BELLINGHAM'S
NEW WATERFRONT
PROPOSALS FOR A MODEL CLIMATE DISTRICT

2021 Scan Design Interdisciplinary Master Studio
College of Built Environments, University of Washington

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Proposals for a model climate district

2021 Scan Design Foundation Master Studio in Urban Design and Landscape Architecture
College of the Built Environments, University of Washington

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Neil McCarthy, *RMC Architects*
Jim and Kathy Kyle

Bellingham Waterfront tideflat - early industrialization //*Whatcom Museum*

LAND ACKNOWLEDGEMENT

The University of Washington acknowledges the Coast Salish peoples on whose land we study and work, the land which touches the shared waters of all tribes and bands within the Puyallup, Duwamish, Suquamish, Tulalip, and Muckleshoot nations.

As University of Washington students, we are thankful to the Coast Salish Peoples whose lands and shared waters we studied in Bellingham, Washington in the Fall of 2021. As future designers, we will strive to continue to learn about the Waterfront's cultural past and present and to support Coast Salish People to the best of our abilities. Additionally, we wish to express our thanks and deepest respect to Jewell James of the Lummi Nation who was generous to meet us on-site to share his insights regarding First Nation political advocacy, culture and relationships with Bellingham's Waterfront and beyond.

Students enjoying the Infinite Bridge in Århus, Denmark // *Photo by Drew Landis*

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FOREWORD

Tour of Bellingham Harbor // *Photo by Nancy Rottle*

Climate change is presenting as one of the greatest challenges of our time, with the International Panel on Climate Change (IPCC) recently issuing a series of deeply-researched warnings that the globe is currently on a pathway to experience disastrous climate change impacts. While adaptation to the many ill-effects of climate change will be necessary, it is also predicted that action can and must be taken to mitigate the severity of these impacts, through reduced greenhouse gas emissions, capture of atmospheric carbon, and changes in built environment practices and the conservation behaviors that well-designed environments can inspire. Within this context, we aspire to render our towns and cities those that encourage delightful, just and nourishing living for people, and are supportive of healthy environments that all organisms depend upon.

Bellingham's former Georgia-Pacific industrial waterfront site presents an unparalleled opportunity to explore how cities can become part of the solution to the climate crisis. By designating this waterfront area a "Climate District," students in the 2021 Scan Design Interdisciplinary Studio were able to maintain focus on solutions for both accelerating climate protection (mitigation) as well as for adapting to projected impacts by planning for inevitable, though variable, future conditions. In conjunction with these challenges, the site is exceedingly complex, with legacy pollution and cultural amnesia, and rich opportunities for direct connections to the city's downtown and a linked system of recreational and ecological open spaces.

Our talented students have done an exemplary job of embracing these complexities to consider what might be possible on this site, to address its many problems and potentials. The three interdisciplinary teams have based their proposals on deep research – as much as the university term allows – to propose and explore solutions that consider existing conditions, community needs, interaction of systems, and temporal processes. They have incorporated "circular system" thinking: How can the district work as a system within itself, and within its immediate contexts of city, county and region, for both local economic and global climate benefit?

We hope that the thoughtful, illustrated proposals of the three student teams may help to advance the thinking of Bellingham's citizens, Port and City government, and may inspire the imagination for how we may urgently plan, build and happily live to better protect our fragile climate and all whom it so dramatically affects. This work could not have had the depth or relevance without the assistance of so many people, and so we have many to thank: the Scan Design Foundation for so generously funding our study tour to Denmark and Sweden, our Master Teacher Louise Grassov and our teaching assistant Sarah Lukins; the Port of Bellingham, especially Brian Gouran, Adrienne Hegedus, Mike Hogan and Kurt Baumgarten; the City of Bellingham, especially Nicole Oliver, Tara Sundin, and Steven Sundin; Mauri Ingram of Whatcom Community Foundation, Alice Clark from Downtown Bellingham, Architect Neil McCarthy, Engineer Mark Buerher, scholar Jewell James, boat captains Jim and Kathy Kyle, and the many professional and academic participants who reviewed the students' work during the term. Special thanks go to Katy Scherrer of CoUrban and Kristi Park of Bio Design Studio who were so instrumental in making the connections and guiding our way through, and to hotelier Peter Frazier for hosting our group's visit and seeing the potential of visionary thinking. We thank you all!

Nancy Rottle, *Professor*
University of Washington, College of Built Environments

Study tour participants and instructors enjoying public space atop a parking garage// *Photo by Heather Parker*

STUDIO OVERVIEW

"In a world in which anthropogenic "natural" disasters run rampant, water stands at times as more foe than friend, viral pandemics await at the ready...it is time to try out new futures, new ways of movement...new ways of witness....We are standing at the edge of an Event Horizon, in more ways than one. Be it by flood or virus, the message from nature is clear – change is inevitable. What will our new normal be? Let it be harmonious, revolutionary. It is the only way we will survive." – Thomas Saraceno, Event Horizons.

The 2021 Scan Design Foundation Master Studio in Urban Design and Landscape Architecture spent Fall 2021 imagining new futures for the Bellingham Waterfront, a post industrial brownfield site at the mouth of Whatcom Creek, particularly focusing on climate protection and 'circularity' thinking.

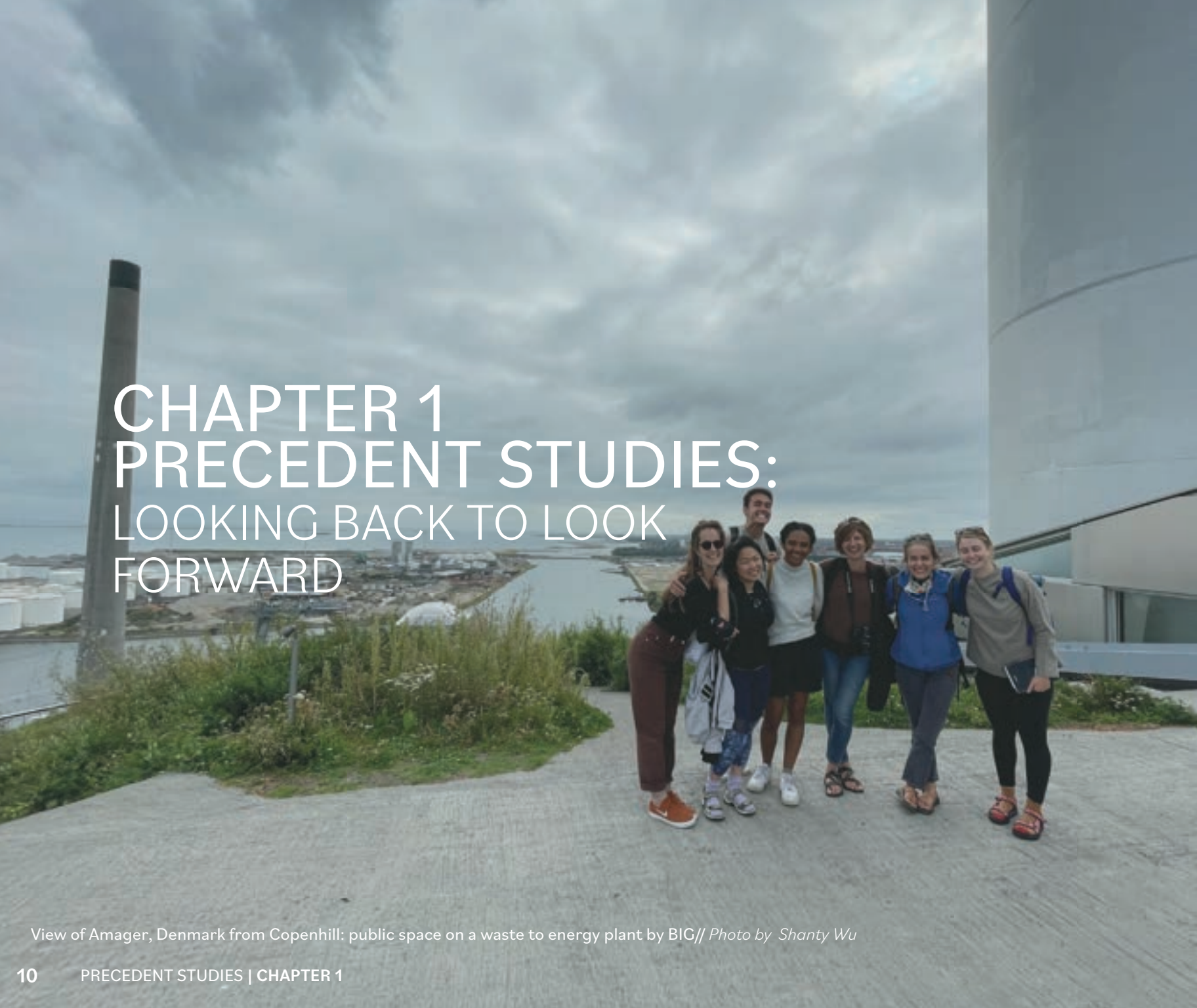
In September, studio participants traveled to Copenhagen, a city with a well deserved reputation for innovative design. The study tour focused on ecologically adaptive design, green stormwater management and the more ineffable elements of design that works for people — design for community and for a joyful and playful public realm. We analyzed how these elements work together to create vibrant public space that is both physically resilient and strengthens community resilience by fostering community connections, connection to the land and an understanding of waste, energy, water and other critical systems.

In Denmark and Sweden, students explored many sites by bike, foot and rail that share several of the key opportunities and constraints present on the Bellingham Waterfront. This formed a base of knowledge that informed site planning and design for Bellingham's new waterfront.

Once back in Seattle, the students completed precedent studies, visited the Bellingham waterfront, met with community members, and analyzed the underlying site context. This research created the foundation for the development of group site proposals. During the quarter students received a wealth of feedback and insight from our master teacher Louise Grassov, countless community representatives, and design professionals both in Washington and Denmark. We are excited to share the work with you!

Studio Sequence:

- Copenhagen, Århus and Malmo Study Tour
- Precedent and Framework Studies
- Site visit to Bellingham Waterfront
- Site analysis and narratives
- Site concepts
- Schematic design
- Design development
- Reviews
- Community Exhibit in Bellingham Spring 2022



CHAPTER 1
PRECEDENT STUDIES:
LOOKING BACK TO LOOK FORWARD

View of Amager, Denmark from Copenhill: public space on a waste to energy plant by BIG// *Photo by Shanty Wu*

During our study tour in Copenhagen, Malmö and Århus, students began their design process by visiting and analyzing projects that have similar challenges and opportunities to the Bellingham Waterfront Site. Through these cases, they studied relevant district planning strategies, ecological design, funding mechanisms and governing processes. Our precedents include both successful and unsuccessful cases and analyze lessons that can be implemented on the Bellingham Waterfront Site.

PRECEDENT PROJECTS

JERN-BANEBYEN

Constantine Chrisafis
Shanty Wu

Courtesy of Cobe

JERNBANEBYEN WITH BELLINGHAM SITE OVERLAY. google earth (2021)

JERNBANEBYEN SITE TODAY jernbanenyen.dk

THE FORMER LOKOMOTIVAERKSTED (1980) luftfotodanmark

A NEW "GREEN" DISTRICT

Buildout Date: 2030
Anticipated Population: 10,000
Development Area: 365,000 m2
Landowners: DSB and Freja Ejendomme

Jernbanebyen is a new large "green" district recently approved in Copenhagen. Plans anticipate a complete redevelopment of an old railway maintanence site. Currently one of the largest development plans in the inner-city, the project anticipates a full build-out of 10,000 people by 2030 (Nässtrom, 2021).

A POST-INDUSTRIAL LANDSCAPE

The current site, refered to as the "New Goods Station" is one of the last undeveloped industrial sites in the center of Copenhagen. It was closed in 2000, after 99 years of operation, when the Danish railway DSB stopped its freight traffic. From 2009, DSB finally started renting out abandoned railway buildings to office communities, businesses and creative people. The area covers a total area of about 555, 000 square metres, around 175, 000 are still actively used by the Danish railways" (Baeriswyl, 2021).

HISTORY OF THE SITE

From: jernbanebyen.dk

1895: Natural salt marshes are filled in. A railway workshop and freight station are built.

1901: Large rail depot is constructed.

1909: Workers village are constructed (Den Gule By).

1939: Repair and maintenance facilities expanded, and allotment garden established on the site.

1964: Customs house constructed.

1970: Container facility constructed.

2000: Freight station site closes, after a century of operation.

2009: Remaining railway buildings vacated and rented to businesses.

THE COMPETITION 2020:

A master plan competition is announced. Five major interdisciplinary teams participated:

Snøhetta I BIG and SLA I Vandkunsten and Holscher Nordberg I WERK Arkitekter I COBE.

2021: COBE was selected as the winner, pitching their vision of a car-free ecodistrict. The firm laid out a flexible master plan with the intention of creating "a destination in the city with usages sustained by green areas and open spaces, facilitating various activities and, contributing to a high degree of liveability for future residents" (COBE Proposal).

Existing site at Jerbanebyen


COBE Architects site plan proposal and strategies

THE WINNING PROPOSAL

The COBE proposal for Jernbanebyen was to create the greenest district in Copenhagen. The goal is to have more living space and more green in the city. Car-free, green, healthy, sustainable, climate-conscious and innovative.

GREEN SPACES

Between green open spaces, streets and alleys are designed for cyclists and pedestrians, weaving through the site to resemble the shape of an onion.

FROM CONCEPT TO DESIGN

PROPOSAL STRATEGIES

COBE Architects


WORKSHOP CITY


WOVEN


EVERYDAY CITY


PEARL CHAIN

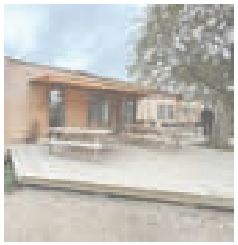
PROPOSED CIRCULATION SYSTEM

The proposed site is well connected to two metro stations and the suburban rail network. Additionally multiple bridges will link the site to the broader city context.

Street rendering I COBE Architects

Comprehensive Plan I jernbanebyen.dk

food hall and urban farming center



temporary student housing

existing rail infrastructure

site entrance

Existing Conditions I A post-industrial green space

COPENHILL

Rhys Coffee +
Emily Saeger

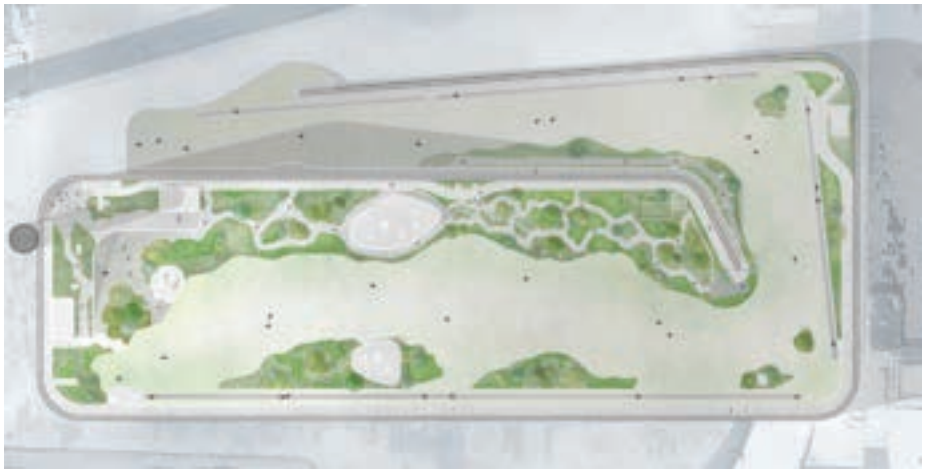
Courtesy of Hufton +Crow

"My son turns one next month – he won't ever remember that there was a time when you couldn't ski on the roof of the power plant – or climb its facades. He will take that for granted – and so will his entire generation. Clean energy and skiable power plants is going be the baseline of their imagination –the platform from which they will leap and propose new and wild ideas for their future."

-Bjarke Ingels, Founder of Bjarke Ingels Group

PROJECT PHILOSOPY: HEDONISTIC SUSTAINABILITY

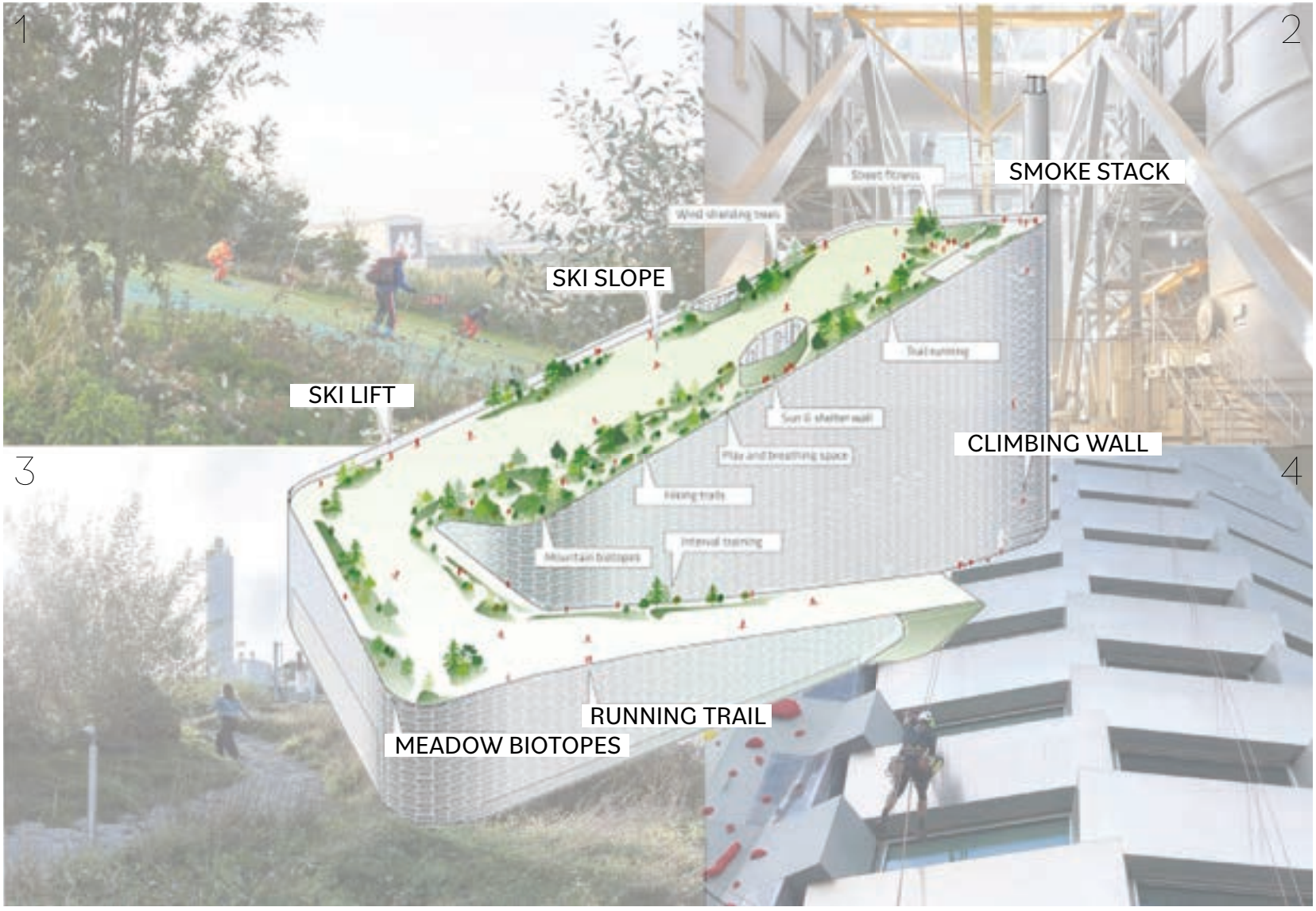
Hedonistic sustainability counters the stereotype that in order to achieve sustainability we must sacrifice our quality of life. Copenhill is a reimagination of what is possible when you integrate clean energy and leisure, a beacon for future design. (Bjarke Ingels, 2011)



Plan view of Copenhill, Photo Credit: BIG.

Amager Powerplant with Bellingham Waterfront Site overlay

Nearly a decade in the making, Copenhill is a unique multifunctional public space on top the worlds cleanest waste to energy plant, Amager Resource Center (ARC), designed by Bjarke Ingels Group (BIG) and the support of several other design firms, including SLA, AKT, Lunchinger + Meyer, MOE, Ramboll, Jesper Kongshaug. The plant offers a wide range of services, from skiing to hiking trail, in addition to providing 30,000 homes with electricity and 72,000 homes with heating in the Copenhagen area. The plant came online in 2017 and the ski slopes opened in 2019 (Journal of AIA, 2019).

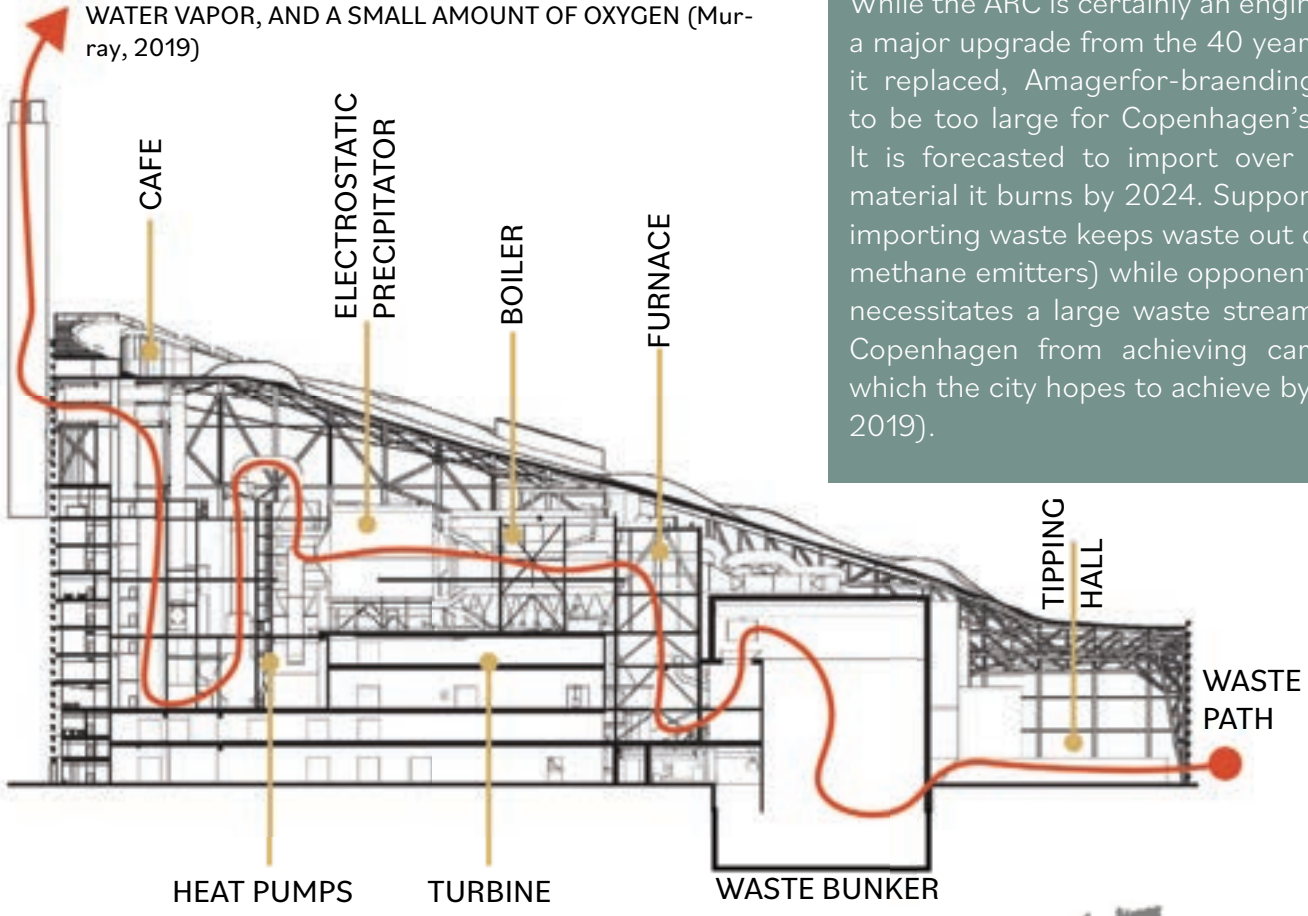


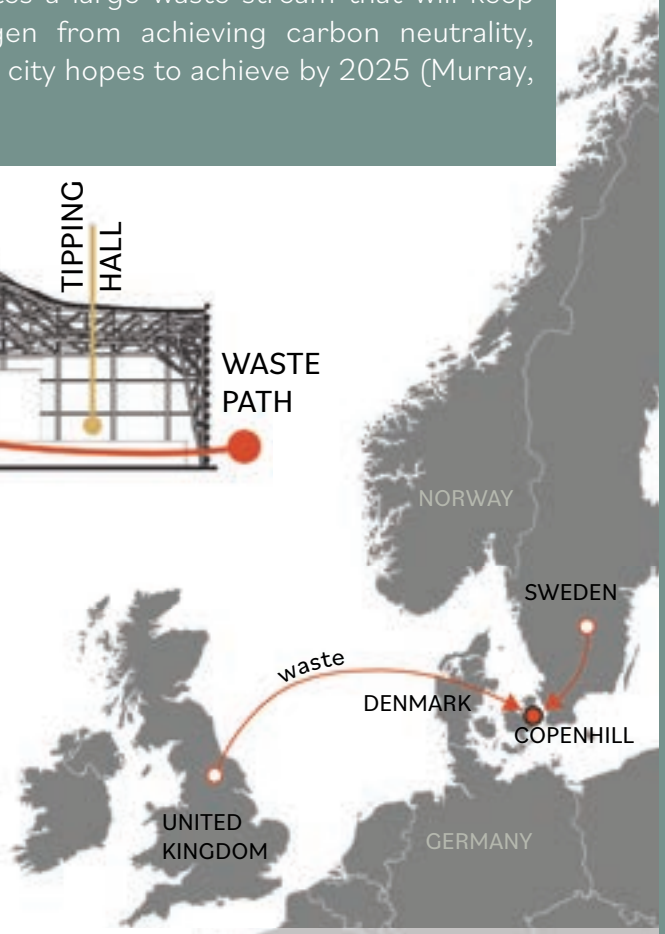
Copenhill Services

1. The artificial ski slope, made out of plastic bristles and grass, provides a 400 meter ski run year-round Photo Credit: Hufton+Crow.
2. The 4.4 million square foot facility can processes 440,000 tons of municipal solid waste to clean energy annually, Photo Credit: Hufton+Crow.
3. SLA's landscape mimics mountain ecologies, boasting rockscapes, 7,00 shrubs and 300 pine and willow trees, which frame public hiking and running trails throughout the roof, Photo Credit: Laurian Ghinitoiu.
4. Designed by Walltopia, the 85 meter climbing wall is currently the tallest in the world, Photo Credit: Copenhill, (Crook 2019 + SLA).

COPENHILL'S WASTE DILEMMA

While the ARC is certainly an engineering feat and a major upgrade from the 40 year old incinerator it replaced, Amagerfor-braending, it is proving to be too large for Copenhagen's waste stream. It is forecasted to import over half the waste material it burns by 2024. Supporters argue that importing waste keeps waste out of landfills (high methane emitters) while opponents feel the plant necessitates a large waste stream that will keep Copenhagen from achieving carbon neutrality, which the city hopes to achieve by 2025 (Murray, 2019).





Waste Processes: (TOP) Section view of Copenhill and the path waste travels to be converted to clean energy, Photo Credit: BIG. (LEFT) Image of waste bunker that sits 11 meters underground, Photo Credit: Hufton +Crow (RIGHT) Map of foreign waste streams.

WESTERN HARBOR/ BO-01

Adam Koehn +
Will Prescott

Courtesy of Guidebook Sweden
https://www.guidebook-sweden.com/en/guidebook/destination/vaestra-hamnen-innovative-district-in-malmoe

VISION

The Western Harbor in Malmö is a mixed-use urban development project rooted in environmental, economic, and social sustainability. The Bo01 eco-district which began as a part of the European Housing Exposition in 2001 was the ambitious initial phase in this redevelopment of the city's waterfront. The project represents a shift from Malmö's industrial past to the neighborhood becoming a national example for sustainable urban development.

Western Harbor (Dashed) and Bo-01 (Shaded) with Bellingham Waterfront overlay

photo credit: Joakim Raboff

Site Plan
(Malmö City Planning Office)

HUMAN SCALE URBAN DESIGN

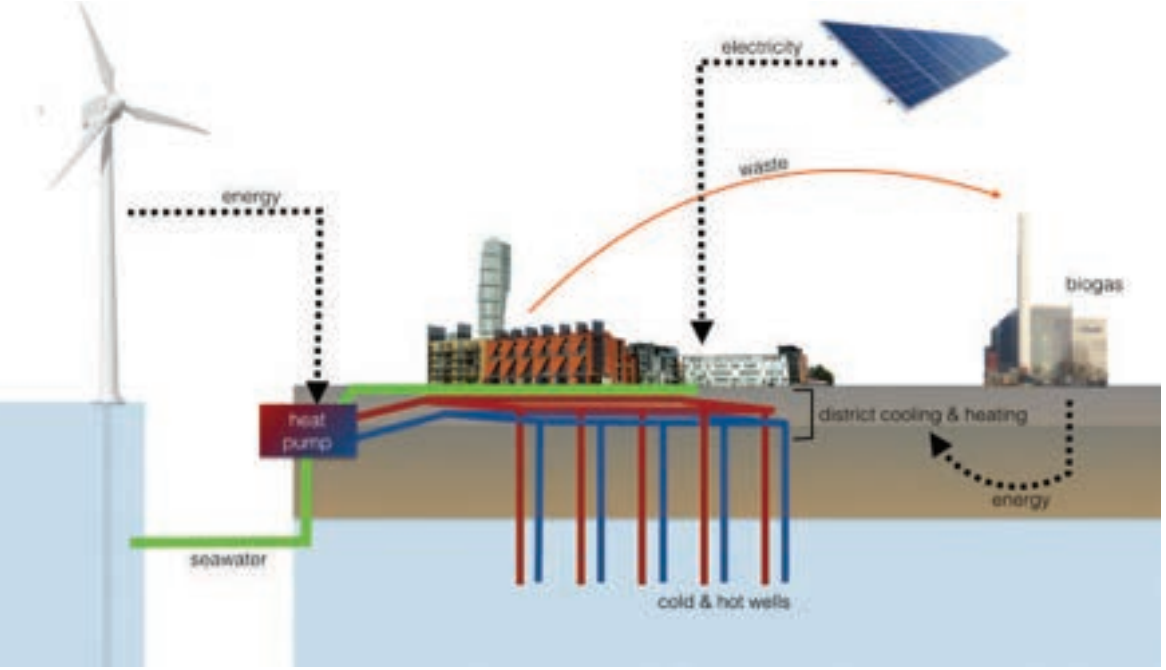
Swedish urban designer Klas Tham emphasized the importance of the human scale in the design of Bo01. Referencing the scale and organic layouts of medieval cities and villages, Tham strove to create an urban plan that inspired intrigue, complexity, mystique and surprise. Diverse small scale housing occupies the center of the plan, while larger scale buildings along the perimeter help to shelter interior residents from the wind.

