future.

References

[1] *Climate in Westport, Washington* (Climate). Accessed 2021, November. https://www.bestplaces.net/climate/city/washington/westport#:~:text=Westport%2C%20Washington%20gets%2076%20inches,inches%20of%20snow%20per%20year

[2] Washington State Military Department Emergency Management Division (EMD). (2012). *Project Safe Haven: Tsunami Vertical Evacuation on the Washington Coast, Pacific County*. Washington State Military Department Emergency Management Division. https://mil.wa.gov/asset/5ba41ffbdc444

[3] Washington State Military Department Emergency Management Division (EMD). (2013). *Washington State Hazard Mitigation Plan*. Washington State Military Department Emergency Management Division, 1-84. https://mil.wa.gov/asset/5ba41fc712fcd.

[4] Flood Factor. *Flood risk overview for Grays Harbor County.* Accessed 2022, April. https://floodfactor.com/county/grays-harbor-county-washington/53027_fsid

[5] IPCC. (2021) Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. [Masson-Delmotte, V., Zhai, P., Pirani, A., Connors, S. L., Péan, C., Berger, S., Caud, N., Chen, Y., Goldfarb, L., Gomis, M. I., Huang, M., Leitzell, K., Lonnoy, E., Matthews, J. B. R., Maycock, T. K., Waterfield, T., Yelekçi, O., Yu, R., & Zhou, B. (eds.)]. Cambridge University Press. In Press.

[6] Adelsman, H., Ekrem, J., Binder, L. W., Cook, K., Cooper, K., Helbrecht, L. M., Jamison, R., Phillips, J., Pickett M. P., Roalkvam, C. L., Salisbury, S., Siemann, D., & Speaks, P. (2012). Preparing for a Changing Climate—Washington State's Integrated Climate Response Strategy. Washington State Department of Ecology. https://apps.ecology.wa.gov/publications/documents/1201004.pdf

[7] Ruggiero, P., Bolte, J., Lach, D., Stevenson, J., Schwartz, C., Serafin, K., & Evans-Wilent, J. (2020). *Grays Harbor Coastal Futures Exploring alternative futures on the Washington coast.* Oregon State University. http://explorer.bee.oregonstate.edu/Topic/GraysHarbor/ProjectOverview.aspx

[8] City of Westport Water Department (CWW). (2021). *2020 Consumer Confidence Report.* City of Westport Water Department (14). https://www.ci.westport.wa.us/CCR%202020.docx

[9] Kettle, N. P., & Dow, K. (2016). The Role of Perceived Risk, Uncertainty, and Trust on Coastal Climate Change Adaptation Planning. *Environment and Behavior*, *48*(4) 579–606. https://doi.org/10.1177/0013916514551049

[10] Lefebvre, H. (1991). *The Production of Space* (D. Nicholson-Smith Trans.). Blackwell: Oxford. ISBN-13: 978-0631181774

[11] Tuan, Y. F. (1977). *Space and place: The perspective of experience*. Minneapolis: University of Minnesota Press. ISBN 01-8166-3877-2

[12] Stanton, H. (2019). *Integrating Hazard Mitigation Strategies into the City of Westport's Comprehensive Plan Update* (Publication No. 27670070) [Master's Thesis, University of Washington: Department of Urban Planning]. ProQuest Dissertations & Theses Global. https://digital.lib.washington.edu/researchworks/handle/1773/45278

[13] Dolšak, N., & Prakash, A. (2018). The Politics of Climate Change Adaptation. *Annual Review of Environment and Resources*, *43*, 317-341. https://doi.org/10.1146/annurev-environ-102017-025739

[14] Alberti, M. (2016). *Cities that think like planets: complexity, resilience, and innovation in hybrid ecosystems*. University of Washington Press.

[15] Fenton, A., Paavola, J., & Tallontire, A. (2017). Autonomous adaptation to riverine flooding in Satkhira District, Bangladesh: implications for adaptation planning. *Regional environmental change*, *17*(8), 2387-2396.

[16] Islam, M. R., Ingham, V., Hicks, J., & Kelly, E. (2018). From coping to adaptation: Flooding and the role of local knowledge in Bangladesh. *International journal of disaster risk reduction*, *28*, 531-538.

[17] Javeline, D., Kijewski-Correa, T., & Chesler, A. (2019). Does it matter if you "believe" in climate

change? Not for coastal home vulnerability. *Climatic Change*, *155*, 511–532. https://doi.org/10.1007/s10584-019-02513-7

[18] Schwartz, P. (2012). *The art of the long view: planning for the future in an uncertain world*. Currency.

[19] Cash D. W., Clark, W. C., Alcock, F., Dickson, N. M., Eckley, N., Guston, D. H., Jäger, J., & Mitchell, R. B. (2003). Knowledge Systems for Sustainable Development. *Proceedings of the National Academy of Sciences - PNAS*, *100*(14), 8086–8091. https://doi.org/10.1073/pnas.1231332100