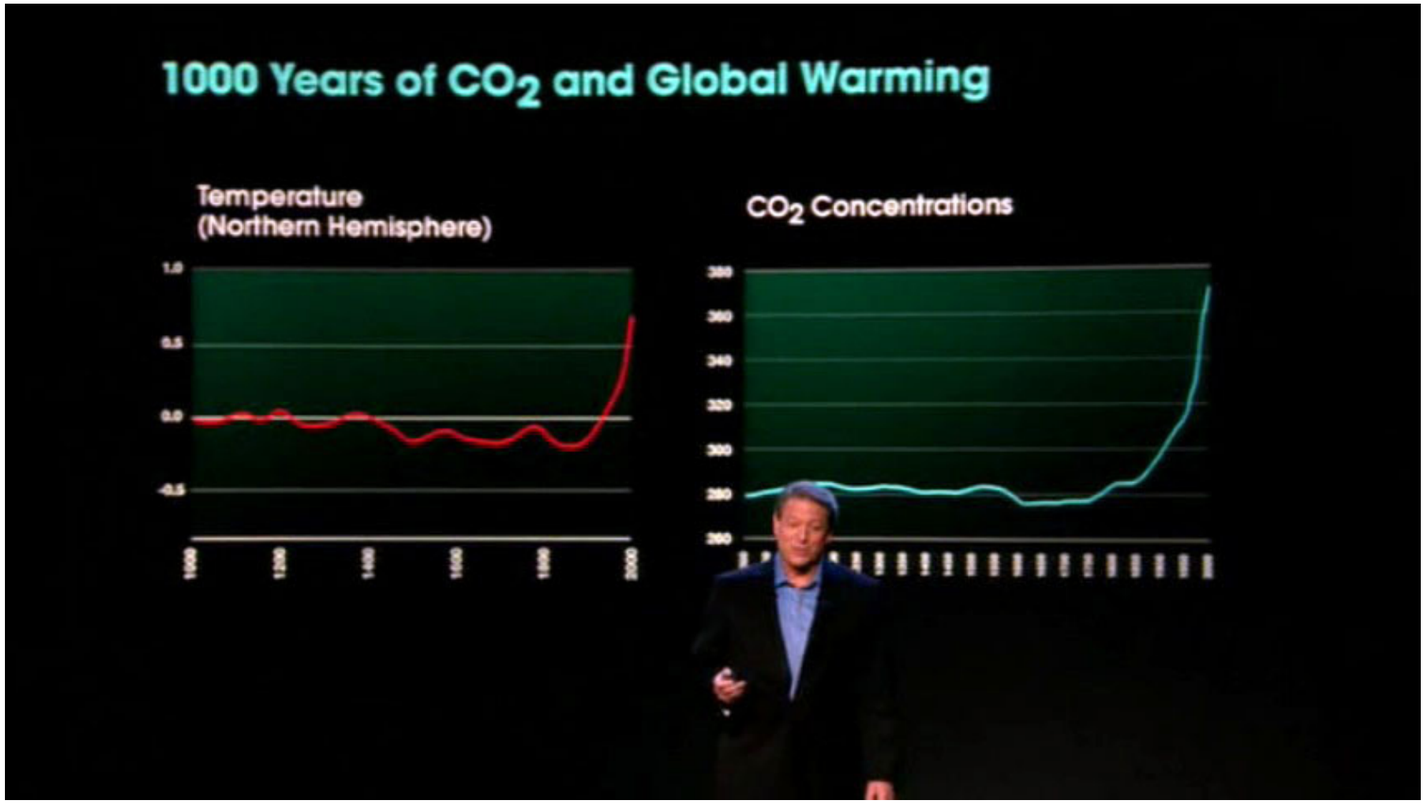
Soaking Up Sea Level Rise: Greenstreet Solutions for Coos Bay, OR

Peter Olson

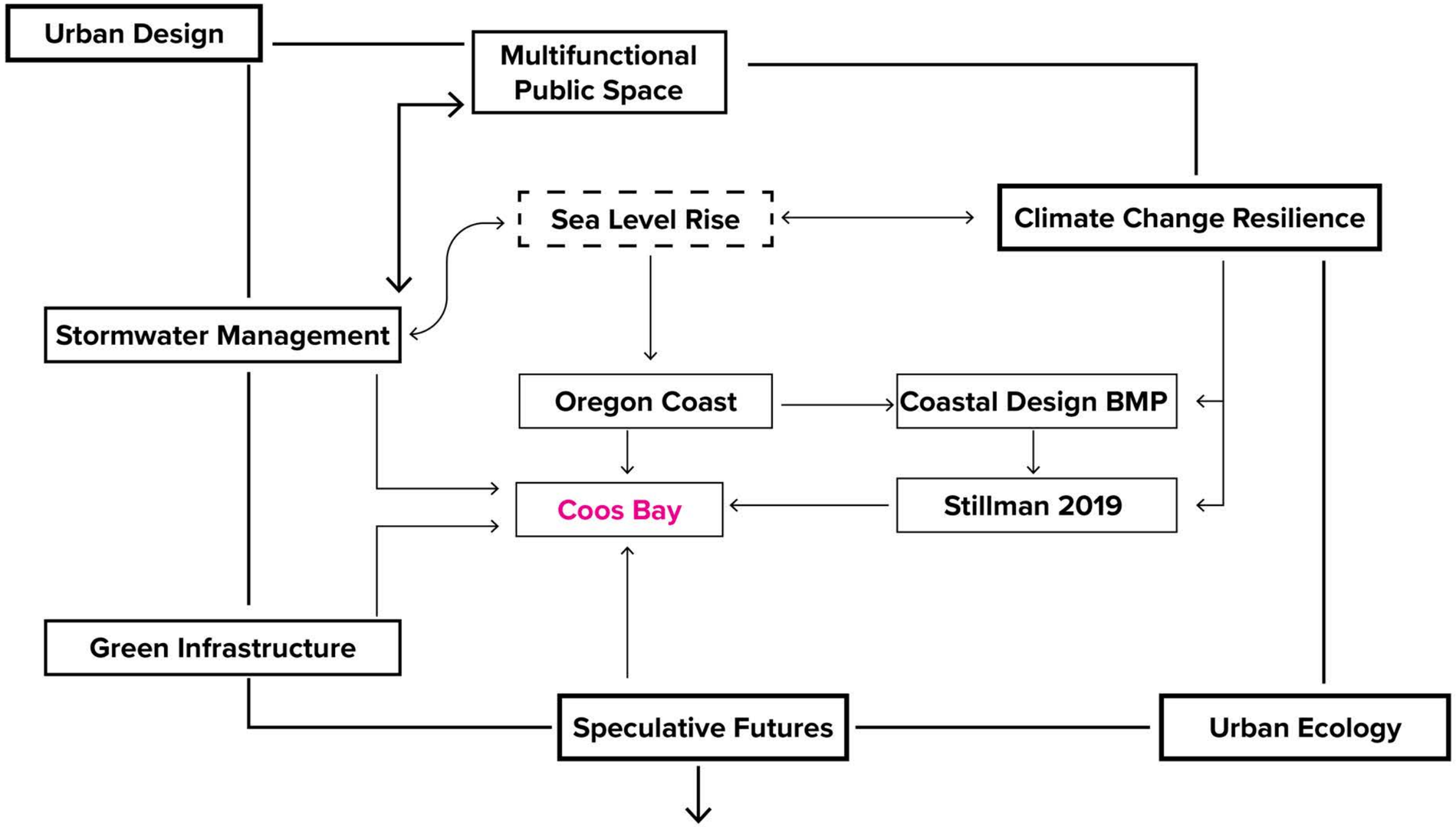
UNIVERSITY OF OREGON
MASTER OF LANDSCAPE
ARCHITECTURE 2023

Table of Contents

8th grade yearbook picture at Farragut Middle School in Knoxville, TN ca. 2011



An image that would haunt me for years
An Inconvenient Truth*, 2006*



Landscape architects must create visions of the future for cities to implement...
designers must be leaders in envisioning a better world

Present

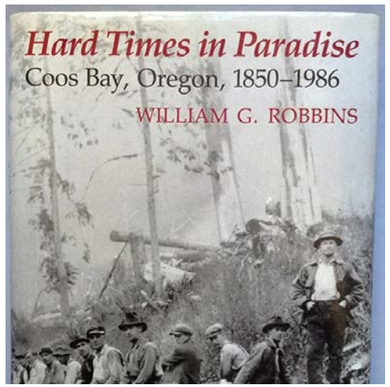
Tourists in Venice, Italy, equip waders to traverse through knee-high flooding to see landmarks;
The Independent c. 2019

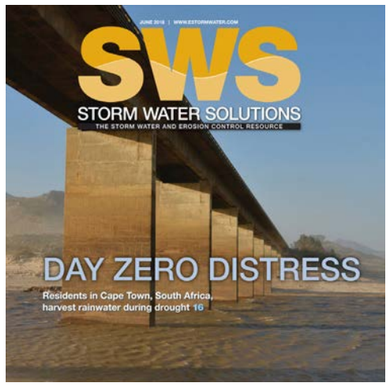
Future?

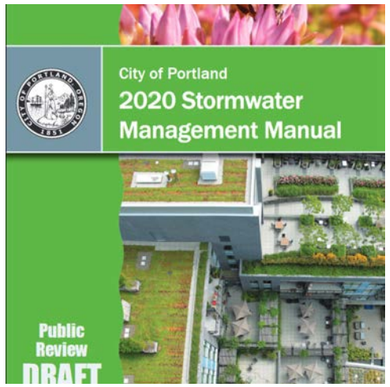
Tourists in Coos Bay, OR, equip waders to traverse through knee-high flooding to see landmarks; c. 2029

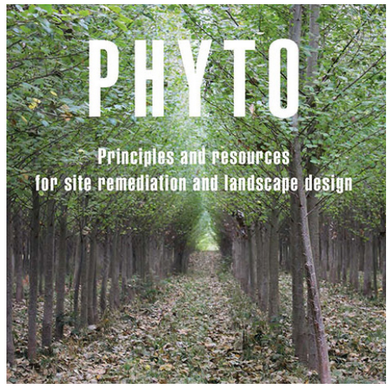
5

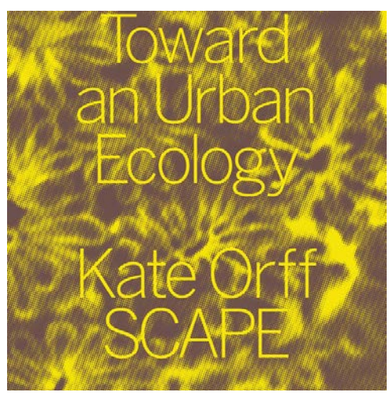
Literature & Inspiration

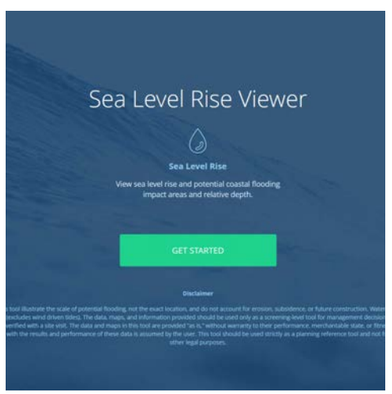




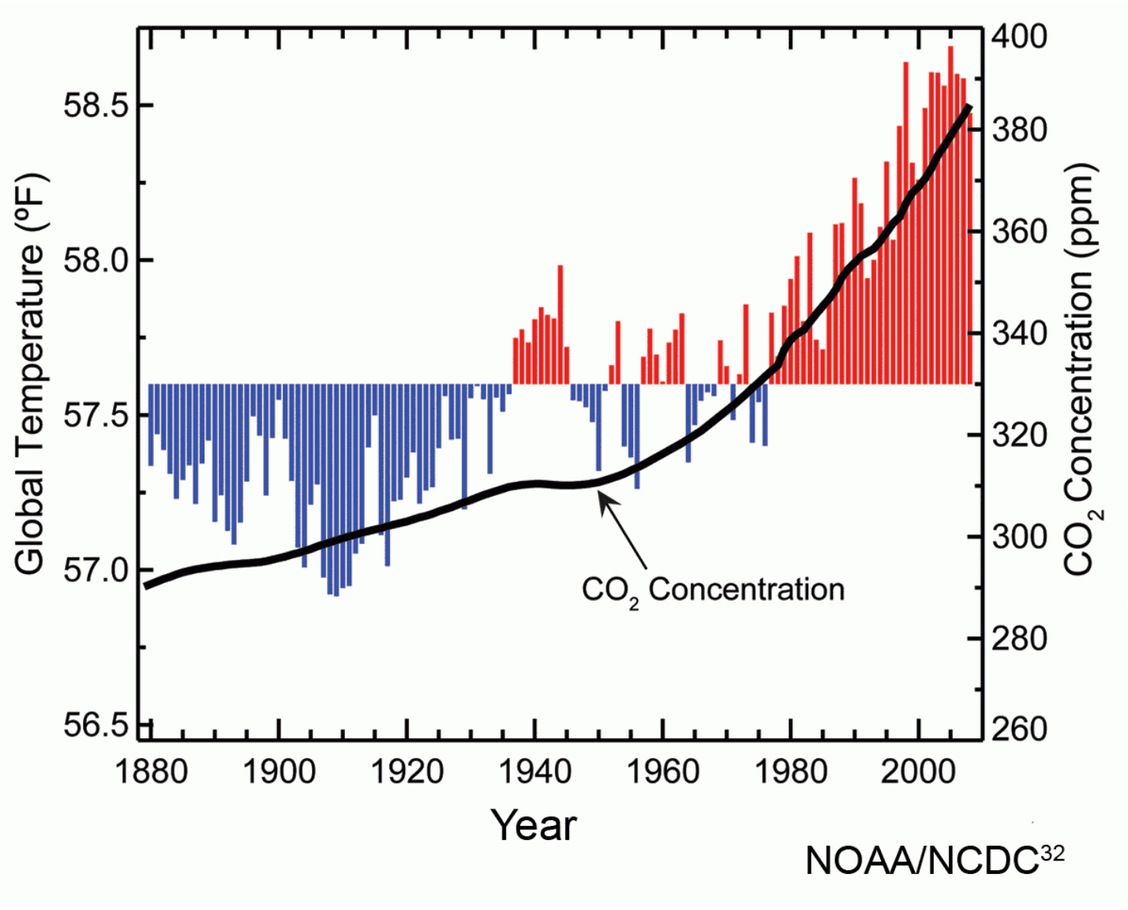








Climate Change & Sea Level Rise



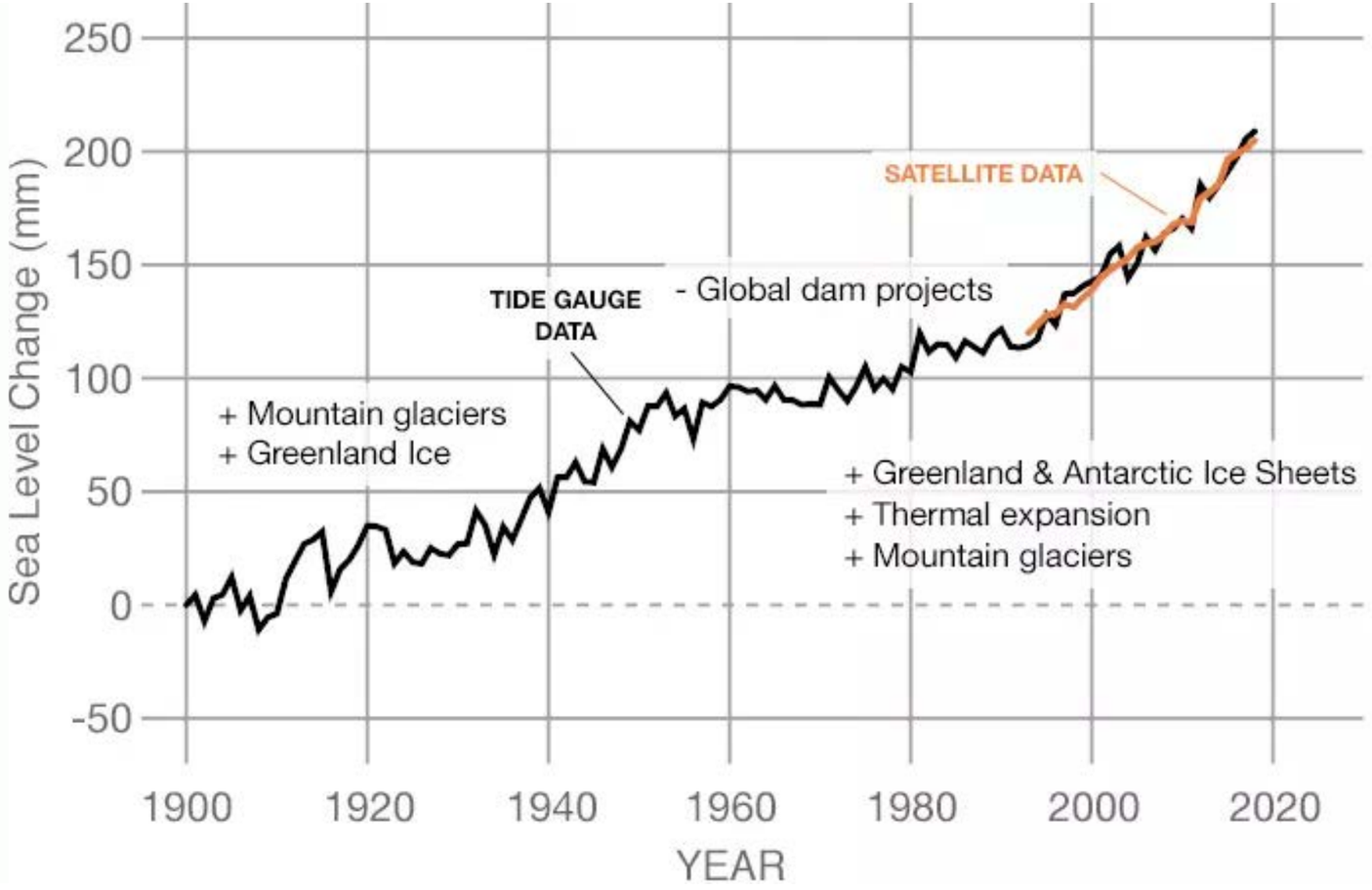
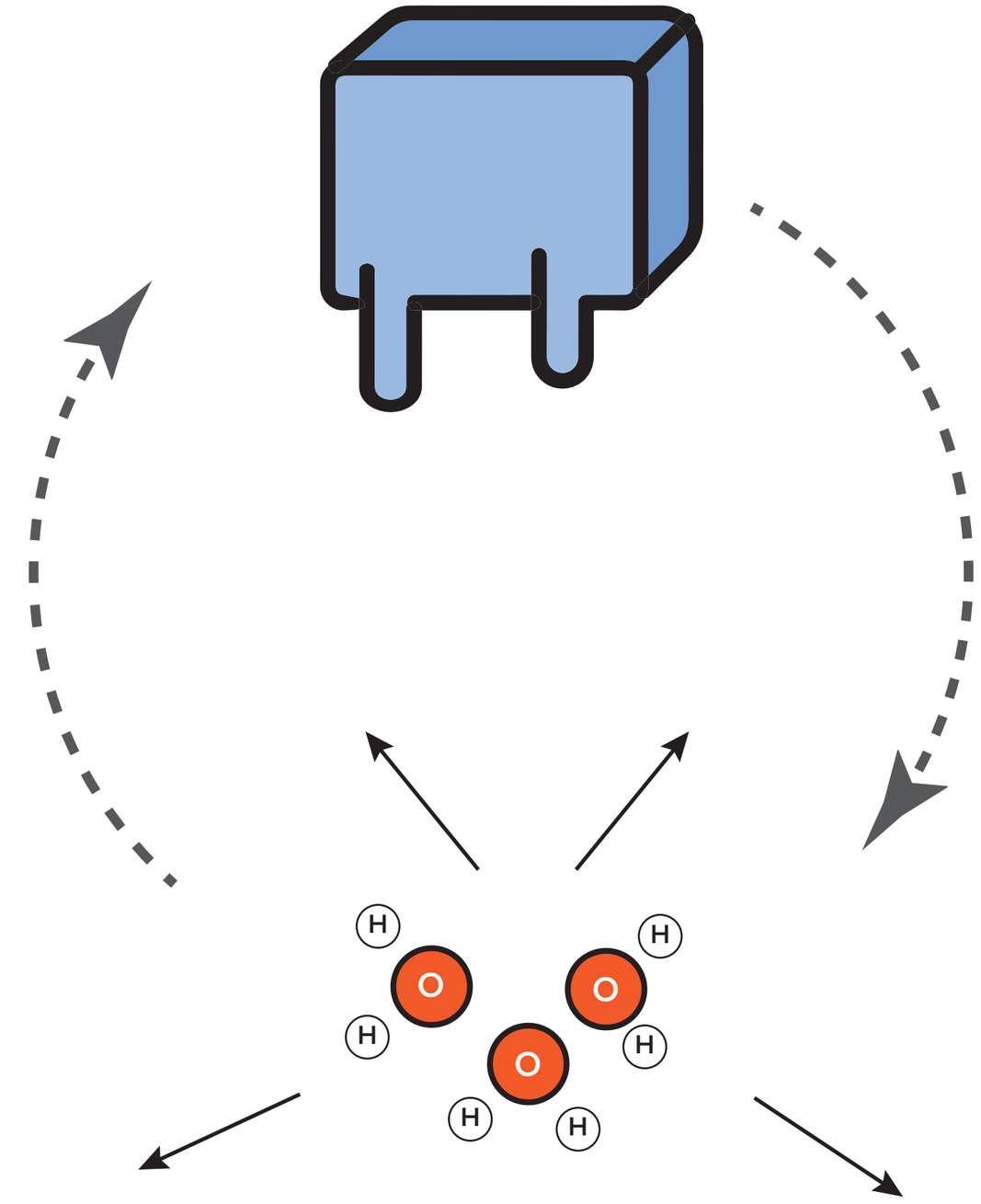
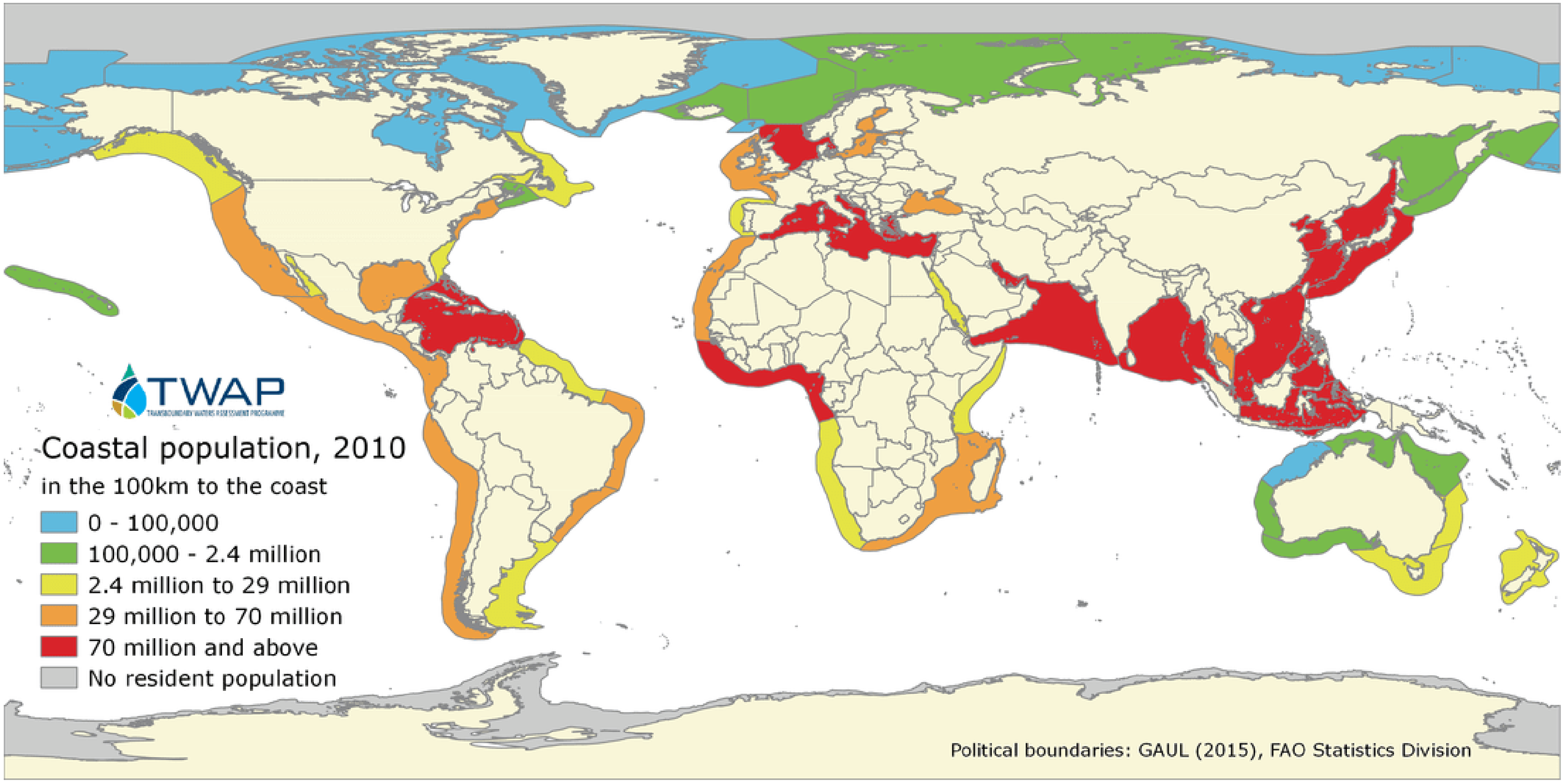