CLOSED LOOP ENERGY SYSTEMS

The Bo01 project has been designed to integrate food, water, and energy infrastructure into a cohesive and circular urban system. With over 3000 square meters of solar panels, wind turbines on the tops of buildings, and a biogas supply, the district is supplied with 100% locally renewable energy.

Trash/compost chutes and in-unit sink disposals transport food waste into underground tanks and then sent to Sjölunda wastewater treatment to be converted into biogas (which powers things like public transit) and bio-manure (fertilizer for future food production).

Sketches by Klas Tham



Energy Transfer Diagram
(CMU at Carnegie Mellon)

Facade Solar Collector
(http://buildipedia.com/)

Trash/Compost Collector
(https://www.urbanwins.eu)

photo credit: Vhamnen
https://vhamnen.com/index.php/tag/scaniaplatsen/

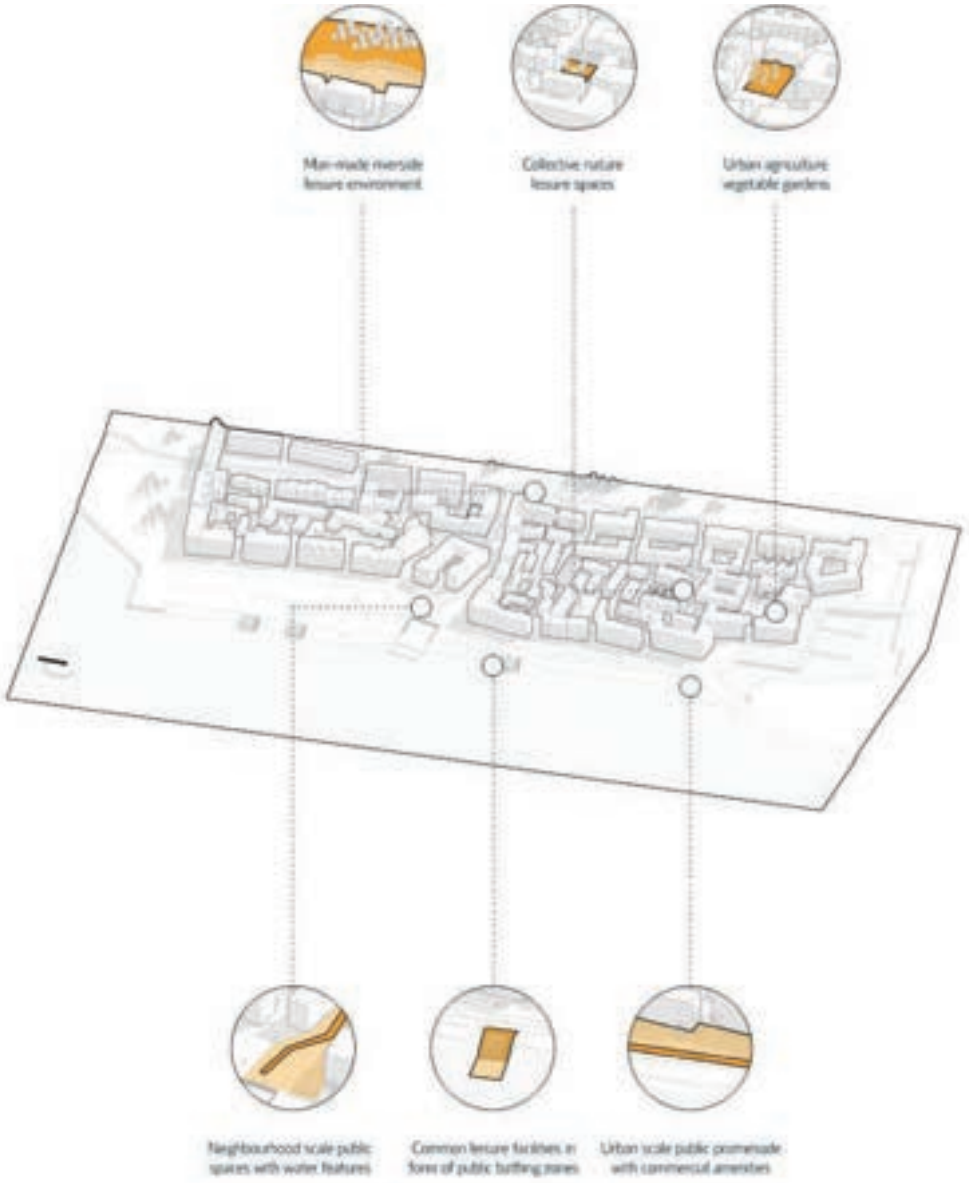
STORMWATER STRATEGIES

With Malmö's history of flooding, stormwater on the site was a serious design consideration. The planning for the housing district purposefully integrated the stormwater management system into the neighborhood's main public spaces. While these systems are often set below the ground, the Bo01 project left the system on the surface and open for the residents to experience and engage in. During rainfall, water runs through channels along the sidewalks and passes through a series of vegetated cleansing ponds before eventually finding its way into the Oresund.

RECLAIMING THE WATERFRONT

As industrial activity along the coast began to dissipate, Malmö saw the opportunity to connect the city back to the Oresund. Due to the water's strong current, swimming was not one of the expected programmed elements in the original master plan. However, persistent input from residents made apparent that that this was something they wanted implemented and the city proceeded to install a number of jetties for public access. Now, people from all over Malmö engage in all sorts of recreation along the waterfront including swimming, picnicing, and sun bathing.

photo credit: Peter Alred Hess



Site Axonometric
Szymon Marciniak

photo credit: Plume d'Aure
http://plumedaure.com/en/vastra-hamnen/

photo credit: Building Our Sustainable Future
http://buildingoursustainablefuture.blogspot.com/

photo credit: Bjare (FlickRiver)

ÅRHUS Ø

Erin Irby + Leila Jackson
+Erynne van Zee

Rendering by BIG

1. DOKK1 Library. Image Credit: Emily Saeger
2. Århus (Mixed Use). Image Credit: Emily Saeger
3. Dommen. Image Credit: Leila Jackson
4. The Iceberg (Housing). Image Credit: Emily Saeger
5. Waterfront. Image Credit: Leila Jackson
6. Harbor Baths. Image Credit: Erin Irby

Århus Waterfront with BellinghamWaterfront Site Overlay

Århus Ø is a transformation of a former industrial harbor into a lively, public-oriented waterfront development. Planned and constructed between 1997-2021, Århus Ø aims to prioritize public space amidst private development and is largely recognized by a series of iconic buildings including The Iceberg and Århus.[1] Equally compelling are its public amenities which include the DOKK1 Library, Dommen and the Harbor Baths.

Building heights and topography of Århus City and Århus Ø

ÅRHUS: A GROWING, 21ST CENTURY CITY

The second largest city in Denmark after Copenhagen, Århus has seen sustained population growth since the 1980s.[2] Steady flows of Århus University students and an influx immigrant populations have bolstered Århus' existing population growth and have driven the transformation of post-industrial sites. **ÅRHUS Ø** is a direct response to Århus' growing population and desperate need for increased housing throughout the city.

Evolution of Århus North Harbor 1840-2021

LARGEST SHIPPING CONTAINER PORT IN DENMARK 1

AVERAGE AGE OF ÅRHUS IN-HABITANTS 37.7 YEARS OLD 2

ÅRHUS POPULA-TION: 345,000 3

> 40,000 STU-DENTS AT ÅRHUS UNIVERSITY 4

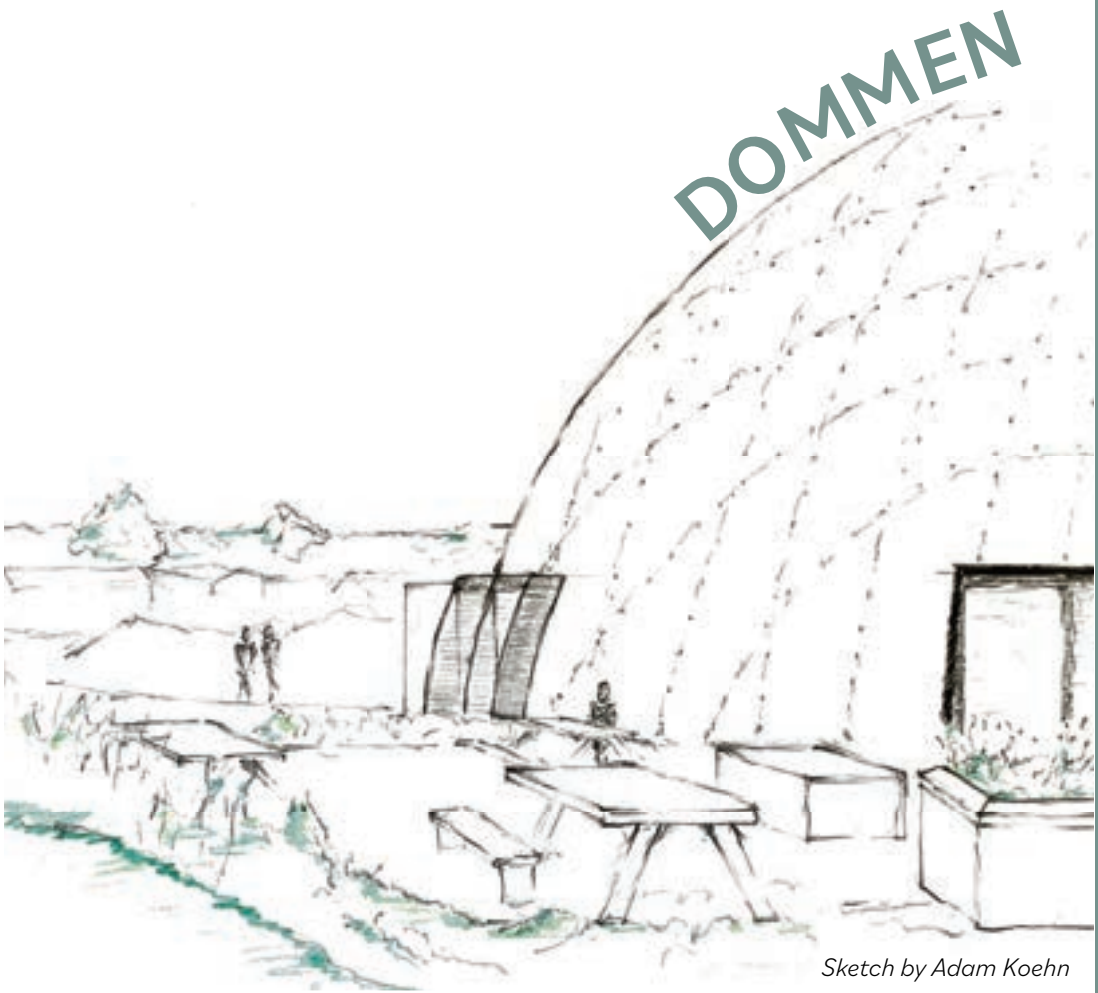
Photo credit: Adam Mørk

DOKK1

Dokk1 Libary is a cornerstone community space and model of sustainable design in Århus Ø. The space is designed to be "...not simply a building. It is a place for exchanging knowledge and opportunities and a multicultural meeting point that will change people's perception of the entire city".[1] A playground outside engages visitors of all ages in kinesthetic play, and complements the creative commons inside the library. Architecturally, Dokk1 is designed to be a low-energy building, both in its operation and construction, and includes automated shades, seawater cooling, and recyclable construction materials.[2] Culturally and ecologically regenerative spaces, such as Dokk1, offer inspiration for considering what cornerstone community space could benefit the Bellingham waterfront.

CULTURALLY & ECOLOGICALLY REGENERATIVE SPACES

Dommen (The Dome) invites visitors into a geodesic dome oasis. This human-scale respite offers office space, a cafe, and lush plants as a place to pause and rest. The Dome is grounded in intentional material choices, such as the use of cross-laminated timber that is milled to minimize waste and allow for future disassembly and adaptation.[3] The Dome may inspire innovative and adaptive designs for buildings and landscapes on the Bellingham waterfront.



Sketch by Adam Koehn

ÅRHUS SOUTHERN HARBOR DISTRICT

Drew Landis +
Matt Olszewski

photo credit: BIG

SOURCES
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"Samlade Skrifter Om Västra Hamnen." Till Startsidan Malmo.se, 4 Mar. 1970, https://malmo.se/Stadsutveckling/Stadsutvecklingsomraden/Vastra-Hamnen/Samlade-skrifter-om-Vastra-Hamnen.html.
MacLauchlan, Braoin. "BO01 Community in Malmö Celebrates 20 Years as a Global Source of Inspiration." CityTalk, 15 Sept. 2021, https://talkofthecities.iclei.org/bo01-community-in-malmo-celebrates-20-years-as-a-global-source-of-inspiration/.

// SHL ARCHITECTS

SYDHAVNSKVARTERET

Århus/ Denmark

Size: 75,000 m²
Competition: 1st prize, tender 2019
Status: 2021 Planned construction
Client: Århus Municipality
Developer: A. Enggaard A/S
Partner Architects: AART Architects/ RUM3 Studio
Landscape Architect: LABLAND

The project will become a unifying urban development icon for the city, drawing a new skyline for Århus. The project will be a versatile reflection of city life by combining the diversity of the existing settlement, and will create a connection to the city's newly developed waterfront. The master plan will include workshops, creative businesses, a hotel, cafes, retail, offices, art installation spaces, and recreational areas evoking a strong sense of community and urban life.

Scaled outlines of the Bellingham site compared to that of the Århus Southern Harbor District.

TRANSFORMING THE EXISTING CONDITIONS

URBAN TRANSPORTATION CORRIDOR

The goal is to create a unique foundation upon which a vibrant district can develop. A diverse commercial area can cultivate a range of functions from art and cultural production to collaborative projects with the socially disadvantaged.

INNOVATIVE URBAN CORE

The project will showcase innovative buildings such as a mass-timber parking houses (garage) with vertical gardens and public space to be used for socio-cultural events.

UTILIZE EXISTING INDUSTRIAL LANDSCAPE

Inspired by New York's high line park, a former coal bridge is going to be turned into the major linkage to the city. This corridor will cut through the site connecting both ends to the businesses within the district.

A FRAMEWORK FOR URBAN LIFE

The concept is to foster diversity of use in the district before developing the urban spaces and allow the urban life to grow from the bottom up. This creates a foundation for further development that prioritizes community and creativity.

By strengthening existing communities, opening the district to the city with new connections, and fostering the creation of new industries, such as food, fashion, art, music, animation, gaming, and education, the district can encourage the emergence of a vibrant commercial ecosystem; a district that provides the opportunity to retain and develop new talent in Århus and which steps into its own as an integrated part of the city.

CONSIDERATION OF SCALE

One of the biggest concerns for the site is that of scale and the relationship between the proposed high-rise buildings, the existing city-scape, and the humans that occupy it.

Transforming the coal bridge into a pedestrian bridge not only creates a centralized pedestrian axis but also doubles the interactive height between the buildings and pedestrians. Building setbacks further assist the pedestrians within the district by reducing wind tunnels and “refracting” sunlight.

CHAPTER 2
ANALYSIS + FLOWS:
BELLINGHAM INDUSTRIAL REDEVELOPMENT CONTEXT

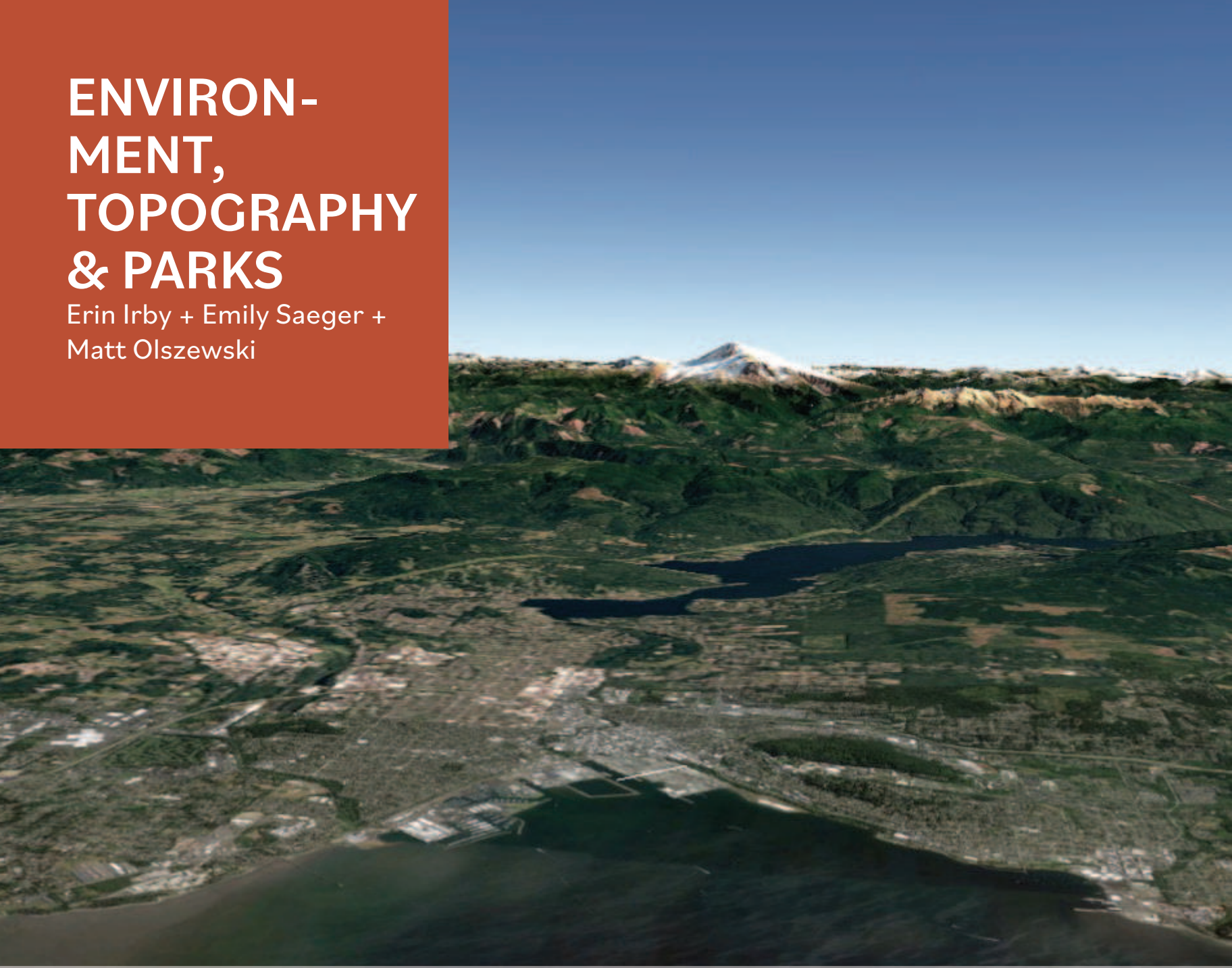
Bellingham Waterfront leftovers from Georgia Pacific Plant// *Photo by Nancy Rottle*

In this chapter, we analyze the Bellingham Waterfront Site to understand its historical context, existing environmental opportunities and constraints, how it connects (or could connect) to the rest of Bellingham and its broader regional context in Whatcom County and Washington State.

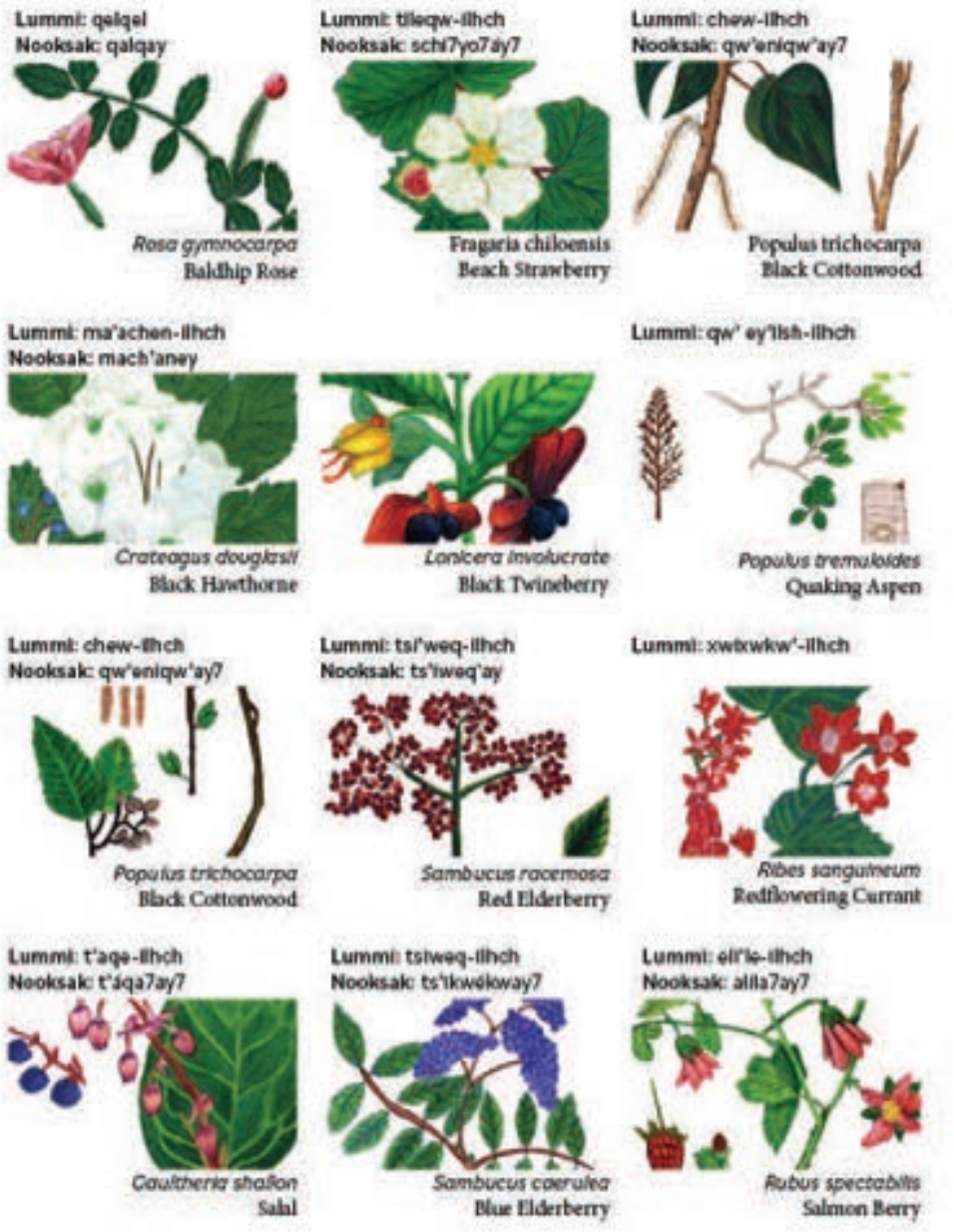
SITE CONTEXT

ENVIRON-MENT, TOPOGRAPHY & PARKS

Erin Irby + Emily Saeger + Matt Olszewski



BELLINGHAM NATIVE PLANTS



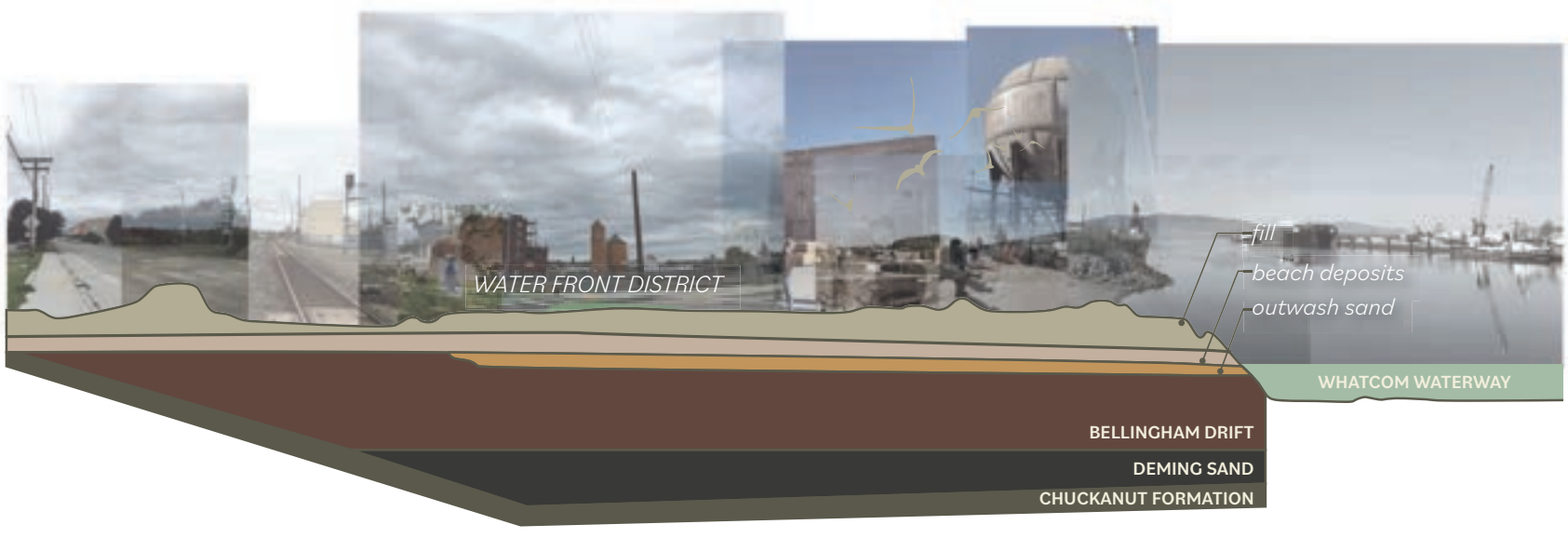
Bellingham native plants are those species that occur or historically occurred within the state boundaries before European settlement. Native species help create a healthy riparian habitat that increases water quality (stabilizing stream banks, filtering ediment and pollutants) and improves fish and wildlife habitat (providing shade, cover, food and places to raise young.)

The adjacent graphic is a compilation of information and botanical drawings done by Whatcom Middle School students in collaboration with the Washington Native Plant Society, Department of Ecology, the Lummi Nation, and Nooksak Indian Tribe.

SOILS AND EXISTING SITE CONDITIONS

"The **geologic deposits** in the project vicinity are the result of both **glacial and non-glacial processes that have occurred during the last 12,000 years**, and recent human activity. The most recent glacial events include the Vashon and Sumas Stades of the Fraser Glaciation (glacial advancement) and the intervening Everson Interstade (glacial retreat). Sea level fluctuated significantly in response to the glacial advance and retreat, relative to the land surface and present day sea level."

-Port of Bellingham Geotechnical Survey



Section informed by Bellingham Geotechnical Report

Bellingham Bay is home to a wide variety of terrestrial, avian and aquatic species. While salmon is a vital species for the Lummi Nation and Nooksack Tribe as an important cultural keystone and foodway, it is also interconnected to a web of both land and marine life. Entwined with the life of the salmon is a web of other species including forage fish such as Pacific Herring and Surf Smelt and voracious predators such as harbor seals, sea lions, and Southern Resident Orca whales.

EXISTING PARKS

1 BOULEVARD PARK

2 CORNWALL BEACH PARK

3 WAYPOINT PARK

4 MARITIME HERITAGE PARK

5 WHATCOM FALLS PARK

6 BLOEDEL DONOVAN PARK

POTENTIAL GREENWAY:
LAKE WHATCOM - BELLINGHAM BAY

The City of Bellingham has the opportunity to create a greenway from Lake Whatcom to Bellingham Bay, and south to Fairhaven by connecting existing parks - Bloedel Donovan, Whatcom Falls, Maritime Heritage, Waypoint, and Bouledvard - to Cornwall Beach, a planned park on the new waterfront. Strengthening connections along this corridor which already passes under I-5, would increase recreational opportunities for Bellingham residents and tourists, while enhancing wildlife corridors.

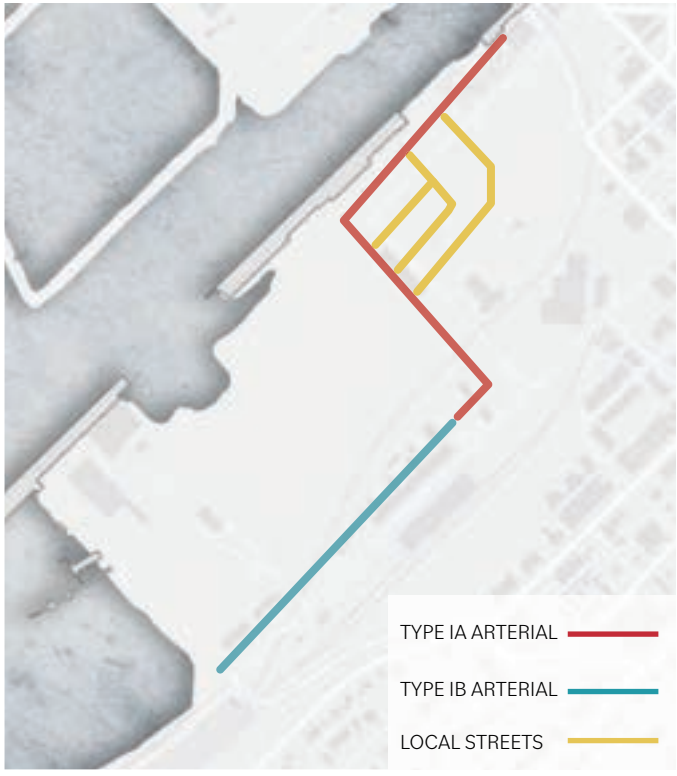
STREETSCAPE URBAN DESIGN

RAIN GARDEN MEDIANS SERVE AS CRUCIAL BASINS FOR STORMWATER

EXISTING STREETSCAPE ALONG GRANARY STREET

PLAZAS INTEGRATING STORMWATER INFRASTRUCTURE

FUTURE STREETS

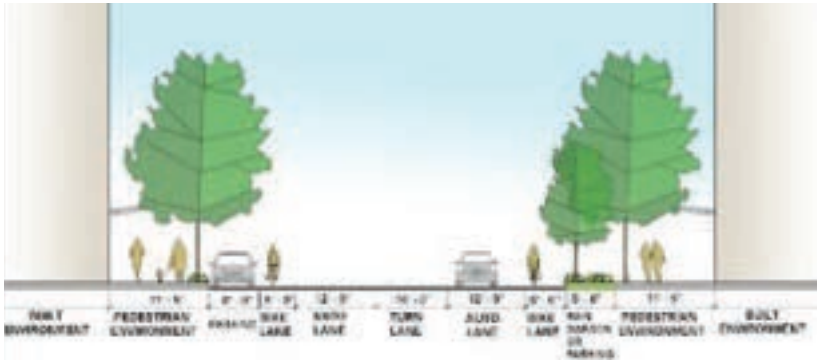


PRECEDENT STORMWATER STREETSCAPES

PORTLAND, OR

VANCOUVER, BC

TYPE IA ARTERIAL



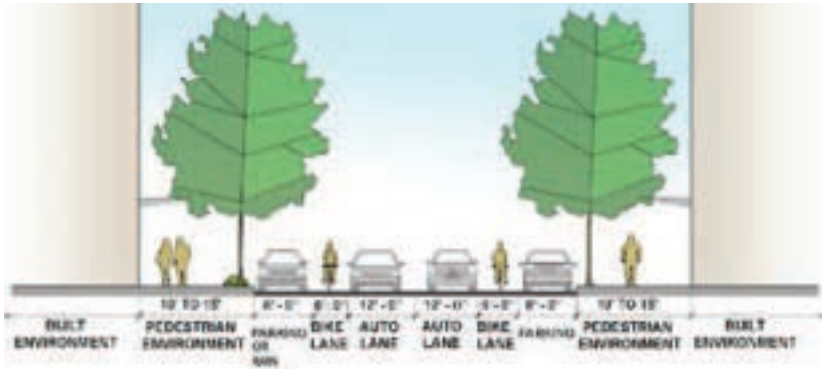
ROW: 85 ft. (2-way Street) with one turn lane at intersection or optional center landscaping.

BIKES: Two dedicated bike lanes or a cycletrack

PARKING: Parallel parking on one or both sides of street

LANDSCAPING: Street trees, highlighted landscape areas at wide sidewalk, natural biofiltration option in lieu of on street parking on one side of street

TYPE IB ARTERIAL



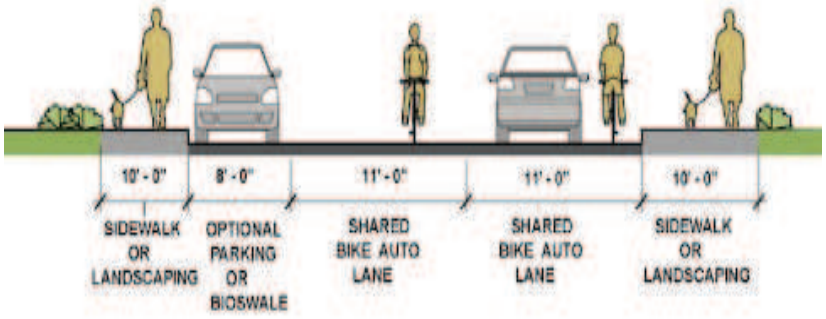
ROW: 72 to 82 ft. (2-way Street)

BIKES: Two dedicated bike lanes

PARKING: Parallel parking on one or both sides of street

LANDSCAPING: Street trees, natural biofiltration option in lieu of on street parking on one side of Street

LOCAL STREETS



ROW: 36 to 56 ft. (2-way Street)

BIKES: Auto lane shared with bikes (Innovative design which favors pedestrian and bicycles).

PARKING: Optional parallel parking or bioswale on one side of street

LANDSCAPING: Street trees, low scale shrubs and ornamentals over utility vaults

OUTDOOR RECREATION & EVENTS

The Port and WMBC have added three jump lines to the bike park to help beginning riders practice their technique in summer 2021

In all, 68,000 tons of dirt were hauled in by Oceanside Construction and formed into the approximately 20,000-square-feet of various berms and banked turns that make up the track

Downtown Sounds summer concert series turns under utilized space into something extraordinary. each year the event grew, now taking up two entire city blocks on Bay and Prospect Streets

Future waterfront expansion of downtown sounds

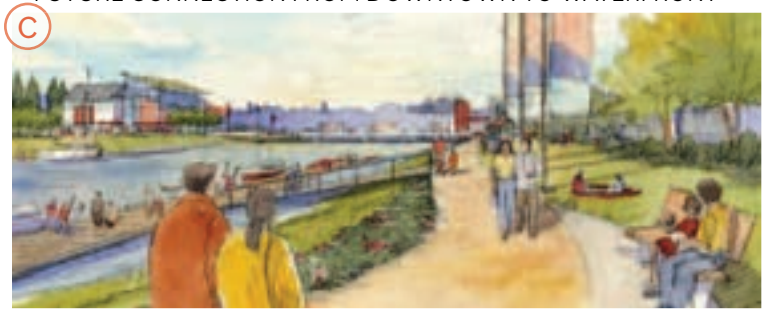
First run in 1973, the Ski to Sea is a multi-sport team relay from the Mt. Baker Ski Area to Bellingham Bay

Bellingham's Wednesday Farmers Market at the Waterfront

FUTURE POTENTIAL VIEWSHEDS

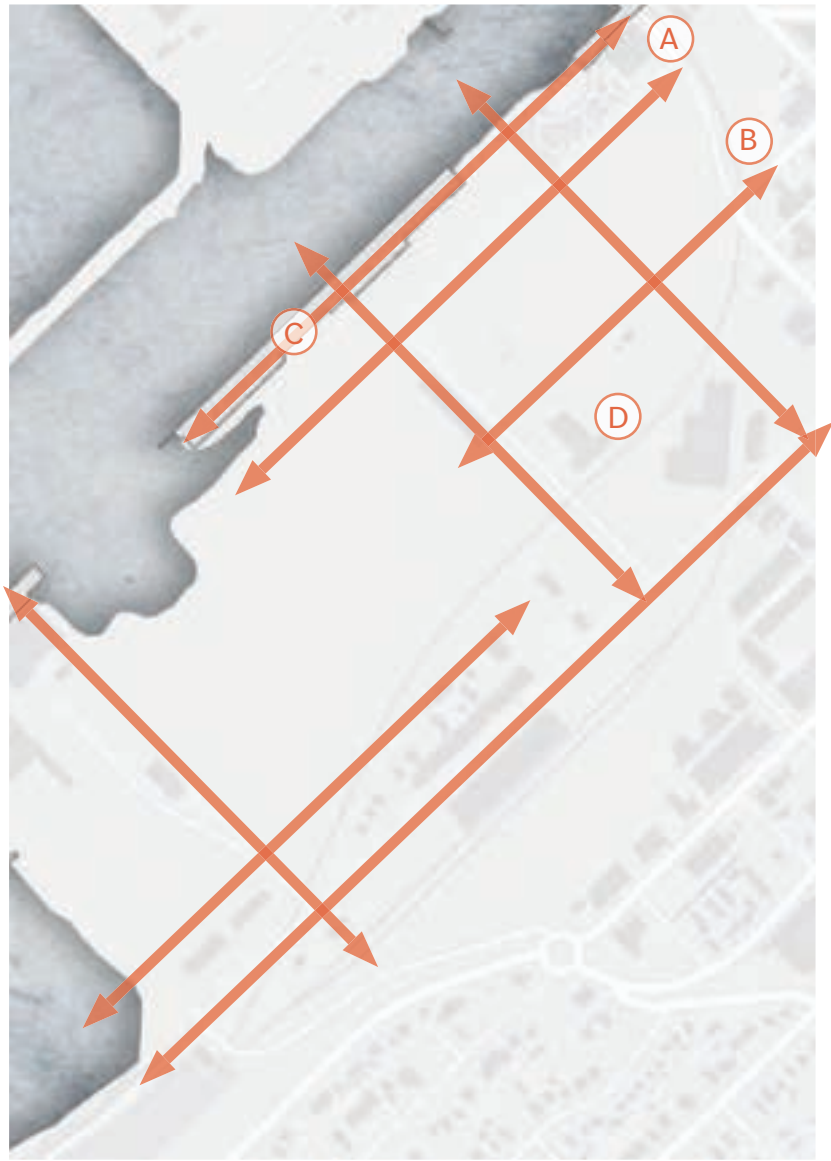
FUTURE GREEN SPACE IN WATERFRONT CORE

FUTURE CONNECTION FROM DOWNTOWN TO WATERFRONT



WATERFRONT PROMENADE

WATERFRONT DISTRICT NODE

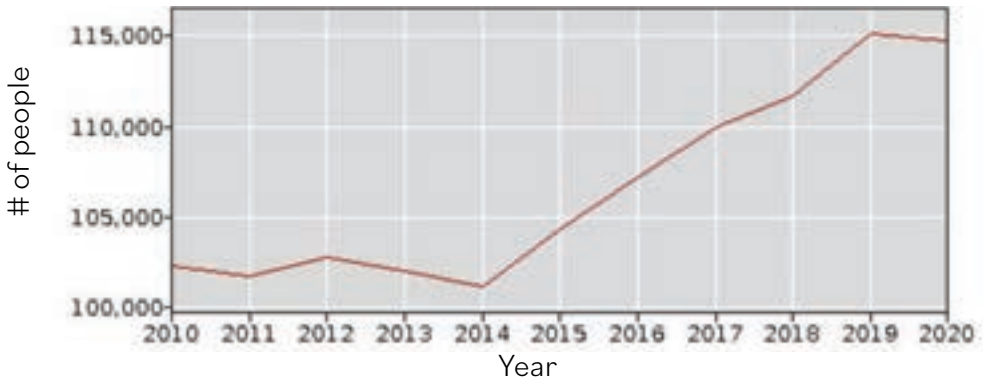


ECONOMY & SUSTENANCE

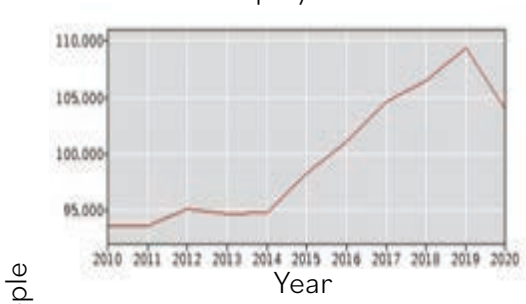
Lucas Helander +
Tim Spenser + Shanty Wu

BELLINGHAM STATISTICAL AREA:

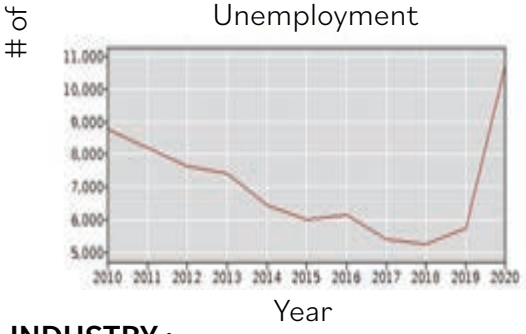
Labor Force



Employment



Unemployment



WHATCOM COUNTY ECONOMIC CHARACTERISTICS:

In 2019, 20% earned $50,000 - $74,999 of total house income and benefits. 4.7% earned less than $15,000 annually. 5.9% earned $200,000 or more. Median household income is $69,372.

INDUSTRY :

In 2019 the agriculture, forestry, fishing and hunting, and mining is about 2.2%, retail trade is 12.8% and the largest industry is education, health care and social services at 22.9%.

ECONOMY + JOBS

Bellingham offers a dynamic workspace, however it is notable that the city of Bellingham only has three companies that employ over 1,000 people. By examining the list of top employers in Bellingham one can begin to understand the job makeup of this small city. Bellingham relies on these larger companies and industries for economic stability, but it is really the aging small business sector and tourism that drives the local economy.

1,100 small businesses in Bellingham are over 20 years old and account for $4 Billion or 63% of all small business revenue in Bellingham. Not only are these older businesses economic drivers, they employ 2 of every 5 employees in the city of Bellingham.

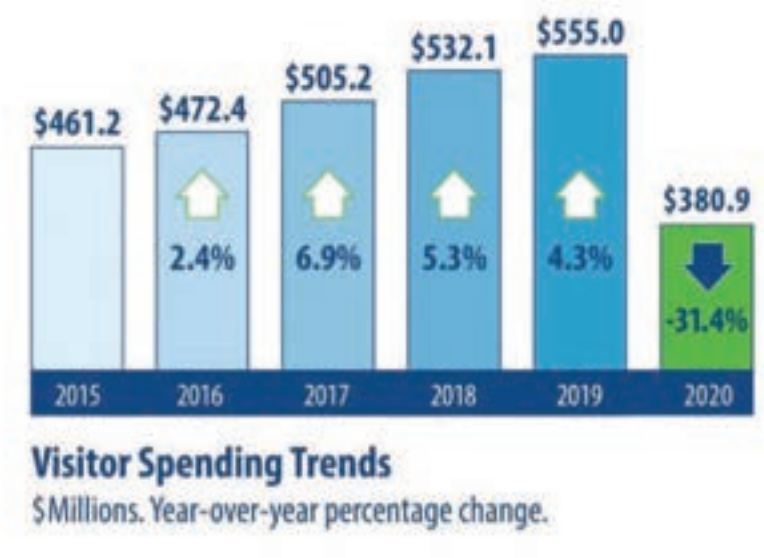
Rank	Company	Full Time Employment [1]	Notes
1	St Joseph Hospital	2,126	
2	Lummi Nation	1,780	Tribal
3	Western Washington University	1,499	FTE (1,689 headcount)
4	Bellingham Public Schools	987	
5	Whatcom County	881	
6	BP Cherry Point	820	Refinery
7	The City of Bellingham	788	
8	Fred Meyer	778	
9	Haggen	751	Retail and corp office
10	Zodiac Interiors	607	Aircraft interior manufacturer
11	Alcoa Intalco Works	580	Aluminum smelter
12	T mobile	437	Call center
13	Bellingham Tech. College	430	
14	Lynden School District	430	
15	Family Care Network	426	Medical services
16	Smith Gardens	400	Greenhouse
17	Anvil Corporation	400	Engineering firm
18	Peoples Bank	394	
19	Lynden Door Company	380	Door manufacturer
20	Alpha Technologies	373	Power solutions equipment
21	The Markets	370	Retail and corp office
22	Ferndale School District	358	
23	Matrix Service Inc	340	Heavy industry contractor
24	Diamond B Construction	300	Heavy industry contractor
25	WECU	292	Credit union

1. We ask businesses for permanent and full-time employees based in Whatcom County. Getting that number is harder than you might think due to differences in how companies define full-time, how to count people who work in different locations during the year, etc. Some figures are estimated from prior years. For discussion purposes and reference.

Source: Center for Economic and Business Research at Western Washington University, 12/31/16

TOURISM DRIVEN ECONOMY

Tourists are one of Bellingham's greatest economic drivers. On average a tourist visiting for the day brings $58 worth of economic value and $278 when spending a night in Bellingham. Many of these tourists come from Canada, and with recent border closings Bellingham has paid the price. Bellingham Whatcom County Tourism recently reported that total travel spending in Whatcom County generated $70.7 million in state and local taxes in 2019, and "each household in Whatcom County would have to pay an additional $831 in taxes each year were it not for tourism."



Direct travel spending in Whatcom County took a $174M hit in 2020, down 31.4% from 2019, with tourism-supported employment down 44%. In an industry that previously grew on average 3.7% per year, this gap could show an opportunity for rebound.

THE PORT OF BELLINGHAM

Port of Bellingham is currently the owner of the waterfront site, as well as an important factor in the local and extended economy of Whatcom County. The Port's mission is to **"promote sustainable economic development, optimize transportation gateways, and manage publicly owned land and facilities to benefit Whatcom County".** This mission statement is used to direct the Port's decisions in their redevelopment and planning of the site. With the future in mind, and a desire to strengthen the community and economy of Bellingham, the Port's decisions and motives in its redevelopment will not only shape the site directly, but will influence Bellingham and Whatcom County for years to come.

PORT OF BELLINGHAM'S ECONOMIC CONTRIBUTION

8,780 total jobs*

$42,120 average wage

$406.3 million in total payroll

$1.4 Billion in business revenue

$37.7 million in state/local taxes

11% of the local economy

50% of the impact is attributed to maritime activity

** Total jobs include direct employers on port property, jobs produced by wage expenditures by these direct employees, and jobs created when port businesses make local purchases with suppliers.*

FOREIGN TRADE ZONE #129

The Port of Bellingham is classified as a Foreign Trade Zone. This classification provides foreign and domestic merchandise to be considered international commerce and outside of U.S Customs territory. Therefore, activated businesses in an FTZ can reduce or eliminate duty on imports and take advantage of other benefits to encourage foreign commerce with the United States.

PORT REVOLVING LOAN

The Port of Bellingham administers an Economic Development Administration Revolving Loan Fund (RLF) with a range of $35,000 - $125,000. The eligibility requirements to qualify for a RLF Loan from the Port include:

- Business must be located in Whatcom County
- Borrower must have 10% in the deal
- For every $35k loaned, 1 job must be created within 2 years of closing

SMALL CITY PARTNER

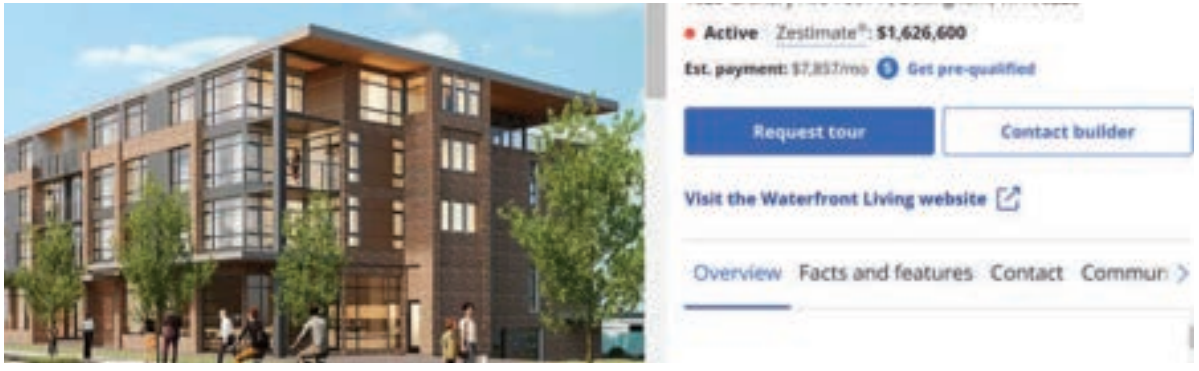
The Small City Partnership is an initiative of local government leaders to create and support a healthy and diversified economy for its residents.

- Creating information and planning for public investment in the county
- Developing a blueprint for the economic future
- Providing better research and understanding of the economy

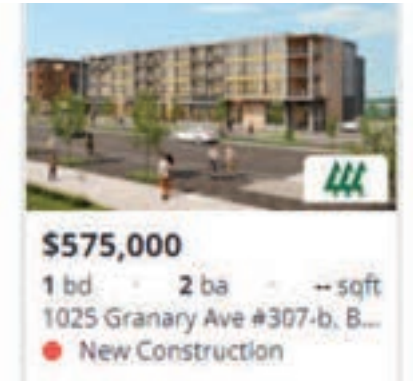
Through 2016, the port contributed $662,210 to small city projects. The city provided $1,076,617 in matching funds. Over $42 million in capital project funds have been raised to complete infrastructure projects. These projects have supported private investment and job creation across the cities.

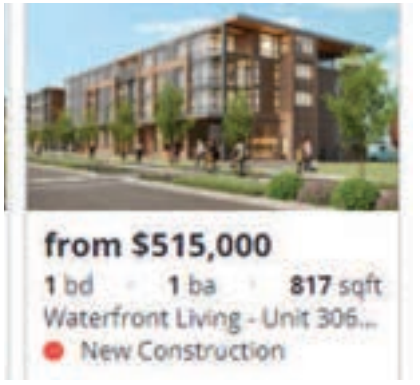
SHELTER + HOUSING

1025 GRANARY AVE, BELLINGHAM, WA 98225 - PLANNED



"This beautiful luxury apartment is located on Granary Ave in Bellingham waterfront. It is offered at $1,650,000 and would be fully built in 2023. The cost of HOA is $600/mo, home insurance $578/mo, property tax is $1,120/mo, no mortgage insurance. Est. payment is $7,845/mo."





Additional luxury new homes available from $575,000 - $515,000.

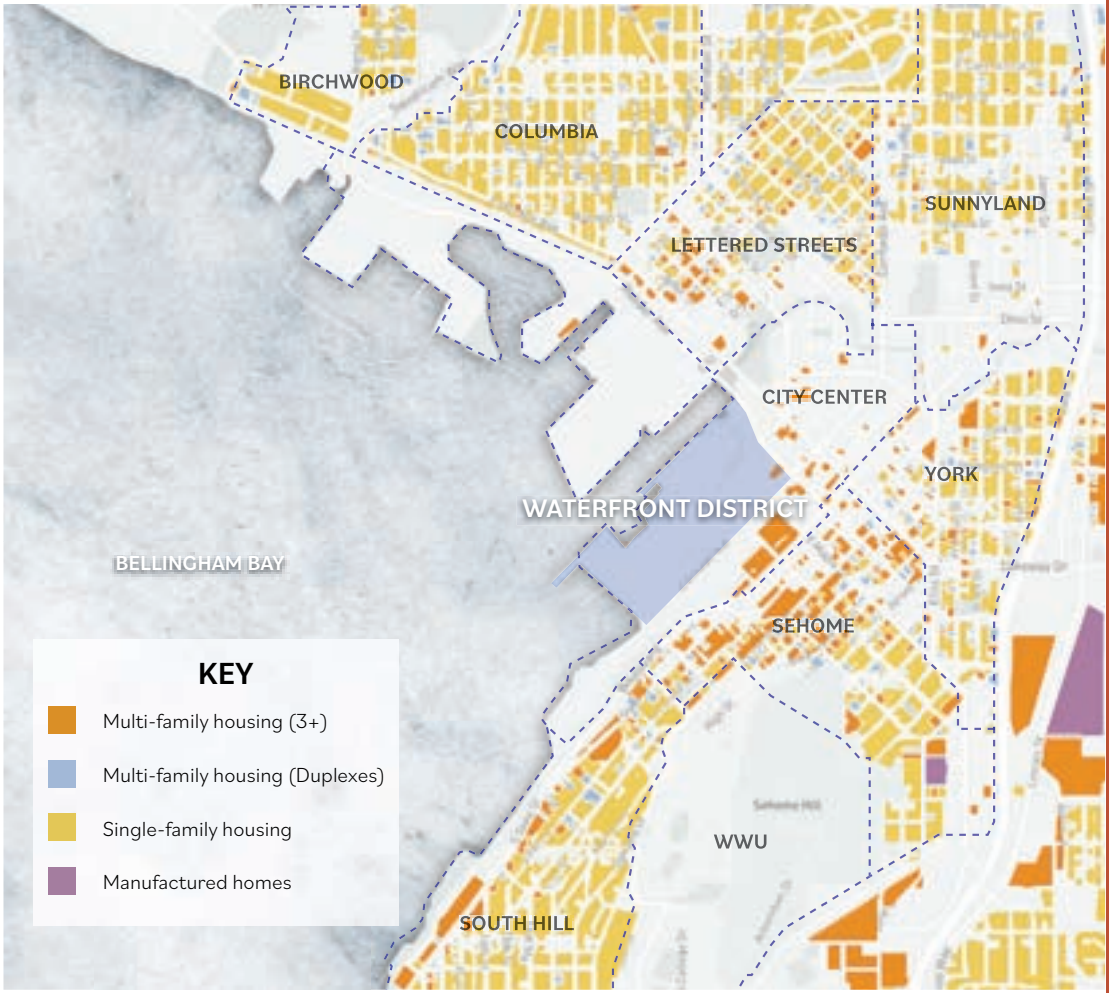
BELLINGHAM HOUSING AT A GLANCE

Bellingham was the **9th-least affordable** mid-sized city in the US in 2020

Median home price in 2021: **$625K** (up 28.3% over 2020)

54% of homes renter occupied / **46%** owner occupied

30% of renters are severely cost-burdened



Adapted from: City of Bellingham, https://bellingham.maps.arcgis.com/apps/Cascade/index.html

Housing affordability is one of the key issues that a redeveloped Waterfront District could help to address in Bellingham. Like many cities in the US, Bellingham is experiencing an historic housing shortage that has led to skyrocketing home prices and rents. A preponderance (46.7%) of Bellingham's total housing stock are single-family homes, which serve to further limit the availability of affordable housing. Despite this need, it is important to carefully consider where housing could be placed given the health and safety challenges in the Waterfront District and accounting for the impacts that climate change will have on the area.

FOOD + FARMING

The Bellingham waterfront is embedded in a complex web of flows related to food and farming. Nearby farmers markets sell produce grown locally within city limits at urban farms and gardens and more broadly throughout Whatcom County. The local fishing economy brings in catch from the Salish Sea, the Washington coast, and as far away as Bristol Bay, Alaska.

The greater agricultural landscape of Whatcom County is a key piece of state and national agricultural markets, specializing in berry production and ranking 6th among all WA counties for total agricultural production (whatcomcd.org). In the last decade, the number of small farms (less than 10 acres) in the country that grow for the regional market rather than for export has grown by 2% (Gallagher). The proposed Millworks Project on the waterfront site includes a Food Campus that could draw together these threads and build on the growth of local agriculture to connect the site to its local and regional context through food.

Photo credit: Evan Abell, The Bellingham Herald

WHATCOM COUNTY AGRICULTURE AT A GLANCE

Over **100K** acres of productive farmland

1,712 farms

97% family farms

2% organic farms

15% sell directly to consumers

$372M in annual agricultural production

65% of red raspberries grown in USA

LOCAL FOOD PRODUCTION + CONSUMPTION

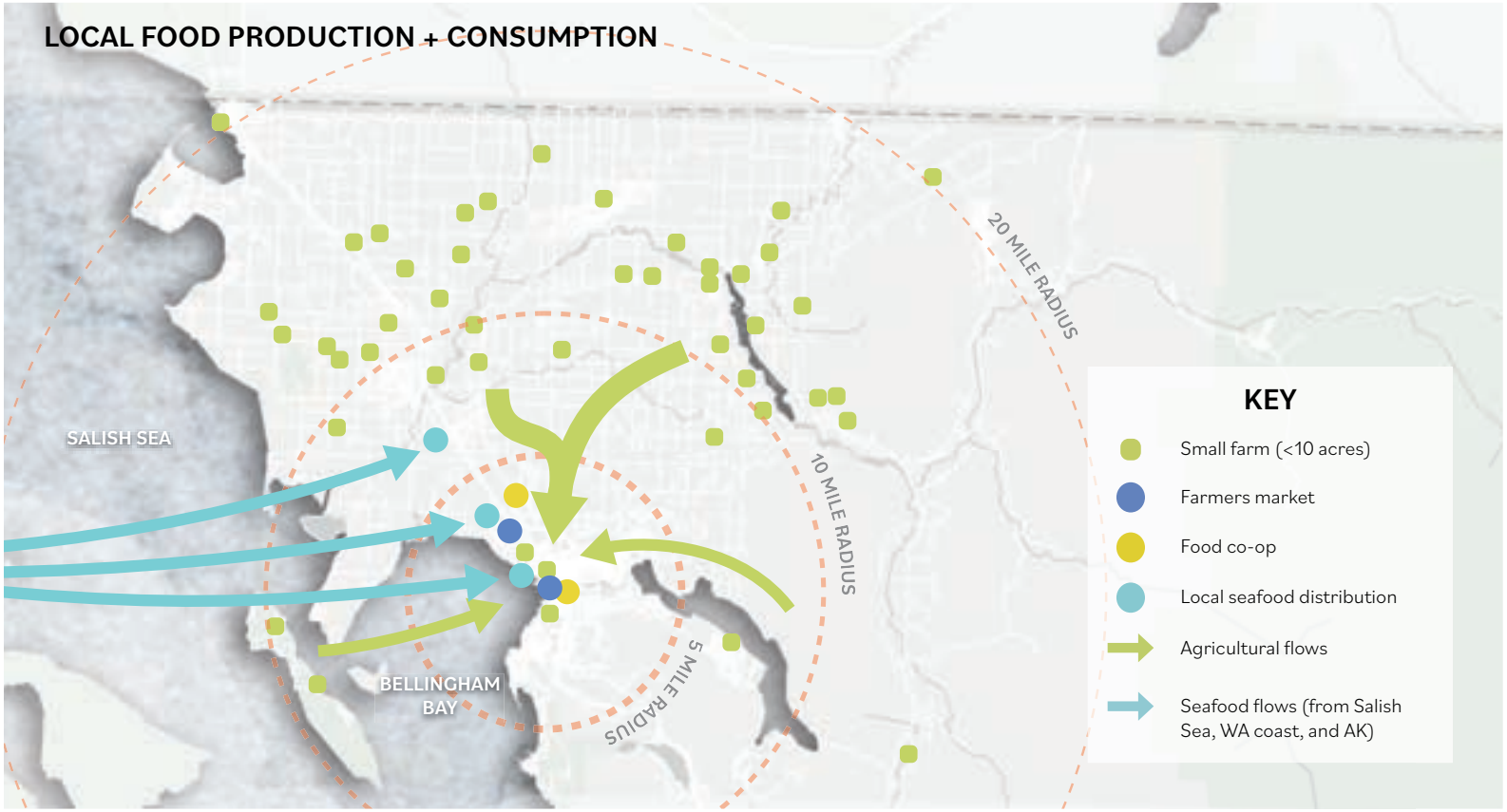



Photo credit: Alex Smith, whatcomtalk.com

ON-SITE ECONOMY

In addition to the economic activity directly attributable to the Port of Bellingham, the Waterfront District is home to multiple new businesses and industries. Silfab Solar, a photovoltaic (PV) panel manufacturer based in Canada, operates a plant on the site. The Granary Building, refurbished by Harcourt in 2015, houses businesses that have brought new jobs to the Waterfront District.

SOLAR PANEL MANUFACTURE

Silfab Solar acquired its PV manufacturing facility from the Port of Bellingham in 2018. Silfab expanded operations at the facility, which had previously been run by another solar panel manufacturer, tripling the plant's production capacity to 450 megawatts of panels annually. This expansion created around 30 new jobs (Pickerel). With the opening of its Bellingham facility, Silfab became the fifth-largest solar panel manufacturer in North America.

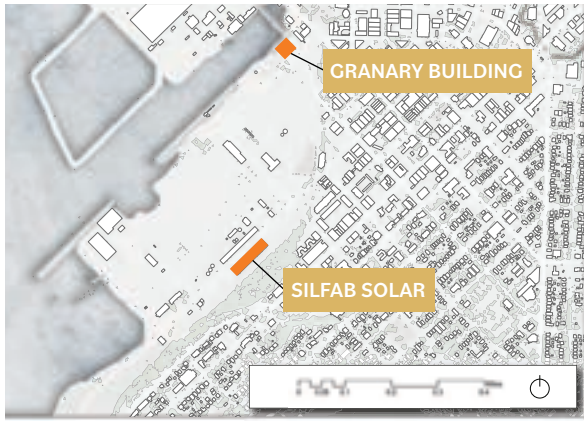



Photo credit: The Bellingham Business Journal

In 2020, Bellingham was recognized for its citywide solar energy program. The preexisting momentum of renewable energy infrastructure could be expanded in a Waterfront District that models climate mitigation.

THE GRANARY BUILDING

An adaptive reuse of an historic grain elevator dating from 1915. Renovation by Harcourt began in 2015, and the building now houses six stories of office and retail space

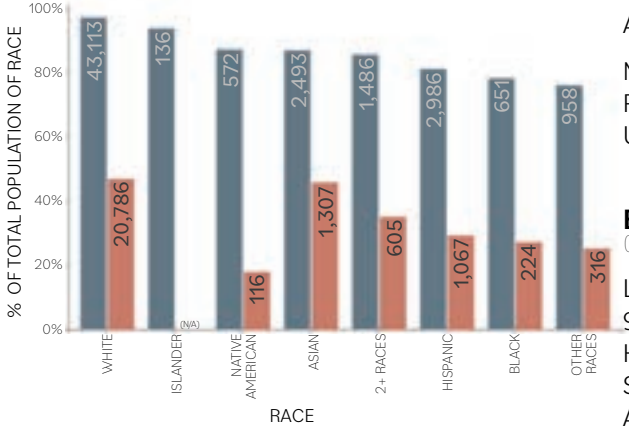
The Granary Building houses the Bellingham offices of Körber Digital, a Germany-based IT services company. The firm leased space in the building in 2020 and is expected to bring around 120 jobs to the waterfront (Meacham, 2020). In addition, several small businesses call the Granary Building home.