Image source: NOAA

Climate Change & Sea Level Rise



Climate Change & Sea Level Rise



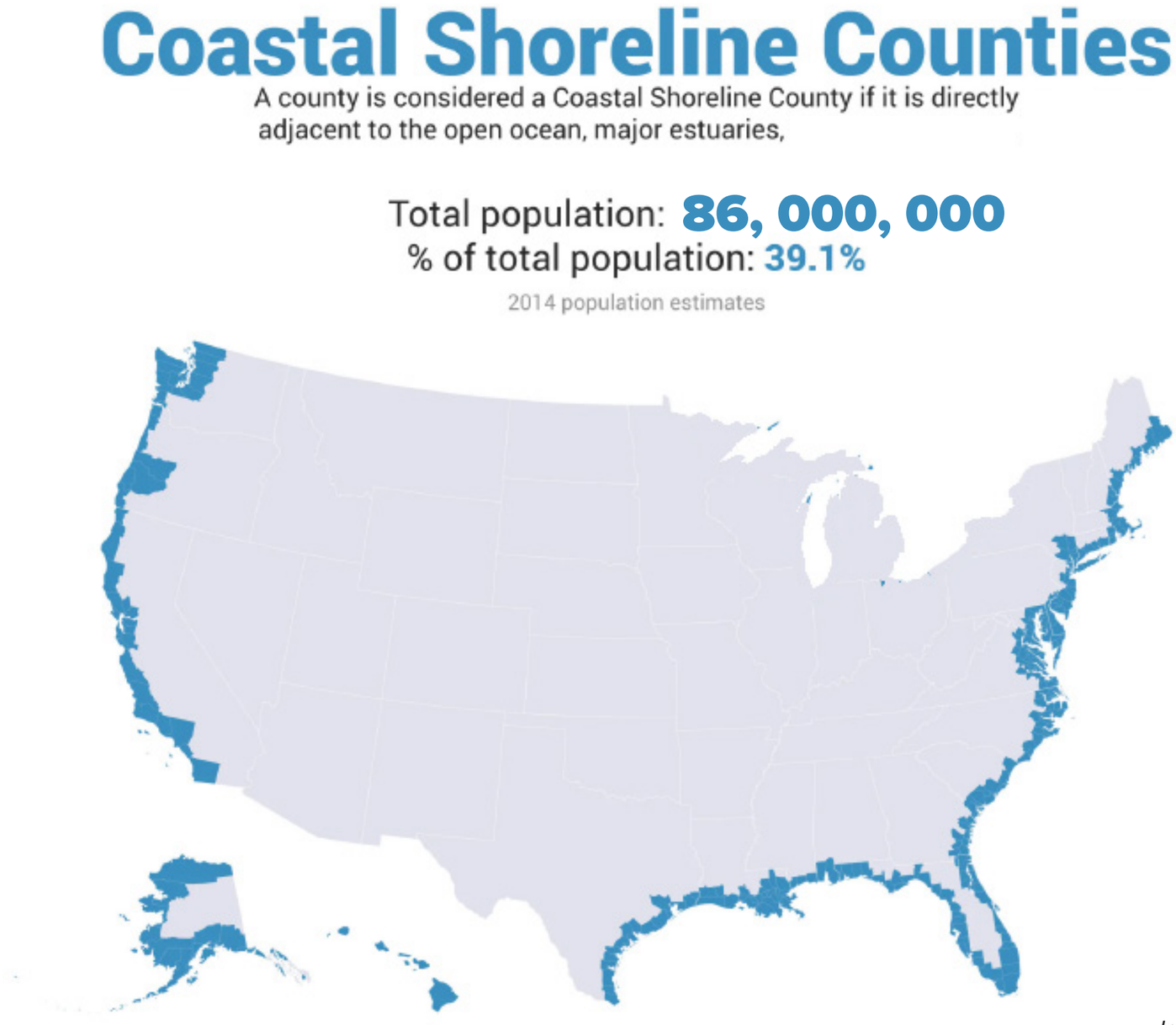


Image source: dataviz.com

Oregon Sea Level Rise

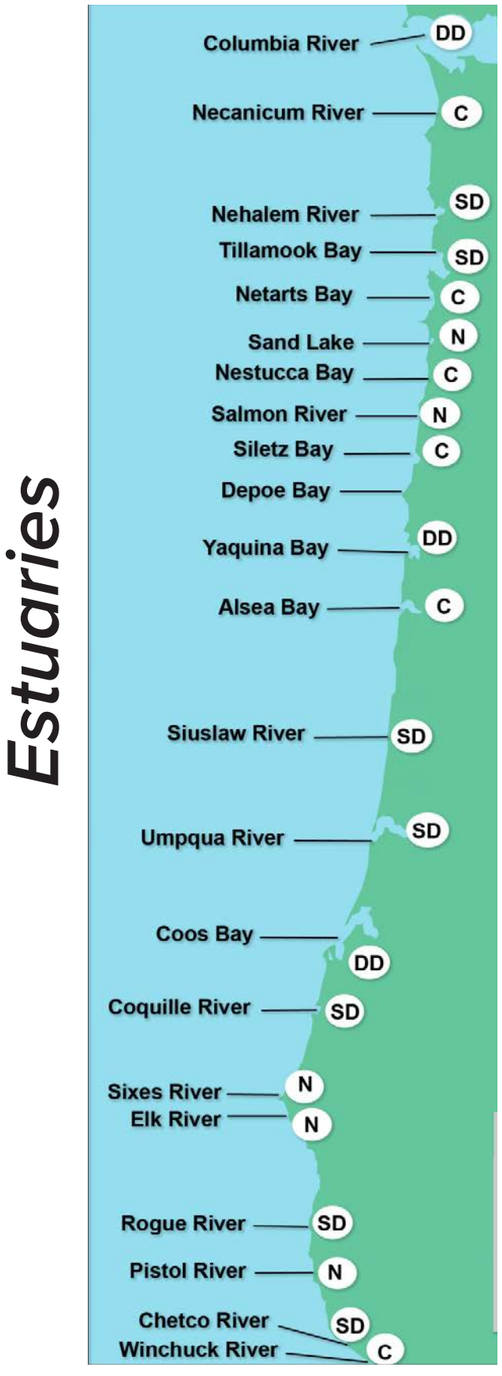


Image source: USGS

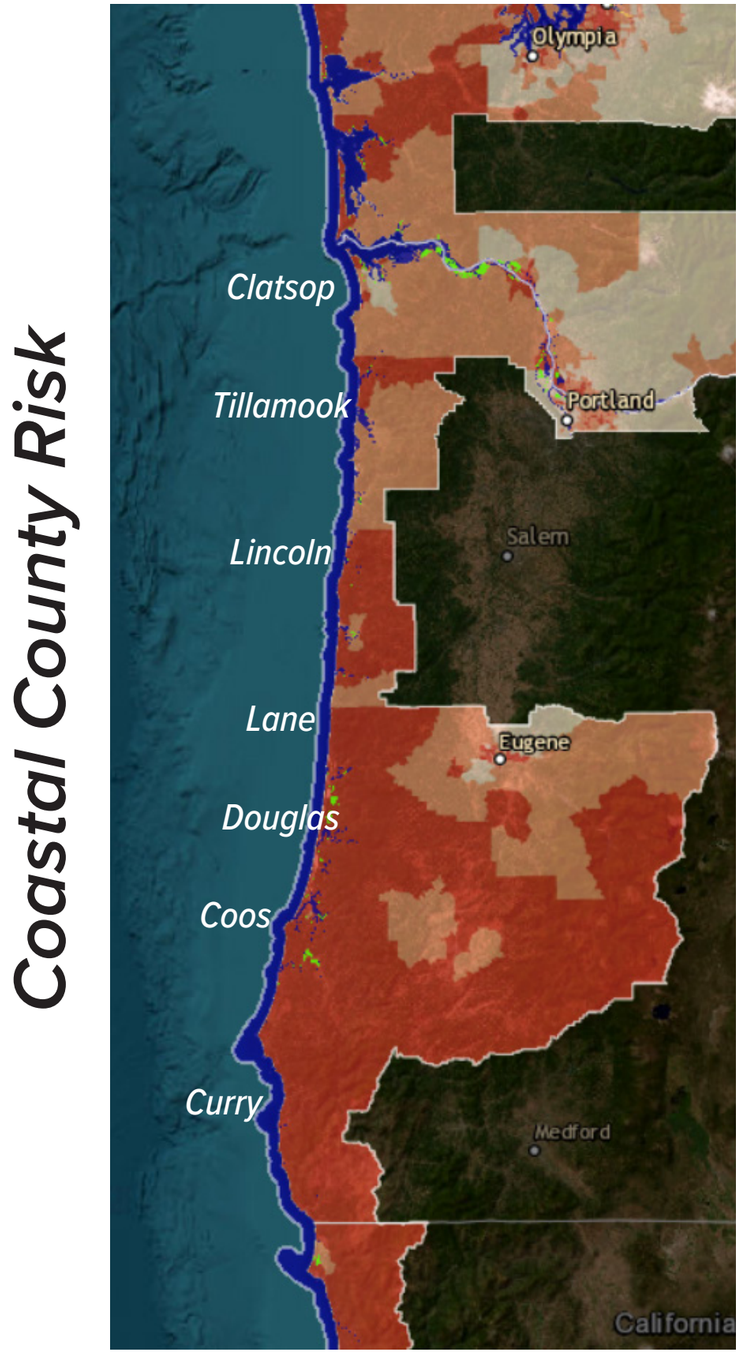


Image source: NOAA

Oregon Coast Population:

~660,000 (2020 census)

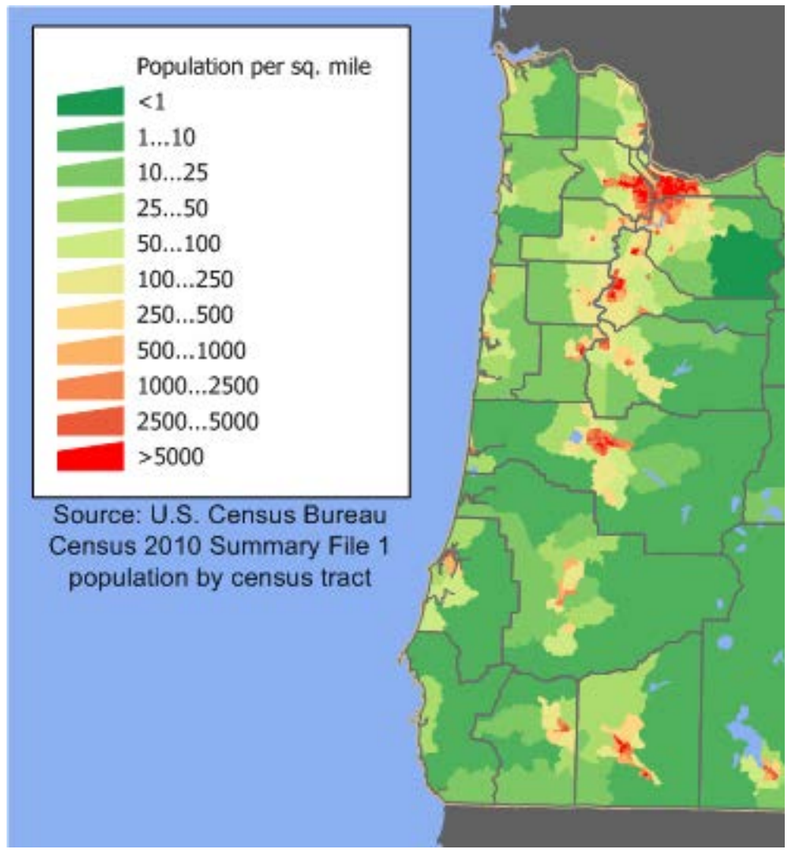


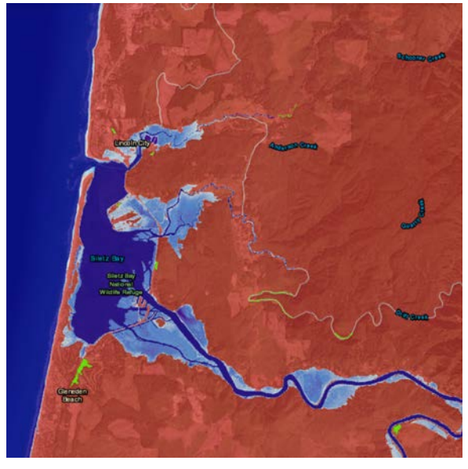
Image source: Oregon Conservation Strategy

Oregon Sea Level Rise: 2100 Projections

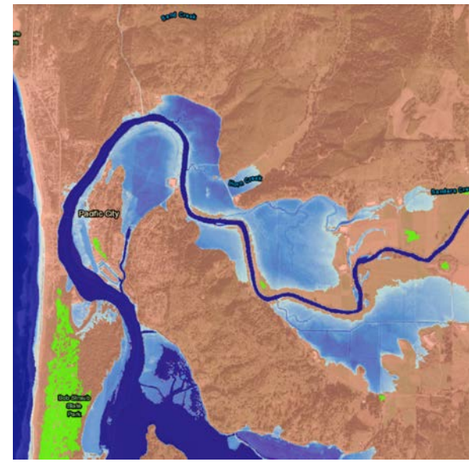
Coos Bay

Seaside

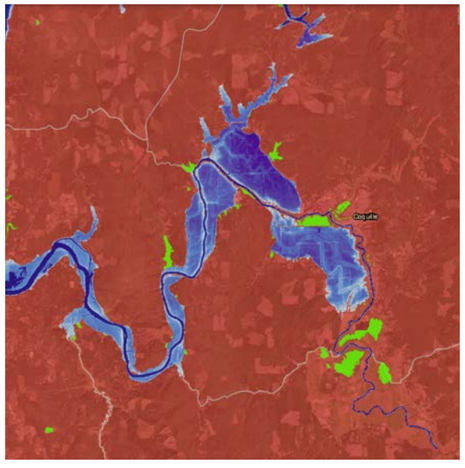
Lincoln City



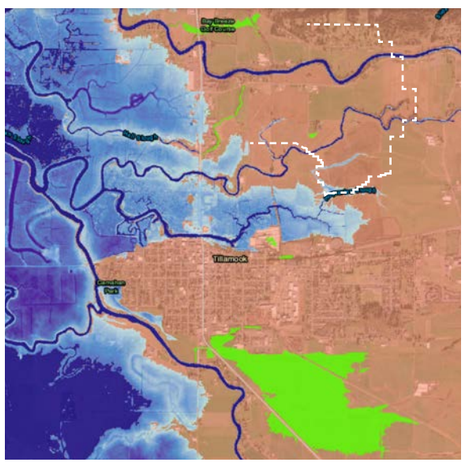
Pacific City



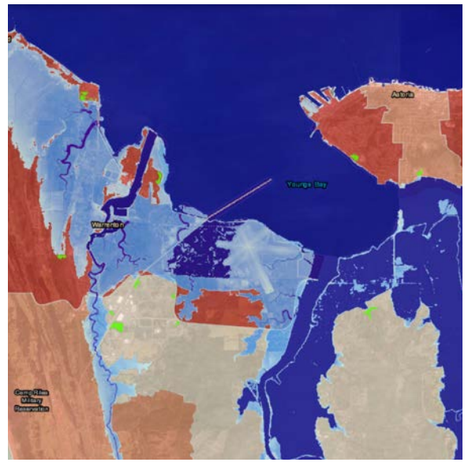
Coquile



Tillamook



Warrenton



Yachats

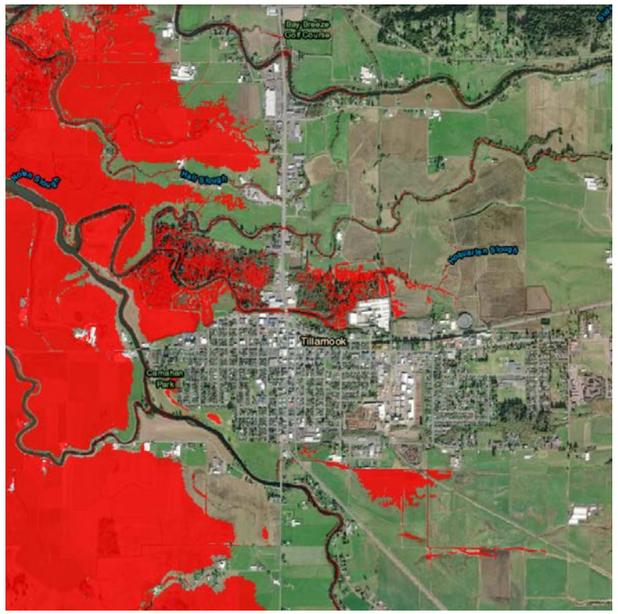
Image source: NOAA

Oregon Sea Level Rise: 2100 Projections

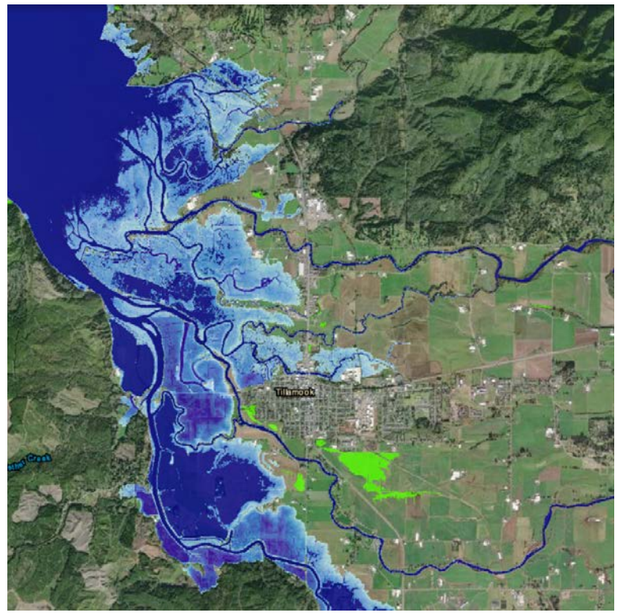
Approximate Projections per NOAA

Tillamook

High Tide Flooding Risk



Low SLR Projection



High SLR Projection

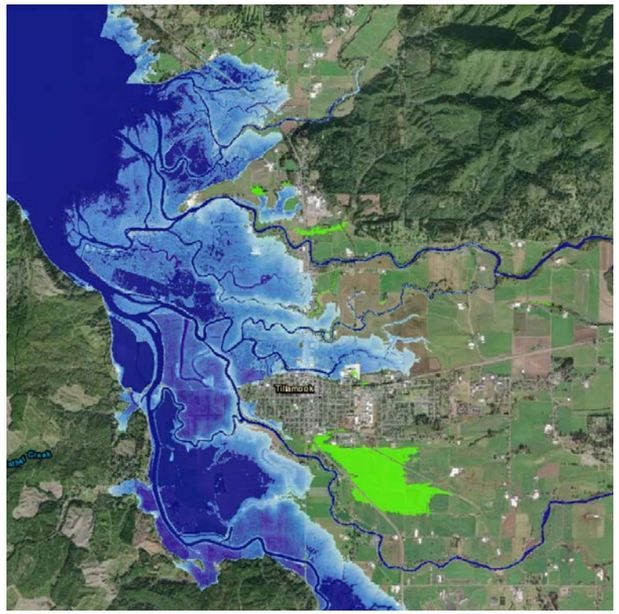


Image source: NOAA

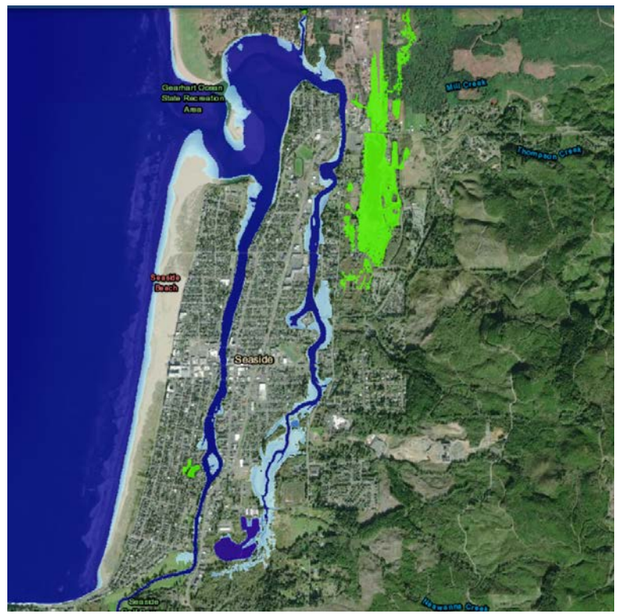
Oregon Sea Level Rise: 2100 Projections

Approximate Projections per NOAA

Seaside

High Tide Flooding Risk

Low SLR Projection



High SLR Projection

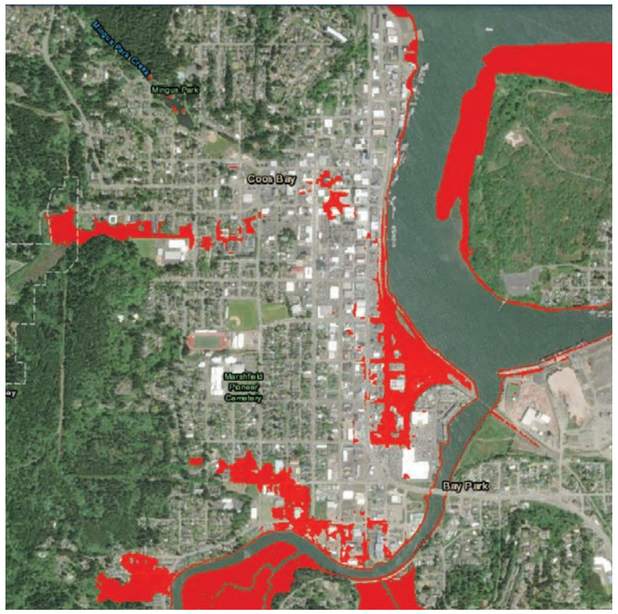
Image source: NOAA

Oregon Sea Level Rise: 2100 Projections

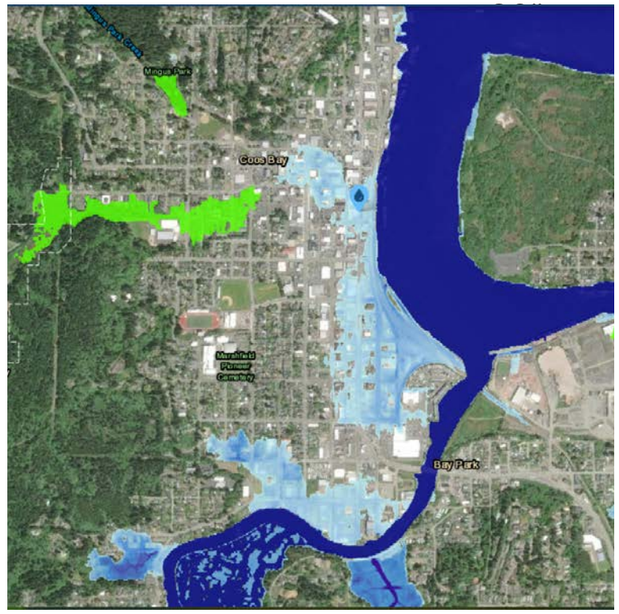
Approximate Projections per NOAA

Coos Bay

High Tide Flooding Risk



Low SLR Projection



High SLR Projection

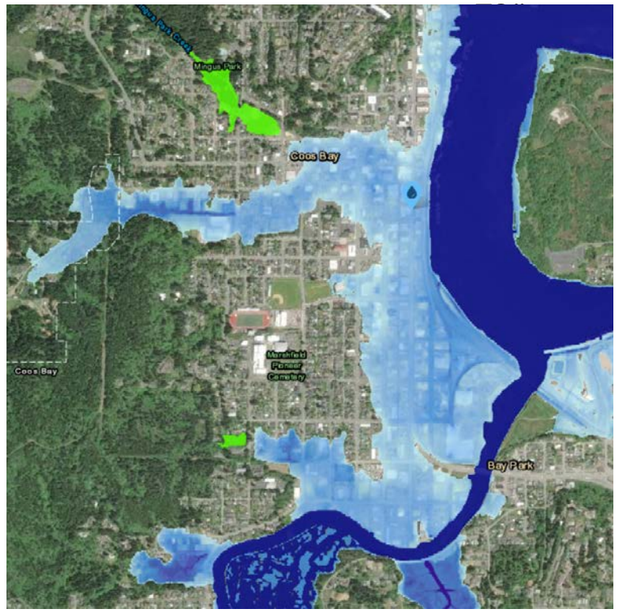


Image source: NOAA

COOS BAY, OR

“OREGON’S BAY AREA”