- Arboretum Coffee
- Artivem Mead Co.
- Bellingham Yoga Collective
- Clover Mini Spa
- Honey Salon

Photo credit: bellinghamdowntownwaterfront.com

PEOPLE, CULTURE, HERITAGE & WELL-BEING

Leila Jackson +
Drew Landis



BELLINGHAM EDUCATION ATTAINMENT RATE

HIGH SCHOOL GRADUATION RATE

BACHELOR'S GRADUATION RATE

DEMOGRAPHIC DATA

(w/national national Data where available)

Overall Population: 96,014
- White: 83.20% (61.6 - 71%)
- Asian: 5.94% (4.2 - 7.8%)
- Two or more races: 4.80% (10.2%)
- Other race: 3.09% (8.4 - 14.1%)
- Black or African American: 1.60% (12.4 - 14.2%)
- Native American: 1.14% (1.1 - 2.9%)
- Native Hawaiian or Pacific Islander: 0.23% (0.2 - 0.5%)

Median Age: 31.5 yrs (38.1 yrs)
Women: 33.4 yrs, 52% of population
Men: 30.1 yrs, 48% of population

Rate of Home Ownership: 45.4% (65.4%)
Average Family Size: 2.88 persons
Average Household Size: 2.28 persons

Median Income: $38,309 ($67,520)
Poverty Rate: 20.82% (11.4%)
Unemployment Rate: 6.9% (5.2%)

EDUCATION

(number attained, percent of total, national percentage)

Less Than 9th Grade: 807 (1.49%) (n/a)
9th to 12th Grade: 2,164 (4.00%) (n/a)
High School Graduate: 9,823 (94.52%) (89.8%)
Some College: 11,487 (76.37%) (62.18%)
Associates Degree: 5,882 (55.15%) (45.16%)
Bachelor's Degree: 14,943 (44.28%) (34.98%)
Graduate Degree: 9,029 (16.68%) (13.04%)

Students Enrolled at WWU: 16,142 persons
(accounts for 52.88% of all Bellingham students)

OVERALL POPULATION DENSITY

AVERAGE INCOME BY LOCATION

BACHELORS DEGREE ATTAINMENT BY LOCATION


CULTURAL INSTITUTIONS
1_VITAL CLIMBING GYM
2_SPARK MUSEUM
3_PUMP TRACK
4_WWU SCULPTURE GARDEN
5_WHATCOM MUSEUM OF HISTORY
6_MT BAKER THEATER
7_SYLVIA CENTER FOR THE ARTS
8_MT BAKER SNOQUALMIE NATIONAL PARK
9_LARABEE STATE PARK
PUBLIC ART SITES
HISTORIC/HERITAGE SITES
EDUCATION INSTITUTIONS

9000BC | BELLINGHAM BAY IS INHABITED BY COAST SALISH GROUPS

The area in and around Bellingham Bay, and adjacent territories, is home to a number of groups including the **Lummi, Nooksack, Saanich, Samish, Semiahmoo,** and **Songish.**

1855 | TREATY OF PT. ELLIOT

Lummi, along with other northwest coastal tribes were paid a total of $150,000 for their lands and paid an additional $15,000 in relocation costs and expenses.

1880 | RESIDENTIAL SCHOOLS

Indigenous children in the region were sent to Catholic residential schools with the goal of stripping the indigenous people of their language and culture, and imposing Euro-American culture on them. These schools included Stickney Home Mission School for Indians (Lynden, WA), and Chemawa Boarding School (Salem, OR) - pictured.

1852 | LUMBER AND COAL MINING INDUSTRY BOOM

The Roeder-Peabody lumber mill is established on Whatcom Creek, housing one of the leading industries in the region. By 1853, coal mining had begun in the new city of Sehome, and alongside the Fraser River gold rush, brought over 75,000 people through the growing area.

1885 | CHINESE EXPULSION

Chinese residents are expelled from Bellingham in a campaign led by a local newspaper. Civic leaders campaigned to drive Chinese workers away from the area. When they succeeded, the towns celebrated with a torchlight parade.

1900 | SALMON INDUSTRY

From 1900 until about 1945, canneries were the area's largest employers. The Pacific-American Fisheries cannery was the largest structure in Washington and the largest Pacific salmon processing-plant in the world. The Lummi (and other native tribes) were excluded by the state of Washington from the commercial fishery.

1893 | NEW WHATCOM SCHOOL

New Whatcom School is established, which would eventually would become Western Washington University.

1907 | SOUTH ASIANS EXPELLED

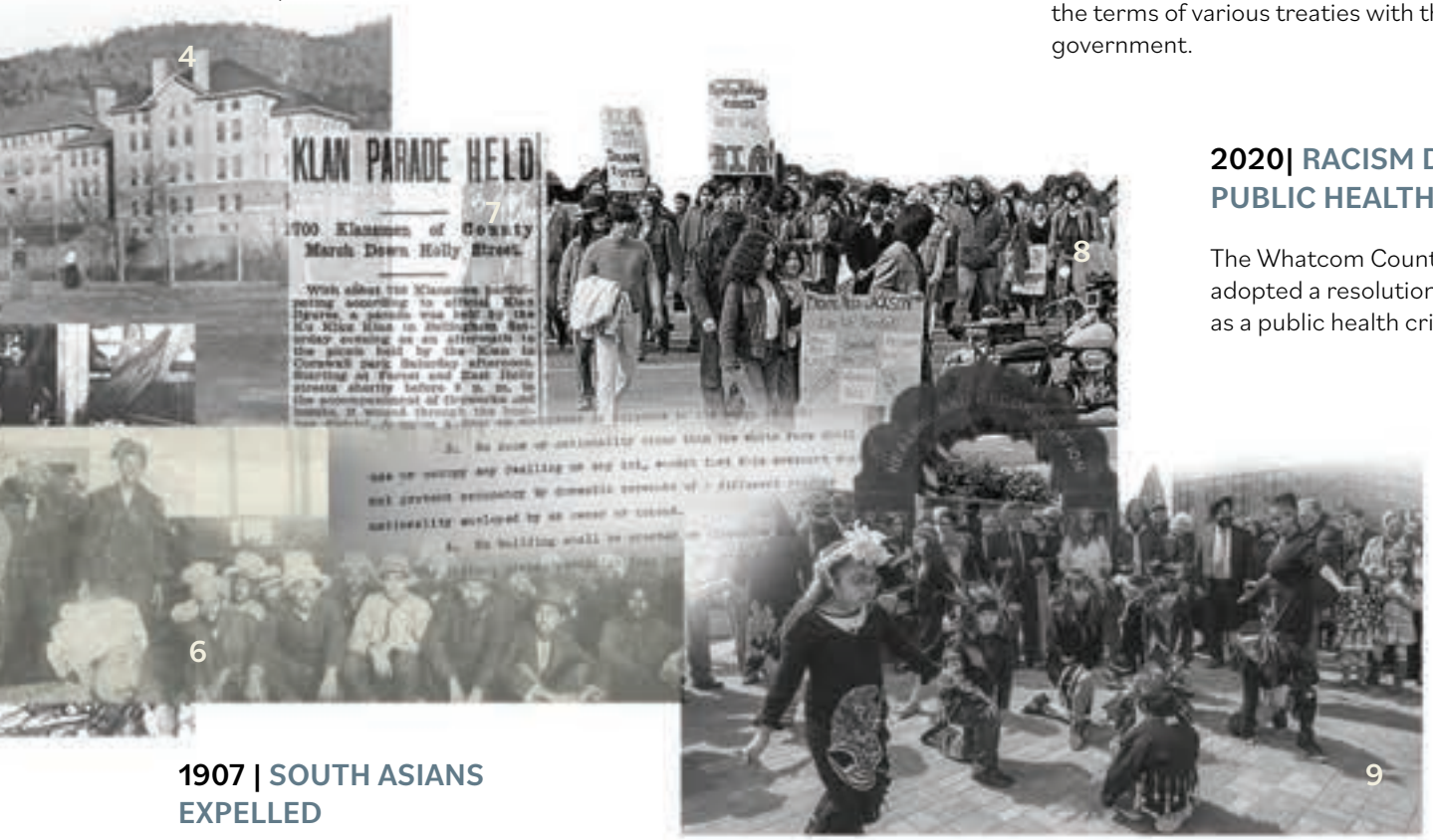
East Indian lumber mill workers, predominantly Sikh, are violently attacked and driven out of Bellingham.

1925 | WHITE SUPREMACY

Bellingham hosted the strongest KKK chapter in WA state throughout the 1920s and 30s. In September of 1925, an organized rally draws a crowd between 12,000 and 25,000 people.

1974 | BOLDT DECISION

Following the 'Fish Wars' (1960s and 70s), where native peoples were engaged in non-violent protest, the case re-affirmed the rights of American Indian tribes in the state of Washington to co-manage and continue to harvest salmon and other fish under the terms of various treaties with the U.S. government.



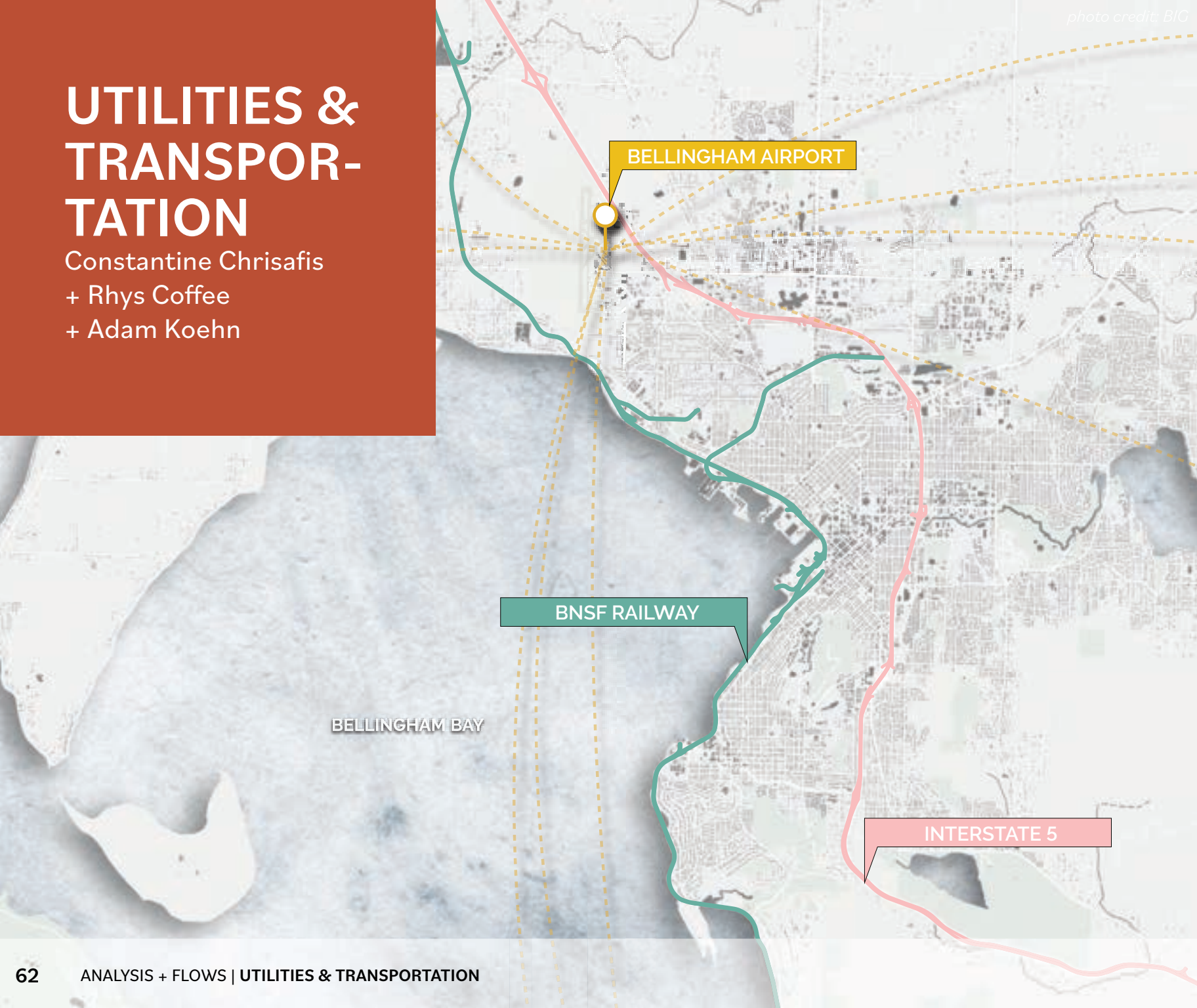
2020| RACISM DECLARED A PUBLIC HEALTH CRISIS

The Whatcom County Board of Health adopted a resolution recognizing racism as a public health crisis.

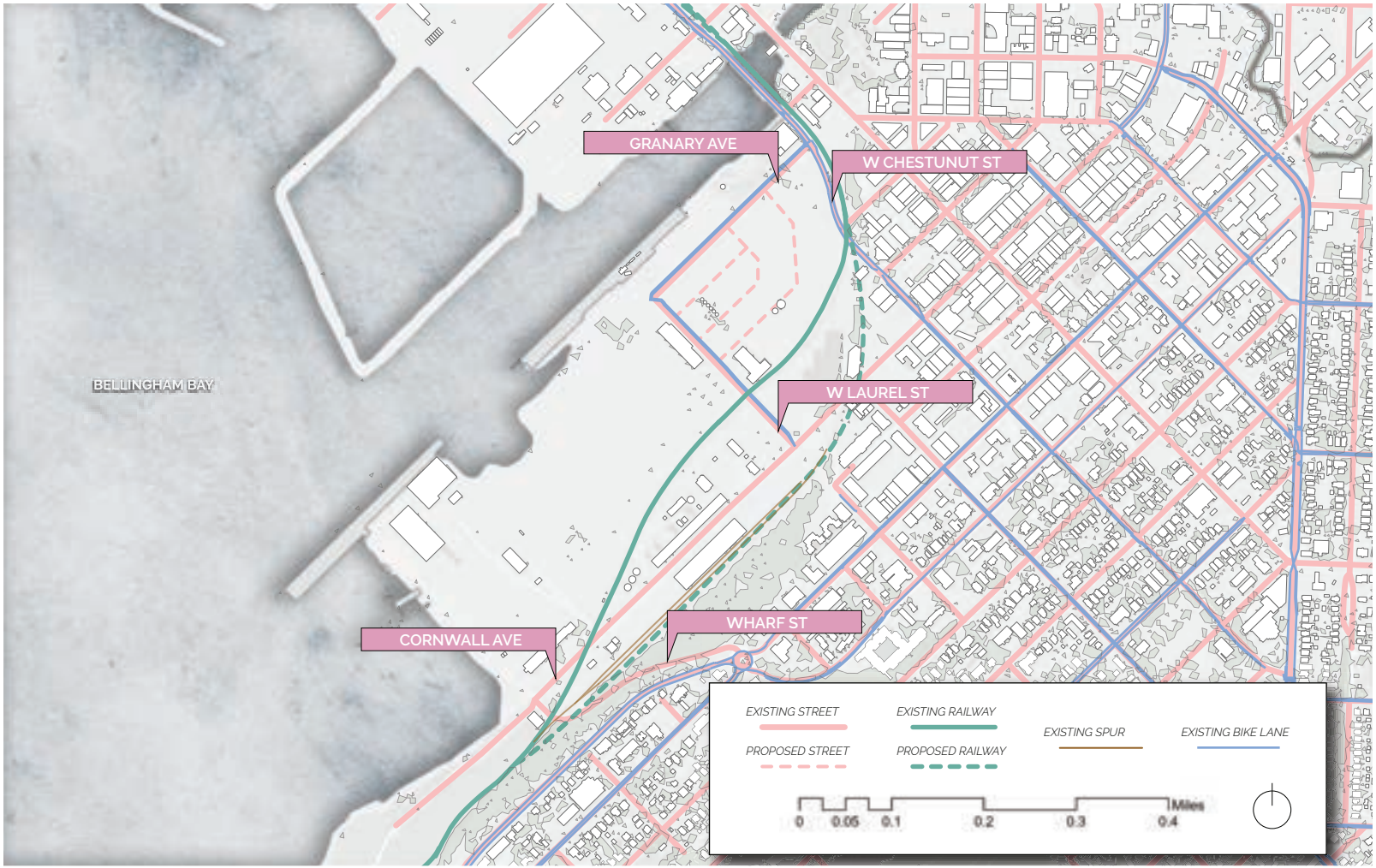
1. BUs0565 (1880-1920) "Site of Roeder-Peadbody Mill on Whatcom Creek below the second Pickett Bridge.
2. Oregon Historical Society (1887). "Students and staff on Chemawa Indian School grounds in 1887)
3. Whatcom Museum " Inspection: Chinese Baggage Sumas, WA).
4. University of Washington. (1904)"Washington State Normal School, Bellingham, WA)
5. Western Washington University. "50,000 Salmon in the Cannery of the Carlisle Pkg. Co."
6. Colliers magazine (1907) "A part of 200 Hindus driven to take refuge in the city hall by anti-Orient rioters"
7. Bellingham Herald (1926). "Klan Parade Held"
8. Bellingham Racial History TImeline (1947). "Racially restrictive covenant"
9. University of Washington. (1971). "Native American students' fishing rights protest"
10. Bellingham Herald (2018). "Arch of Healing and Reconciliation installed"

UTILITIES & TRANSPOR-TATION

Constantine Chrisafis
+ Rhys Coffee
+ Adam Koehn



Certain conditions of the site including topography, industrial access, and the active railway pose unique circulation challenges to the future development of the Bellingham Waterfront District. Currently, the site has three formally constructed roads: Granary Ave, W Laurel St., and Cornwall Ave. Proposed streets in the 2019 Sub Area Plan intend to link Bellingham's downtown to the new development and provide safe and accessible infrastructure for pedestrians and bikers. While automobile access is necessary for those traveling from across the city, building designs will need to integrate parking within and underneath the structures, mostly on sites off of the shoreline to promote walkability near the water's edge.

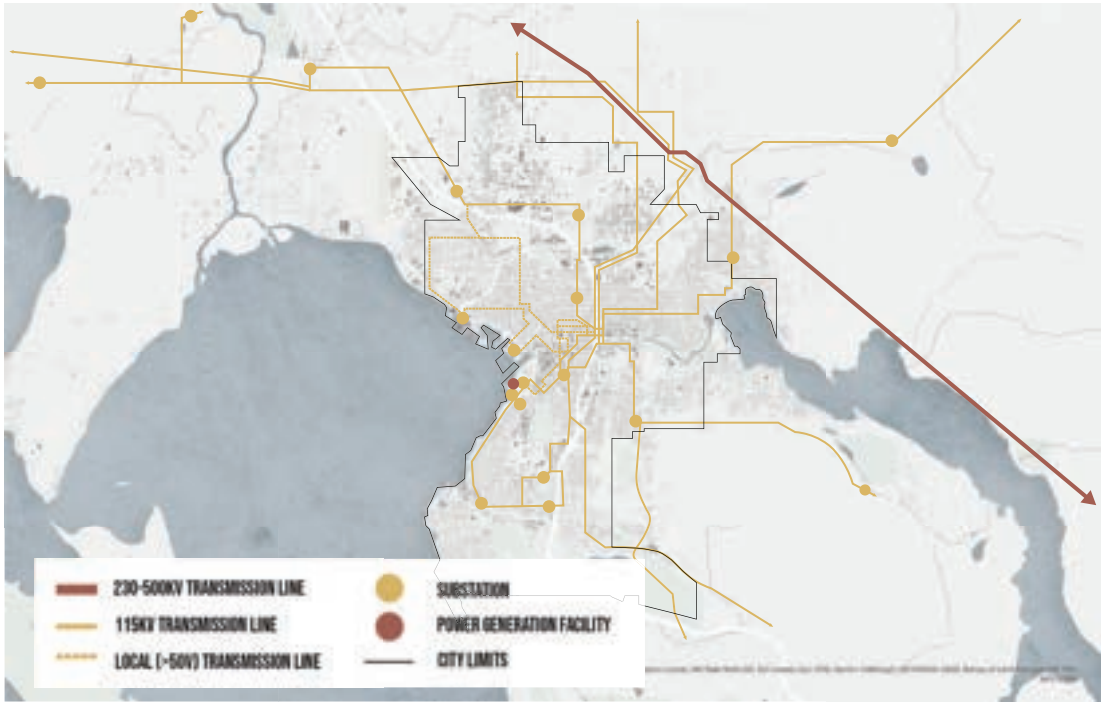


BELLINGHAM POWER INFRASTRUCTURE

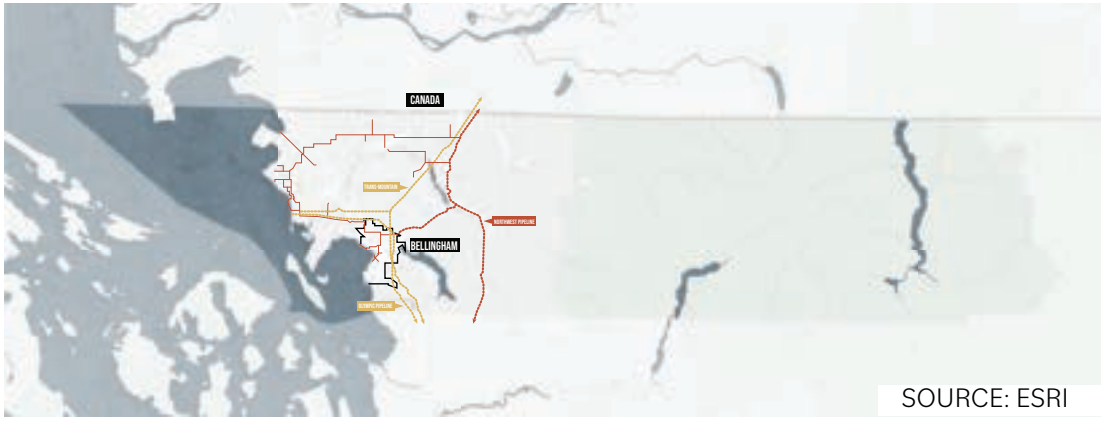
Bellingham Washington is a nexus of infrastructure, both in oil and natural gas. With a well-connected electricity grid extending across the Western states and even up to Canada, the city lies at the junction of a large network connecting Washington, and the rest of the country. **The city relies on Cascade Natural Gas for its natural gas supply and Puget Sound Energy for electricity.**

Puget Sound Energy (PSE) is an energy utility based in the U.S. state of Washington, providing the Puget Sound region with electrical power and natural gas. The company's electric and natural gas service area spans 6,000 square miles (16,000 km2)

Cascade Natural Gas: Until the early 1950s, Pacific Northwest communities outside the larger metropolitan areas were passed over for natural gas service. In 1953, the Cascade Natural Gas Corporation was formed to serve these communities with affordable natural gas.

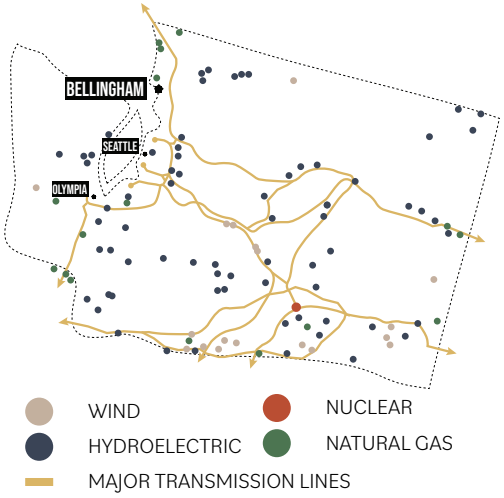


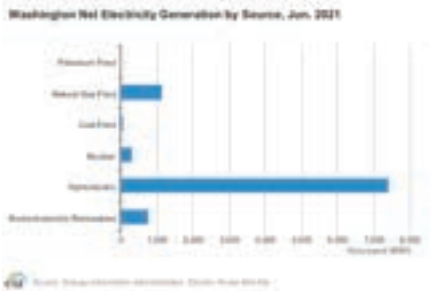
ELECTRIC TRANSMISSION INFRASTRUCTURE I BELLINGHAM



SOURCE: ESRI

CRUDE OIL AND NATURAL GAS INFRASTRUCTURE I WHATCOM COUNTY



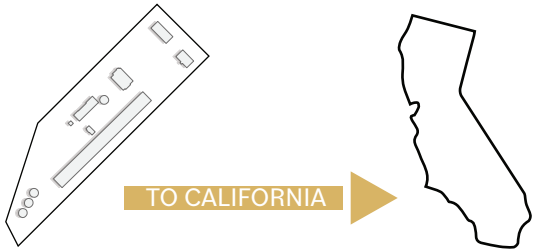


STATE ENERGY FLOWS

Bellingham's power grid is connected to intra-state and transnational electricity networks, however it usually draws power from generation facilities in Washington State.

Green Direct is a program designed to provide PSE customers the ability to purchase 100 percent of their energy from a dedicated, local, renewable energy resource. Bellingham participates in this program, however, when peak power events happen, non-renewable energy is tapped.

BELLINGHAM SITE I EXISTING SITE INFRASTRUCTURE



ECOGEN NATURAL GAS PLANT

The site currently hosts a natural gas-fired power plant (Ecogen). The plant sends energy down to California during "peaker events". **What are Peakers?** Peakers are the last resort power plants that turn on when grid energy demand is peaking. For example, a peak event is a hot day when everyone turns on their air conditioners at the same time. It's more energy demand than the regular grid can handle.

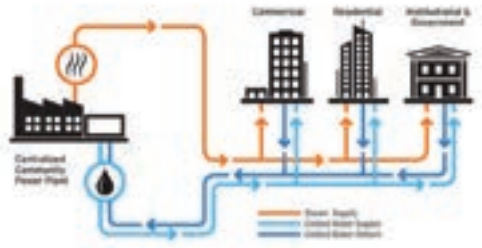
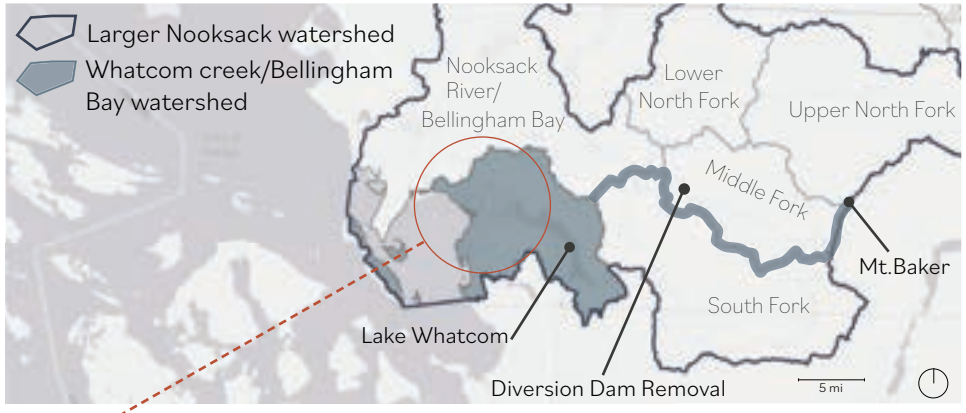


diagram adapted from corix

WHAT IS DISTRICT ENERGY?

District energy systems are a highly efficient way to heat and cool many buildings in a given area from a central plant. The site is planned to run on a district energy system. **A main spine of district energy infrastructure is already present under Laurel Avenue, and will expand as the site is further developed.**

FIGURE 1. Bellingham is situated in the Whatcom Creek/Frontal Bellingham Bay watershed within the larger Nooksack watershed. Bellingham sources its drinking water from Lake Whatcom via a 1,200 ft wooden gravity fed pipe. From the 1960s-2020 water would periodically be diverted to Lake Whatcom via a dam in Deming. The Lummi Nation and Nooksack Indian Tribe led the fight for dam removal and prevailed, opening up 16 miles of critical salmon habitat.



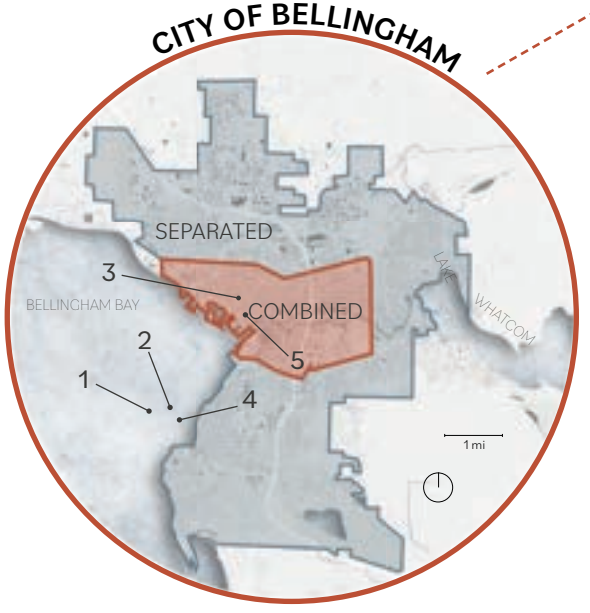


FIGURE 2 (LEFT). Outfalls and sewer types. Bellingham's current sewer service area covers roughly 39 square miles. 97% of Bellingham's total collection system piping is on a separated system. The combined sewer system (wastewater and sewage) exists in the oldest part of the city (Downtown). Between 2008-2014 only 2 CSO events occured due to severe rain events. **1.** Outfall 001, primary outfall for the WWTP, extending 2,375 ft into Bellingham Bay at a depth of 76 ft. **2.** Outfall 002. **3.** Bellingham's only combined sewer outfall, C Street outfall 003. **4.** Post Point WWTP. **5** Oak Street Pump Station (Washington State Department of Ecology, 2014).
FIGURE 3 (RIGHT). Waterfront site pipesheds and outfall locations (David Evans and Associates, Inc., 2007)

WASTE STREAMS OF BELLINGHAM

FOOD WASTE is sent to Green Earth Technology a composting facility that diverts over 20,000 tons of organic material from the landfill each year. The compost created here is sold to farms and businesses in Whatcom county.

NEWSPAPER is sent to Keyes Packaging Group where it is recycled into apple trays.

GLASS is sent to Strategic Materials where it is sorted by color then sent to Saint-Gobain where it is melted into new glass bottles.

GARBAGE is sent to either the Roosevelt Regional Landfill via the Burlington Northern Santa Fe rail or The Columbia Ridge Landfill via the Union Pacific Railroad.

STEEL CANS are sent to Scnitzer Steel where it is shredded. After shredding it is sent to Seattle where it is smelted and formed into rebar.

ALUMINUM CANS are sent to Anheuser-Busch Inc in Los Angeles, California. They are sorted and then sent to Muscle Shoals, Alabama where they are melted into new cans.

CORRUGATED CARDBOARD is sent to Westrock Paper and Packaging where it is recycled into new cardboard and paper grocery bags.

PLASTIC is sent to Pralumex Inc in Walnut, California. Depending on demand, plastic may continue to Malaysia or Indonesia.

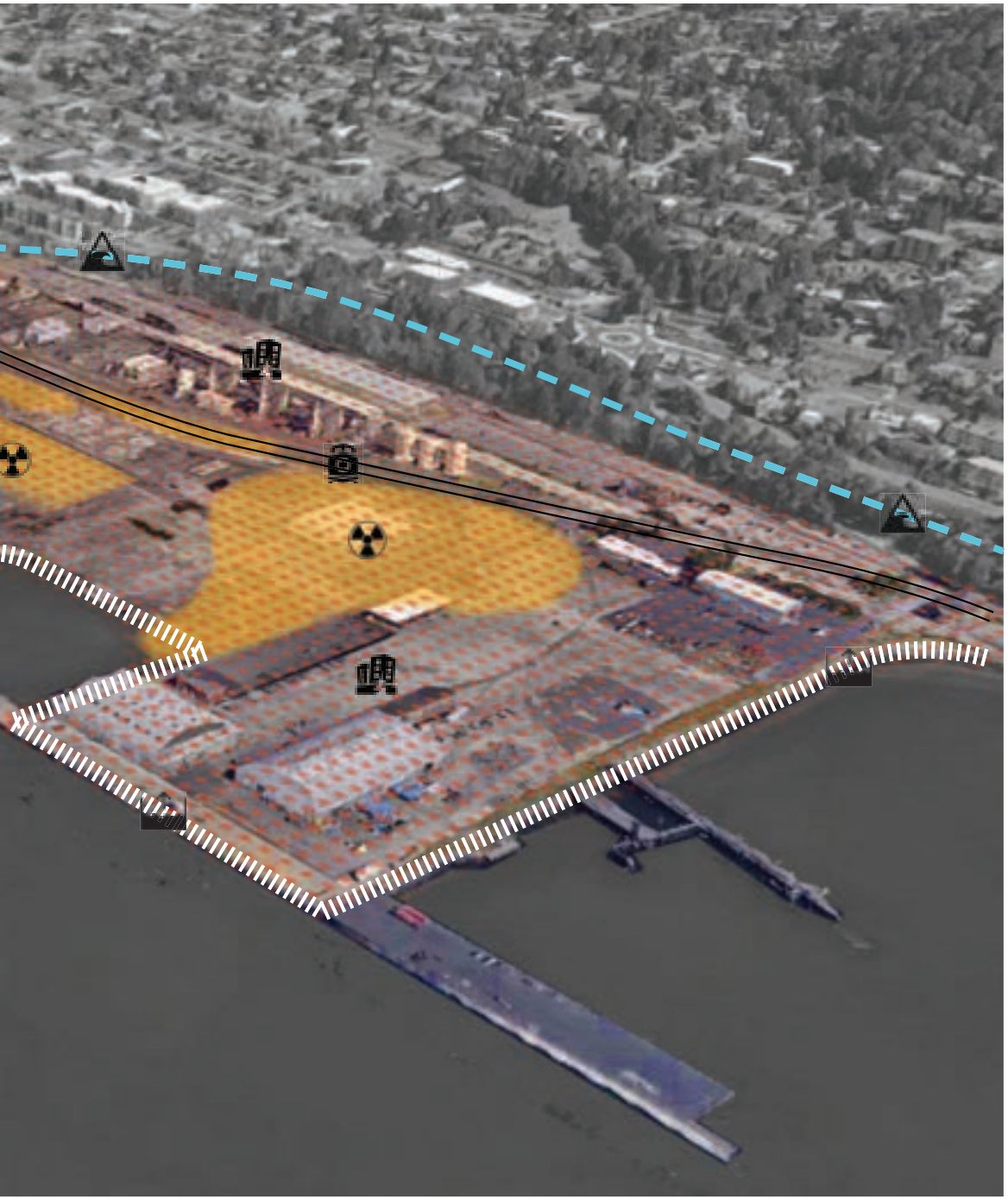
MIXED PAPER is sent to America Chung Nam in Walnut, California where it is recycled into linerboard.

(RE Sources, 2020)

HEALTH, SAFETY & HAZARDS

Erynne Van Zee +
Will Prescott

photo credit: Google Earth



SOIL CONTAMINATION

EARTHQUAKE/ LIQUEFACTION RISK ZONE

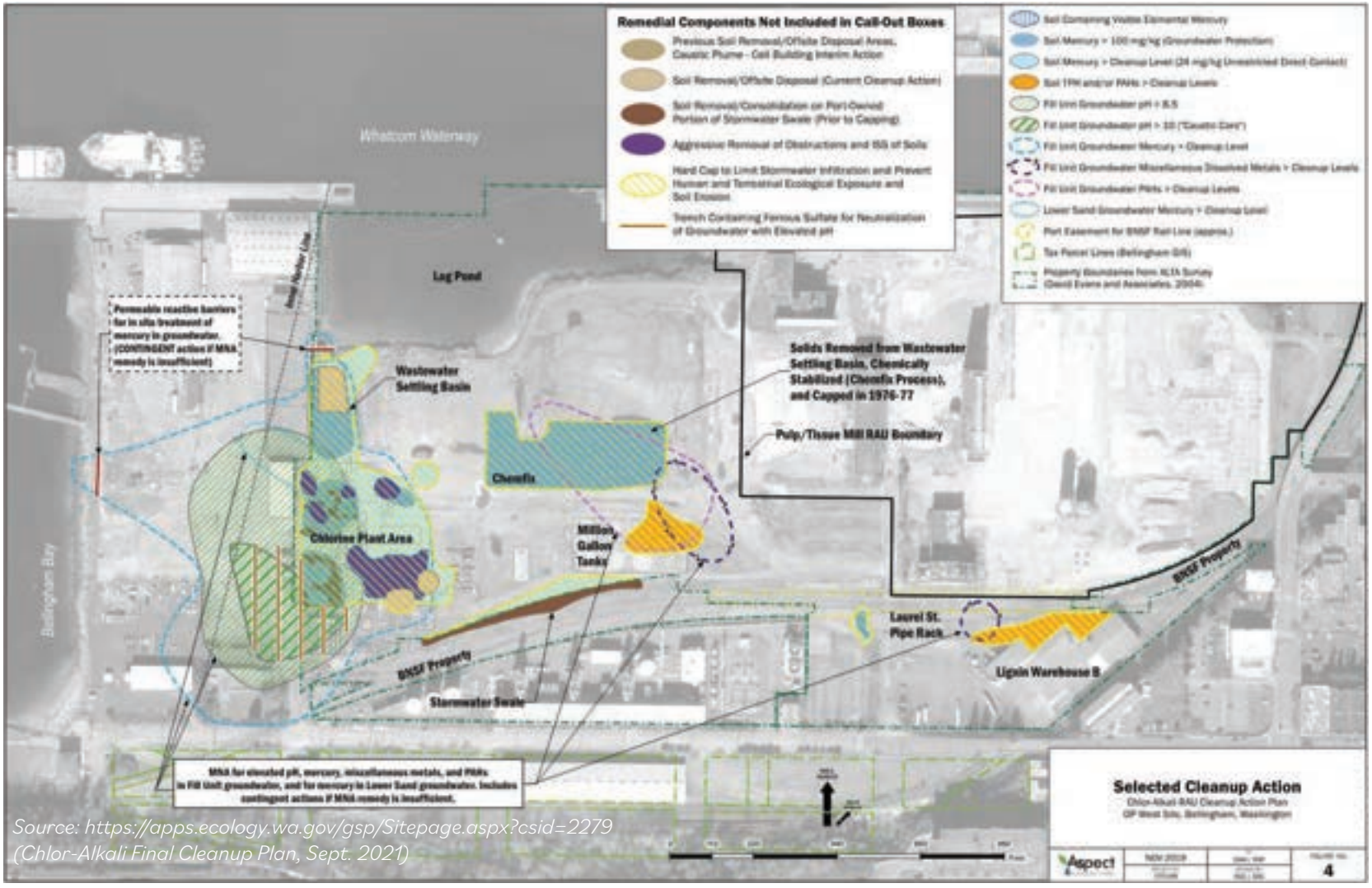
TSUNAMI INUNDATION LINE

FREIGHT TRAIN LINE

SEA LEVEL RISE RISK ZONE

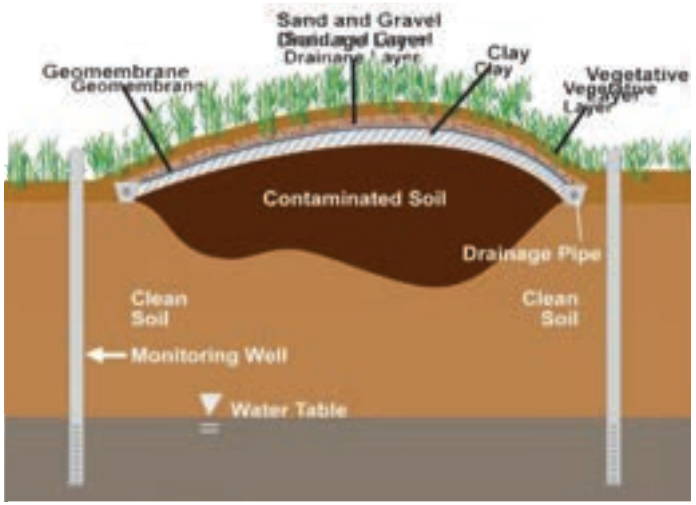
SOIL CONTAMINATION

The industrial history of the site since colonial settlers arrived in the area left much of the soil with traces of contamination. Georgia Pacific caused most of the existing soil contamination, which left elements of mercury, petroleum, acidic plumes, and metals in the ground. Remediation plans aim to cap these toxic areas, extract and ship away heavily polluted areas, and provide neutralizing soil amendments to acidified zones.



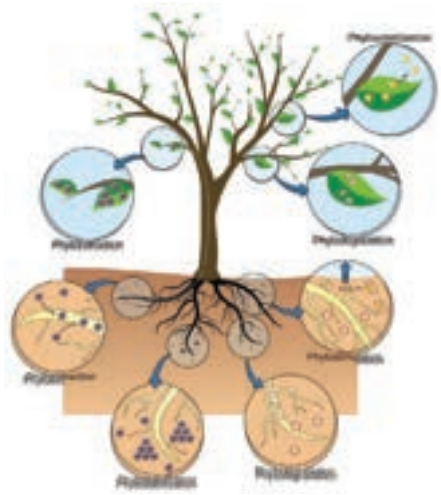
Source: https://apps.ecology.wa.gov/gsp/Sitepage.aspx?csid=2279 (Chlor-Alkali Final Cleanup Plan, Sept. 2021)

SOIL REMEDIATION STRATEGIES



CAPPING

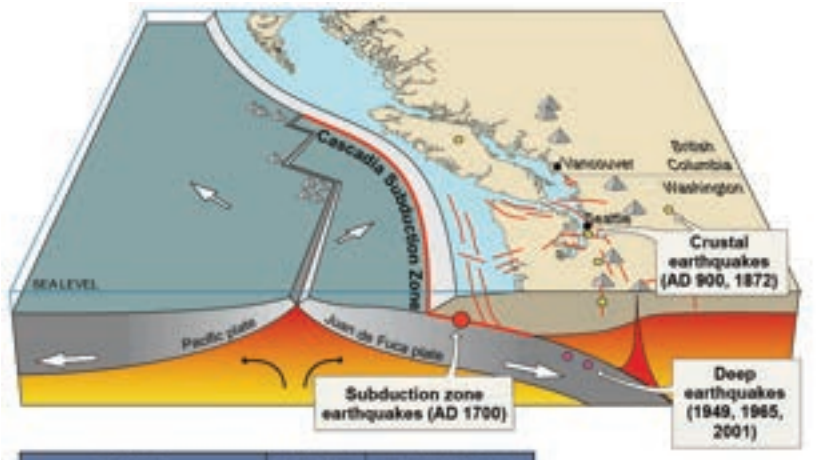
Hard caps (thin layer of asphalt/concrete) or soft caps (thicker layer of clean soil) can be utilized to prevent access to contaminated soils below. Hard caps have the benefit of limiting water penetration and spreading contaminants into the water table, while also limiting contaminat off-gasing. Soft caps allow for a more natural cover to the soil that can become a parkspace amenity, but they still allow stormwater to percolate into the water table. These caps are typically accompanied by monitoring wells along their perimeter, which provide information about how contaminants may be moving through the soil. The current contamination mitigation plan focuses on capping the majority of the site.



PHYTOREMEDIATION

Phytoremediation utilizes the natural processes of plants to remove contamination from sites. Specific plants utilize different natural methods of removing different types of contamination, and a detailed plan should be developed to determine which types of plants are appropriate for a given site. While the petroleum on the Bellingham waterfront has been proven to be remediated with plants, mercury contamination can be a far more difficult chemical to effectively phytoremediate. These processes can take an extended period of time to take effect, and it can be difficult to predict their efficacy. But they are a relatively lower cost method of remediation that provides numerous ancillary ecological benefits.

EARTHQUAKES & TSUNAMIS



Source	Max. Size	Recurrence
Subduction zone	M 9+	200–600 years
Deep Juan de Fuca plate	M 7+	30–50 years
Crustal faults	M 7+	Hundreds of years?

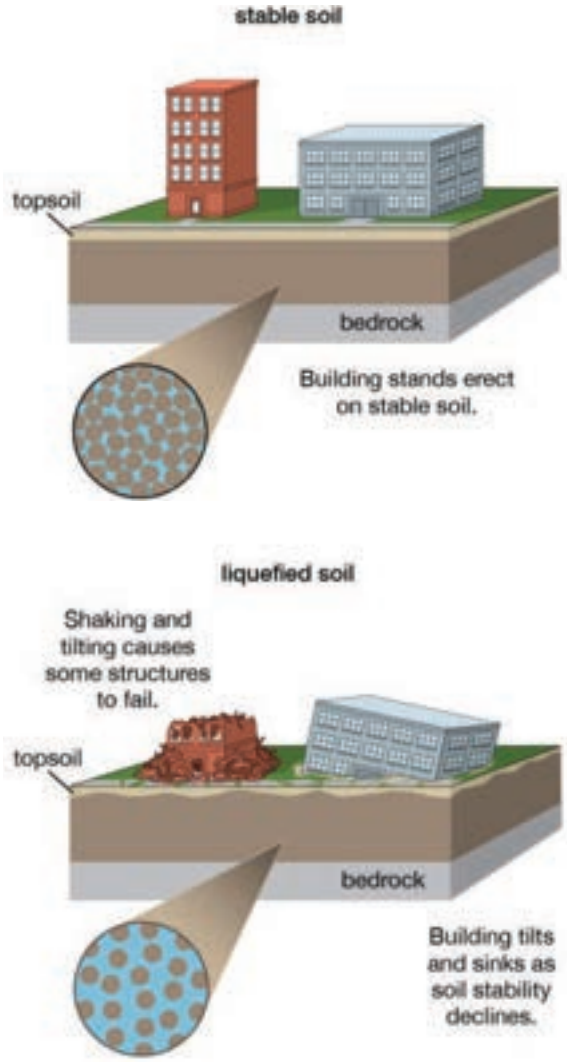
Volcano
Active crustal fault
Active plate boundary fault

*figure modified from USGS Cascadia earthquake graphics at http://geomaps.wr.usgs.gov/pacnw/pacnweq/index.html

EARTHQUAKES

Washington state has the second highest risk for earthquake damage in the United States due to its proximity to many fault lines and the Cascadia Subduction Zone. Most of the populated areas in the state have a 40-80% chance of experiencing a major earthquake in the next 50 years. However, Bellingham is far enough from the majority of the fault lines to be at risk of immediate earthquake damage. The artificial soil fill that makes up the majority of the waterfront puts the site at increased risk of liquefaction, which causes soil particles to shake loose and groundwater to rise to the surface, causing major destabilization to existing buildings.

Source: Washington State DNR, 2014



SOIL LIQUEFACTION

Source: Encyclopedia Brittanica

TSUNAMI EVACUATION ROUTES
Source: Washington State DNR Geology Portal, 2021

TSUNAMIS

Following an earthquake, coastal regions are at risk of being inundated by tsunamis that can cause major destruction to low lying areas. While the majority of Bellingham is built on a raised bluff and outside of the inundation zone, the artificial fill along the waterfront is within range of a large wave. Fortunately, Bellingham is buffered by a series of coastal islands that would slow a large tsunami and provide up to two hours of notice before landfall. In this situation it would be important to provide clear and legible evacuation routes from the waterfront, particularly when increased residential density is proposed for an area that has limited arterial access.

EXPOSURE TO HAZARDOUS MATERIALS & NOISE

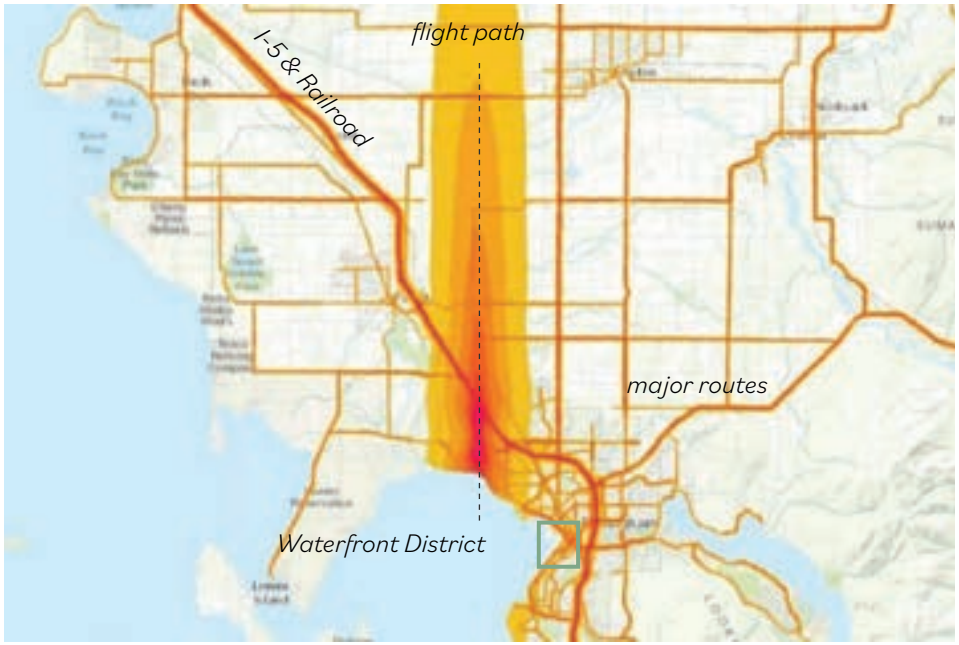
A derailed oil train 15 miles north of Bellingham in December 2020
Source: Baumann 2020

The railroad that passes through the site poses exposure to hazardous materials and significant noise pollution. The BNSF rail line carries crude oil, including Bakken crude oil and tar sands oil, as well as coal (Lavelle 2021). Crude oil is brought in from British Columbia, Alberta, and North Dakota to oil refineries in the Bellingham periphery, such as BP's Cherry Point Refinery (Lavelle 2021). Derailment is a serious threat to the site, and could result in fire, death, and contamination of surrounding soil and water, particularly if carrying crude oil.

Source: WA DOE "Crude Oil Movement by Rail and Pipeline" Quarterly Report, April - June 2021; Lavelle 2021

Noise pollution is a hazard at both the regional and site scale. The airport flight path, I-5, and the railroad are sources of repetitive, high-decibel noise, as shown in the image below (Donaldson 2017). At the site scale, the railroad runs across the southeastern edge, on average 15 per day and the freight truck route is along Cornwall Ave (site visit interviews Oct 8 2021). These sources of noise must be taken into consideration for design proposals to mitigate physical and mental health impacts of noise pollution (Hammer, Swinburn, & Neitzel 2014).

HEALTH IMPACTS OF NOISE



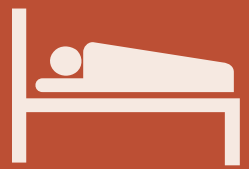
A heat map of noise pollution in Whatcom County
Source: Donaldson 2017

<75
DECIBEL AVERAGE OVER 8 HOURS

CDC recommended noise exposure limit to avoid hearing damage and physical and emotional stress

Center for Disease Control. "What Noises Cause Hearing Loss?"

disrupted sleep and hormone regulation



Hammer, Swinburn, and Neitzel 2014; Yanti Anis the Noun Project

impacts early childhood development and performance in school

Hammer, Swinburn, and Neitzel 2014; kids by Trevor Mowry the Noun Project

5000%

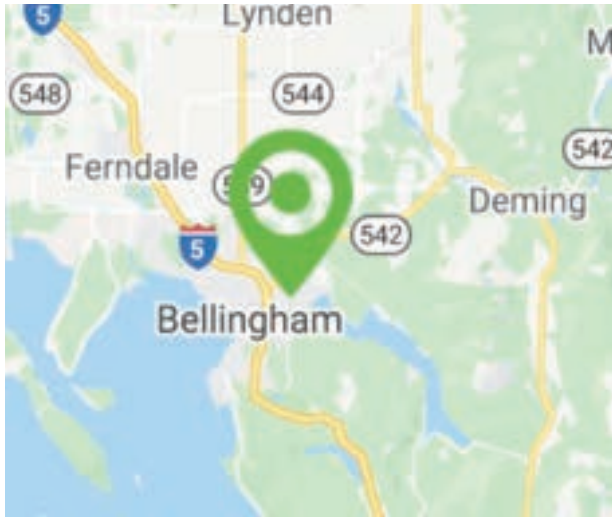
of the recommended daily dose of noise if 100 ft from the train tracks for all 15 trains throughout the day while the horn blows for 5 minutes

The Engineering Toolbox. "Noise - Maximum Daily Dose Level"

AIR POLLUTION

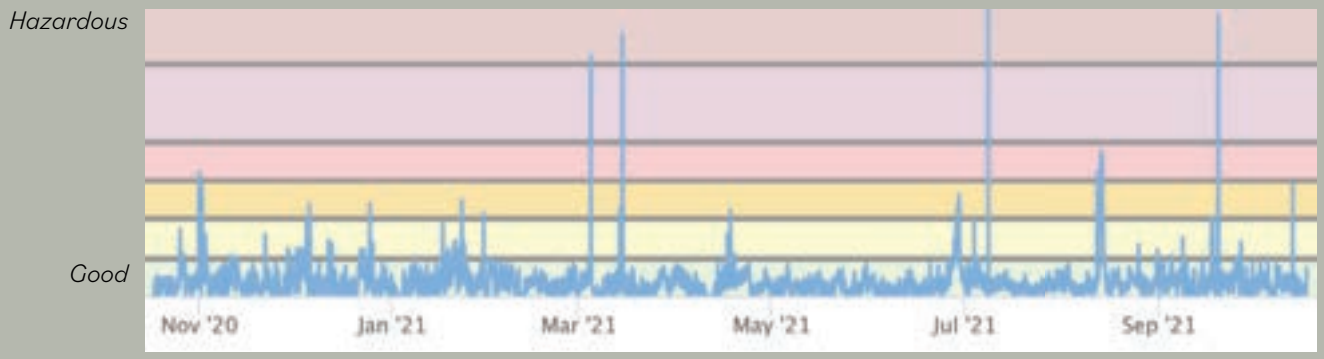
Air quality in the Bellingham area is generally good year round. Proximity to Bellingham Bay and the prevalence of winds from both the southwest and east provide good air circulation, especially along the Waterfront District. The Northwest Clean Air Agency (NWCAA) is responsible for monitoring air quality and industry emissions in compliance with the Clean Air Act for Whatcom County, and is a reputable source of air quality data. However, NWCAA only has one monitoring station in Bellingham, so air quality data lack spatial resolution. The station only measures particulate matter 2.5 (PM2.5), which are particles with a diameter less than 2.5 microns and are monitored due to their ability to get deep into our lungs when we inhale.

PM2.5 sources include wood burning, wildfire smoke, dust, and vehicular traffic. PM2.5 is regulated at the national and state levels under the Clean Air Act.



Location of the NWCCA monitoring station
Source: Northwest Clean Air Agency

Particulate Matter 2.5 (PM2.5) Concentrations from October 2020 - 2021

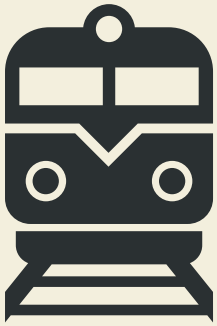


Source: Northwest Clean Air Agency

DIESEL TRUCKS

Diesel trucks emit a variety of pollutants that are harmful to human and environmental health. Fine particulate matter (PM2.5), nitrogen oxides (NOx), and black carbon contribute to the Greenhouse Gas Effect, and are also known to irritate human lungs (EPA). Diesel emissions are linked to cases of asthma, lung disease, and cardiovascular illnesses, particularly for communities living in close proximity to diesel pollution (Schulte et al 2013).

Sources: EPA "Learn about Impacts of Diesel Exhaust and the Diesel Emissions Reduction Act"; Schulte et al 2013 "Diesel Exhaust Exposure in the Duwamish Study". University of Washington School of Public Health; Truck by Souvik Bhattacharjee from the Noun Project



TRAIN LOCOMOTIVES

Although movement of cargo by train is more efficient than by truck, train locomotives are still responsible for PM2.5 and other exhaust emissions. Initiatives to improve locomotive exhaust include Tier 4 locomotives, which achieve over 90% reductions in NOx and PM2.5 compared to unregulated locomotives (Tier 0) from prior to 2000 (CARB 2020; TERC). BNSF has yet to upgrade to Tier 4 (2015 -present) locomotives on the railroad running through Bellingham, thus relying on Tier 1-3 which have significantly worse emissions (Zumwalt 2021).

Sources: California Air Resources Board (CARB) "2020 Locomotive Emissions Inventory" 3 Sept 2020; Transportation Environmental Resource Center (TERC) "Engine Emissions (Locomotives)"; Zumwalt, Abe. Personal interview 9 Oct 2021. Locomotive by Mourad Mokrane from Noun Project

SMOKE SEASON

Climate change in the West is creating increasingly hotter and drier summers. Extreme smoke events like what the Pacific Northwest (PNW) experienced in September 2020 will continue to occur, and are connected to wildfires in California and British Columbia, as well as the PNW. Wildfire smoke poses serious health threats from PM2.5 and incinerated chemicals from burned built environment materials and forests (Public Health Insider 2021). Projections for increasingly long, severe smoke seasons will continue to be compounded by extreme heat and climate change (Halofsky et al 2020).

Sources: Halofsky, Peterson, Harvey (2020)"Changing wildfire, changing forests." Fire Ecology. 16. Accessed 17 Oct 2021; Public Health Insider "Wildfire Season is Comin g- Get Smoke Ready!" 17 June 2021. Wildfire by Louis Prado from Noun Project

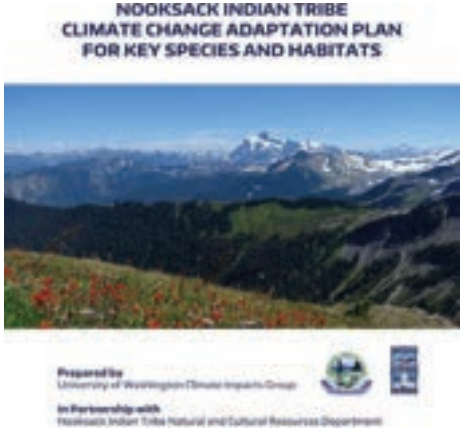
PREDICTED CLIMATE CHANGE IMPACTS

Sea level rise is an important consideration for the Waterfront Site. The Bellingham Waterfront Sub-Area Plan projects sea level rise by 2100 will be 15 inches to 50 inches above today's high water mark (Port of Bellingham/City of Bellingham 2019). From site visits on Oct 8, 2021, our class heard that the City is currently planning for 4.5 feet of sea level rise, which is consist with the predictions from the University of Washington Climate Impacts Group's relative sea level rise projection tool (Climate Impacts Group "Sea Level Rise Visualization").

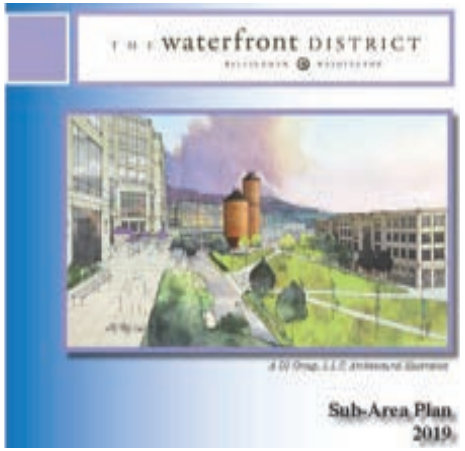
The reality of sea level rise along the Bellingham Waterfront District poses serious concerns for the future of development on the site, as the majority of the site is between 15 and 20 ft above sea level. This means that, especially with the uncertainty of climate change and compounded effects from more severe and frequent winter storms, areas of the site may become completely and/or occasionally under water depending on the daily tides, sea level rise, and storms.

SECTION OF PROJECTED SEA LEVEL RISE IMPACTS ON THE WATERFRONT DISTRICT, INFORMED BY THE BELLINGHAM WATERFRONT DISTRICT SUB-AREA PLAN 2019.

CLIMATE CHANGE ADAPTATION PLANS



This 2020 climate change plan focused on the Nooksack River watershed and specifies ongoing, near-term and long-term strategies for combating climate change. The study is divided into 6 habitat types (wetland, subalpine, riparian, marine, forest, estuary, and alpine) and 7 at-risk species (Alaska Yellow Cedar, Western Redcedar, Evergreen Huckleberry, Black Bears, Black Tailed Deer, Elk, and Mountain Goat).



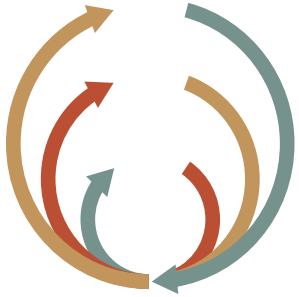
The 2019 Waterfront District Sub-Area Plan was written by a team of commissioned experts to assemble a framework for anticipated development in the former industrial zone. Its climate adaptation strategies focus on environmental cleanup from previous industrial uses, as well as reestablishing shoreline habitats to encourage more wildlife to return to the site.

Figure 3-2: Habitat Restoration Opportunities

CLIMATE CHANGE ADAPATION / MITIGATION STRATEGIES

The site struggles with numerous challenges --**liquefaction, sea level rise, noise pollution, soil contamination**-- however, these challenges present opportunities that will be addressed through multi-benefit strategies. Centering climate change mitigation and adaptation is crucial to achieving long-term resilience on the site.

Given the existing conditions of the site, the following **mitigation and adaptation strategies** will address site challenges while also providing promising opportunities. These strategies do not exist in silos, and in fact are often **achieved in relationship with others**, which presents opportunities to create closed-loop and regenerative systems at the district scale.



Circular economy icon by We All Design from the Noun Project

CARBON SEQUESTRATION

Carbon sequestration is essential for large-scale climate change mitigation. On site, landscape strategies such as tideflats restoration and phytoremediation, coupled with architectural strategies such as cross-laminated timber, are viable examples of designing for carbon sequestration. Designs that also leverage carbon sequestering non-human inhabitants on site, such as mussels and clams, will enhance carbon capture in the Waterfront District.

SHORELINE ADAPTATION

The site sits at sea level, and with projected sea level rise, it will need to anticipate a dynamic shoreline edge. Though often perceived as a problem that must be contained, the erosion of soils along shorelines is a natural process. While erosion is a serious challenge for urban development along shorelines, designing with the dynamic nature of waves and sediments rather than designing to stop their dynamic tendencies may offer opportunities that also support carbon sequestration and habitat restoration.