City Pop.
2020: 16,000 1,500/sqmi
2010: 15,300

Metro Pop.
2020: 31,500
2010: 31,220

CITY AREA: 16 sqmi

AVG ANNUAL PRECIP: 65”
Driest Months: July, August
Wettest Months: January, February

USDA ZONE : 9A

AVG ELEVATION: +23’-0” ABOVE SEA LEVEL

MAIN INDUSTRIES
- *TOURISM*
- *SHIPPING*
- *MANUFACTURING*

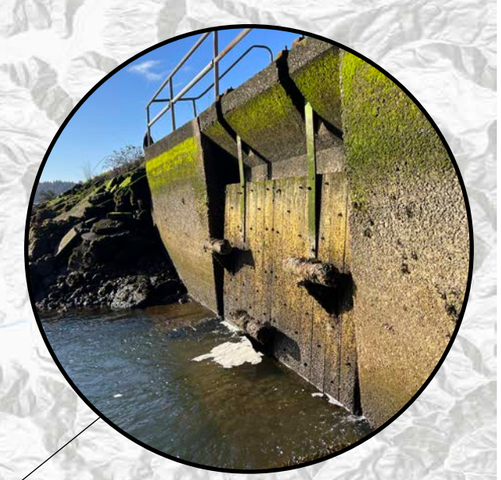
Coos Bay Watersheds + Tidegates + Storm Pipes

0 0.75 1.5 3 Miles

Tide Gate

Watershed Boundary

Stormwater Line



1

2

3

4

5

6

7

8

Resevoir

West-to-East Section: Coos Peninsula

(3x vertical exaggeration)

W
To Pacific Ocean

E
To Douglas County

Local High Point
283’

North Spit

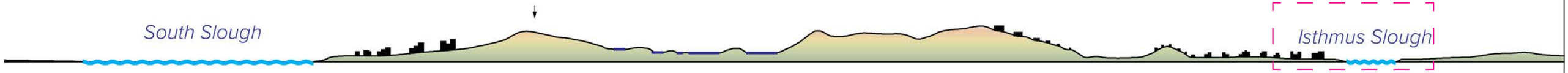
Empire District

Pony Resevoir

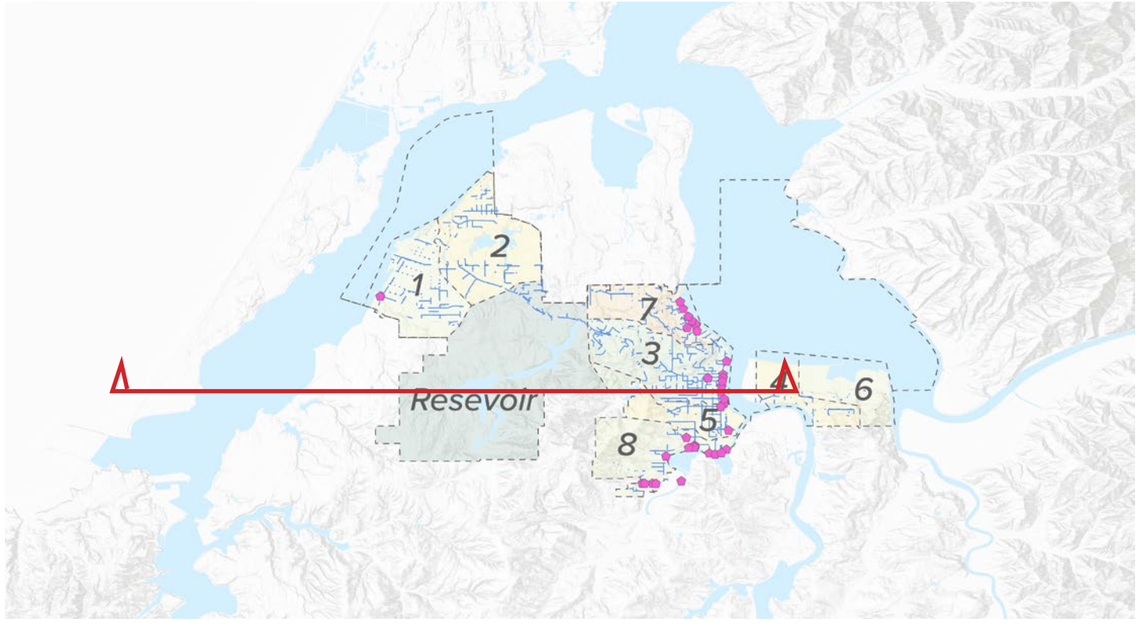
Milton Crest Distict

Downtown District

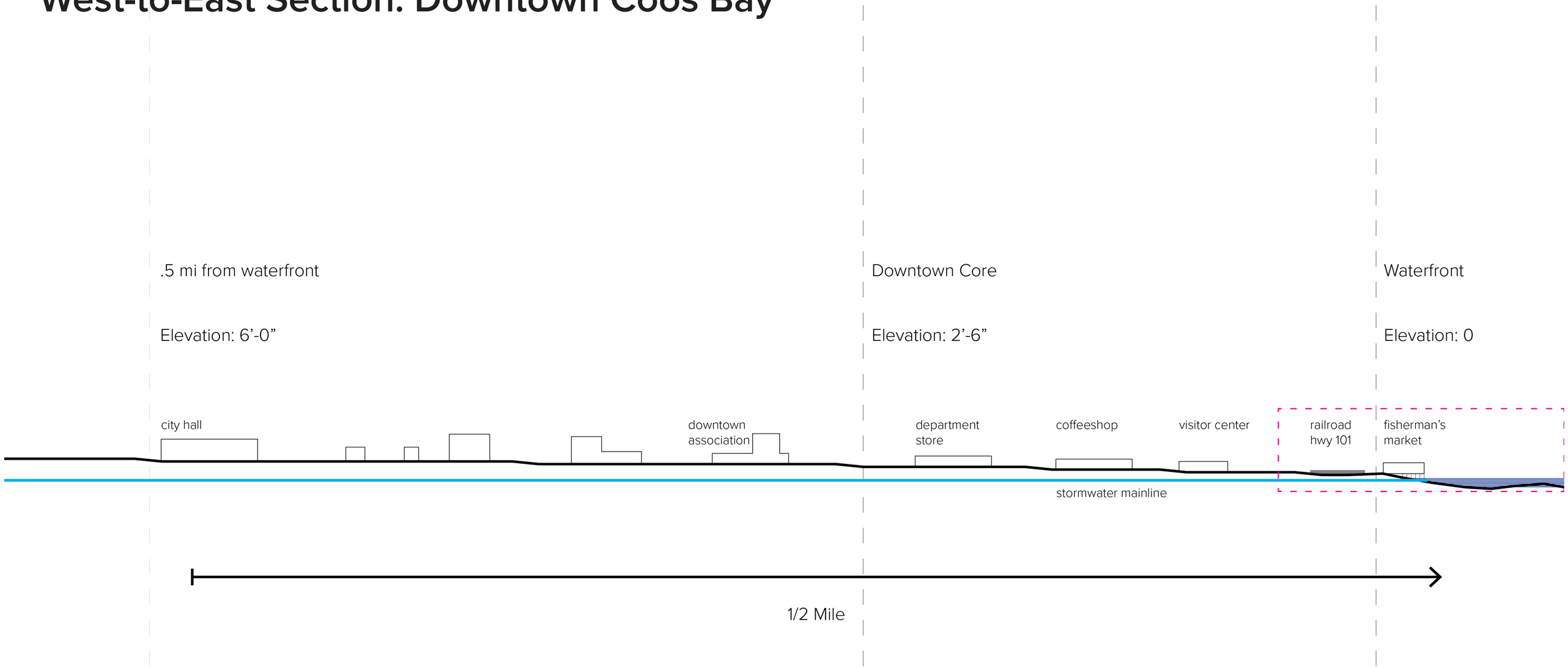
Eastside District



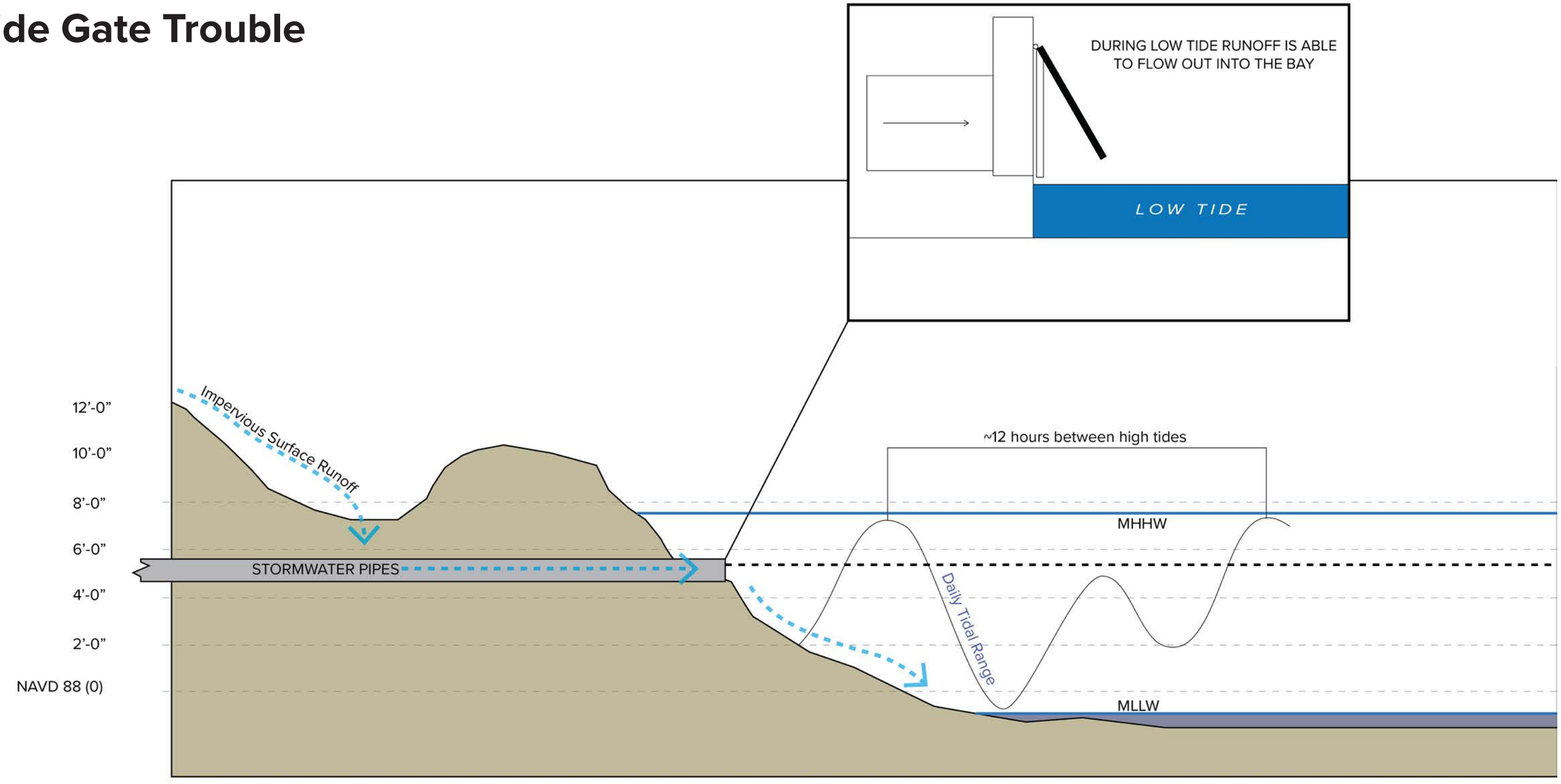
7 mi



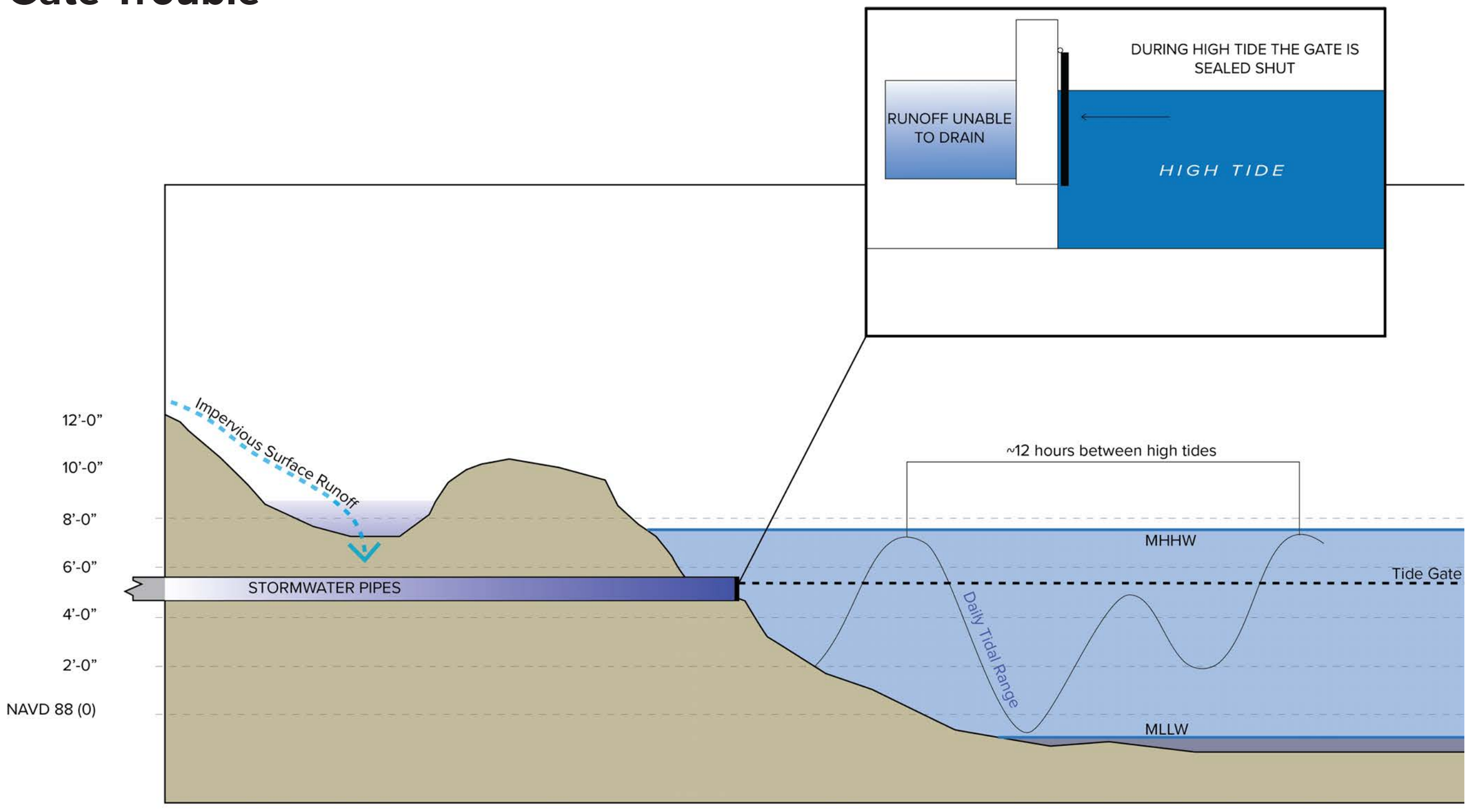
West-to-East Section: Downtown Coos Bay



Tide Gate Trouble



Tide Gate Trouble



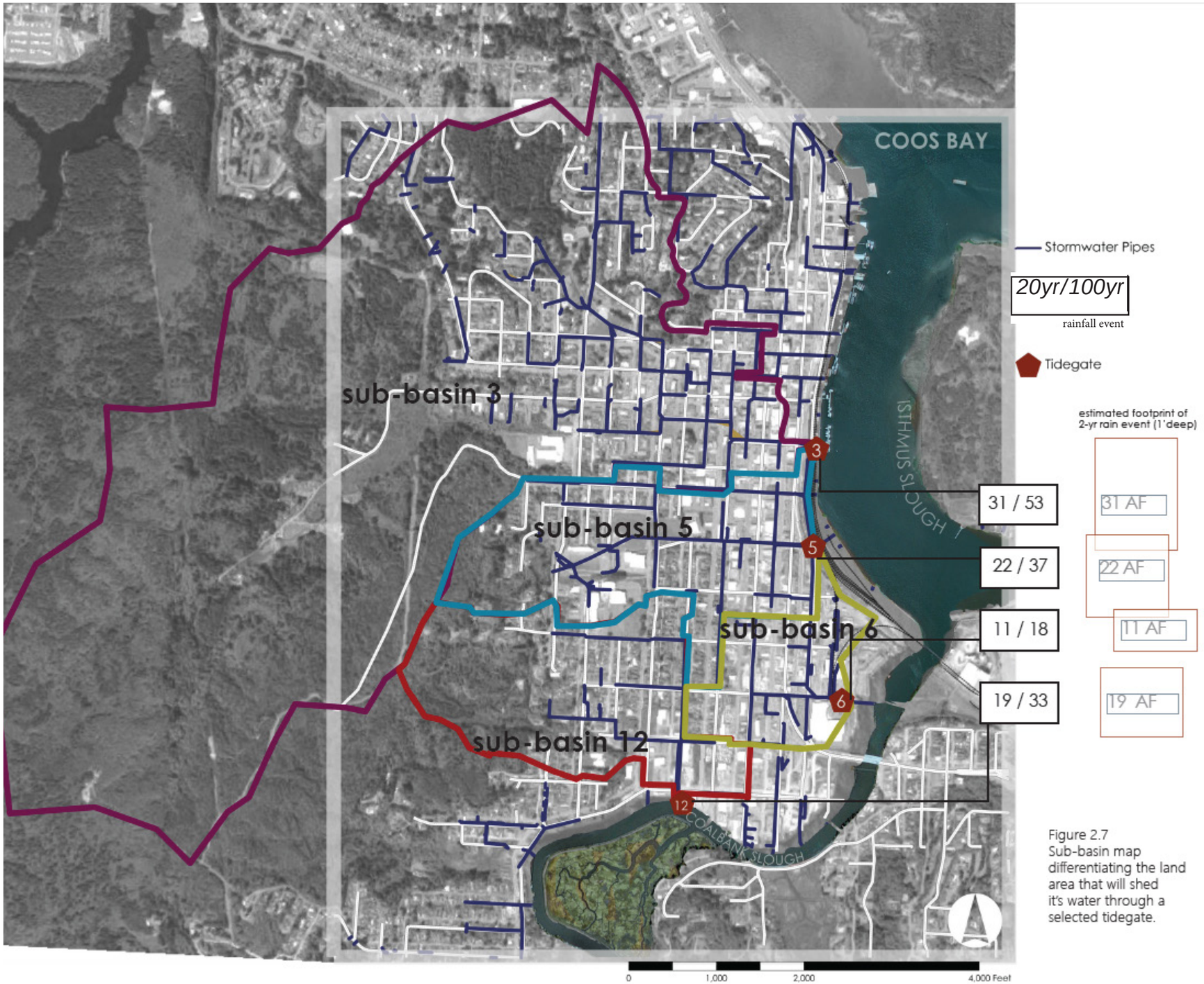
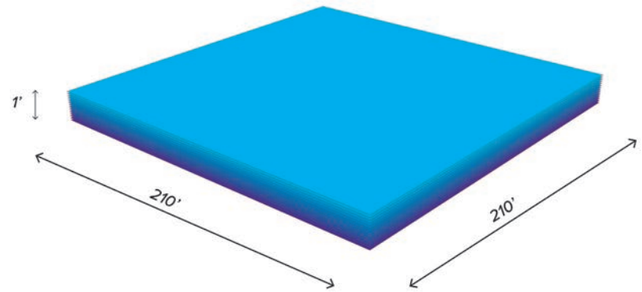


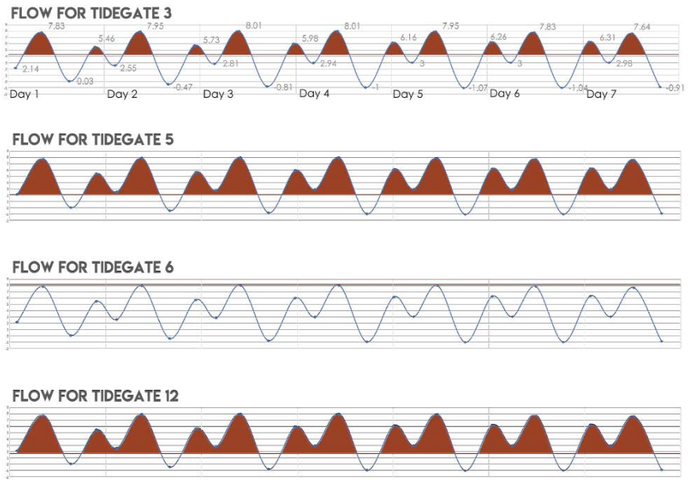
Figure 2.7
Sub-basin map differentiating the land area that will shed it's water through a selected tidegate.