SOIL REMEDIATION

The soil contamination from acidic materials, heavy metals, and hydrocarbons are public and ecological health concerns. Although traditional soil remediation strategies, such as excavation and capping, can address the contamination on site, biological and “living” strategies such as phytoremediation with trees and grasses are legitimate options that should be considered and may also help meet other goals of the site, such as district-scale energy.

PUBLIC HEALTH EQUITY

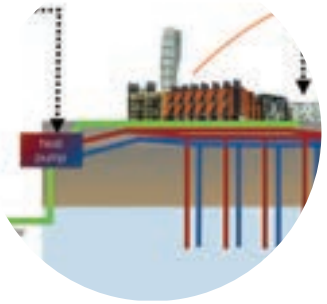
Climate change will exacerbate the frequency of extreme heat events, flooding, and air pollution. Given the exposure of the site, incorporating designs that provide shelter during extreme events, such as dense wildfire smoke and 100+ F days, will anticipate users’ needs and may double as emergency shelter. Intentional incorporation of urban tree canopy and materials selection can help mitigate urban heat island effects while also meeting other climate-related goals.

POTENTIAL LOCAL ENERGY SOURCES

TRADITIONAL

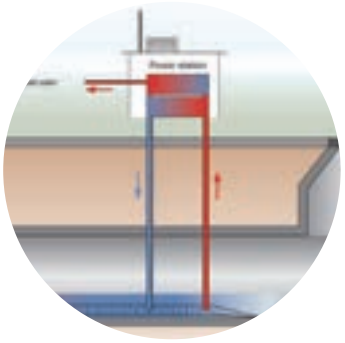
Off & On-Shore Wind Turbines

Passive & Active Solar Design

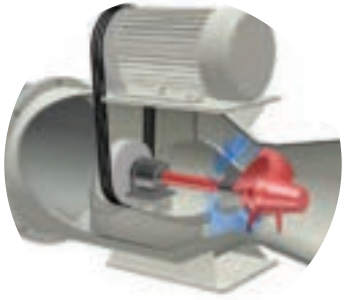


Geothermal / Seawater Cooling

SITE-SPECIFIC



Recover Heat from Wastewater Pipes



Utilize Mico-Hydro at Lake Whatcom Pipe

Recover Energy from Passing Trains

CHAPTER 3
SITE PROPOSALS:
GROUP MASTERPLANNING

View of Bellingham Waterfront from Chestnut Street looking Southwest // *Photo by Nancy Rottle*

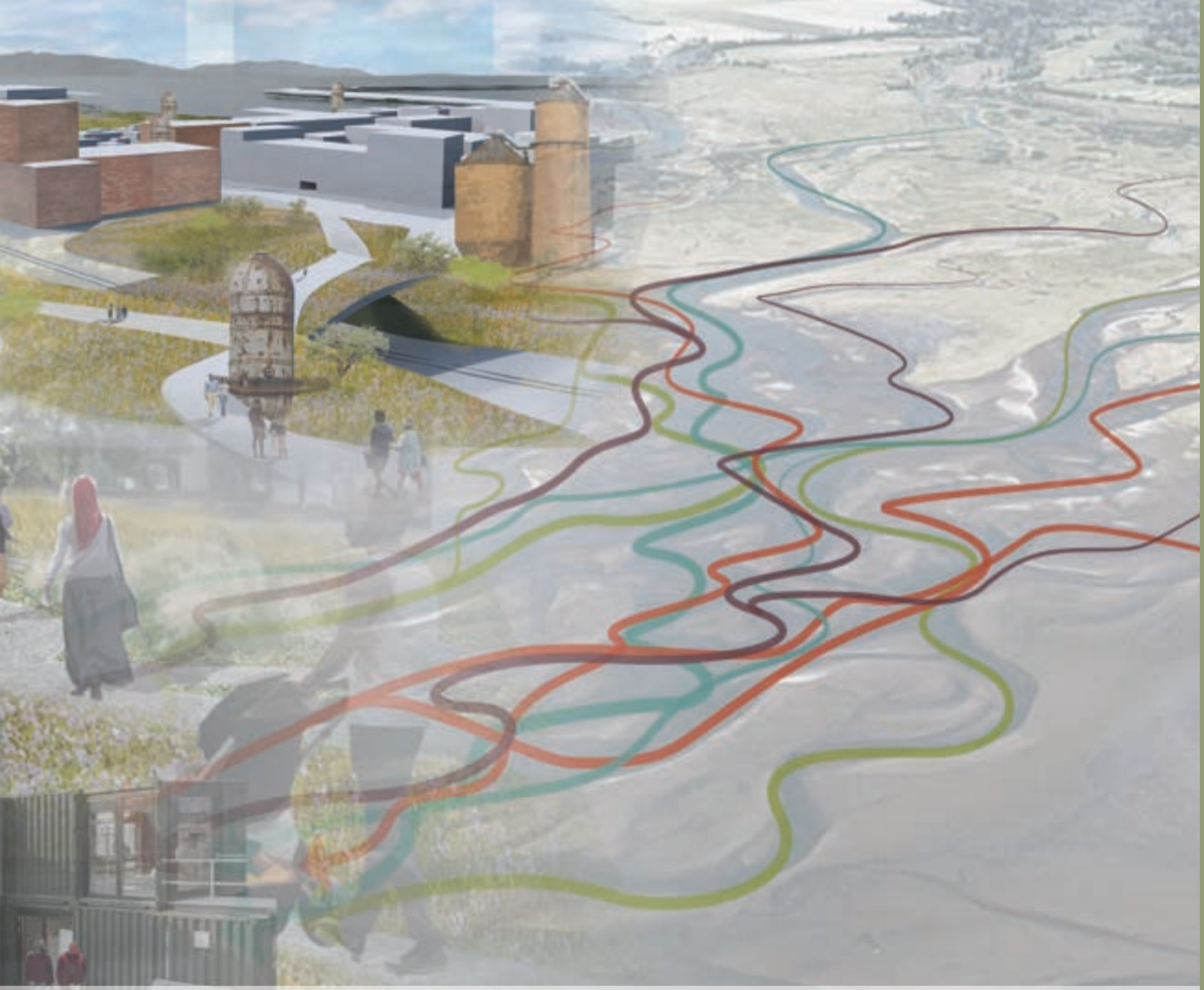
This chapter represents concepts that small groups of students generated for a Bellingham climate district that carefully engages with the context of the site, and applies lessons learned from our study tour in Denmark and Sweden. Each site proposal has a different approach, highlighting phasing, storytelling and several imagined but possible futures.

PROPOSALS

EM[BRACKISH]

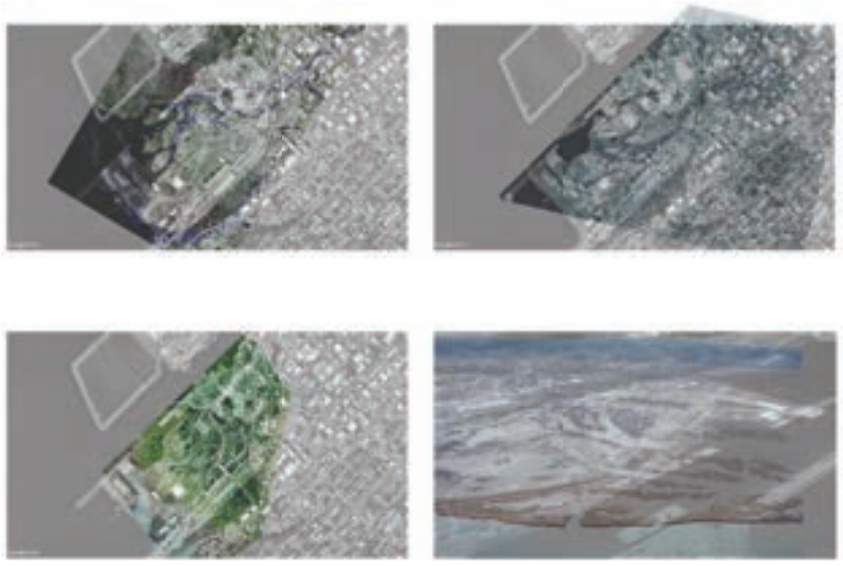
+ Tim Spenser
+ Constantine Chrisafis
+ Leila Jackson
+ Lucas Helander

Em[brackish] proposes that four overlapping and interconnected systems should drive the development of Bellingham's Waterfront District. Cultural Landscapes root the site in its past and future stories. Vibrant Edges create soft, porous, adaptable transitions into and across the site. Ecological Cycles & Services establish the circular flow of water, energy, and materials. Innovative Housing opens the District to habitation by the widest range of residents. Together, these systems describe a powerful strategy for climate mitigation as well as an active, livable, and beautiful Waterfront District.

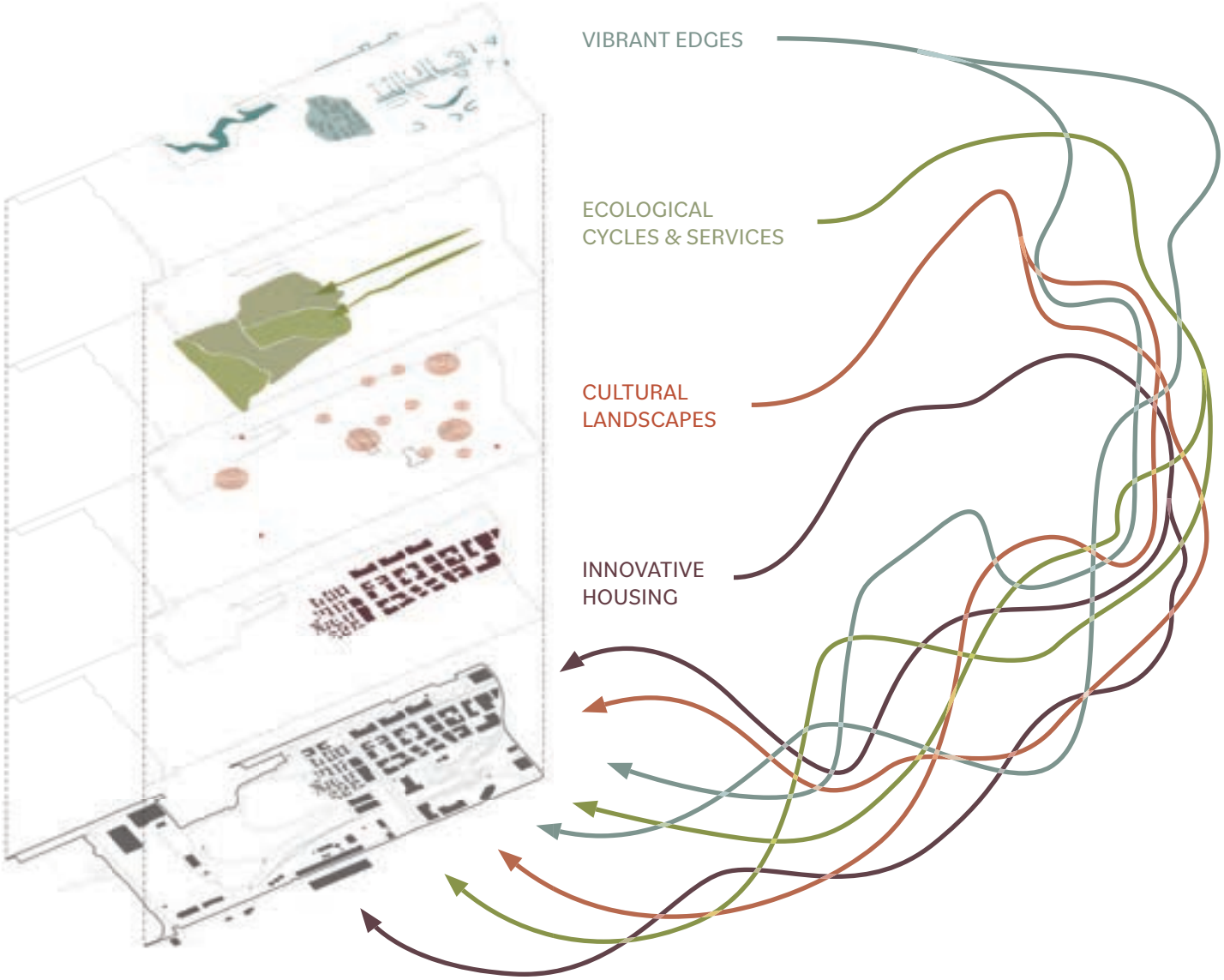


EM[BRACKISH]

Given the multiple challenges facing the Waterfront District, our team focused on establishing multifunctional and overlapping solutions. These coalesced into thinking about four multiscalar systems. We took inspiration from the circuitous flow and rich biodiversity of the estuary ecosystem, and the liminal state of its brackish waters. We coined the term "embrackish" to describe the process of initiating complex, circular transitions from one condition to another across the site. We propose four embrackished systems that drive site development, program, and processes. The concept also harkens back to the site's past as a coastal tideflat.



Conceptual diagram superimposing imagined estuaries over the Bellingham site.



Overlapping systems help to define design approach

VIBRANT EDGES

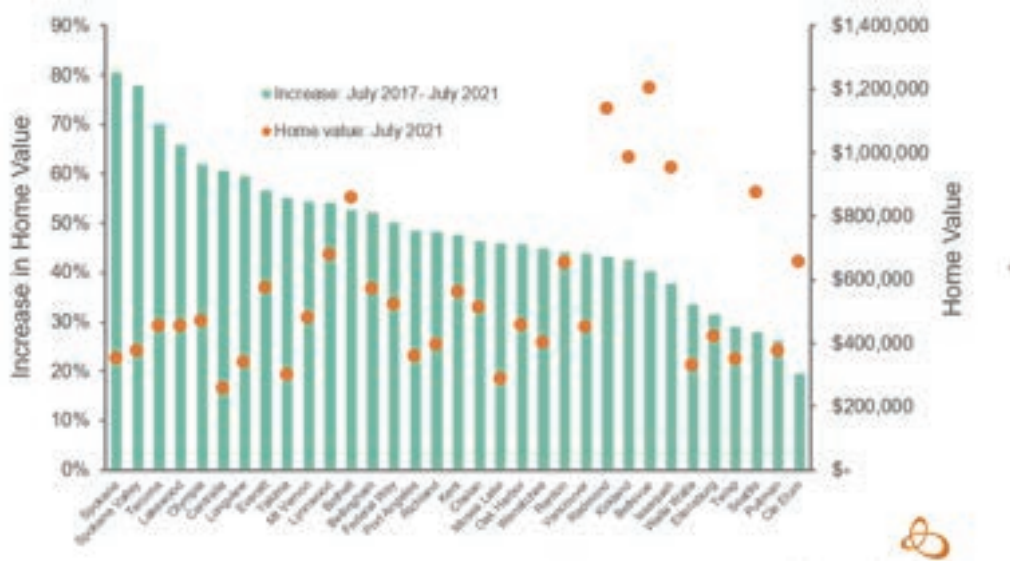
By approaching the site through a series of systems to focus on, we as a group identified key areas that needed to be addressed. By identifying the need for vibrant edges throughout the site, we identified three major edges that required immediate attention.

These three main edges include the **waterfront edge, the rail line edge, and the downtown edge.** These three major edges not only affect what can be done on site, but also affect how the surrounding area can access the site.

Our goals were to reclaim and activate the waterfront edge, buffer and protect the on site activities from the train, and soften the downtown edge to help unify the site with the rest of Bellingham.

INNOVATIVE HOUSING

AN AFFORDABILITY CRISIS IN BELLINGHAM - INCREASE IN HOME VALUE (2017-2021)



Source: Sightline Institute (2021)

BELLINGHAM'S MODEL HOUSING EXHIBITON

Using the BO01 development as a precedent, Bellingham could utilize the waterfront site as the staging ground for a housing exhibition. This exhibition could showcase different models of housing, and pioneer sustainable building and management practices. The exhibition could bring the site, and the city, national recognition and chart a new paradigm for sustainable growth in the region.

Some housing models that could be explored on the site are Baugruppen, Artists Lofts, Microhousing, Cohousing, Housing cooperatives, and indigenous models of coliving. By using this opportunity to push the limits of the types of housing built in the region, the city could truly make an enormous impact, showcasing the viability of housing models that lie outside of traditional market-rate development.

PRECEDENT: BO01 CITY OF TO-MORROW: MALMÖ, SWEDEN

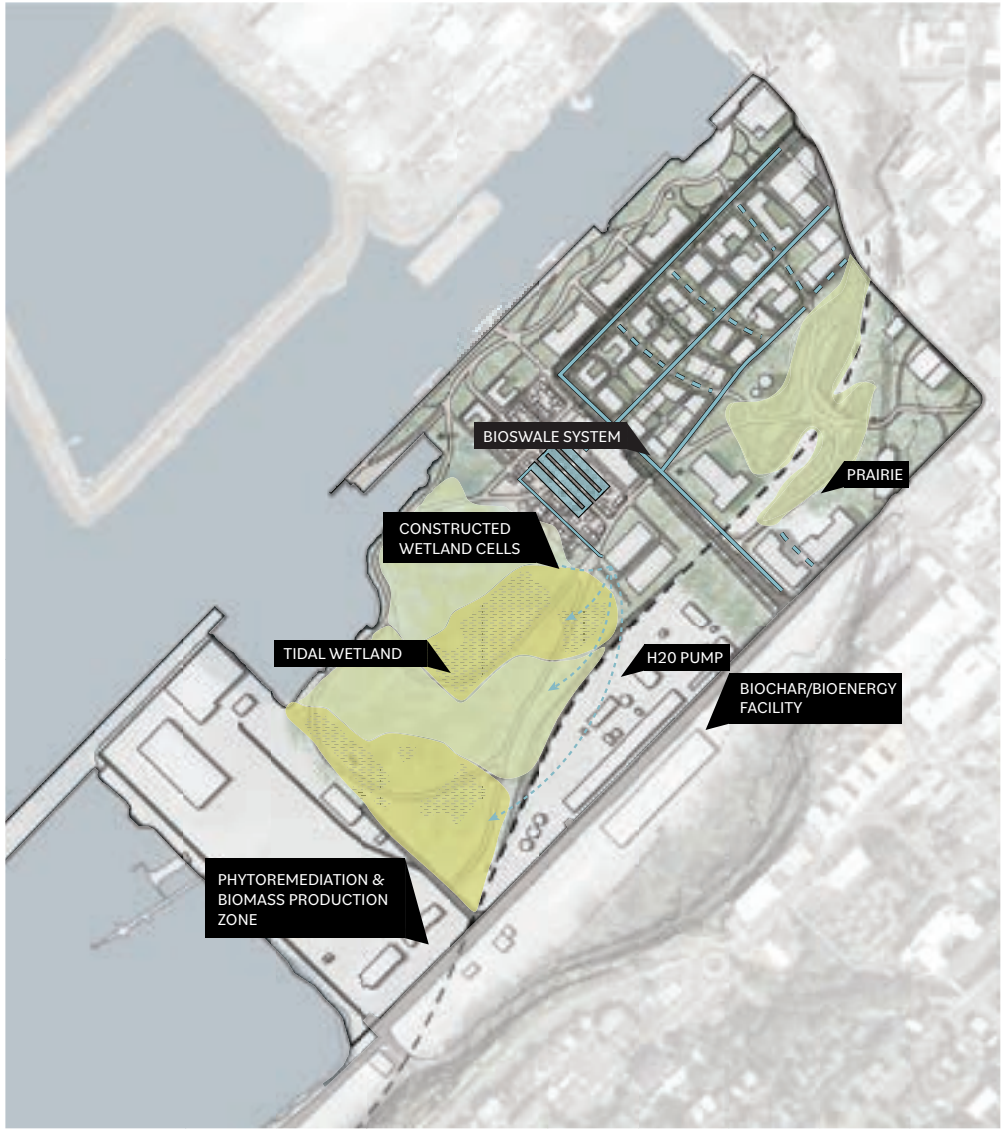
"The area's conversion into a mixed-use development began in 1998 as part of a national housing exhibition that positioned Bo01 as both a modern architectural undertaking as well as a pilot community for new sustainable technologies." - Journal of Green Building

ECOLOGICAL CYCLES & SERVICES

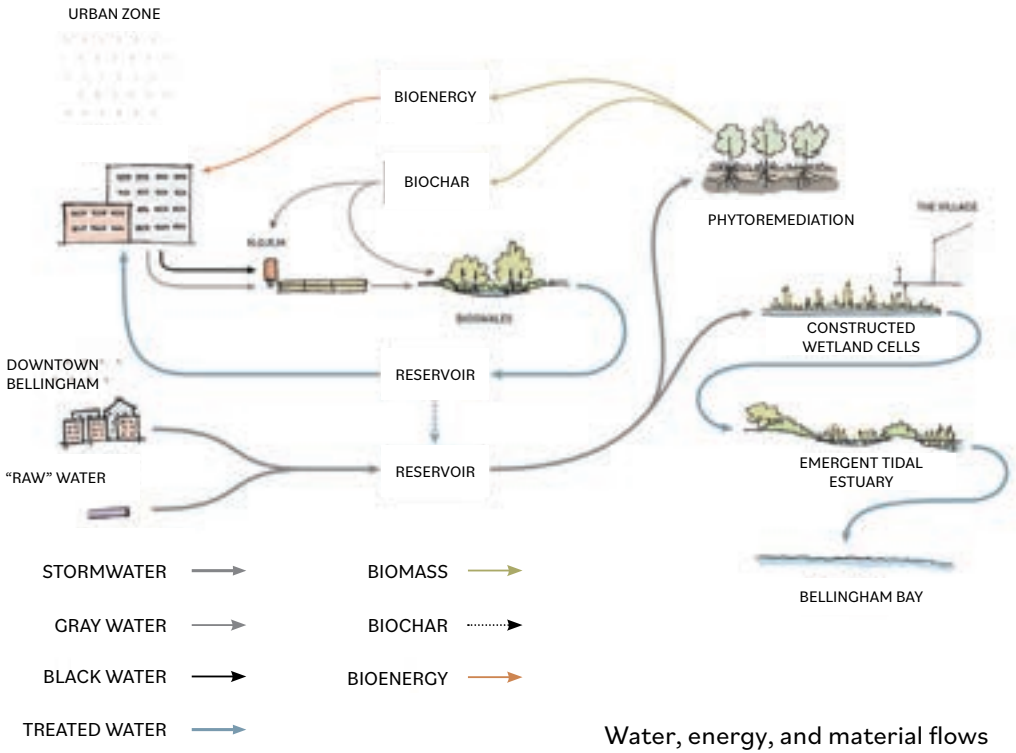
The Ecological Cycles & Services system establishes circular flows of water, energy, and materials and brings forth naturalistic landscapes that capture carbon and offer cultural value.

A network of bioswales flowing through the urban zone brings stormwater to a system of constructed wetland cells. These treat stormwater, which then either enters an emergent tidal wetland or irrigates phytoremediative plantings.

Biomass that is produced in the phytoremediation process is harvested and processed into either biochar or bioenergy. Biochar can be used as an additive in bioswale plantings and in constructed wetland media, increasing its treatment capacity. Bioenergy powers the rest of the District.



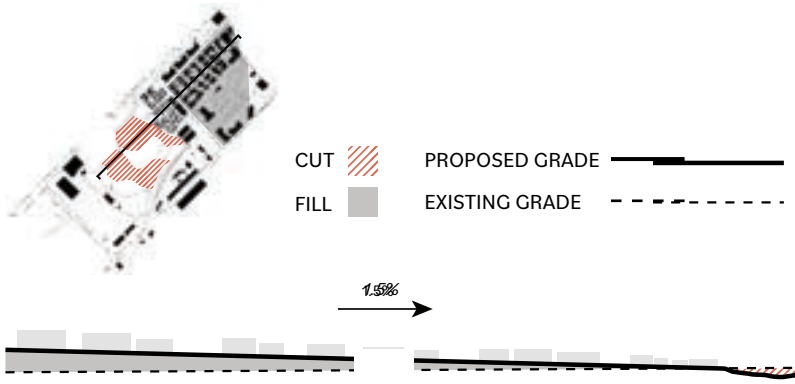
Ecological Cycles & Services plan



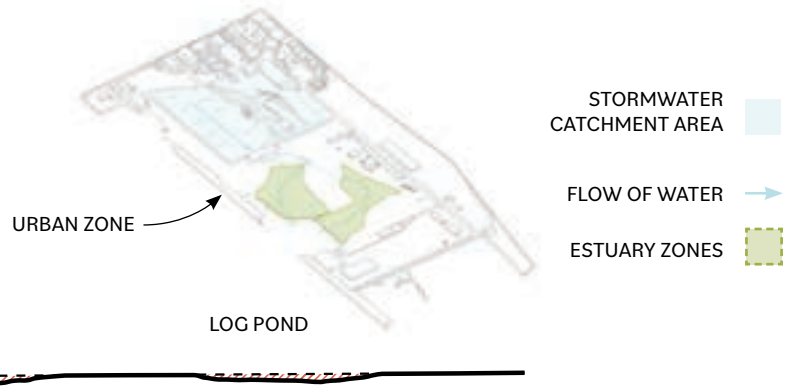
Water, energy, and material flows

An initial process of **cut and fill** is proposed for the site. The minimally contaminated areas adjacent to the Log Pond are excavated. The urban development area is filled to achieve a gentle grade from northeast to southwest.

This regrading enables **passive surface flow** of stormwater from the urban zone toward two emergent estuary zones and ultimately into the Log Pond.



Conceptual grading diagram



Conceptual flow diagram

CULTURAL LANDSCAPES

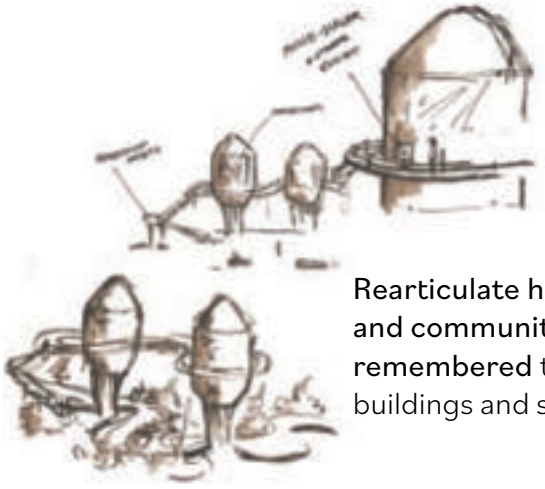
The cultural landscapes system weaves interventions that consider **heritage, social justice, and placemaking** in the District. Em[brackish] merges temporalities where we consider both, the history of the site and its users, and the challenges and opportunities for diverse communities who will shape the future of the District.

PAST ERASED

Research on Bellingham's history shed light on the need to daylight a history of displacement for various marginalized groups. From the **loss of tide flats and the shoreline as a cultural and economic resource for First Peoples**, to the presence, **trauma and displacement of the immigrant labor force that shaped Bellingham's industrial era**, there is a need a need for representation, reconciliation and healing on this site as a beacon of Bellingham's industrial and maritime heritage.

FUTURE REMEMBERED

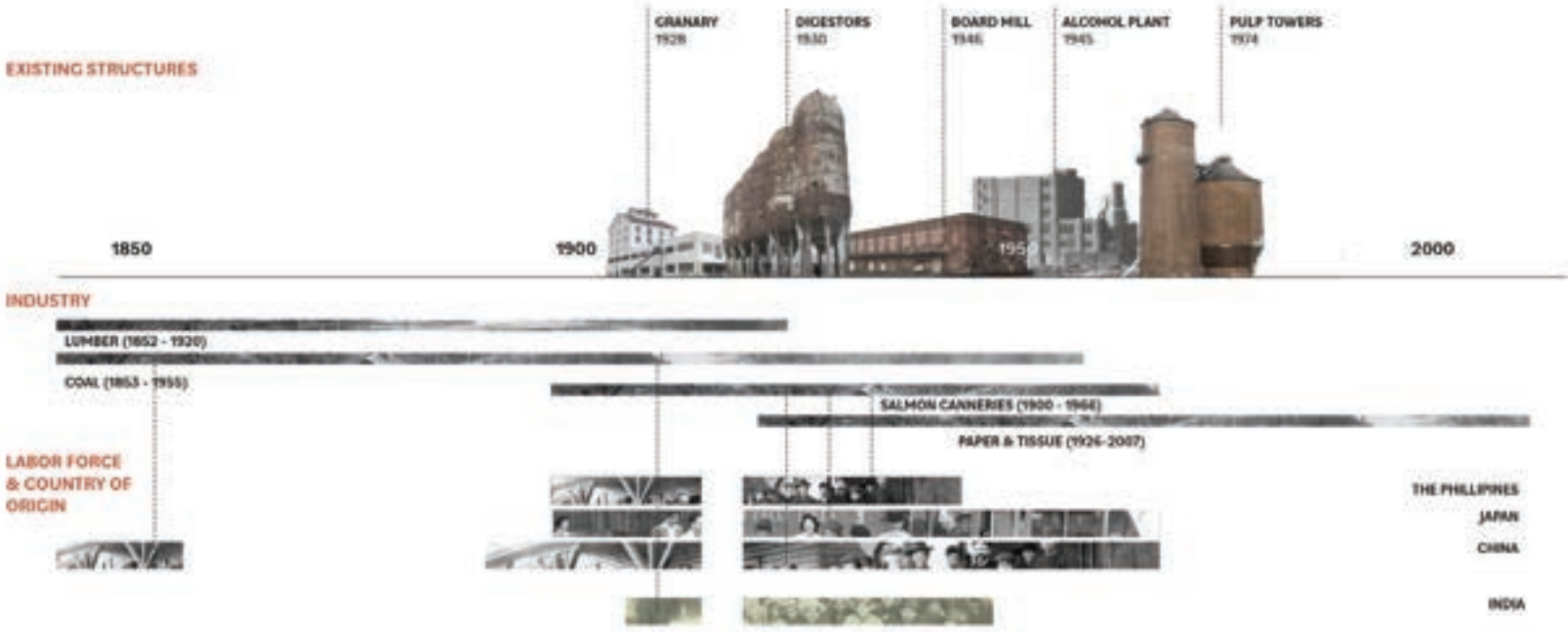
Three central strategies inform how cultural landscape values can be integrated throughout the district:



Rearticulate how history and communities are remembered through buildings and spaces.

Foster diverse futures through public space, innovative and diverse housing & climate mitigation

Provide opportunities for co-creation, co-management and co-ownership across the site.



Adaptive Reuse Timeline: Documenting legacy architecture on site against the context of Bellingham's industrial history and immigrant labor.

PLAN & PROGRAMMING

In looking at the proposed site plan for the site, one can begin to see the how the pockets of greenspace are dispersed through a series of uniquely diverse and distinct development districts. This network of green is used to tie together the on site programming as well as help stitch the existing buildings that have been kept.

In thinking about the site as a series of systems that join each other and overlap in specific moments, but carry out their functions through out the entirety of the site, we have been treating the site as an estuary of sorts.

This approach of thinking about an estuary helped dictate spaces and can be seen in the on-site circulation as a series of primary paths that stem from the north eastern corner and flow throughout the site. These primary paths branch into secondary and tertiary paths as they carry users in and through spaces that can be categorized as public, semi public, and private.