1 Acre-foot = 325,851 gallons

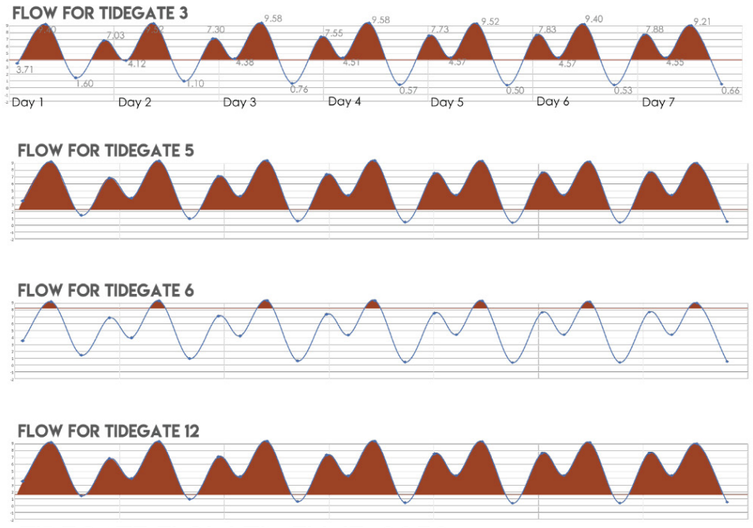
approx 1/2 of an Olympic Swimming Pool



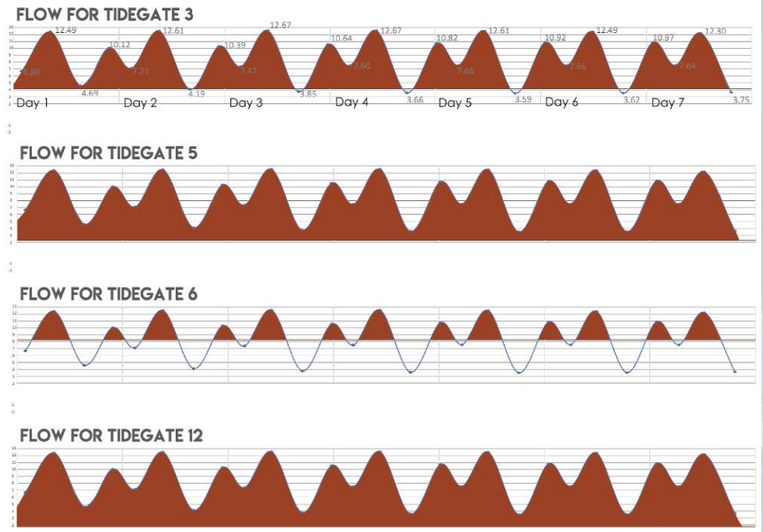
C. Stillman p35



TIDEGATE FLOW TIMELINE: 2019



TIDEGATE FLOW TIMELINE: 2050



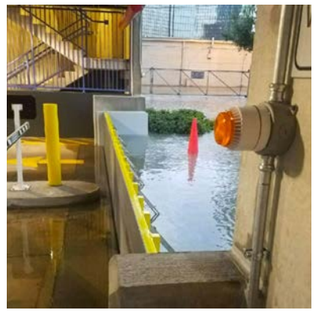
TIDEGATE FLOW TIMELINE: 2100

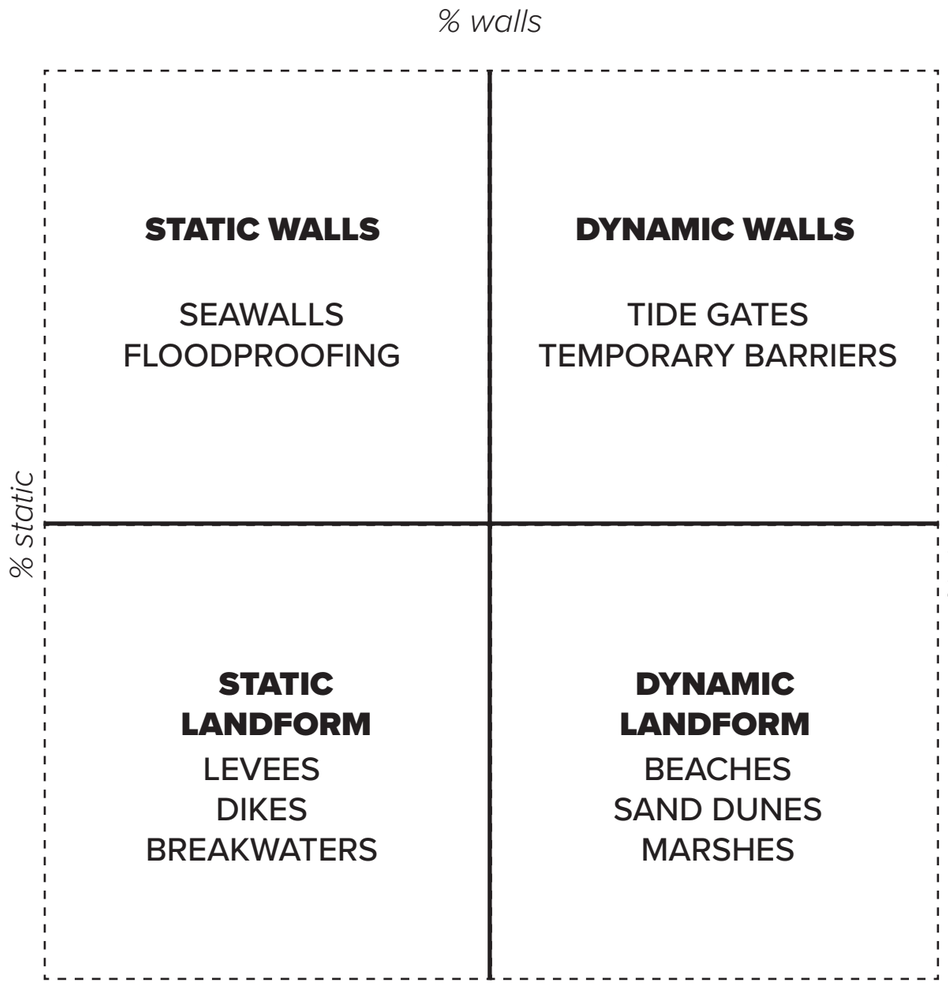
SEA LEVEL, STORMWATER, AND LAND USE:

INUNDATION IN CITY PLANNING FOR COOS BAY, OREGON

C Stillman

Typologies for Coastal Management (Kristina Hill)





source: a typology for the next century of adaptation to sea level rise
Kristina Hill 2015

China: ***Sponge Cities***

Planning, policy, and design initiatives funded by the government for creating greener cities to respond to climate change

A drainage canal turned stormwater park on the Haikou Meishe River (World Future Council 2016)

Quinli Stormwater Park in Harbin (World Future Council)

Image source: World Future Council 2016

The Netherlands: ***Room for the River***

Land use planning that 'sacrifices' flood-prone lands

" AFTER 800 YEARS OF BUILDING HIGHER AND HIGHER DIKES, WE HAVE DECIDED TO DEAL WITH WATER IN A DIFFERENT WAY"

- Gert-Jan Meulepas, Project Engineer

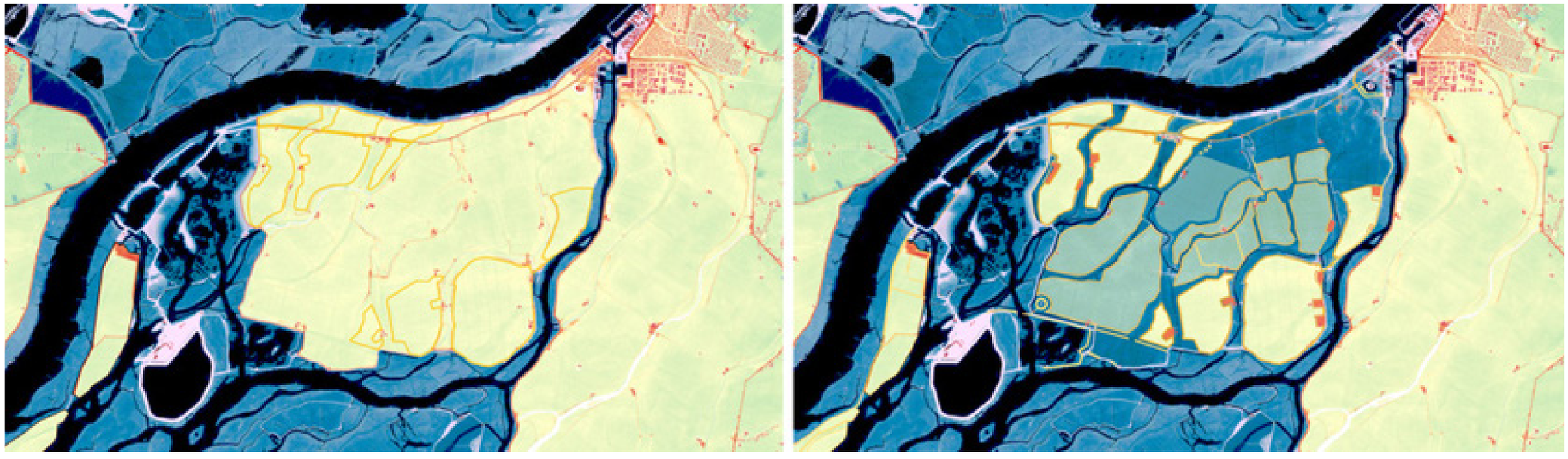


Image source: Public Space Magazine, 2020

Rotterdam, NL: ***Benthemplein [Water Plaza]***

Floodable public space

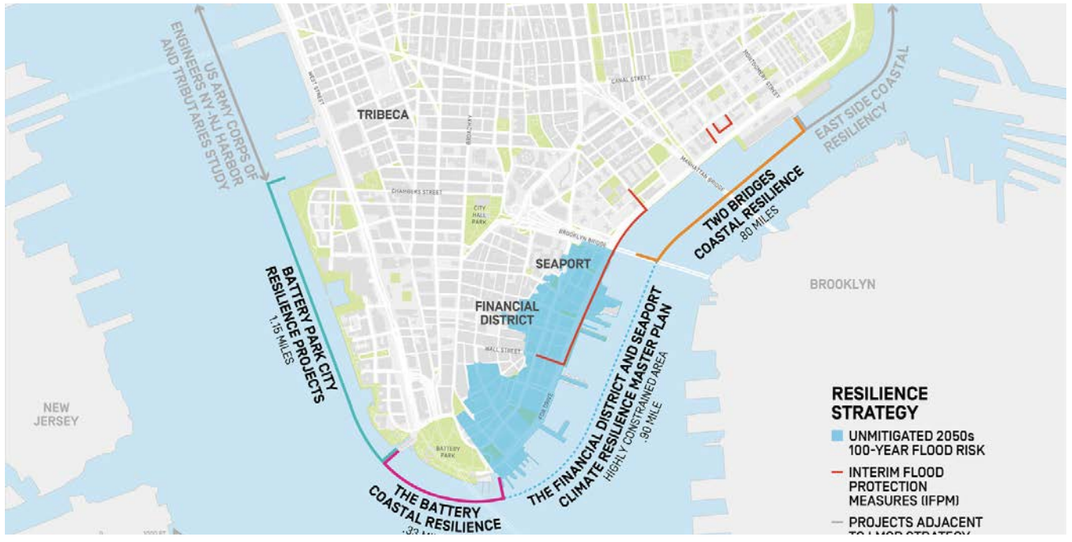
Image source: Public Space Magazine, 2020

NYC, NY: ***Walls and Barriers***

Proposals for handling sea level rise

Rendering of prospective retrofit (NYECDC)

Rendering of USACE proposal

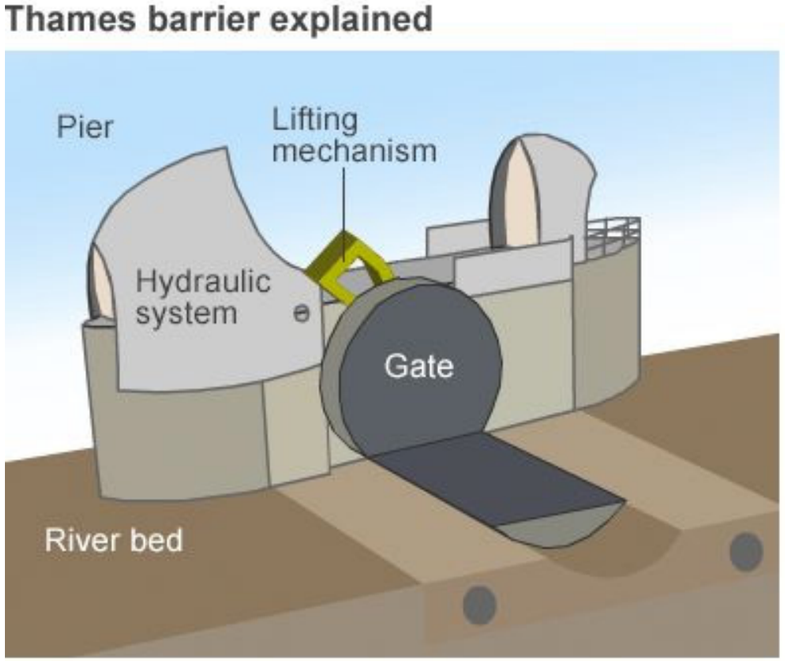


Extent of USACE proposal (NYECDC)

Image source: ArchDaily

London, UK: ***Thames River Tide Barrier***

Using technology to control the tides



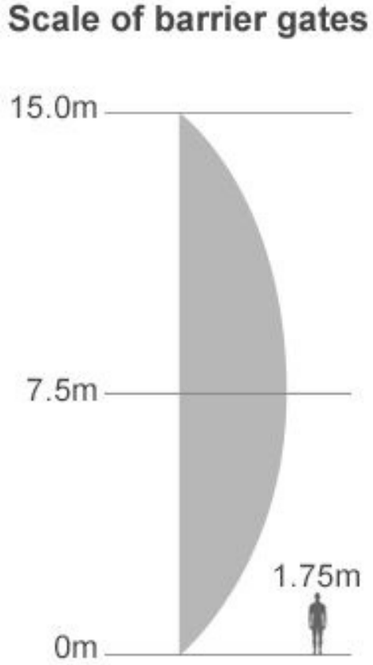
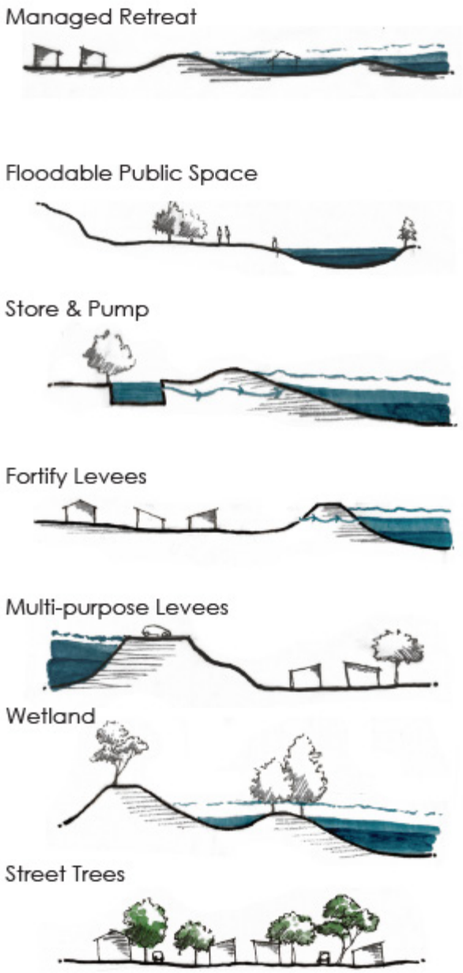


Image source: BBC News 2014

What Works for Coos Bay?



Stillman p13

Table I-2-2
Alternatives for Coastal Hazard Mitigation

Functional Class	Approach Type
1. Armoring structures	Seawall
	Bulkhead
	Revetment - revetment
2. Beach stabilization structures and facilities	Breakwaters (including artificial headlands)
	Groins
	Sills vegetation
	Groundwater drainage
3. Beach restoration	Beach nourishment
	Sand passing
4. Adaptation and accommodation	Flood proofing
	Zoning
	Retreat
5. Combinations	Structural and restoration
	Structural and restoration and adaptation
6. Do nothing	(no intervention)

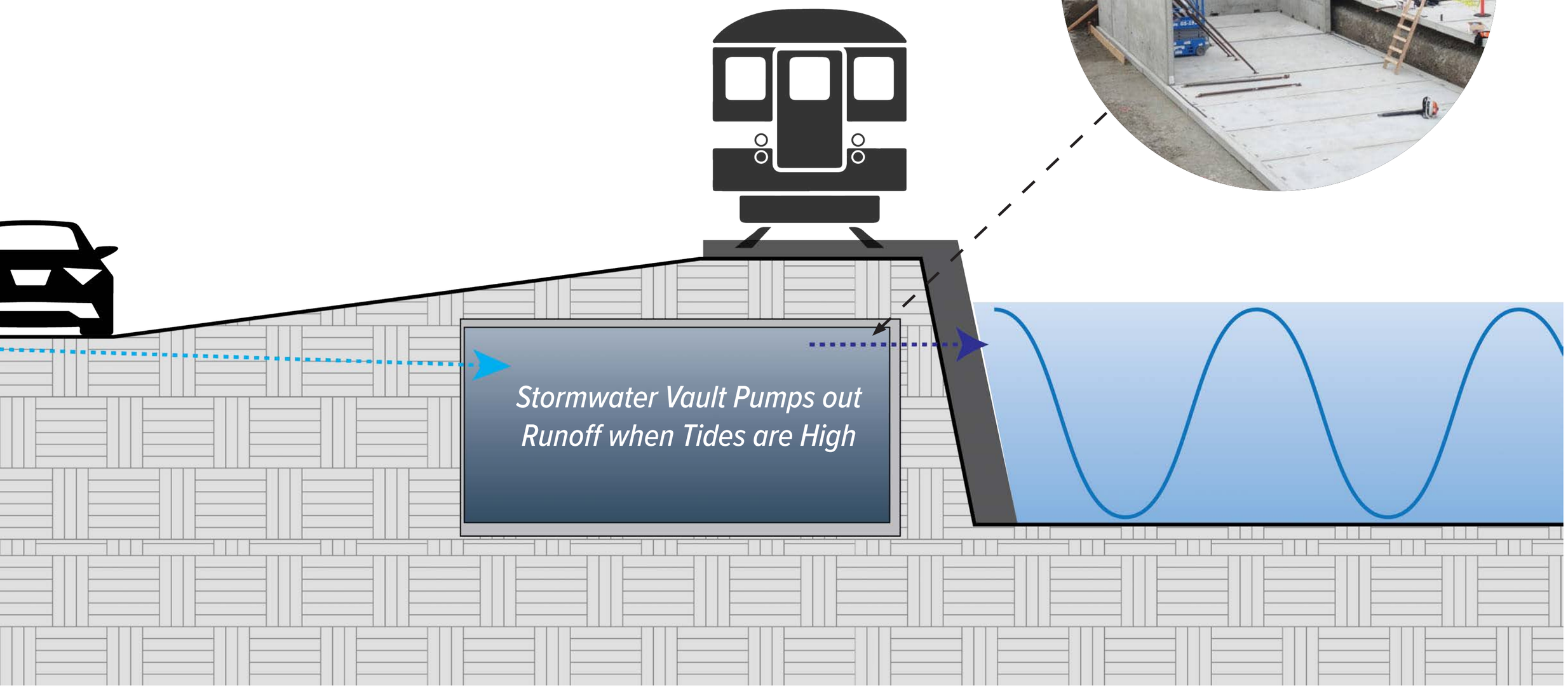
Abbreviated from CEM Part V, Table V-3-1

Any response to levee-overtopping floods will likely be sufficient for stopping sea level rise at that point, but in Coos Bay, ***the problem extends to the stormwater system***. The city cannot ***meaningfully*** address climate resilience without a focus on ***stormwater management in tandem with coastline management***.

Status Quo Solution

Highway 101

Coos Bay Rail Line



Strengths

- precedent designs & specialists for constructions

-”Status Quo” solution; people are familiar with these types of infrastructure already

Weaknesses

- huge amounts of extraction and resources needed

    - particularly concrete and steel
    - must use pumps to move water

- lacks resilience; if one part fails the entire thing fails

Opportunities

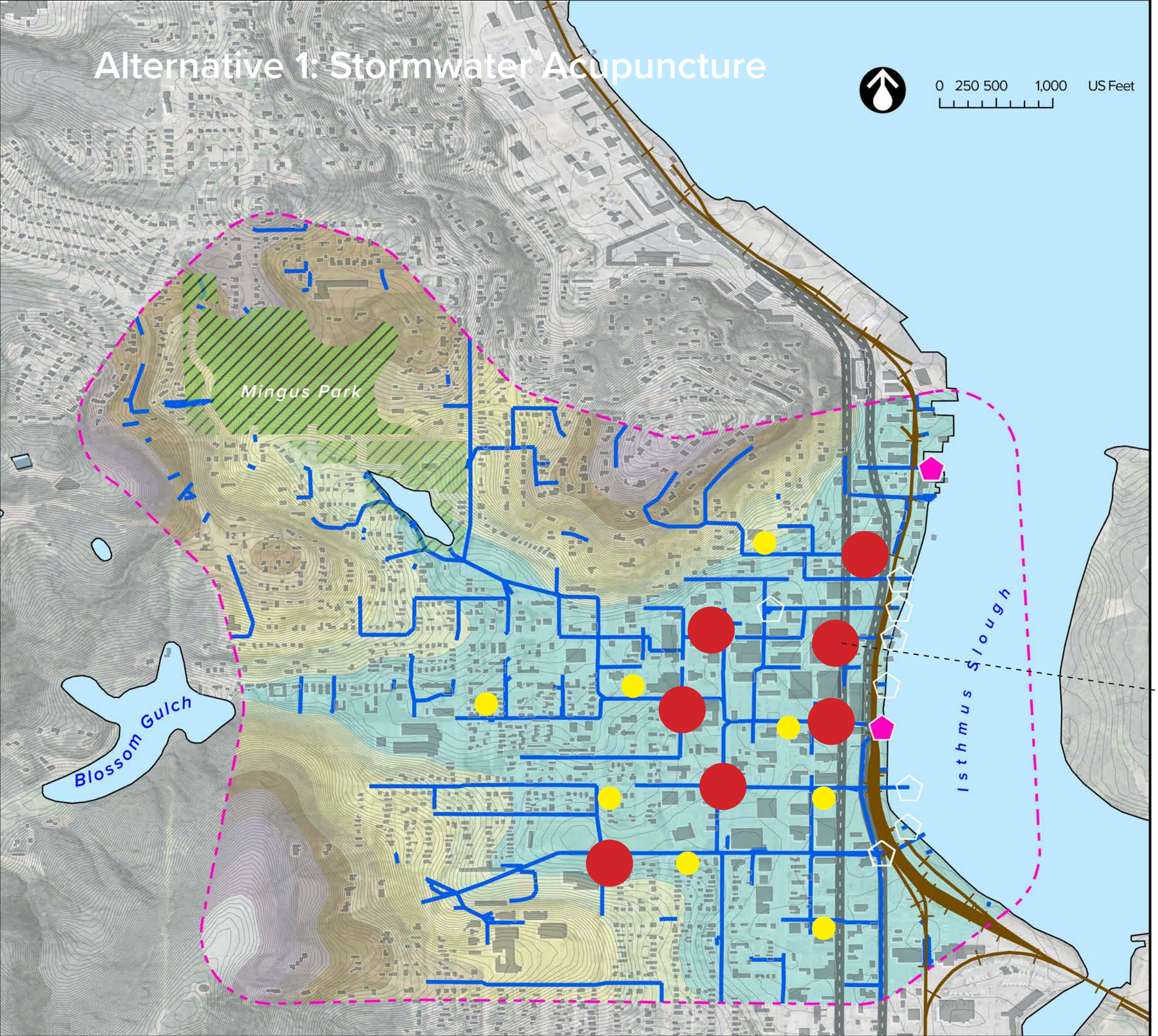
- expand waterfront for pedestrian uses

- prioirtize protecting evacuation routes

Threats

- maintaining location of HWY 101 and railroad take priority to functioning urban spaces

Alternative 1: Stormwater Acupuncture



.25 AF capture

.5 AF capture

Pre's Mural
Curts / Bayshore

Strengths

- efficacy and function increase as more sites are modified

- disperses capture load across multiple sites

- passively capture up to a 20 year storm across the system

Weaknesses

- extra considerations to be made for connections to stormwater system

- doesn’t directly address concerns of urbanism and complete streets

Opportunities

- retrofit under-utilized or abandoned property in downtown

- introduce green urbanism

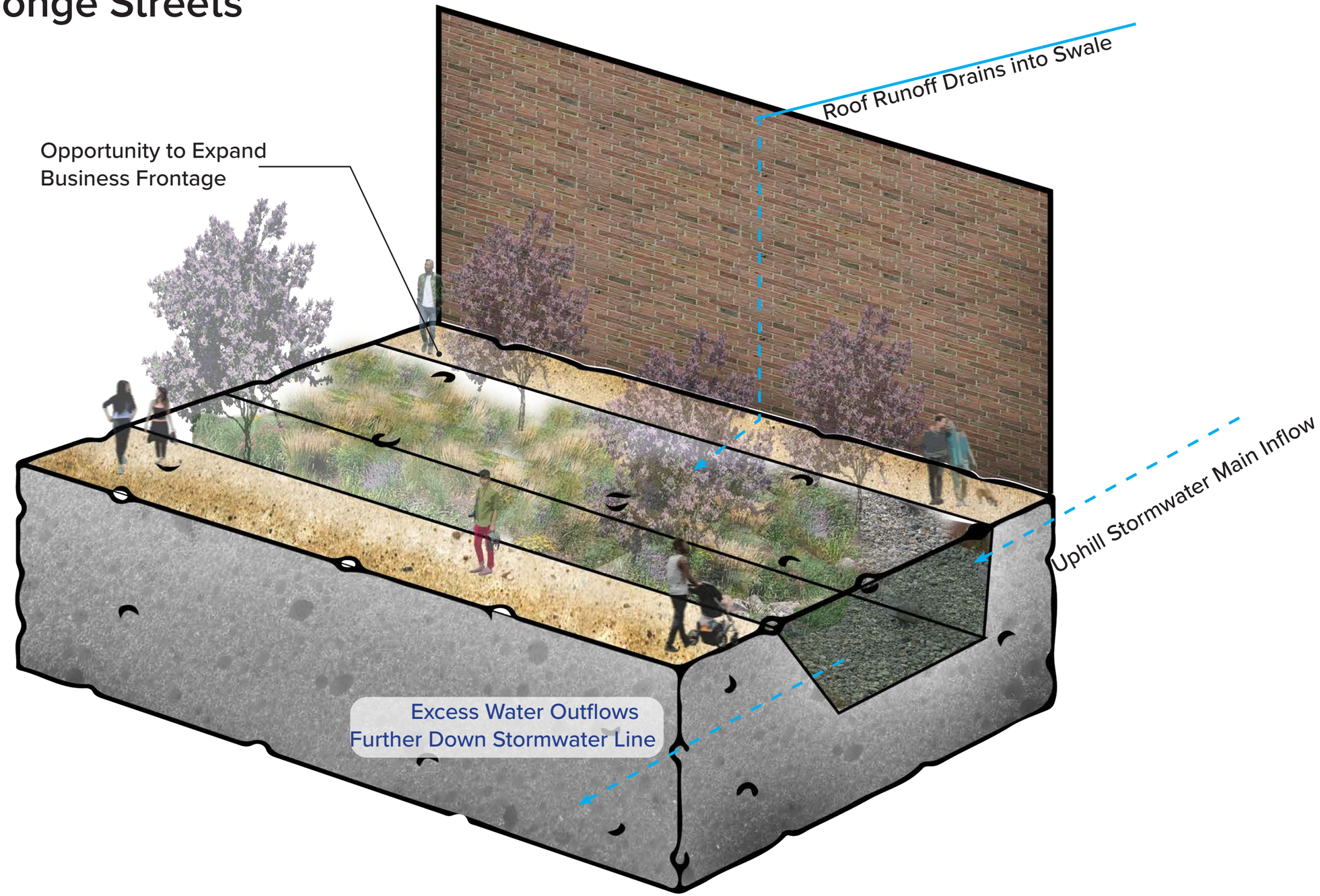
Threats

- too little too late:

    - responding one site at a time may be too slow

- a large amount of sites are needed to capture the requisite storm

Alternative 2: Sponge Streets



Strengths

- highly modular for urban design

- expand capacity through more construction

- provides vegetation and beauty throughout city

- passively capture up to 20 year storm across the system

Weaknesses

- sacrifices large amounts of constructed street

- reduction in traffic capacity

Opportunities

- remove priority for cars in downtown area

- lessen risk of traffic-pedestrian incidents

- provide opportunities for new investments in Coos Bay

Threats

- very radical approach may not be liked by residents

- the city is already very car-dependent, does reducing streets make car dependency worse?