Final site plan

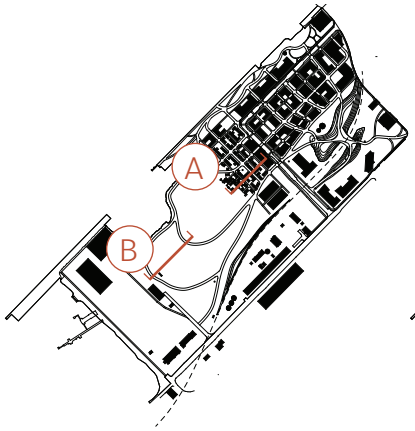
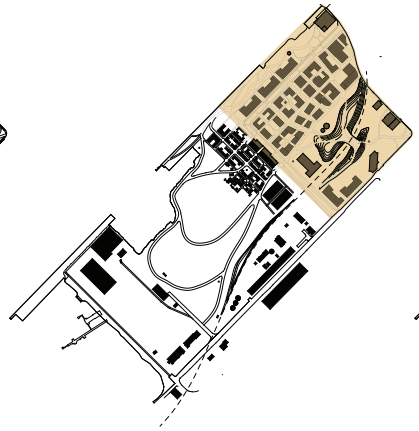
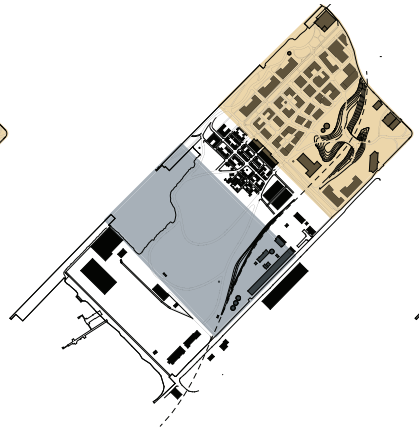


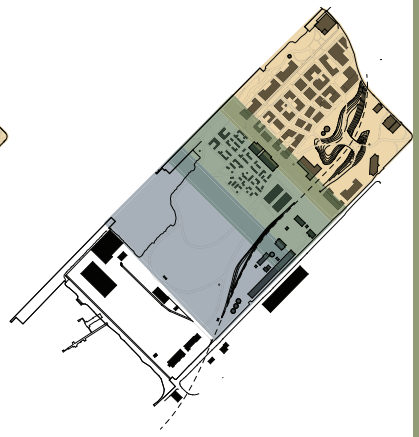
Figure ground with section lines



Urban zone



Phyto/wetland zone



Transition zone

A section A

B section B

DISTRICT PROGRAMMING

A thriving urban district requires diverse and well though-out programming to service both the district and its surrounding urban context.

This programming was based off of a desire to provide the site and Bellingham with what we identified as needs as well as help layer and tie the existing conditions and proposed development.

By approaching the development through an identifying zones based on current conditions, we spatialized and designed spaces that were needed and could be used to create an overall cohesiveness through out the site.

These identified zones were also used as boundaries and references as we strived to design a favorable scale depending on the programming. Building scale decreases from northeast to southwest across the site.

Program diagram

KEY:

1: DOWNTOWN CONNECTION
2: MILLWORKS PROJECT
3: ECO INDUSTRY
4: PHYTO FOREST
5: MARINE TRADES
6: WETLANDS
7: HOUSING VILLAGE
8: RESEARCH CAMPUS
9: WATERFRONT
10: WAYPOINT PARK
11: GRANARY PROJECT
12: HOUSING DISTRICT
13: DISTRICT COMMONS
14: ALCHEMY PROJECT
15: COMMUNITY CENTER

Circulation diagram

PRIMARY PATH SECONDARY PATH TERTIARY PATH

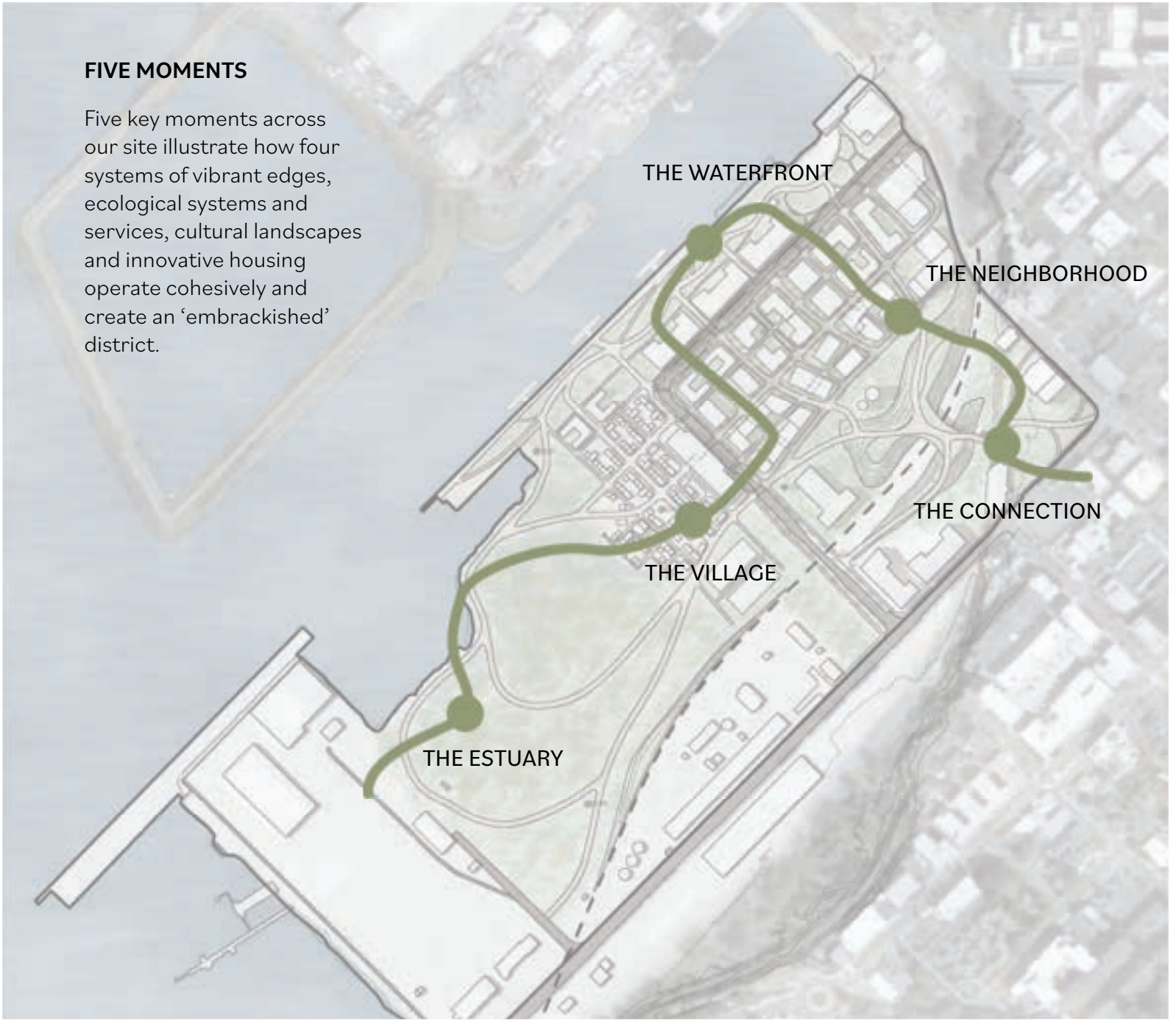
Acid ball & digesters

Acid ball & ceramic towers

The circulation is highlighted by the movement of the digesters throughout the site. These digesters act as a wayfinding device and highlight distinct spaces.

FIVE MOMENTS

Five key moments across our site illustrate how four systems of vibrant edges, ecological systems and services, cultural landscapes and innovative housing operate cohesively and create an ‘embrackished’ district.



THE CONNECTION

THE NEIGHBORHOOD

THE WATERFRONT

THE VILLAGE

THE ESTUARY

THE CONNECTION

In its current context the waterfront site lacked a direct connection to downtown Bellingham. In our proposal we identified a portion of the NE corner of the site that could tie to an adjacent lot and provide a much needed route between the site and Bellingham's Downtown.

Vignette of The Connection looking southeast towards Bellingham Bay

By tying these moments together we have been able to create a unique and accessible route that helps ground the site in its larger urban context.

Like the mouth of a river, the Connection provides an output of circulation onto and within the site. Acting as a catalyst for connection it feeds the distinct districts located on site.

Driven by a direct need and our four systems, the connection bridges and locates our proposed development in the heart of Bellingham.

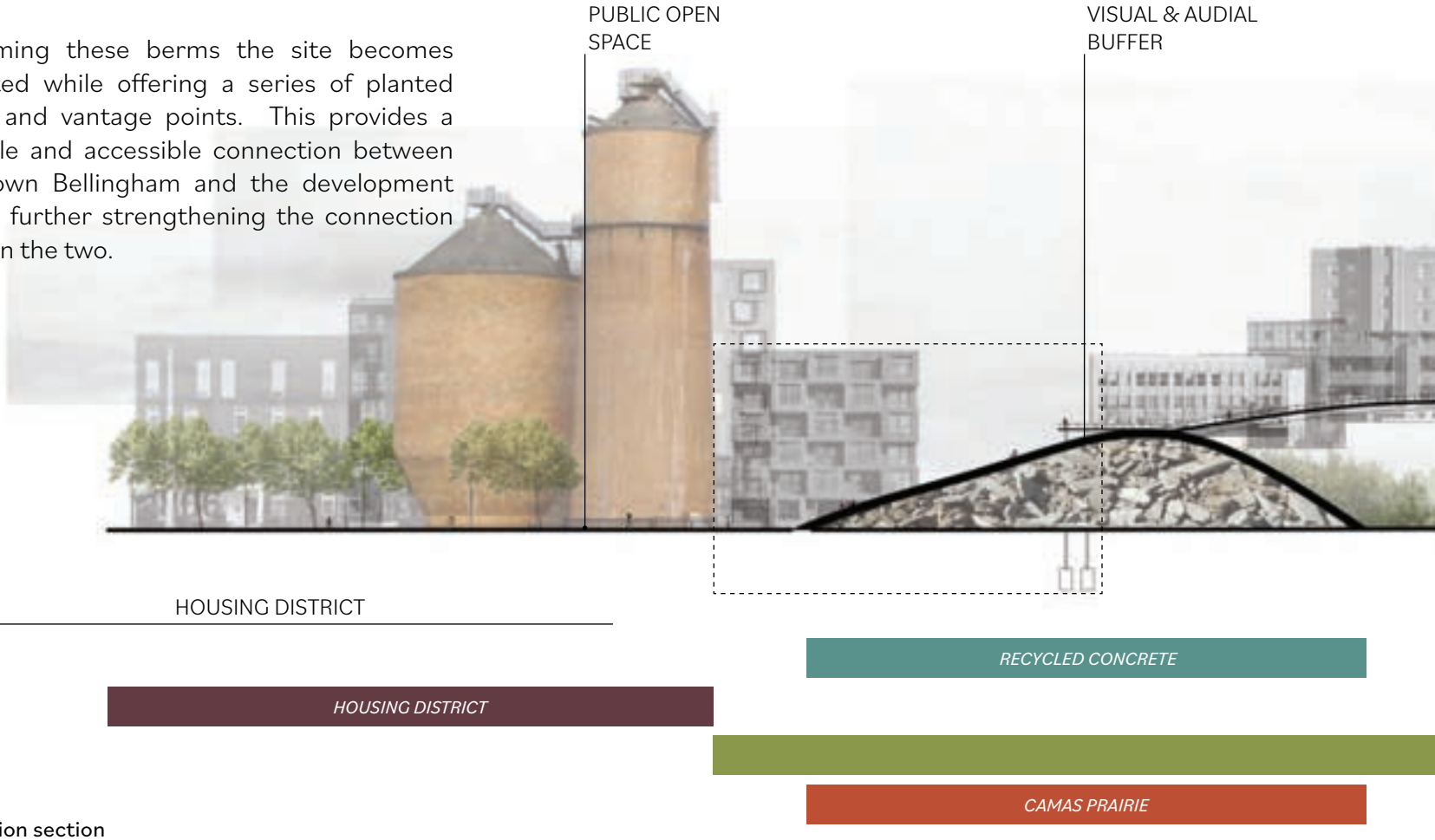
Program diagram

KEY:

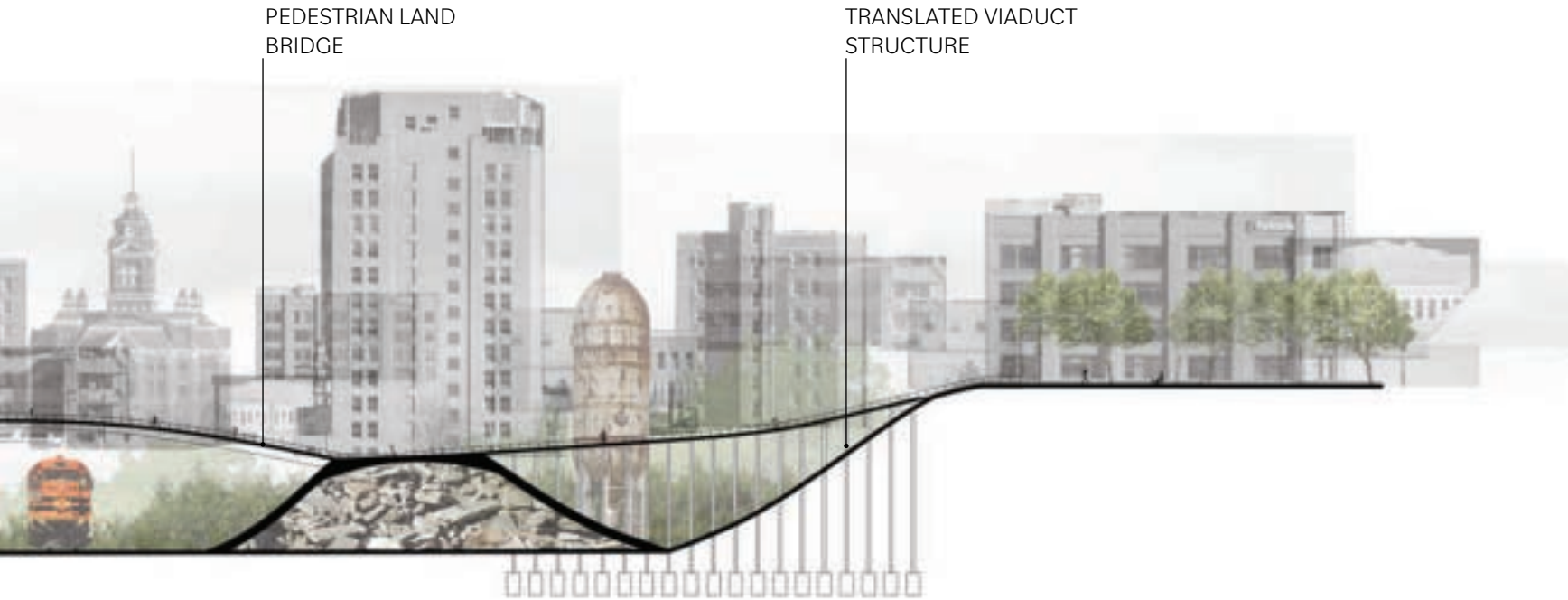
1: TO DOWNTOWN
2: MILLWORKS LAWN
3: TO MILLWORKS
4: LAND BRIDGE
5: AMPHITHEATER
6: TO PHYTO/WETLANDS
7: TO WATERFRONT
8: GREAT LAWN
9: TO WAYPOINT PARK
10: WET PRAIRIE
11: PRAIRIE

The existing site has an unfavorable urban edge and is frequently disturbed by the train that passes through the site. In an attempt to mitigate the disruption from the train and revitalize the urban edge, our group proposed a raised circulation path to help navigate the steep grade change and a series of berms to provide a buffer from the tracks.

By forming these berms the site becomes protected while offering a series of planted spaces and vantage points. This provides a desirable and accessible connection between Downtown Bellingham and the development on site, further strengthening the connection between the two.



Connection section



RECYCLED CONCRETE

EDGE TRANSITION: PROVIDING A DOWNTOWN CONNECTION

CAMAS PRAIRIE

CAMAS PRAIRIE

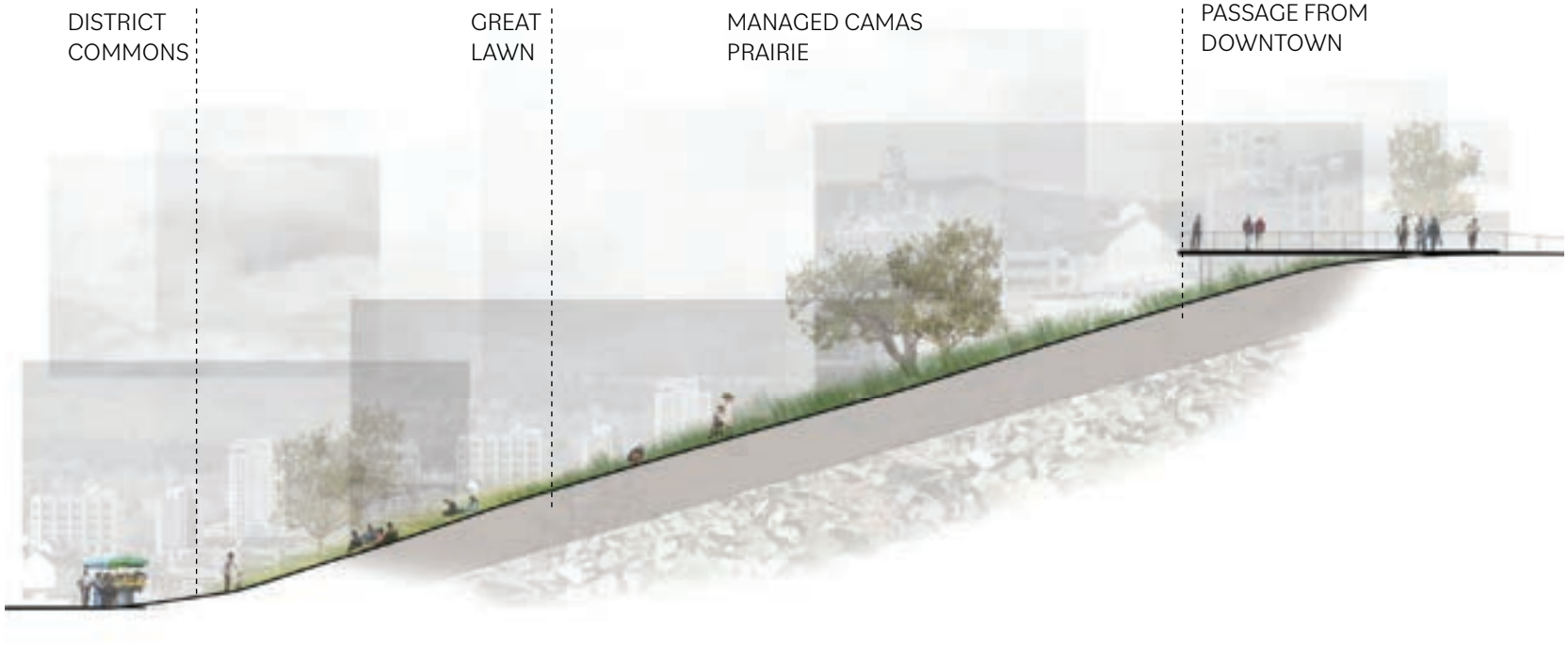
A proposed camas prairie on the hill side of The Connection offers an opportunity for **cultural practices to be embedded** into the landscape and gives opportunity for the **rematration of stolen land** at the waterfront. The prairie ecology also brings climate-adaptive spaces to the District.

As a vital cultural resource for many Coast Salish groups, including the Lummi Nation, camas harvesting can introduce co-management and co-ownership opportunities between Bellingham and Coast Salish groups within the District.

Camas
Camassia quamash

Roemers Fescue
Festuca roemeri

Tufted Hairgrass
Deschampsia cespitosa



Cultural landscapes

CARBON SEQUESTRATION

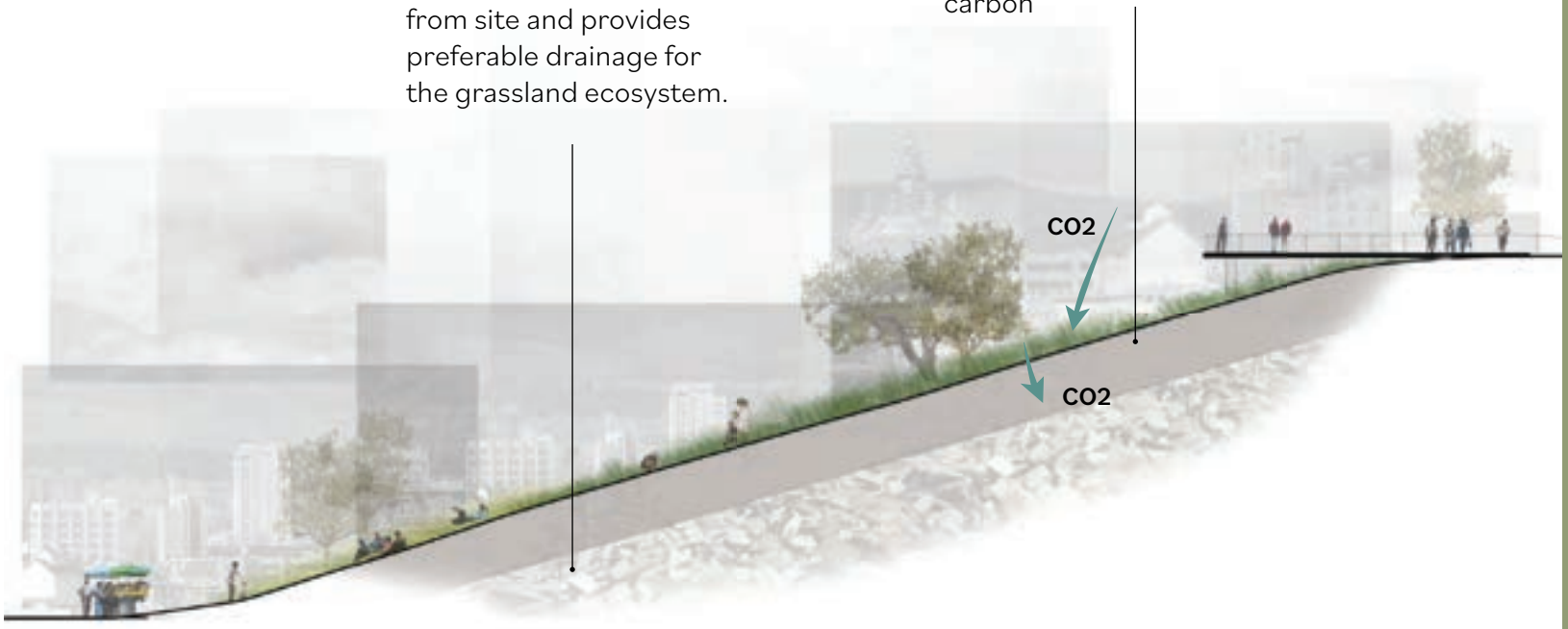
Grasslands are climate resilient carbon sinks in the face of drought, heat waves and wildfires.

Carbon is stored in roots of grasses and in the soil. There is less opportunity for carbon to be released back into the atmosphere compared to forest ecosystems

Approximately 3.5 acres, the proposed camas prairie stores up to 15 tons of carbon

MATERIAL RECYCLING

Recycled concrete diverts existing waste from site and provides preferable drainage for the grassland ecosystem.



Ecological systems

THE NEIGHBORHOOD

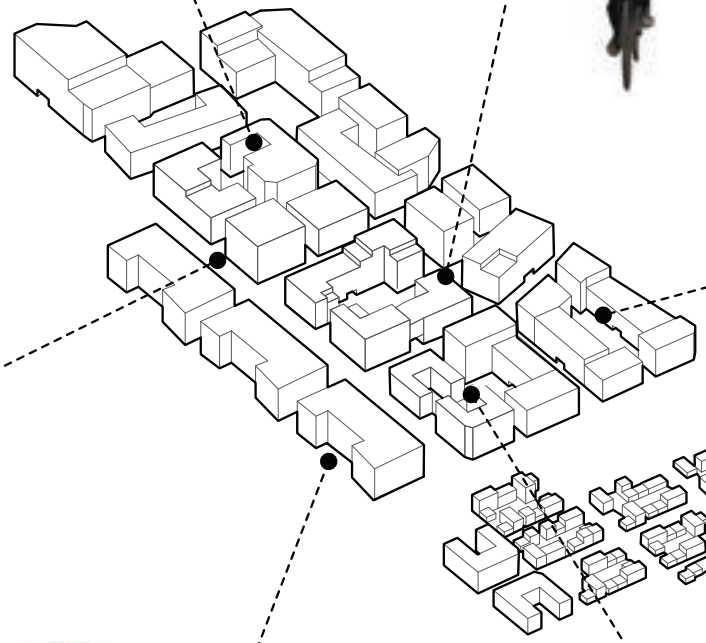
The neighborhood comprises the urban zone on the site. Centered around the housing exhibition, this dense, car-lite, ecodistrict provides a vibrant and bustling node in the master plan.

"I was able to be part of my apartment's design process"

"I can park my bike so easily"

"Our block is sustainable and green"

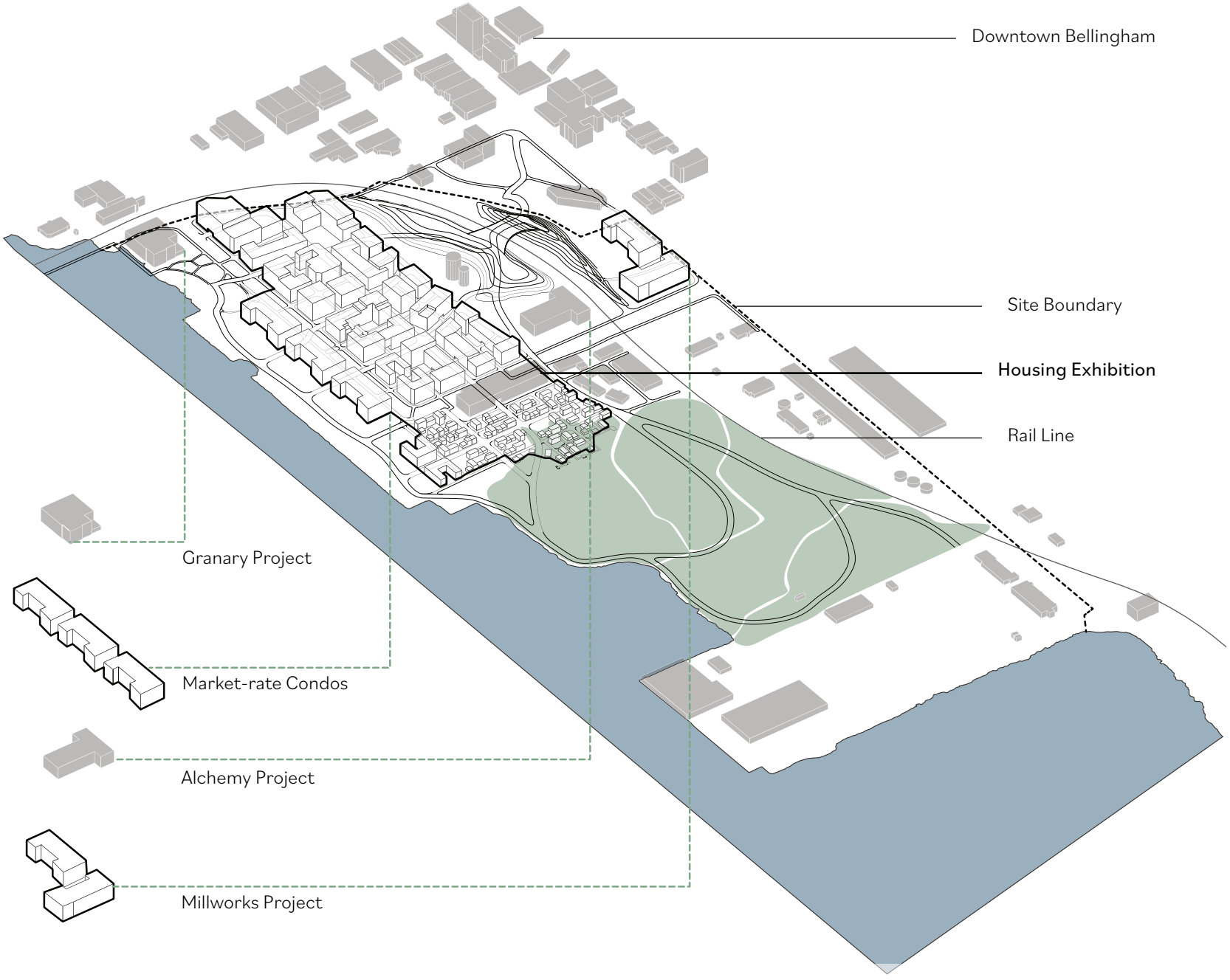
"We love seeing our neighbors everyday at the local cafe"



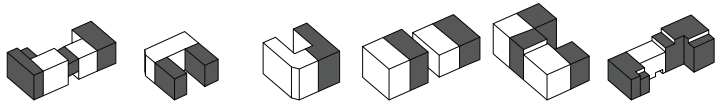
"Shopping for healthy food in my neighborhood is very convenient"

"We love being able to walk our kids to school"

EXHIBITION LOCATION



NEIGHBORHOOD CHARACTERISTICS

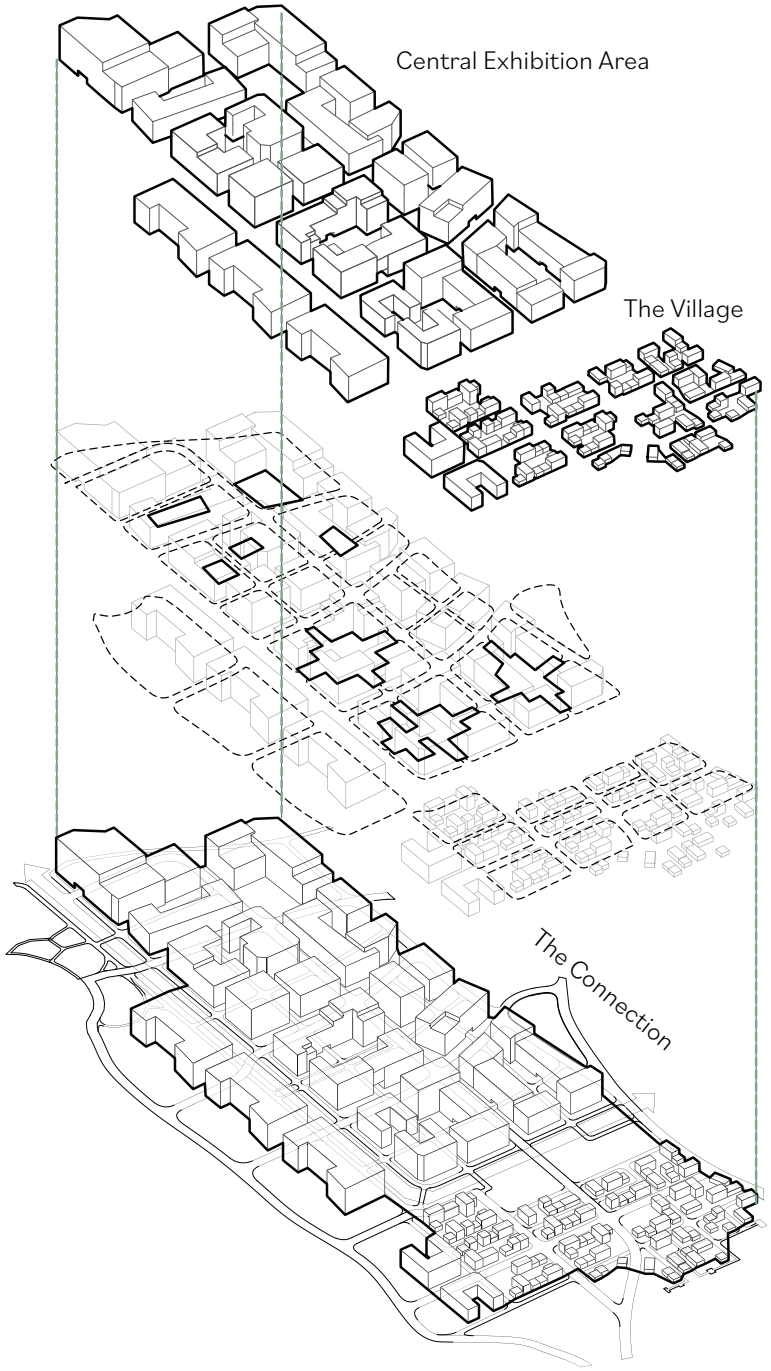


Shared walls increase energy efficiency, and engender a dynamic and diverse environment.