Goals

- create an experimental design exploring passive capture of stormwater runoff for a downtown Coos Bay watershed

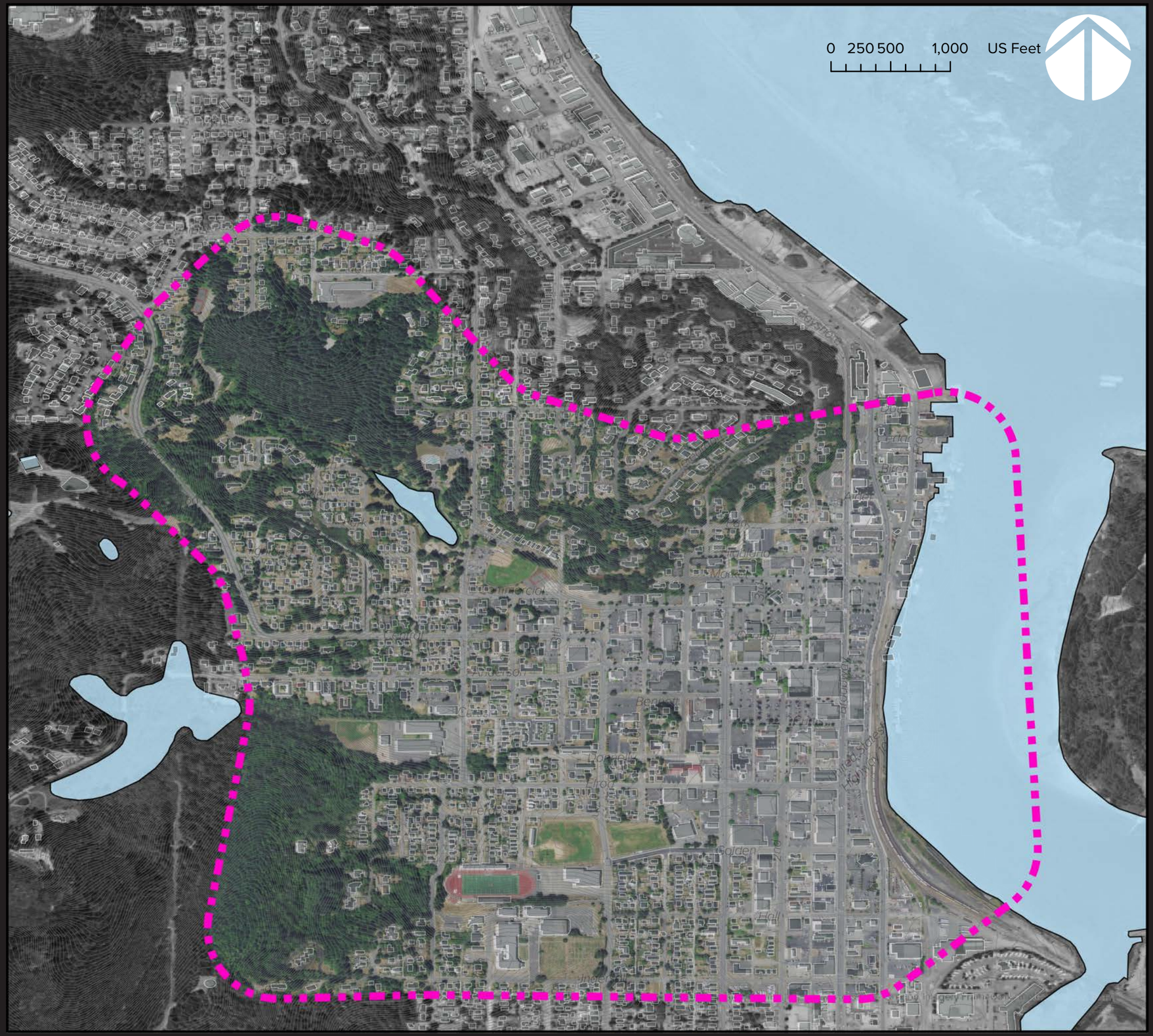
  - target 20 year storm (state policy)

- Create visions of a more resilient downtown for SLR flooding

  - reduce presence of automobile

  - improve pedestrian access

  - introduce principles of green urbanism

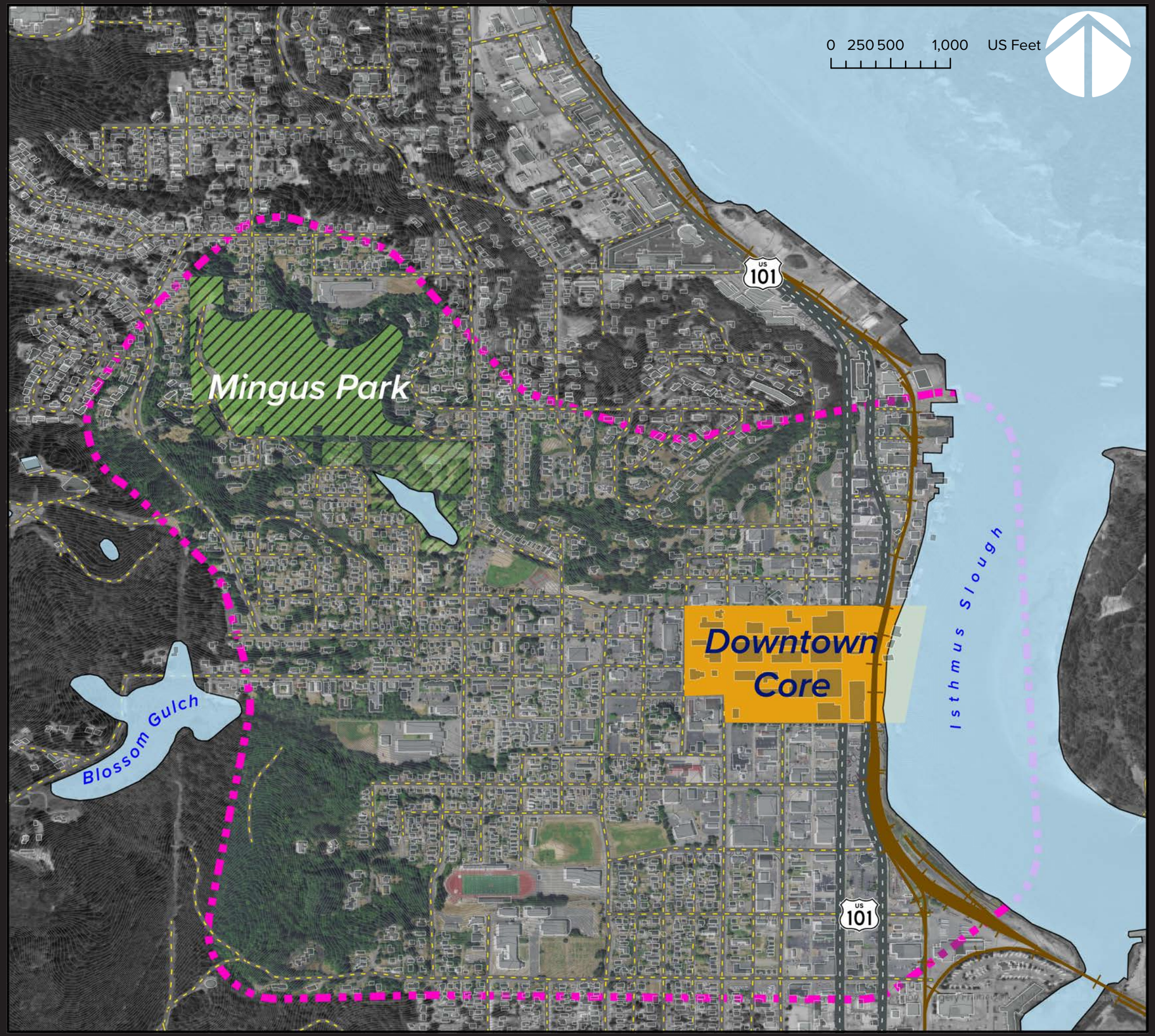


DOWNTOWN DISTRICT COOS BAY

Target Watershed

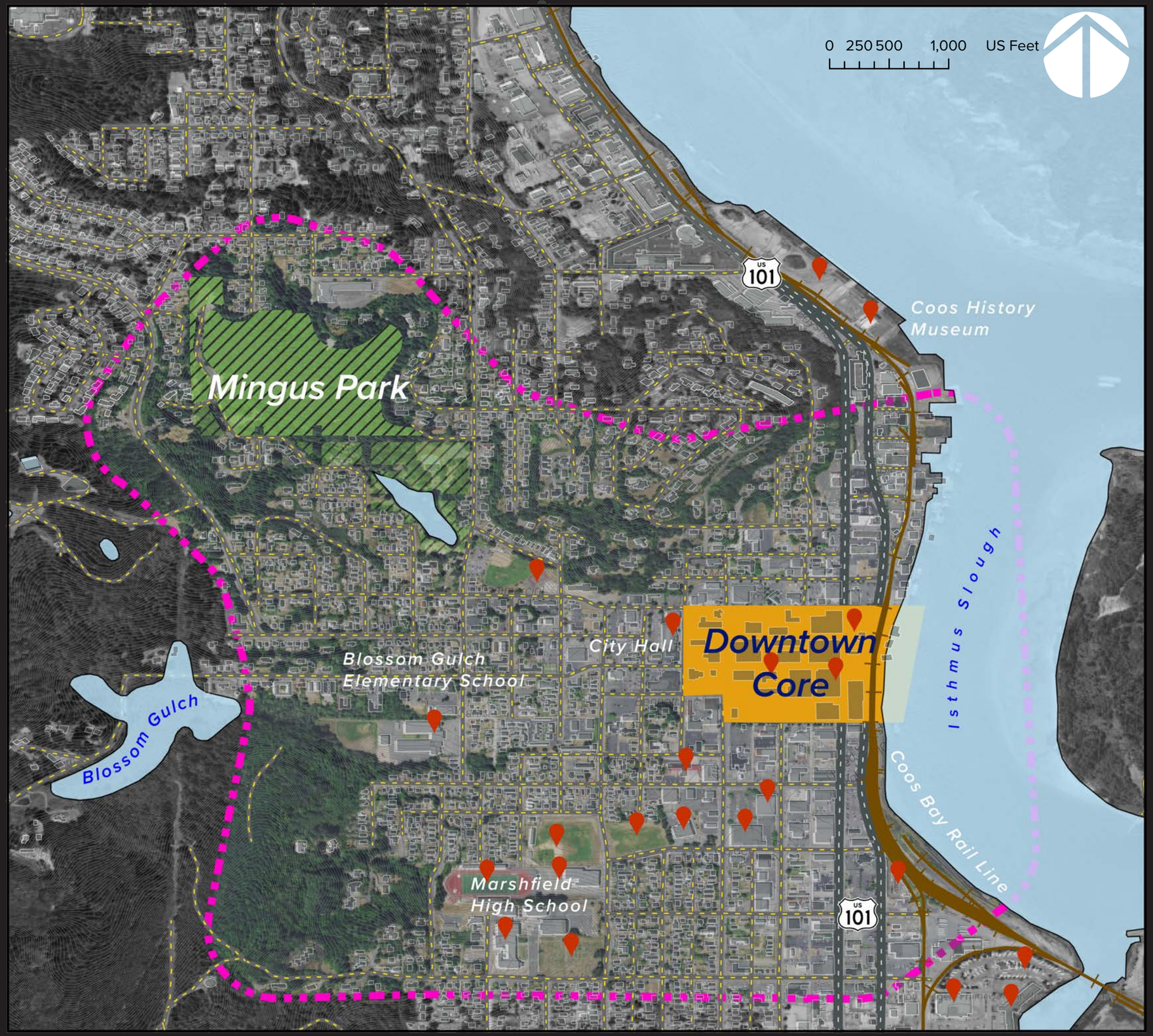
DOWNTOWN DISTRICT
COOS BAY

Context:
Transportation
& Culture



DOWNTOWN DISTRICT
COOS BAY

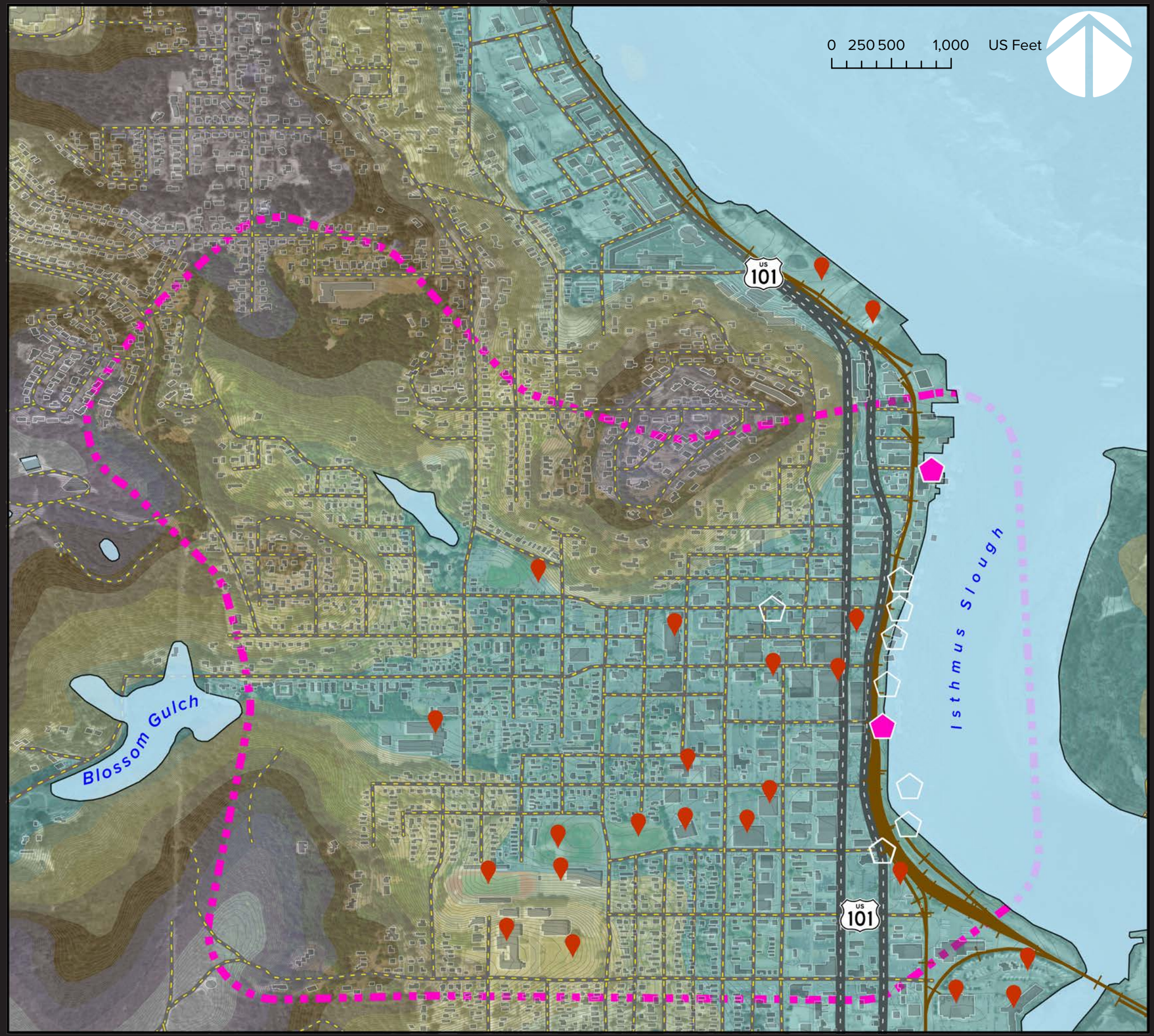
Context:
Transportation
& Culture



Landmark

DOWNTOWN DISTRICT
COOS BAY

Topography



+80’

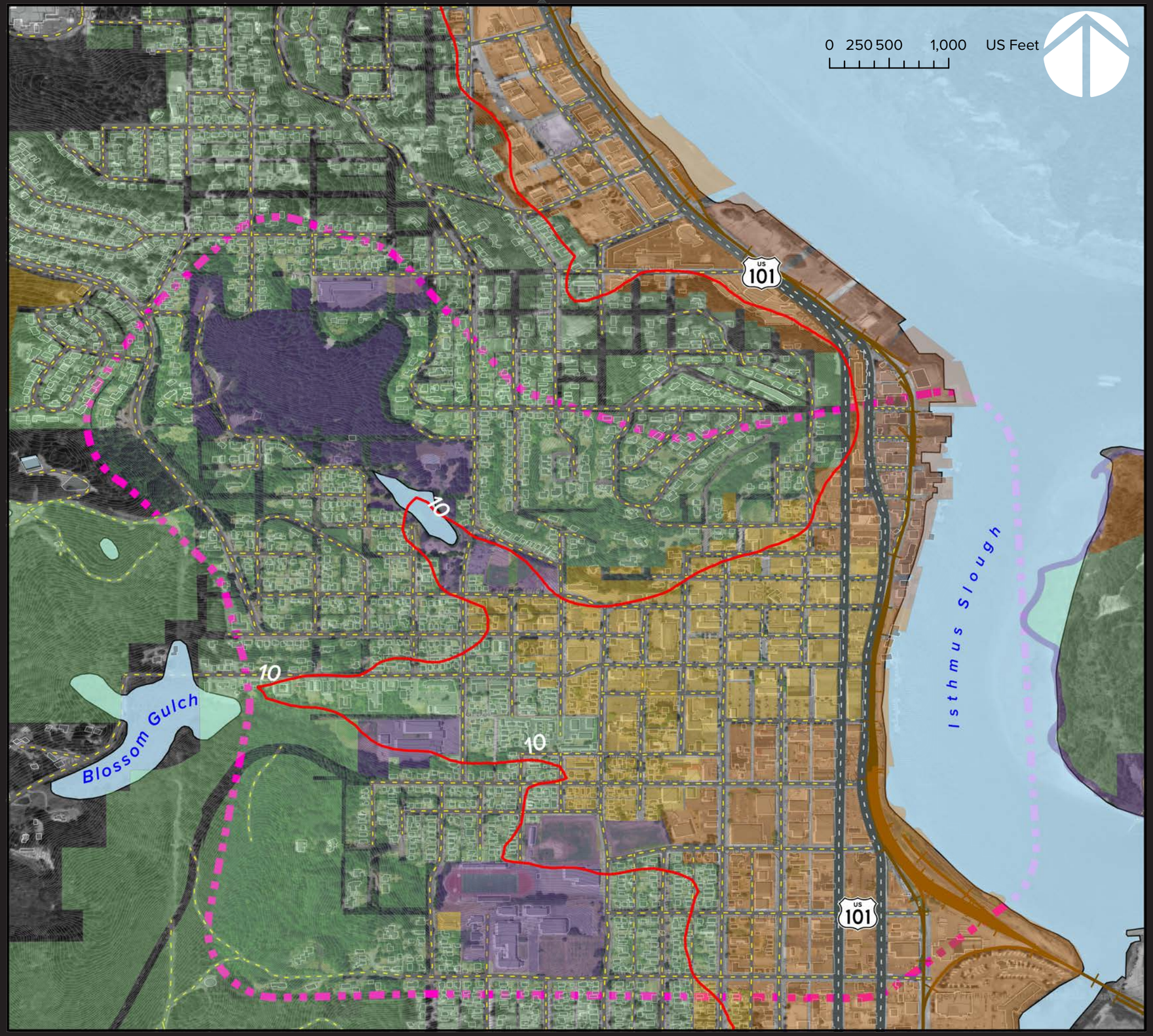
31’-80’

11’-30’

0-10’

DOWNTOWN DISTRICT
COOS BAY

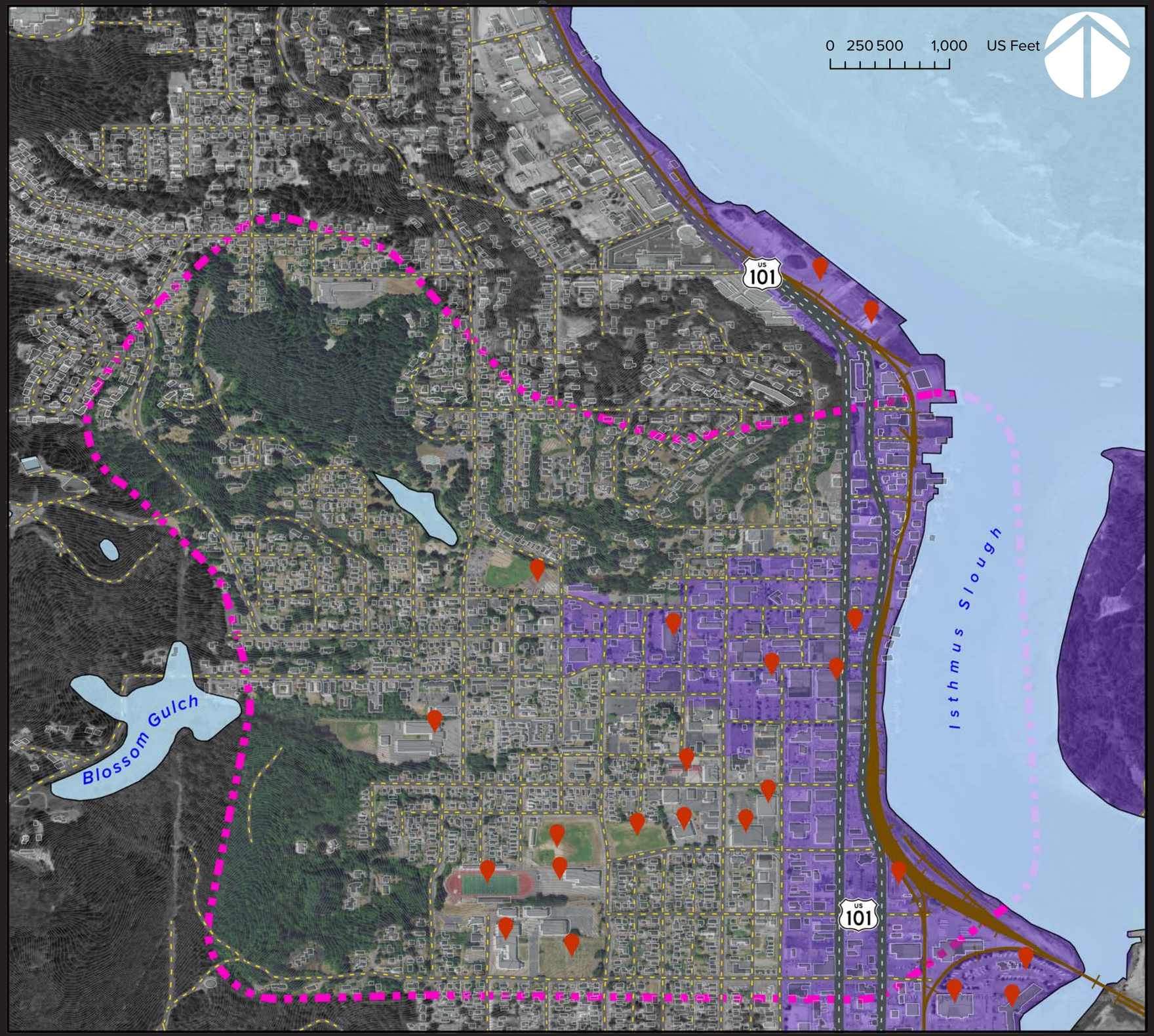
Topography & Zoning



- Industrial
- Commercial
- Residential
- Government

DOWNTOWN DISTRICT
COOS BAY

Urban Renewal



DOWNTOWN DISTRICT
COOS BAY

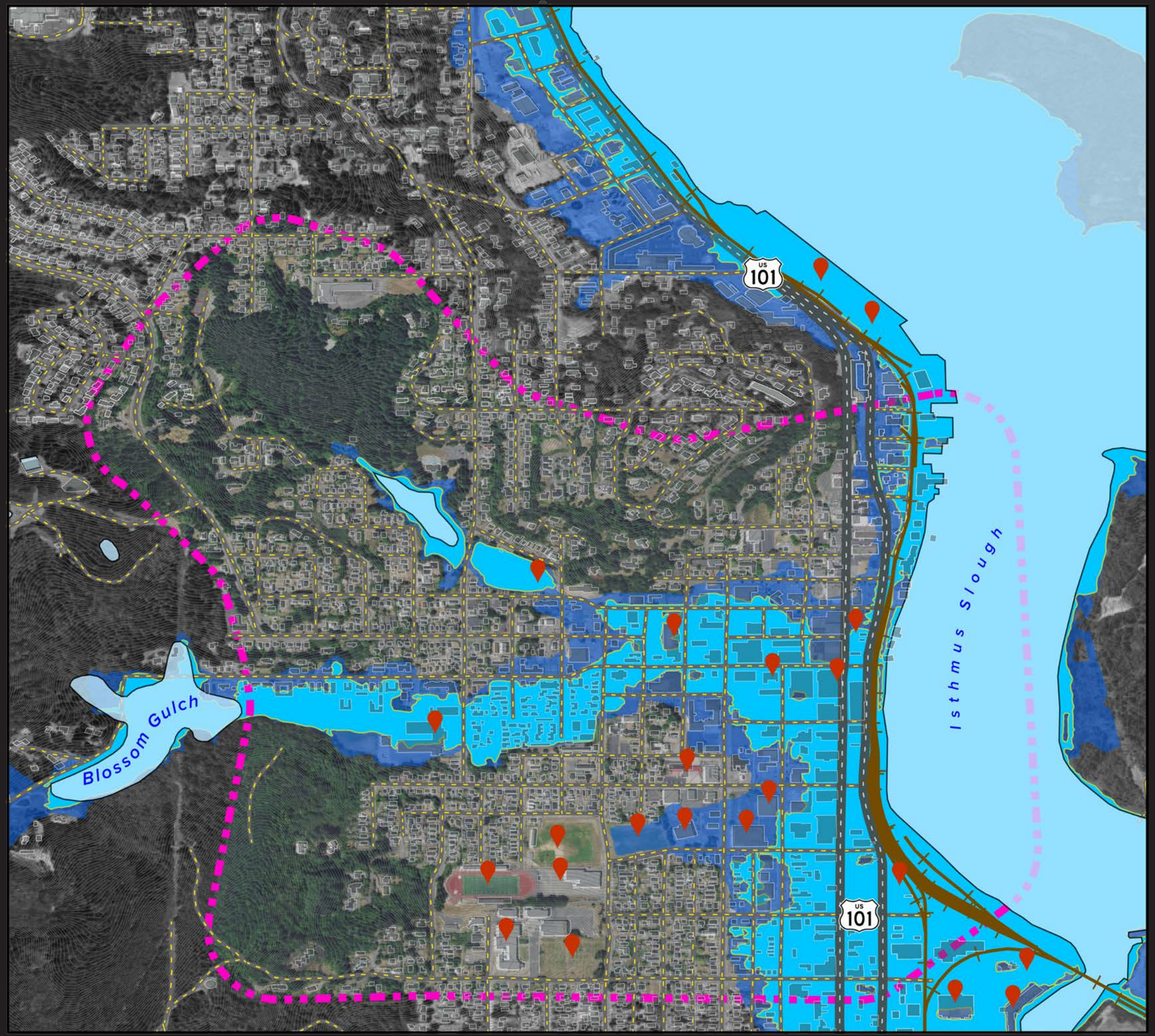
Topography
& Stormwater

20 yr Storm Runoff:

22 AF

100 yr Storm Runoff:

31 AF



DOWNTOWN DISTRICT COOS BAY

Storm Surge + SLR Projection

Infrastructure at Risk:

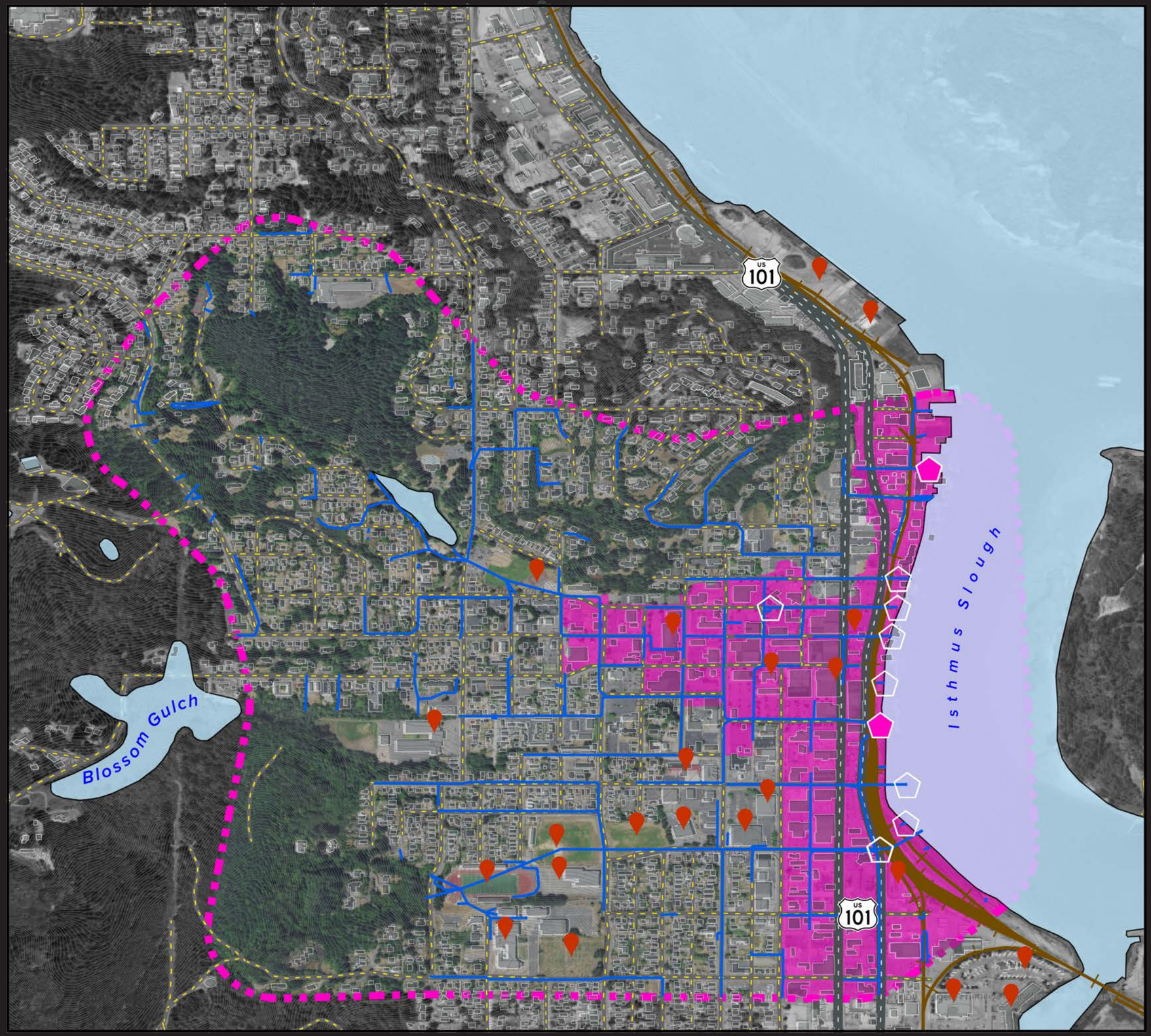
6-8 miles of road

300+ buildings

200+ acres

DOWNTOWN DISTRICT
COOS BAY

Strategic Area of Focus



Cars and Street Space

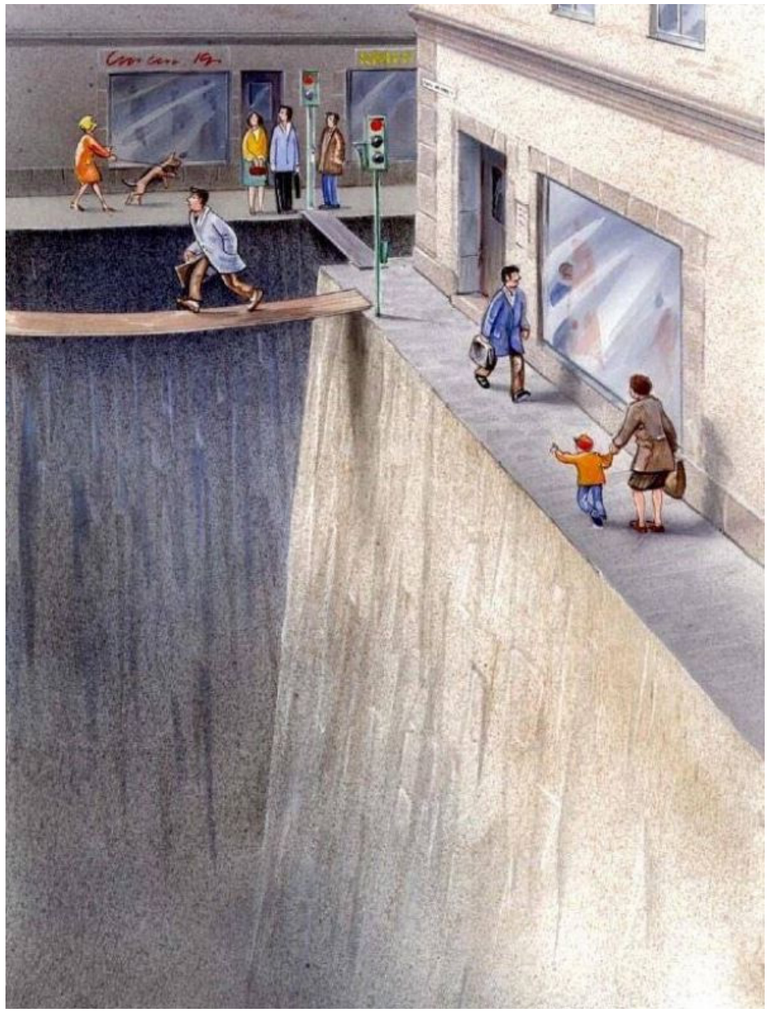


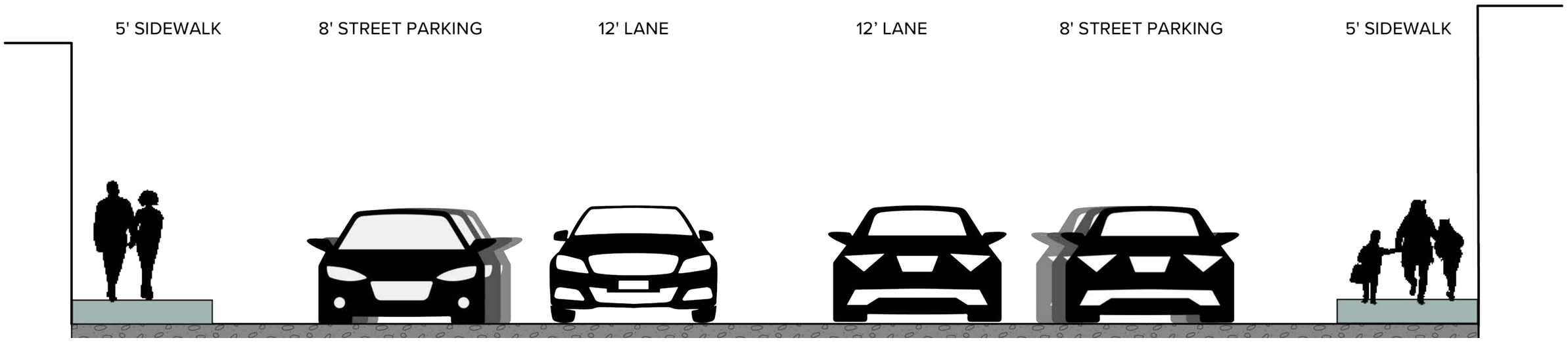
Illustration by Karl Jilg

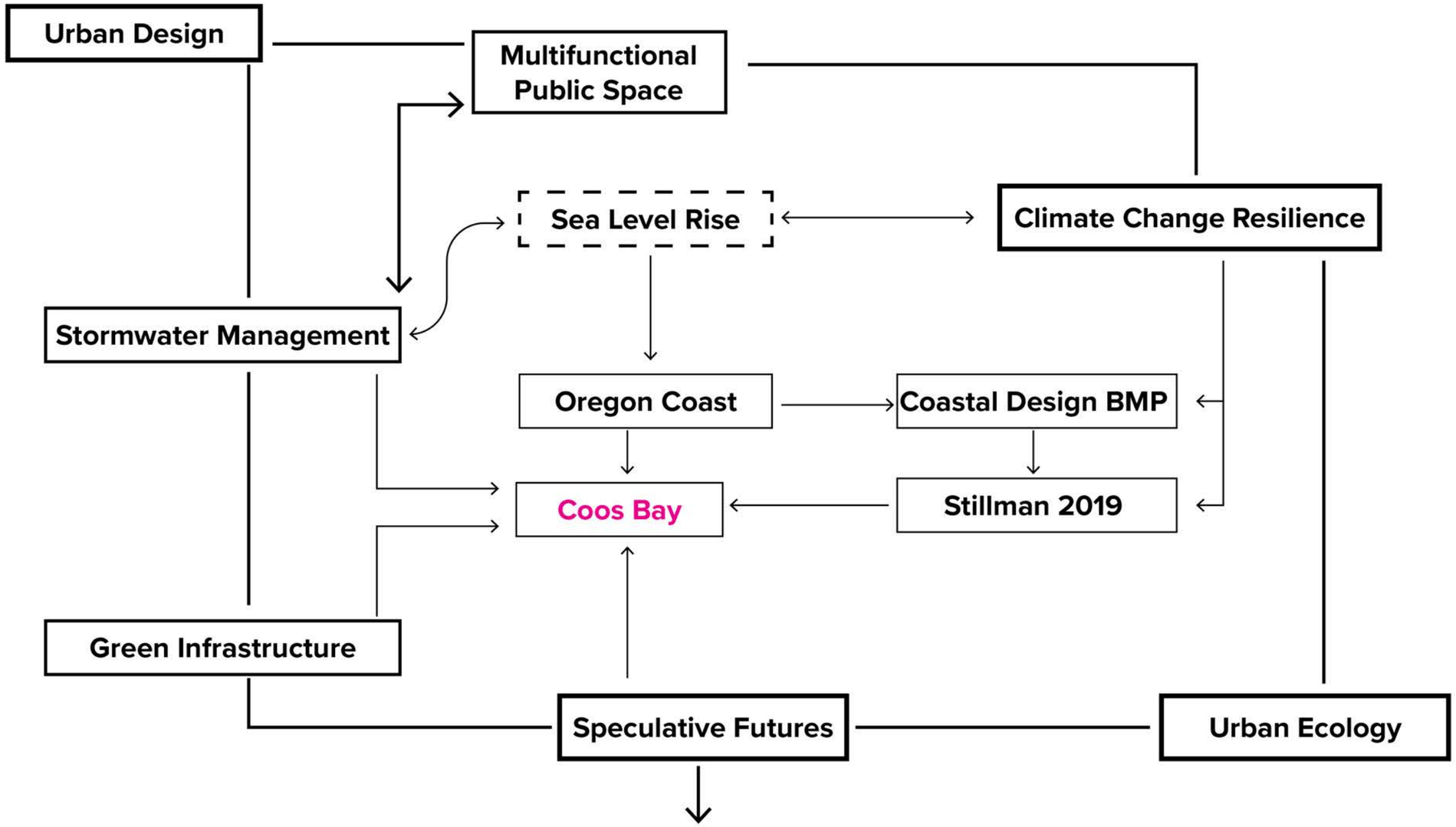
Main Pedestrian Entrance to Coos Bay Marina

Typical R.O.W. in Downtown Coos Bay

60'-0"

COMMERCIAL R.O.W.





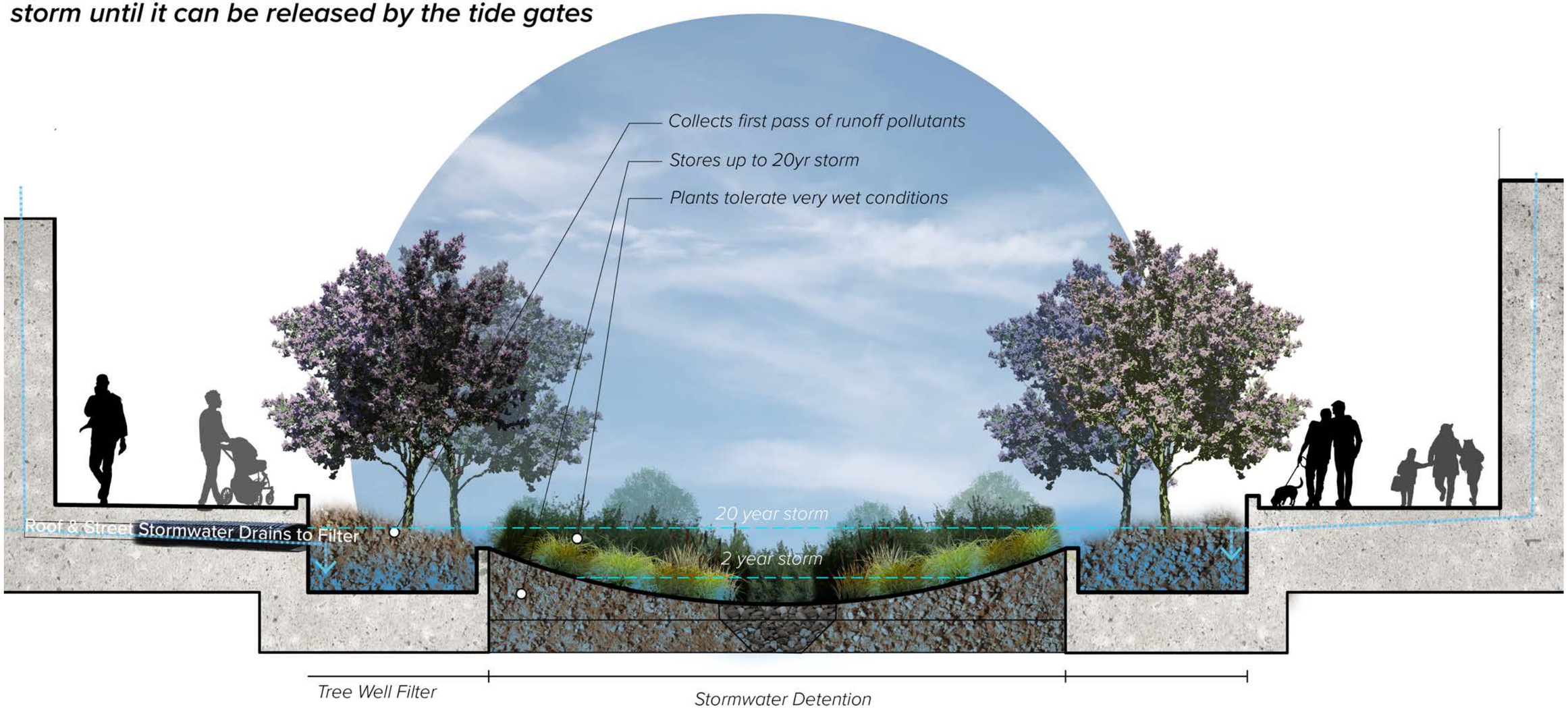
Landscape architects must create visions of the future for cities to implement...
designers must be leaders in envisioning a better world

Early Sponge Street Concept

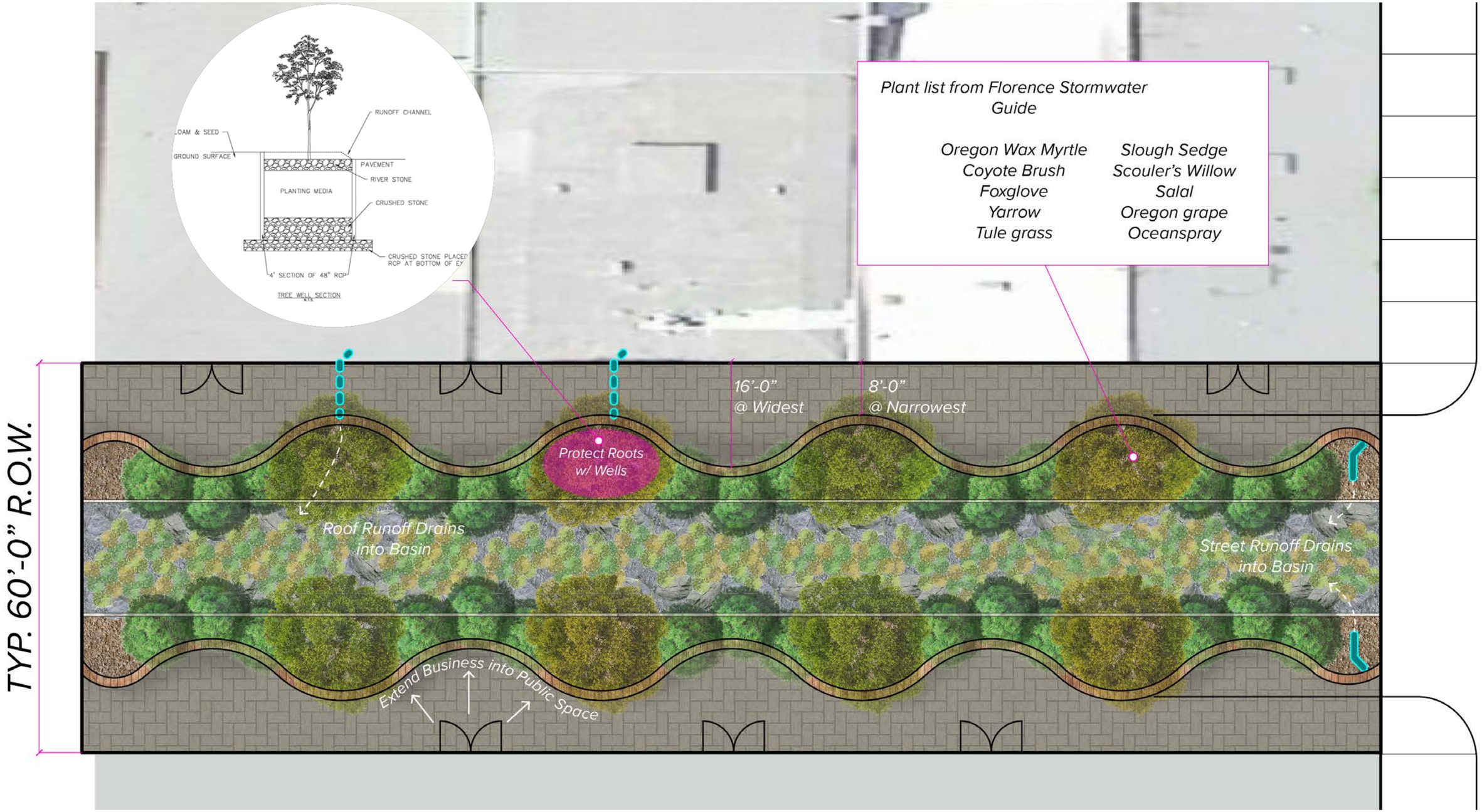
"SPONGE STREET" @ CURTIS / 2ND

Wet Biodetention Swale can capture a 20 yr storm until it can be released by the tide gates

Wet = typically inundated substrate
Bio = using vegetation
Detention = metered release of runoff



Sponge Streets



Trees

Oregon Wax Myrtle

Scouler's Willow

Shrubs

Coyote Brush

Foxglove

Salal

Yarrow

Oregon Grape

Oceanspray

Grasses

Tule Grass

Rush

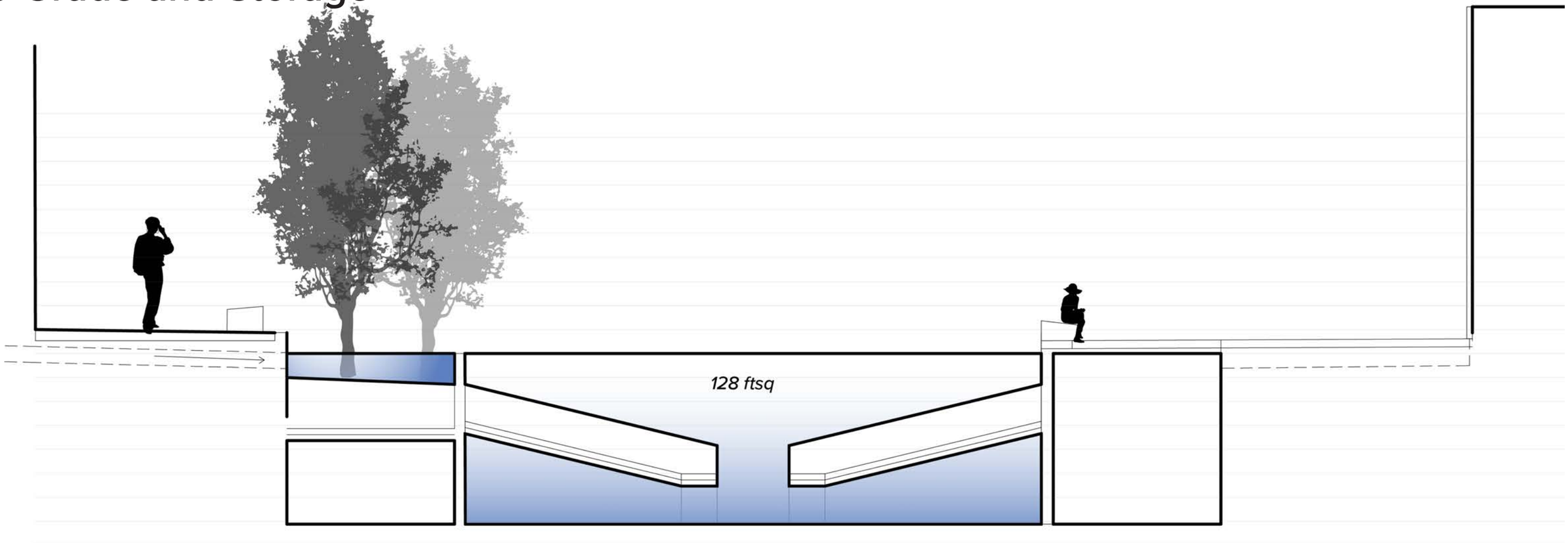
Sedge

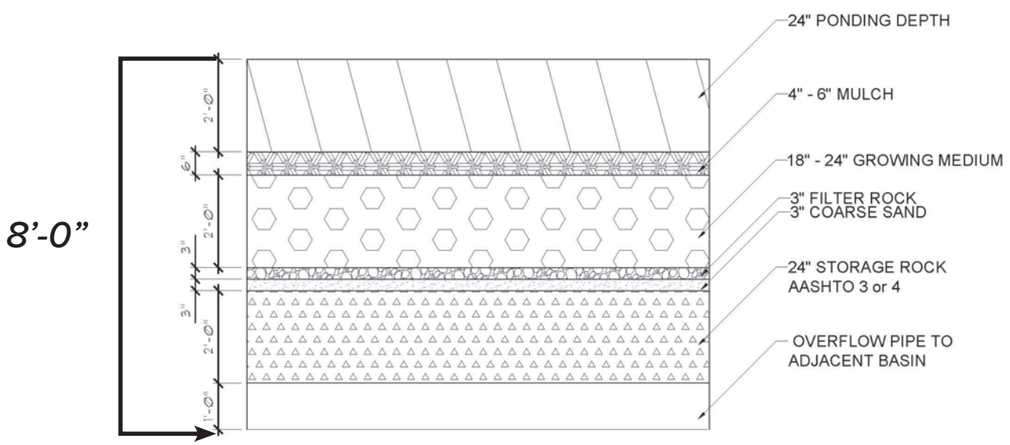
Little Bluestem

Fountain Grass

The Half Sponge

Sub-Grade and Storage





~ 130 cubic feet stored per L.F. of Sponge Street

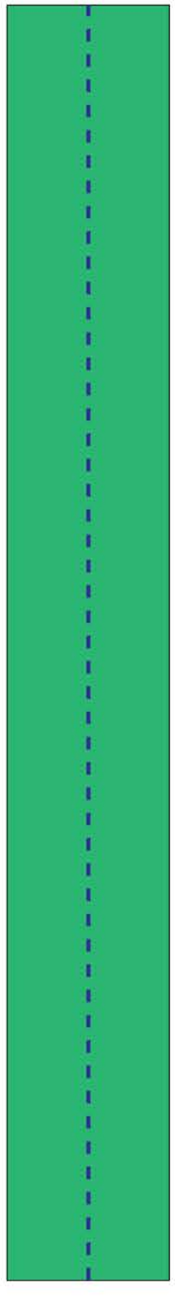
1 AF stored = 335 L.F.
~ 1.5 miles for 22 AF

Typical Block Length

200’-0”

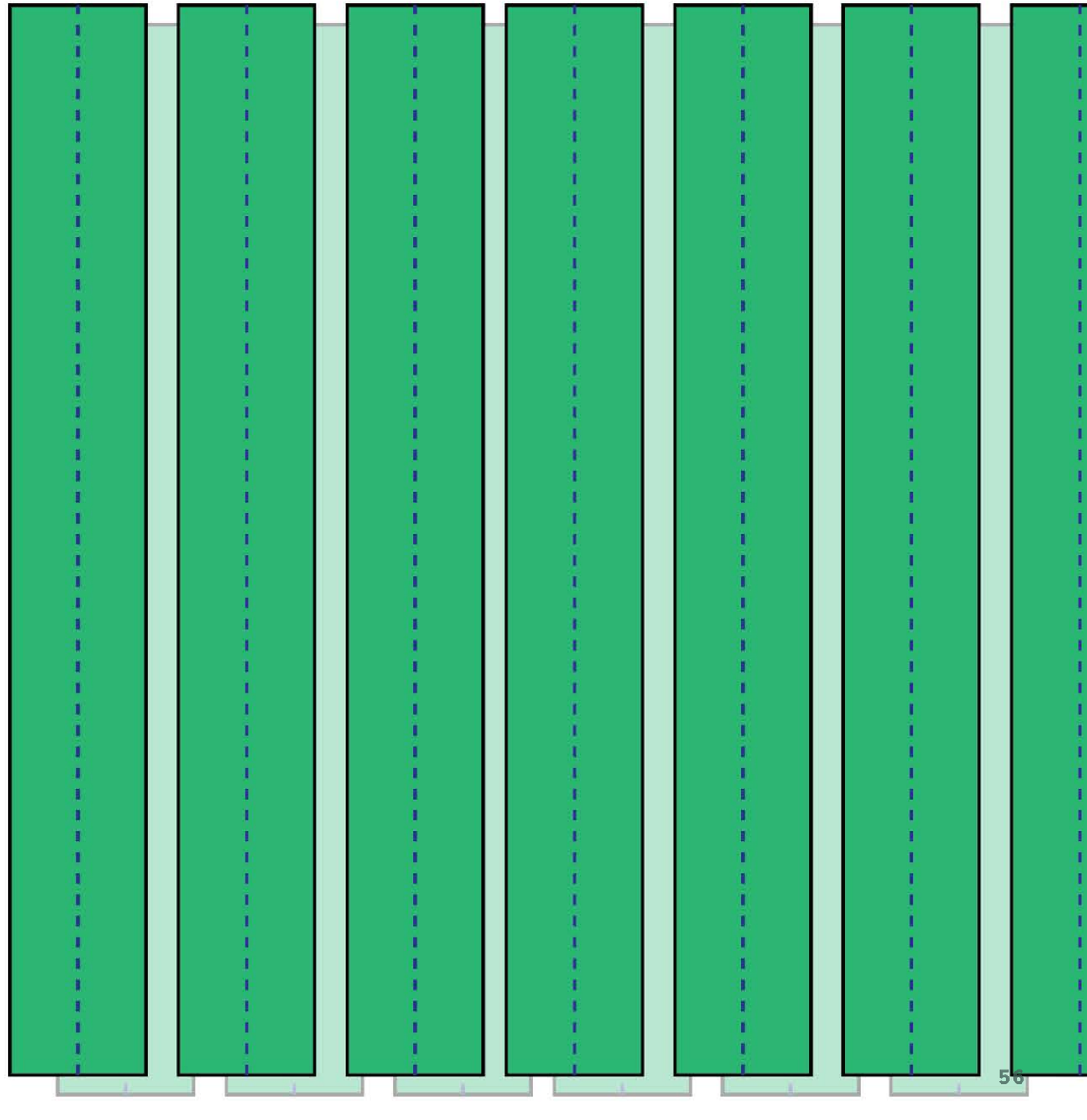
1 AF Capture

335’-0”



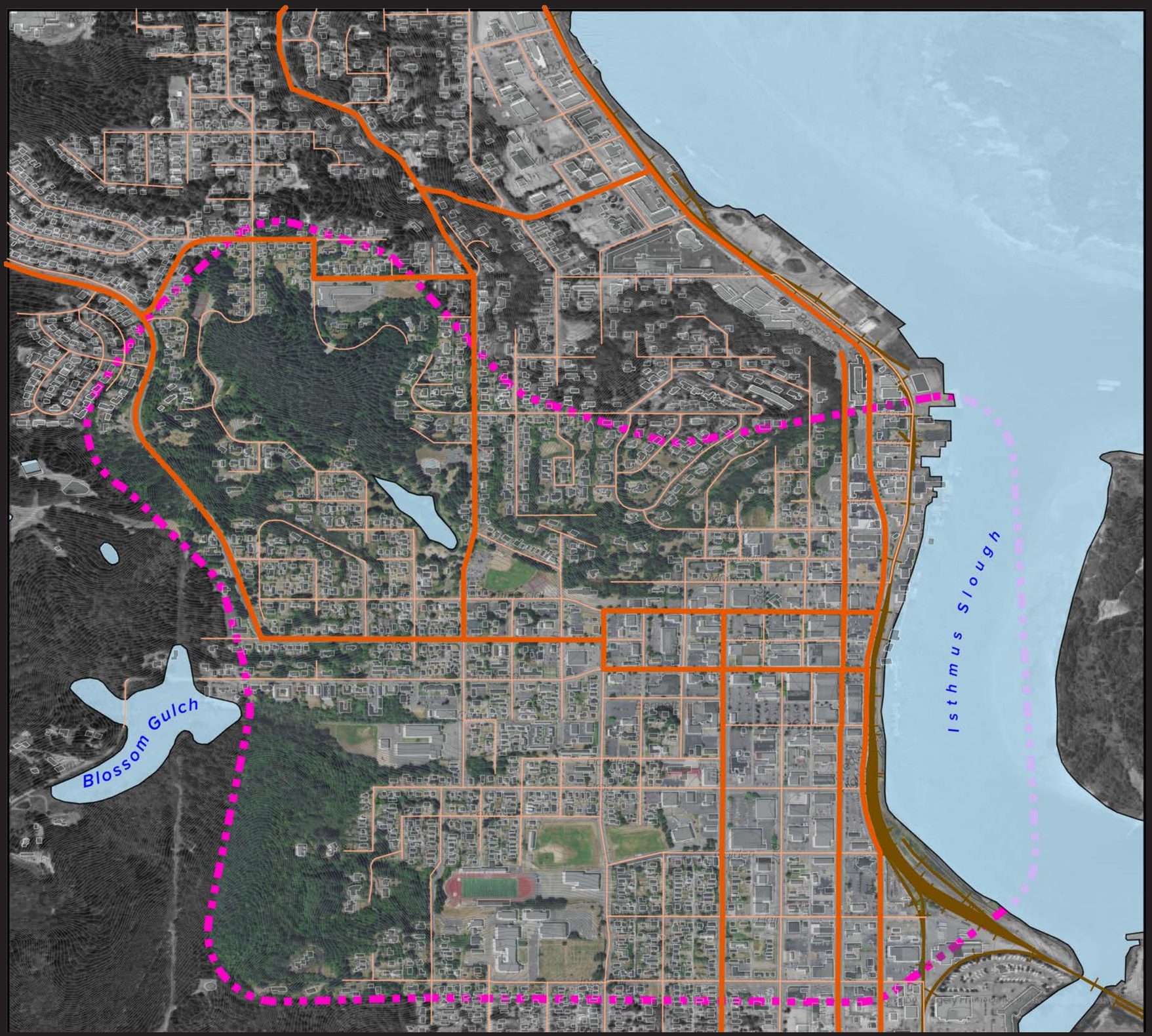
22 AF Capture

7,450’-0”



DOWNTOWN DISTRICT
COOS BAY

Arterial vs Local Streets

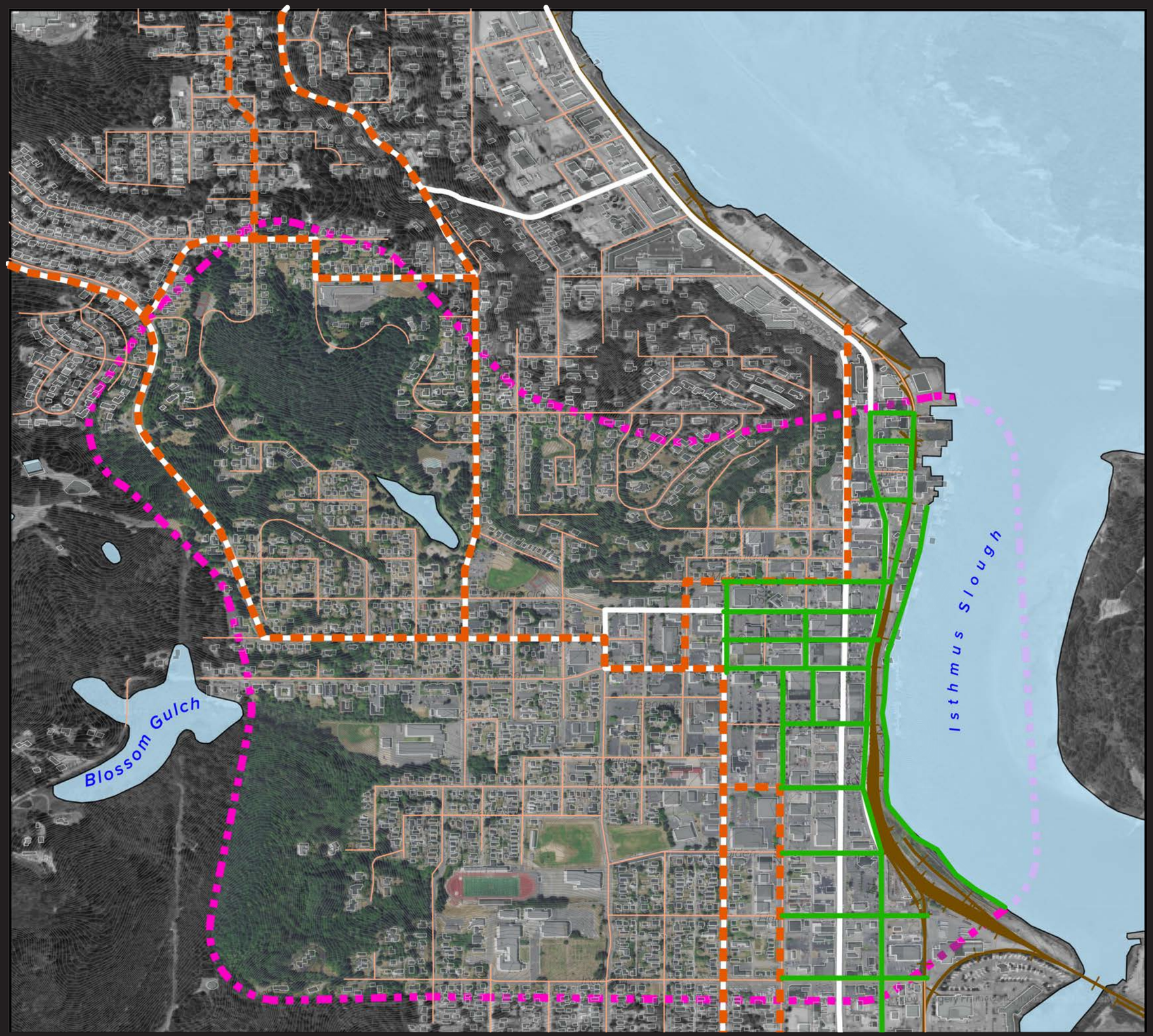


Arterial

Local

DOWNTOWN DISTRICT
COOS BAY

Potential Sponge Streets



Ex. Arterial

Ex. Local

Proposed Arterial

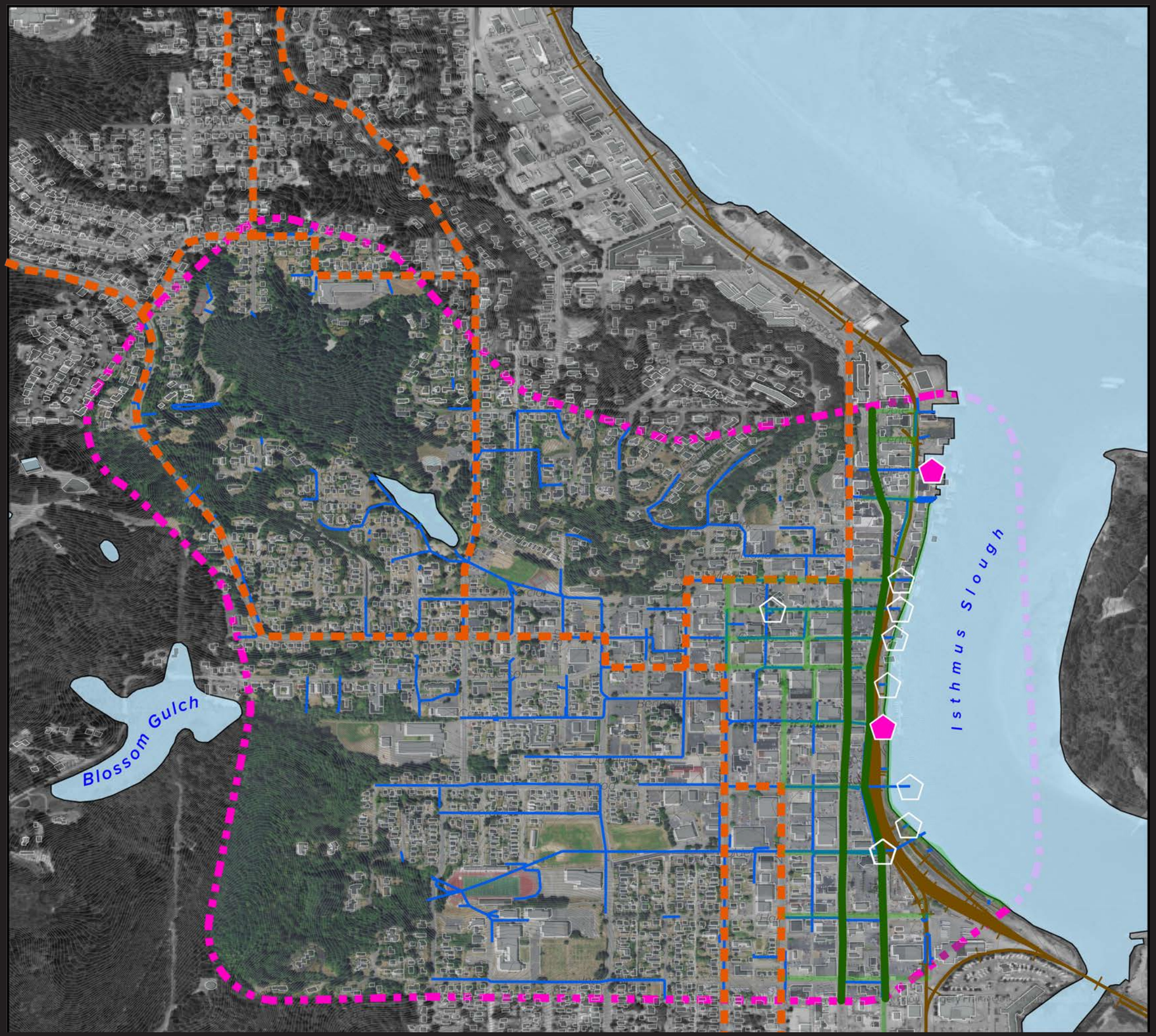
Proposed Sponge

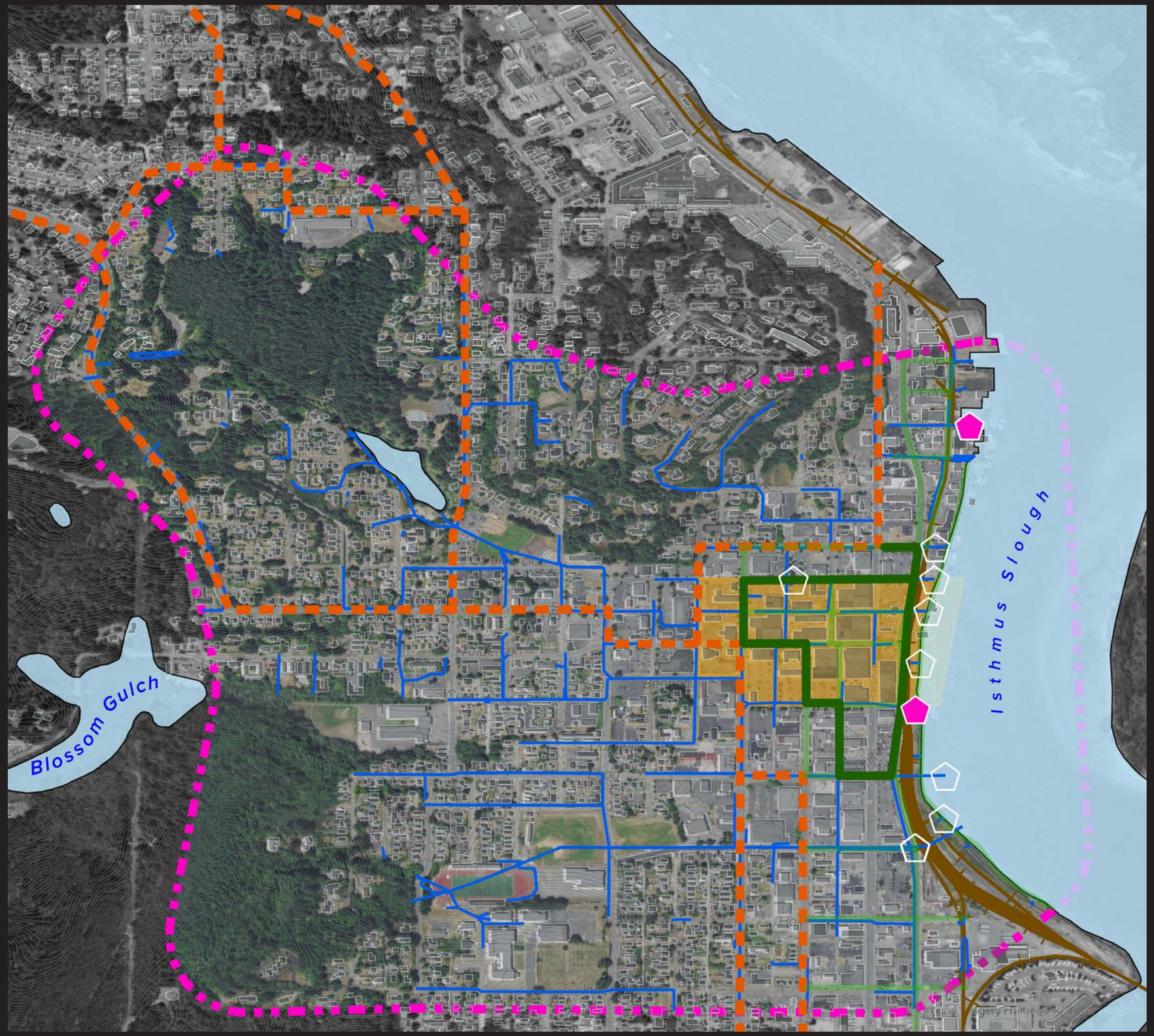
DOWNTOWN DISTRICT
COOS BAY

Sponge Streets Placements

Proposal 1:

Replace Highway 101



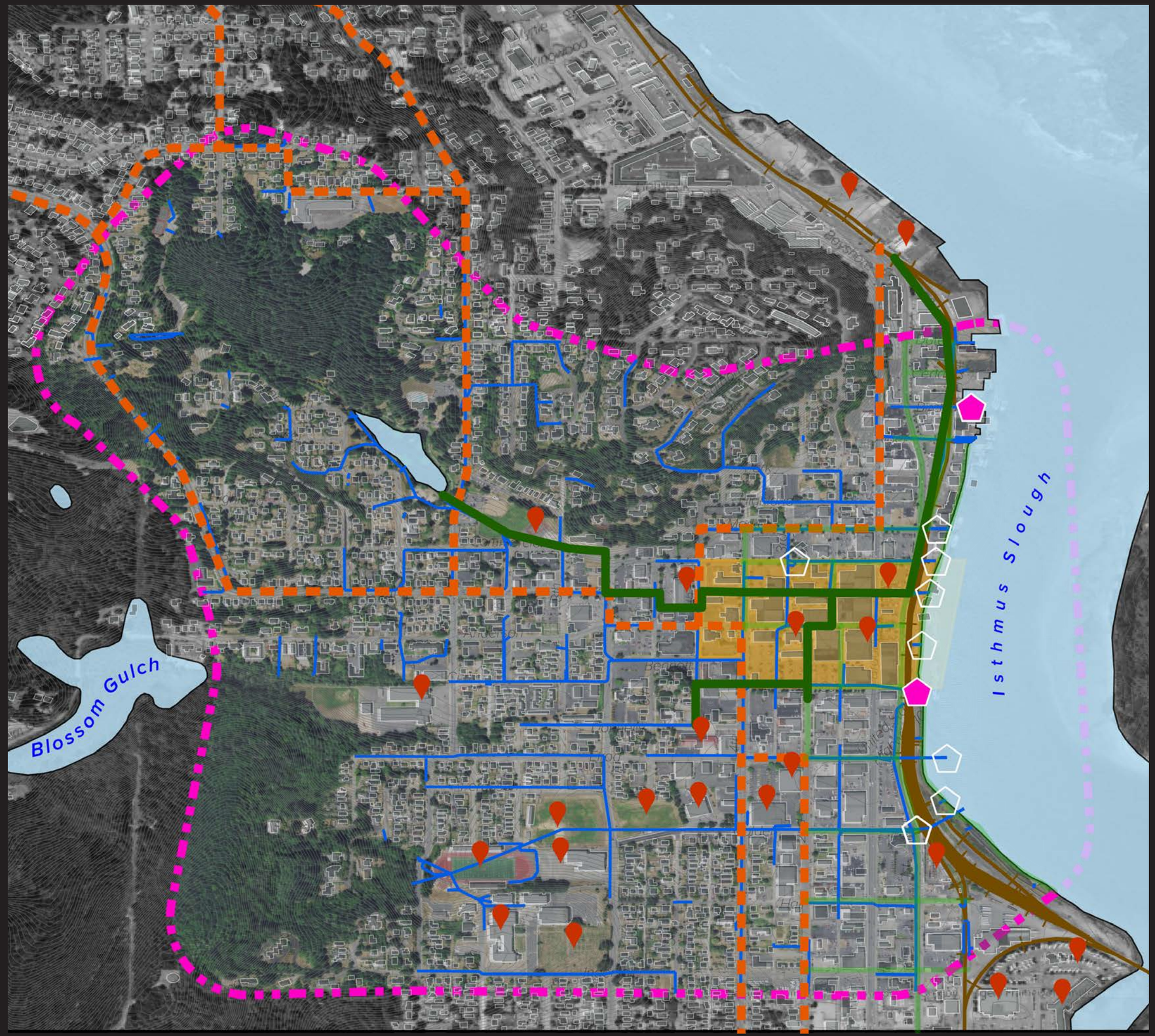


DOWNTOWN DISTRICT COOS BAY

Sponge Streets Placements

Proposal 2:

Focus on Downtown



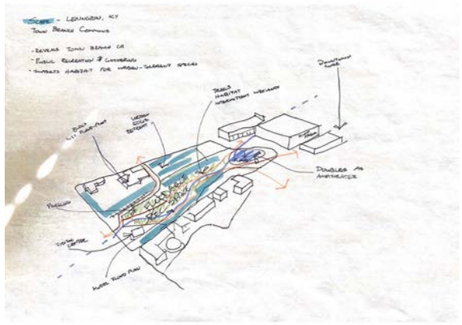
DOWNTOWN DISTRICT COOS BAY

Sponge Streets Placements

Proposal 3:

Connect Landmarks

Cut for Time

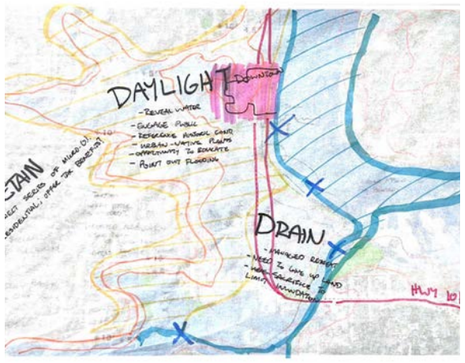


Floodable Plaza Design

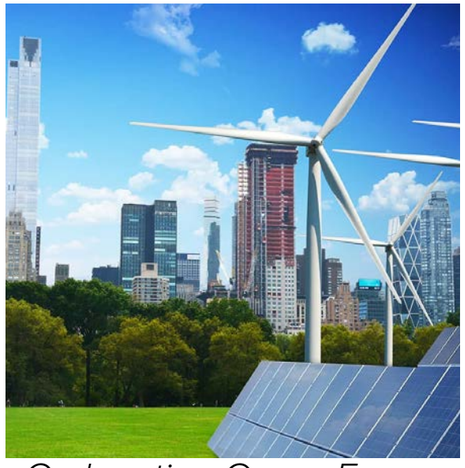
Collaborating with Leapfrog Designs (Source: Leapfrog Designs)

Re-Introducing Wetlands

Sustainable Material Usage (Source: ECOncrete)



Stormwater Intervention Framework for Coastal Stormwater Management



Co-locating Green Energy

Water Storage and Re-Use

Re-Locating HWY 101

Acknowledgements

Project Chair

Michael Geffel

Committee Members

Rob Ribe

Kory Russel

Special thanks to

Brad Stangeland & Mark Morgan

Liska Chan, Mark Eischeid, David Buckley Borden, Ignacio Lopez Buson, Ben Shirtcliff, Jean Yang, Arica Duhrkoop-Galas, Harper Keeler, Nancy Silvers

Chris Stillman

Robert Melnick, Hannah Six, Noah Kerr

The UO ASLA 2022-23 ExComm

The UO MLA & BLA 2023 Cohorts

The Overlook Field School 2022

Mike Ross, Gale Fulton, and Caley Shoemaker at the University of Tennessee

My friends and family, who have supported this journey from thousands of miles away

THANK YOU

Script Transcription

- Hello everyone, my name is Peter Olson and I'm going to be addressing solutions for sea level rise flooding in Coos Bay, OR.
As the most densely populated community on the Oregon Coast, Coos Bay has more infrastructure threatened than any other. Sea level rise projections change quickly, and lately have only been increasing. Currently, the Oregon Coast is projected to experience about 6" in sea level rise by the end of this decade, 30" by 2050, and maybe as much as 6' by the end of the century. Due to an aging stormwater system, the problem isn't as simple as water inching into the mainland. This project will explore options for coastal management and propose methods for Coos Bay to respond to the threat of flooding before 2050.
- My interest in climate resilience began early on in my education, when my 8th grade science teacher, Mr. England felt it pressing that we watch Al Gore's An Inconvenient Truth to get a better understanding of the world we were growing up in. Say what you will of Vice President Gore, but at the time I thought there was no higher authority than the former VP of the United States. I would spend most of high school and early undergrad languishing about how I could be on the front lines of addressing climate change. I didn't want to just ring the alarm bells, I wanted to translate the data into meaningful action that would enable others to survive, or better yet, thrive.
- I received my degree in environmental studies from the university of tennessee, and nearing my senior year I realized I had learned so many ways of analyzing all the problems of the world, but had few tools for actually solving them.
- A chance encounter with some landscape architecture faculty at UT would lead me down this road.
- Designers are integral in creating visions of a future that works better for all of us; the built as well as the natural environment.
- Our job is to inspire others to act, to highlight unseen processes and connections. Whether we like it or not, we are in a leadership position to respond to climate change.
- across the globe, communities are reacting to sea level rise projections with a variety of interventions, ranging from battening down the hatches to keep water out, learning to live with wet feet, or wholesale abandoning land for drier pastures. The Oregon Coast is the second-most productive economic region in Oregon, only trailing behind the Portland Metro area. Our coastal towns must prepare to respond to climate change, and if Coos Bay can't be protected, who will be? Oregon has been a leader in land-use planning and stormwater management, and must further this work to protect the coast.
Via CNN May 23 2023 Via CBS News June 4 2023
- Climate change is here. There is no flinching from that. State Farm and AllState, two of the largest private insurance companies in the U.S., announced in the past two weeks that they will no longer be offering new home policies in California, citing risk from wildfires, flooding, and construction costs. If we read between the lines, these companies have decided climate change is too costly for them to deal with. The west coast is experiencing a multitude of crises all at once, and private companies are seeking to protect their shareholders instead of their policy holders.
- This design project is heavily built upon Chris Stillman's 2019 master's project on drivers of inundation in downtown Coos Bay, where she mapped the extent of SLR-related flooding in Coos Bay. This project seeks to offer a greener alternative to traditional stormwater capture methods created in response to sea level rise for many cities. In exploring options for a masters project, I was most interested in the intersection of climate change resilience and stormwater

management. These issues will be some of the most prevalent ways for landscape architects to work in urban spaces in the next decades.
- We have all seen some form of these graphs. In 2023, it is no secret that the effects of climate change are being felt globally. While the intensity varies at different scales, we understand largely why and how this is happening. Simply, as the ambient atmospheric temperature rises, so does the ambient oceanic temperature.
- Higher temperatures yield higher thermal expansion, increasing the volume of oceans, and higher temperatures also cause frozen water to melt, further increasing the volume. As scientists have warned for decades, this system can only resist so much change. We are starting to see the iceberg tip.
- Globally, about 40% of people live within 50 miles of an oceanic coast. A little less than 4 billion people are directly in harm's way when it comes to sea level rise.
In the United States, this percentage is the same. About 40% of our population, or 86 million Americans, face existential threats to property and way of life by the midpoint of this century. Already, rising seas are heavily impacting Atlantic coast cities like New York, Norfolk VA, and Miami FL. On the Pacific Coast, San Francisco and Seattle have started serious planning for calamitous change.
- In Oregon, our coastline is known for its sublimity; expanses of rocky shoreline and crashing waves, dense forests butting up to beaches and cliffsides. These harsh conditions make living and traveling difficult, and the passage S.B. 100 in 1973 protects the coastline from much further development. Options to migrate people away from lowlands are limited.
- The communities in Oregon that will be most impacted by SLR are typically those sited on estuaries, where geologic systems have set the stage for human settlements. Inherently, estuaries are sites of deposition; as water flows into bays and lagoons, so does the sediment carried down from the mountains and valleys. The smallest of particles travel the furthest, meaning that most of the matter dropped into the bays is the size of clay and loam. This build-up of sediment means that bays and estuaries are far more flat and prone to sea level flooding than other landscapes of the Oregon Coast.

And like Coos Bay are expected to face life changing levels of flooding

Many low-lying coastal towns use tide gates in tandem with their stormwater system. Here we can see the major watersheds of Coos Bay and their corresponding tide gates and stormlines.
Tide gates are used to prevent seawater from flooding the stormwater system. We'll get more into how they work in a minute.
This section reveals how most development takes place near the water, on former marsh and wetlands.
And here we see just how flat downtown Coos Bay is. When we're talking about inches of sea level rise, it's easy to see how these low-lying areas will be hit hard.
Back to tide gates; tide gates use the pressure of tidal water to open and close. When the tide is low, the gate can open and runoff can flow out.
- During high tide, the pressure of the outside water seals the gate shut, meaning the runoff must be stored until the gate opens again. As sea levels rise, the amount of time between tide gate openings will get longer and longer, while the time water can be released to the bay will dwindle. This problem will only get worse and worse as seas rise.
- In her 2019 master's project, Chris Stillman explored the many factors that downtown Coos Bay is facing and mapped out how much water will likely accumulate. A number of design scenarios were envisioned, from doing nothing for 100 years to responding to nuisance flooding yesterday. A pivotal piece of her project was calculating the runoff that each tide gate releases.
Here we can see that the downtown district is made up of several sub-basins.

She also calculated projections for tide gate function. These graphs show us how the
gates will be open for less and less time as sea level rises. In 2050, tidegates for sub
basins 3, 5 and 12 are projected to be open 50% less often
By 2100, these tidegates could be completely shut, leaving all low-lying areas at risk
of flooding. The areas in red are when the tide gates are closed.
- Coos Bay is far from the only city experiencing more water than it's built to handle. In exploring solutions for this project, I looked toward large coastal areas that are prioritizing the fight against climate change flooding and land-water-use policies that prioritize the dynamics of moving water.
- When looking at precedents for Coos Bay, I began with the large scale; looking at adaptive land use policies.
- China is experiencing climate change induced water crises at both ends of the spectrum: mass droughts and mass floods
- The Sponge City initiative was proposed by professor Lin Bingzhang in 2013,
- the Ministry of Housing and Urban Development publishing a guide for low-impact stormwater interventions for builders the very next year.
- The concept behind sponge cities is to use the landscape elements of the city to deal with water issues
- Adapt the needs of the city around the conditions of the landscape
- It sounds simple but is really revolutionary to have such a huge amount of support towards retrofitting cities to be more spongy and work with flooding
- As the saying goes, "God may have created the earth, but the Dutch created the Netherlands". A particularly severe period of flooding in the 1990's sparked an initiative to deal with flooding by changing zoning and land use laws to be more adaptable to the fluctuations of rivers. Rather than trying to 'technology' their way out of an unstoppable force, the intention is rather to let the water go where it may, and encourage it to move away from structures and more towards historic floodplains.
- Deep in the city, it's much harder to change zoning codes. One solution from Rotterdam is to use floodable infrastructure. The water plaza is a series of sunken courtyards that can capture runoff during the rainy season, and function as public space during the dry. The majority of the plaza is still usable when the basins are full.
- After Hurricane Sandy struck the east coast in late 2012, NYC swung into full gear trying to create plans to resist further effects of SLR. The 'Rebuild by Design' competition spearheaded a number of proposals, such as SCAPE's Living Breakwaters. In late 2022, the USACE published a proposal to protect the entire NYC harbor from sea level rise with $52 billion worth of walls, gates, and barriers. After the wildly creative proposals from the design competitions, the army corps' seawall proposals were in stark contrast to the biophilic design featured in the upper left. The property at risk in Manhattan is valued into the trillions of dollars - what will it be worth if we can't meaningfully protect it?
- London sought to completely engineer the solution to their tide problems with a massive movable barrier at the mouth of the Thames This marvel of engineering allows the city to control the tides around London. However, this solution is incredibly expensive and relies on state of the art technology. It will also be very unforgiving if it fails. With a blank check, Coos Bay could look at bridging the mouth of the Coos Estuary.

Stillman ended her project with suggestions of how Coos Bay might respond to the flooding threat. Typically, scenarios dealing with coastlines and waters of the United States are within the jurisdiction of the US ACE. Using an old USACE handbook on coastal hazard mitigation, I predict that an engineer may use a combination of armoring structures and adapting to flooding through the use of storage tanks, likely in the form of large concrete vaults. One might do an entire project covering what the best combination of interventions would be, but that's easily an entire year's worth of

studios.

A quick review thus far:

- Coos bay is going to experience moderate to severe flooding to due sea level rise
- The sea level rise will also reduce the efficacy of the stormwater system by keeping the tide gates closed for longer and longer
- Meaning that any solution proposed must address the need to mitigate flooding when the tidegates are closed. All it will take is a bad storm during a high tide to see downtown be ankle deep in water, if not worse.
- A typical solution might look something like this. Reinforce the seawall/levee and create a vault-and-pump system for dealing with excess runoff. The levee needs to be improved to protect the railroad and highway 101 during the largest of events; king tides and tsunamis.

This type of design is very resistant to flooding, meaning it can withstand a great barrage of water. But climate change is forcing us to adapt and be resilient; to be able

to weather a huge storm and recover. Large walls and barriers do not encourage the

- Strength: Ease of designing and placement, established precedents, specialists already familiar with construction
- Weakness: requires a large amount of resources, especially concrete and steel; if part of the intervention fails the entire thing fails
- Opportunity: expand waterfront for pedestrians, prioritize protecting evacuation route (HWY 101)
- Threat: protecting the railroad and HWY 101 take priority over providing urban space for residents
- I believe that addressing flooding in Coos Bay should be looked at by landscape architects to address issues of livability, pedestrian access, and sustainability alongside functioning infrastructure.

- The Eco-Acupuncture approach is gaining popularity as a bottom-up approach for dealing with sea level rise flooding. Stormwater acupuncture would entail strategically selecting a large number of small sites that serve as micro-interventions at specific places. This strategy could be implemented with benefits to property owners, such as tax credits for runoff captured.
- Develop a number of strategically located different stormwater interventions to reduce runoff during heavy rainfall events
- Seek to revitalize under-performing sites such as:
- Pre’s Mural Memorial
- The Coos Bay Visitor’s Center
- Time Bomb Thrift Store
- Mingus Skate Park

- Strength: Can built over time, multiple sites encourage resilience and resistance to climate change
- If one fails the rest will not
- Weakness: not a typical response; tough to change minds about how the city should look and function
- Opportunities: retrofit under-performing sites in the urban fabric with principles of urbanism and aesthetics
- Threats: Too little too late? Would need to really engineer these sites to ensure they can capture a 20 year storm
- Locate under-performing blocks/streets and excavate to create large wet biodetention swales to hold stormwater while tidegates are closed
- Use principles of Green urbanism and Complete Streets in designing
- Pedestrian safety, accessibility, and usability
- Wider sidewalks, public seating, more pedestrian visibility
- Multi-vehicular traffic; de-prioritizing cars; traffic calming

- Green infrastructure used extensively to create cohesion between built and natural environment
- Create urban setting that is more safe and accessible for pedestrians
- Over half of Coos Bay residents are under 16 and over 65; these are groups that should be protected from excessive vehicular traffic
- Introduce vegetation for shade and urban heat island reduction
- Allow business to expand into sidewalk
- Re-route runoff from streets and roofs into swales
- Planting Choices imported from Portland Stormwater Design manual & Florence Stormwater design manual
- A block could ostensibly store about ¾ a-f before letting hitting the outflow
- Need more storage? Excavate instead of building concrete vaults
- City could set a goal to try and capture an additional acre-foot of runoff each year
- Strengths: Modular, easy to expand capacity; resilient to climate change and increasing runoff, provides vegetation and beauty to downtown, introduces new ways of approaching urban runoff
- Weaknesses: would be a huge change to structure of downtown coos bay and might face significant dissent; rerouting HWY 101 may be a more significant challenge than I anticipate; street swales may encourage pranks or litter and become a maintenance issue; plants need to be safe for consumption
- Opportunities: remove focus on cars in downtown, remove danger of high traffic in pedestrian areas
- Create an alternative to a typical “gray” intervention for a watershed in downtown Coos Bay with a focus on combining stormwater infrastructure with public space
- The popular Portland Stormwater guide recommends facilities that are designed for 20 year storms
- This is also consistent with Oregon stormwater policies
- Re-imagine a coastal downtown for climate resilience and green urbanism
- Coos Bay is very car-oriented
- Aging population needs more pedestrian access to engage in downtown
- I chose tidegate 3 because, according to Stillman, it will have a 50% reduction in “open” hours by 2050; from being open about 14 hours per day to less than
- 8 hours per day. There are also several charismatic, at-risk sites in this sub-basin that could participate in a city-wide retrofit. The Coos Bay Urban Renewal Program has designated a significant portion of the downtown area as eligible for funding towards revitalization. This could be instrumental in retrofitting the downtown core

The watershed is about 500 acres in area, encompassing most of the downtown district of Coos Bay

Here we can see how highway 101 pierces right through the downtown core of the city. When the highway was first constructed in the 1920’s, it was a boon for small coastal towns like Coos Bay to have travellers arrive in the heart of town so readily. Today, the 101 is mainly used as a thoroughfare for residents more so than a scenic route for tourists. This car-oriented infrastructure makes being a pedestrian in Coos Bay much less fun.

Highway 101 also shuttles people away from important landmarks in the downtown district, like Mingus Park and the Coos Art Museum.

The downtown district is very low lying. Most of it is less than 10’ above sea level

The city planned for this, placing mainly industrial and commercial zones along the waterfront.

In recent years, the city has recognized that this part of downtown needs some beautification and created the Urban Renewal Program. Properties within the urban renewal district are eligible for up to $25,000 towards revitalizing their property.

ANd here we see a close up on the stormwater system. This area is mainly served by tidegate 3.

Here we see the extent of sea level rise flooding in the downtown district. No city on
the coast has as much infrastructure at stake as Coos Bay
When we combine these factors: the watershed, urban renewal, and sea level rise
flooding, an area of focus appears.
This comic by Karl Jilg demonstrates how car-oriented streets feel to pedestrians. Next to it is the main pedestrian entrance to the Coos Bay Boardwalk and Marina, where pedestrians must cross Highway 101 twice to get to the waterfront.
The typical R.O.W. in Coos Bay is 60’ wide, with 5’ sidewalks on either end. 5/6th of
the space is dedicated to veghicles
And again we arrive at the intersection of urban design and multifunctional infrastructure.
Which leads me to sponge streets. Sponge streets are wet biodetention swales. Meaning theyre meant to have saturated soil most of the time, and capture stormwater while the tide gates are closed. SPonge streets work similarly to eco acupuncture, but are targeted at enhancing pedestrian life in the city. A sponge street
is simply a street that is capturing water in some capacity.
These sponge streets are very flexible. They can be used to maximize frontage space
for businesses, introduce vegetation and reduce the urban heat island effect, and make downtown Cos Bay more pleasant for pedestrian life.
The plants used are adapted from the Portland and Florence stormwater guides. These are all natives that can tolerate drought, heat, and inundation. After establishment they should thrive in the conditions of downtown.
Sponge streets can be formatted depending on the needs of the site. The half sponge
model is better suited to mixed use areas where vehicles are still necessary.
A full sponge street could ostensibly capture about 130 cubic feet of water per linear foot. To reach one acre foot of storage, a single sponge street would need to be 335 feet, about one and a half blocks of a Coos Bay right of way.
With about 1.5 miles of streets, Coos Bay could confidently capture a 20 year storm while reducing the impact of sea level rise flooding and introducing principles of green urbanism. Over 6 miles of streets are going to be regularly flooded in the next 25 years; why not deal with that in a more productive way?
I know you’re all asking this big question next. Okay, but how do you decide what streets to remove and which ones to keep? Here we can see arterial streets and local streets in downtown. With highway 101 right in the splash zone, we should priopritze relocating it to preserve an evacuation route.
Our area of focus reveals about 3.5 miles of streets that are in the right location to be spongy.
And getting to 22 acre feet only requires 1.5 miles. This could be an integral part of revitalizing downtown and investing in a more resilient future. In my ideal world I would try to replace highway 101 and move it away from the downtown core of the city as well as the splash zone. This proved to be very challenging, however.
Another way to reach the 20 year storm capture could be to create a loop around downtown and connect to the waterfront.
Or create a walking trail through Coos Bay and take advantage of how pleasant a thriving coastal town can be
I learned so much about myself and the process of my own work during this project. I came up with many ideas that I did not have the capacity to explore in a meaningful way. If I could go back in time with what I know now, I would do so many things differently, like getting out to Coos Bay more often and trying to understand the perspective of the people living there and how they would want to move forward. This design project was very focused on radically bringing green urbanism to coos bay in the form of stormwater management, but I think it could on to do so much more.

We will do nothing alone as landscape architects. I learned how little an individual can accomplish in terms of fighting global climate change and providing a better future.
I owe a huge thank you to Michael Geffel, Kory Russel, and Rob Ribe, who helped me work through many, many ideas
Thanks to Brad Stangeland and Mark Morgan, my colleagues at Stangeland & Associates
A special thank you to Liska Chan, Ben Shirtcliff, and Jean Yang, who all helped me bring together my life throughout grad school
Thank you to the CLRG team, who keeps me endlessly inspired to work towards a better world
Thank you to my ASLA executive committee who helped me juggle this project with my presidential responsibilities
Thank you to my cohort and to the other students in this department. It has been a pleasure and an honor to spend the last 3 years rigorously working at this degree.

Works Cited

Al, S. (2018). Adapting Cities to Sea Level Rise: green and gray strategies. Washington, DC: Island Press.

Campbell, M. (2022) EuroNews.Green. *China's sponge cities are a 'revolutionary rethink' to stop flooding*. https://www.euronews.com/green/2022/10/22/china-s-sponge-cities-are-a-revolutionary-rethink-to-prevent-flooding

CIty of Portland Public WOrks (2020) City of Portland Stormwater Management Manual. Portland.gov

Dalton, M.M., Dello, K.D., Hawkins, L., Mote, P.W. & Rupp, D.E. (2017). *The Third Oregon Climate Assessment Report,* Oregon Climate Change Research Institute, College of Earth, Ocean and Atmospheric Sciences, Oregon State University, Corvallis, OR.

Dutch Water Sector (2019) *Room for the River Programme*, Dutch Water Sector https://www.dutchwatersector.com/news/room-for-the-river-programme

Kennen K. & Kirkwood N. (2015). Phyto : principles and resources for site remediation and landscape design (First). Routledge.

Kimmelman, M. (2017). Foreword. In *Structures of Coastal Resistance*. Washington DC: Island Press.

Maruf, R. (2023). *State Farm stops home insurance sales in California, citing wildfire risks* | CNN Business. CNN. Retrieved from https://www.cnn.com/2023/05/28/business/state-farm-california-insurance-wildfire/index.html

Moriarty, L. (2017). Jefferson Public Radio. Coos Bay Suit Over Flood Insurance Rules Could Have a Nationwide Impact. https://www.ijpr.org/post/coos-bay-suit-over-flood-insurance-rules-could-have-nationwide-impact#stream/0

National Research Council. (2012). *Sea-Level Rise for the Coasts of California, Oregon, and Washington*, Washington, DC: National Academies Press.

Neumann, B., Konrad, O., & Kenchington, R. (2017). "Strong sustainability in coastal areas: a conceptual interpretation of SDG14." *Sustainability Science*, March 2016, Vol. 11, Issue 2, pp. 177-178.

Orff, K. (2017) *Toward an Urban Ecology*. Monacelli Press

Robbins, W. G. (2006). *Hard Times in Paradise: Coos Bay, Oregon*. University of Washington Press.

United States. Army. Corps of Engineers. Coastal Enginneering Task Force. (2002) Coastal Engineering Manual Parts II - V Washington, D.C. : [Springfield, VA :] :Headquarters, U.S. Army Corps of Engineers