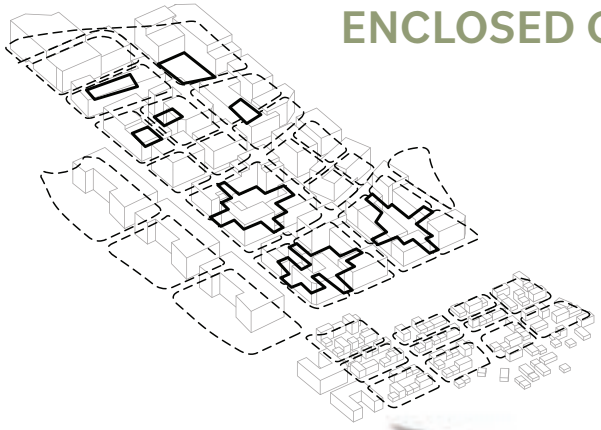
Asymmetrical layout creates various block sizes that are engaging for the pedestrian.

Buildings are constructed close to street, allowing for a system of **enclosed courtyards.**

Different scales of **public space opportunities.**



ENCLOSED COURTYARDS



Enclosed courtyards allow for comfortable microclimates.

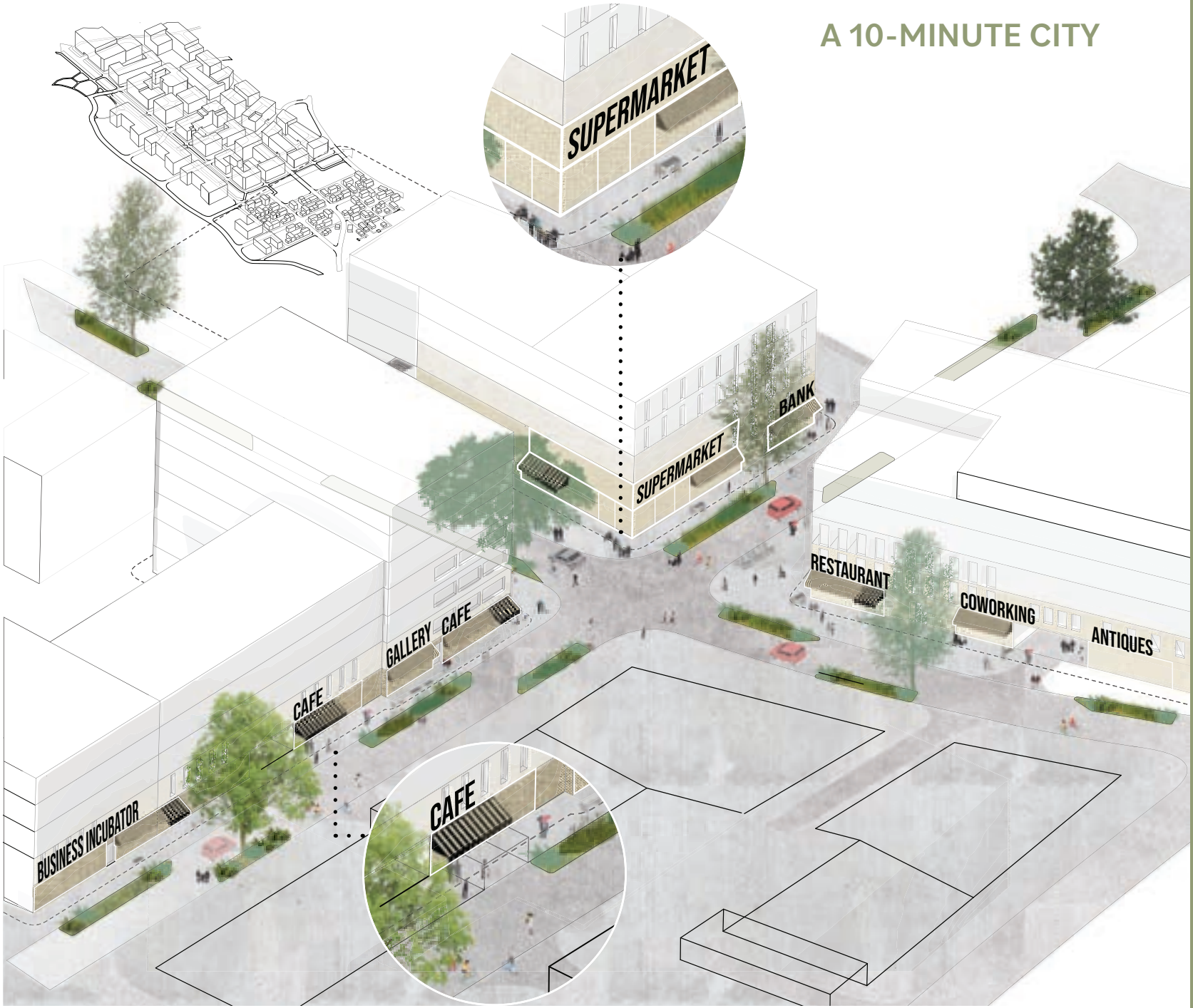
6' frontage zones and walk-up entrances/units off of courtyard.

Green stormwater infrastructure collects water from roofs and courtyard as usable raw water.

Semi-private public space opportunities.

Active corner community uses.

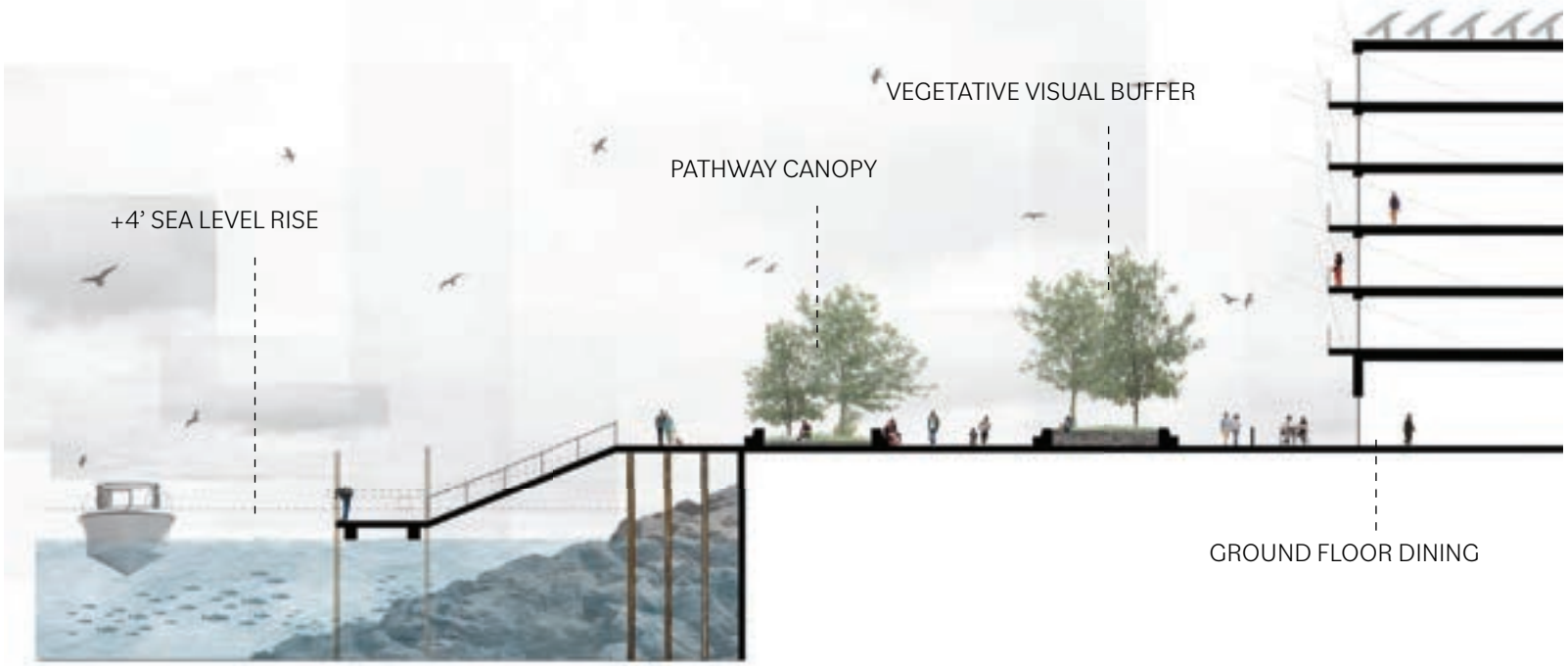
A 10-MINUTE CITY



Vignette looking northwest along the waterfront

THE WATERFRONT

Adjacent to the urban neighborhood, the activated waterfront becomes a vibrant edge with a softened shoreline and floating piers that adapt to rising sea levels and tidal surges. A hierarchy of paths along the waterfront create enclaves of public space.



ADAPTABLE WATERFRONT FOR RISING SEA LEVELS + TIDAL SURGES

SOLAR COLLECTION

MARKET RATE CONDOS

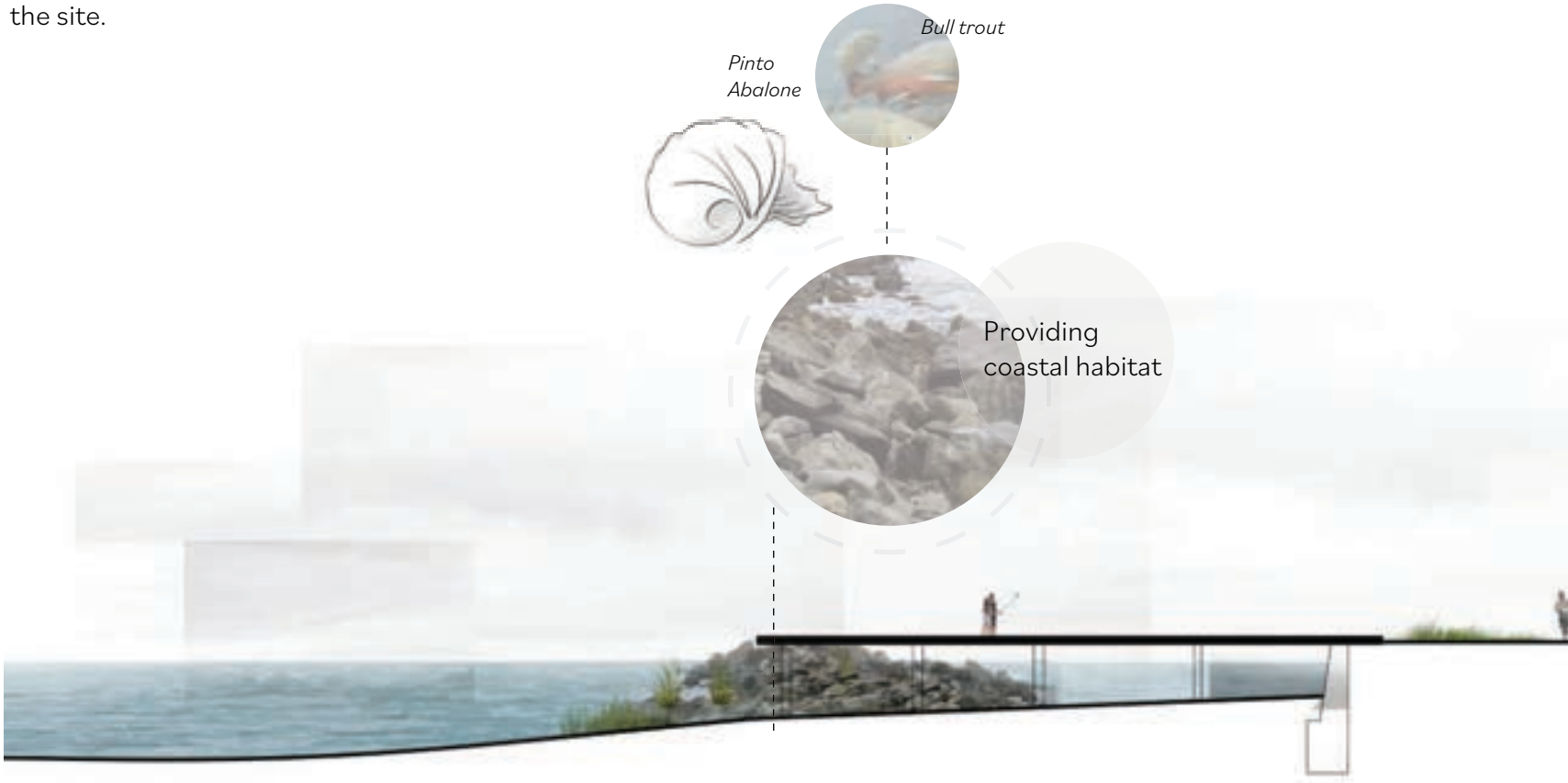
EDGE TRANSITION: ACTIVATED WATERFRONT

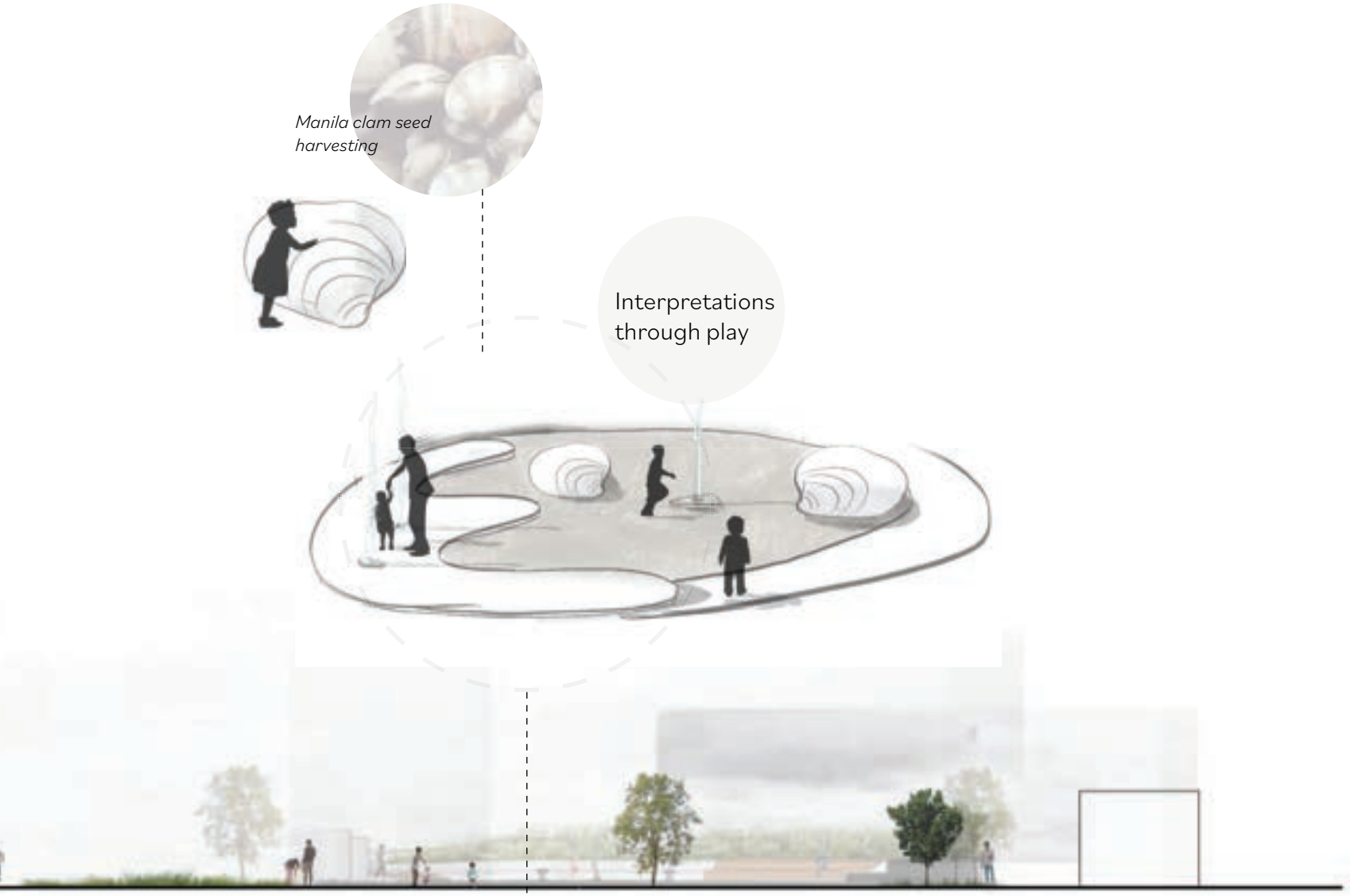
RESTORED HABITAT ON SHORELINE

Waterfront section with systems annotations

REMEMBERING THE HISTORIC SHORELINE

Public space along the waterfront fosters memorable encounters that **signify the ebb and flow of tides, people and wildlife over time, and traditional activities along the shoreline.** This concept of a playground as an interpretation of tidal flats and clam harvesting can serve as a precedent or typology for small-scaled public spaces throughout the site that allude to the historic shoreline against the backdrop of the more industrial character of the site.





Waterfront section with manila clam playground

THE VILLAGE

The Village is a key moment that **mediates** between the urban character of the District's northern portion and the naturalistic character of the estuary. As the estuary develops and matures over time and as sea level rises and creeps into the site, the Village comes more and more into contact with the **changing landscape.**

Vignette looking southwest from the Village

THE VILLAGE

plan & section

Building scale diminishes compared to the main development area, and the streetscape lifts gently away from the ground plane, which has been slightly excavated to accommodate the creation of the estuary and accommodate potential sea level rise. Micro-housing and paths are elevated on piers, giving the area **the character of a seaside wharf.** A system of **constructed wetland cells** is integrated below the "quays." The cells treat stormwater captured from the urban zone and "raw" water entering the site from pipes connected to Lake Whatcom before it is sent to irrigate the phytoremediation areas or flow into the emergent estuary.

Village plan

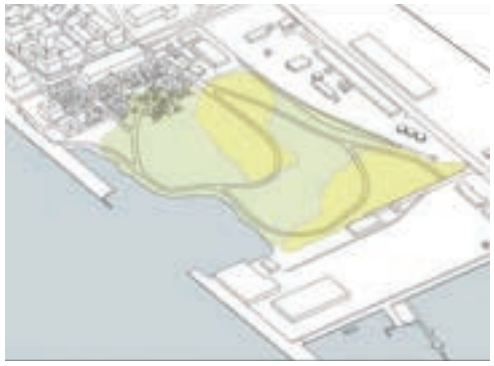
Village section with systems annotation

THE ESTUARY

The estuary gives Bellingham an opportunity to think visionarily about the waterfront district, following the remediation of the land and the activation of spaces through the urban neighborhood and micro housing village.

What begins as a distinct wetland and managed phytoremediation forestry eventually becomes an estuary park that provides a unique experience for visitors to connect and observe the ecological processes from elevated walkways. The space also restores accessibility to the shoreline and connects the waterfront district to adjacent waterfront greenways at Cornwall Park and South to Fairhaven.

Over the long term, the estuary is a climate mitigation strategy that accommodates sea level rise and offers a carbon capturing ecosystem.



ESTUARY ZONES

PHYTOREMEDIATION ZONES

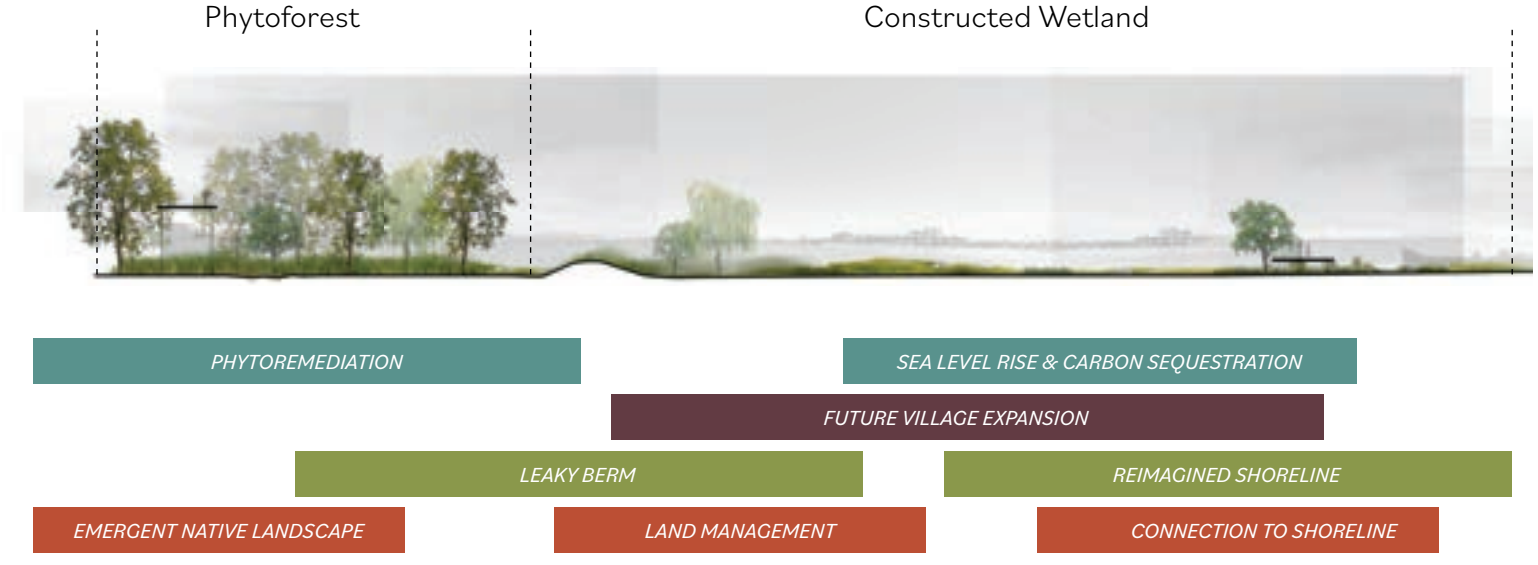
ESTUARY PARK

ESTUARY WITH 4’ SEA LEVEL RISE

Estuary Vignette looking north towards the Waterfront District
Facing Page: Estuary change over time diagrams.

PHYTOREMEDIATION SPECIES & EVOLUTION

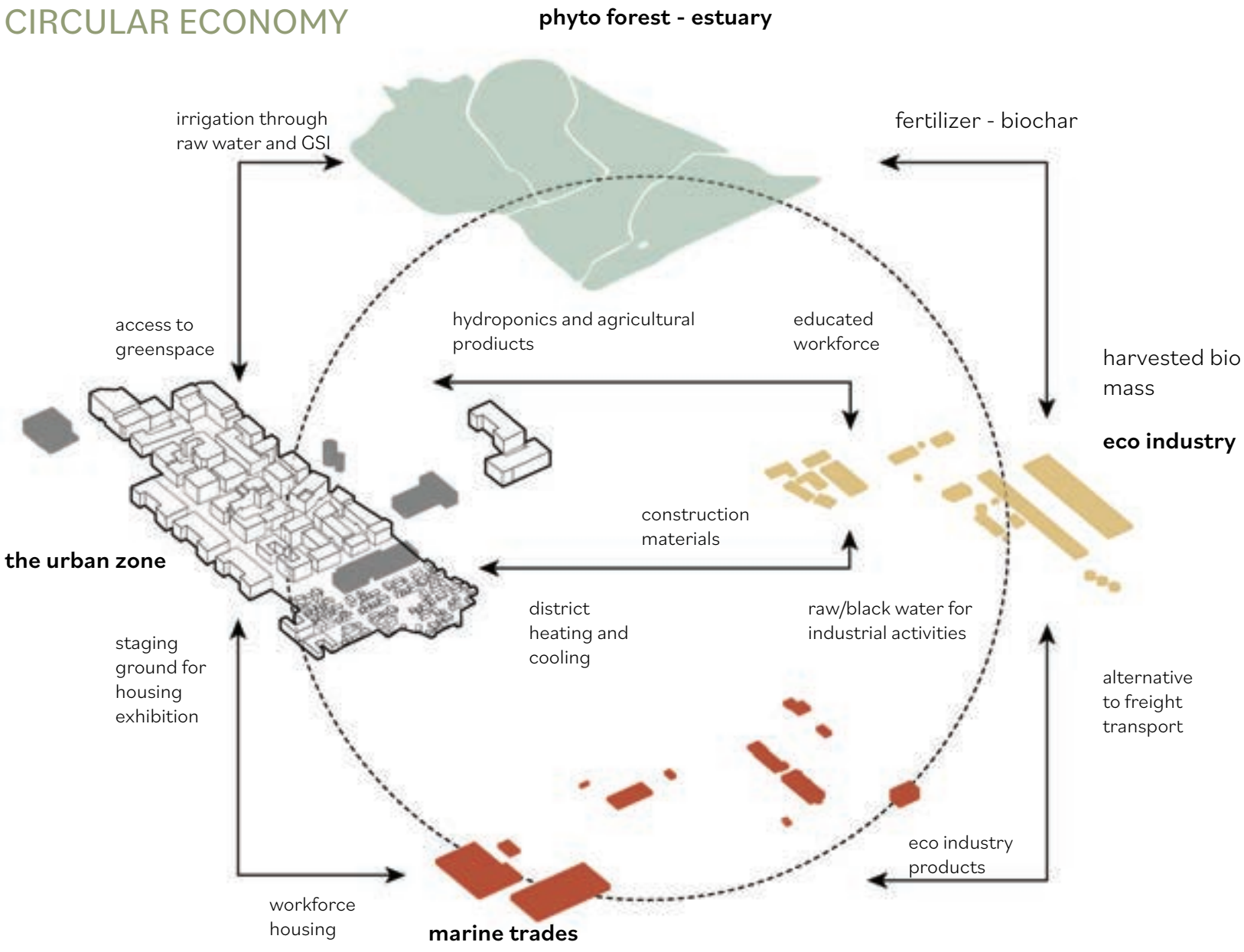
As species chosen for phytoremediation such as giant miscanthus, poplars and ryegrass are no longer needed, they may be replaced with culturally relevant native plantings as part of the wetland ecosystem. The estuary becomes envisioned as a cultural landscape over time. Some species are maintained for biochar production.



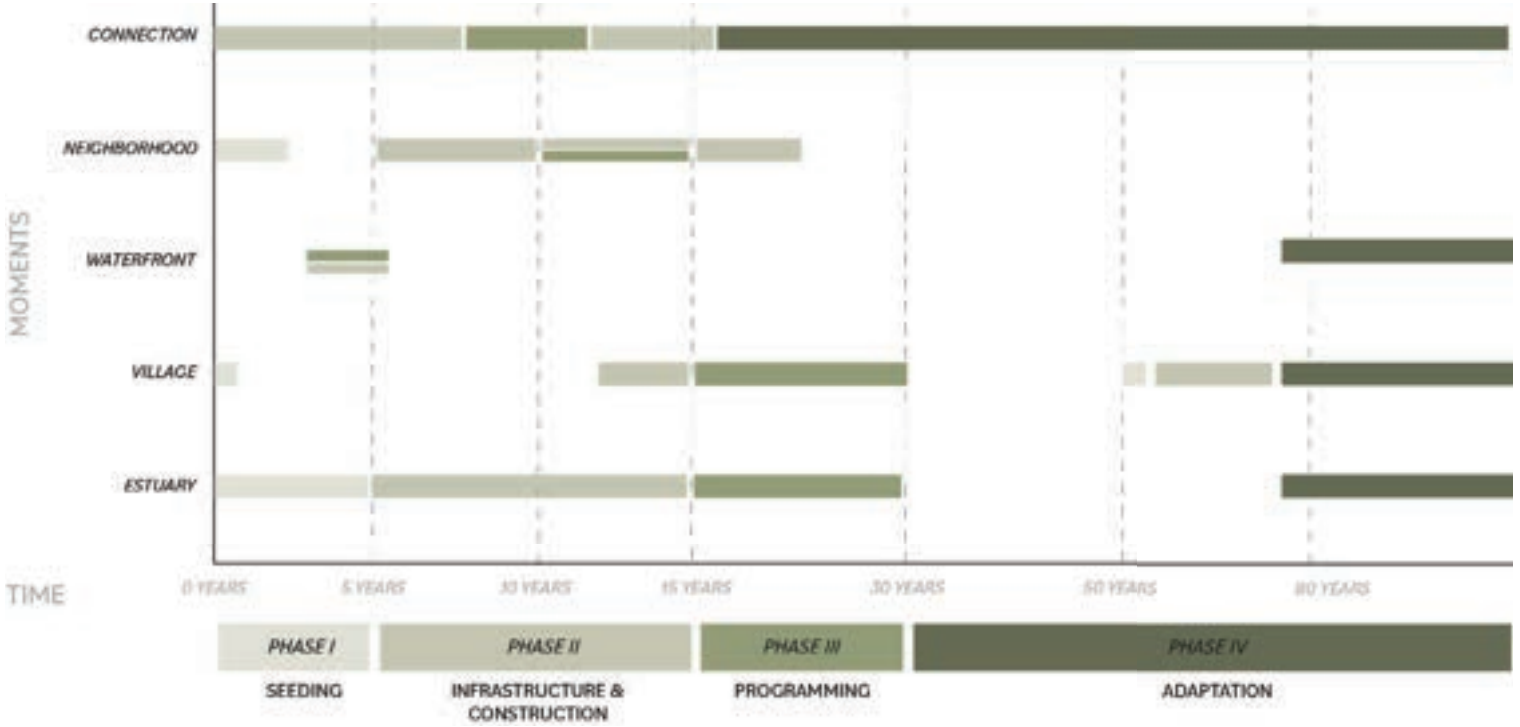
Phytoforest and Constructed Wetland section with systems annotations

Planting evolution diagram

CIRCULAR ECONOMY



By introducing a diversity of uses onto the site, there is a great potential for the integration of circular systems. Eco industrial activities, marine trades, the urban zone, and a restorative phyto forest - estuary ground dynamic flows that cement the district as an innovative climate district.



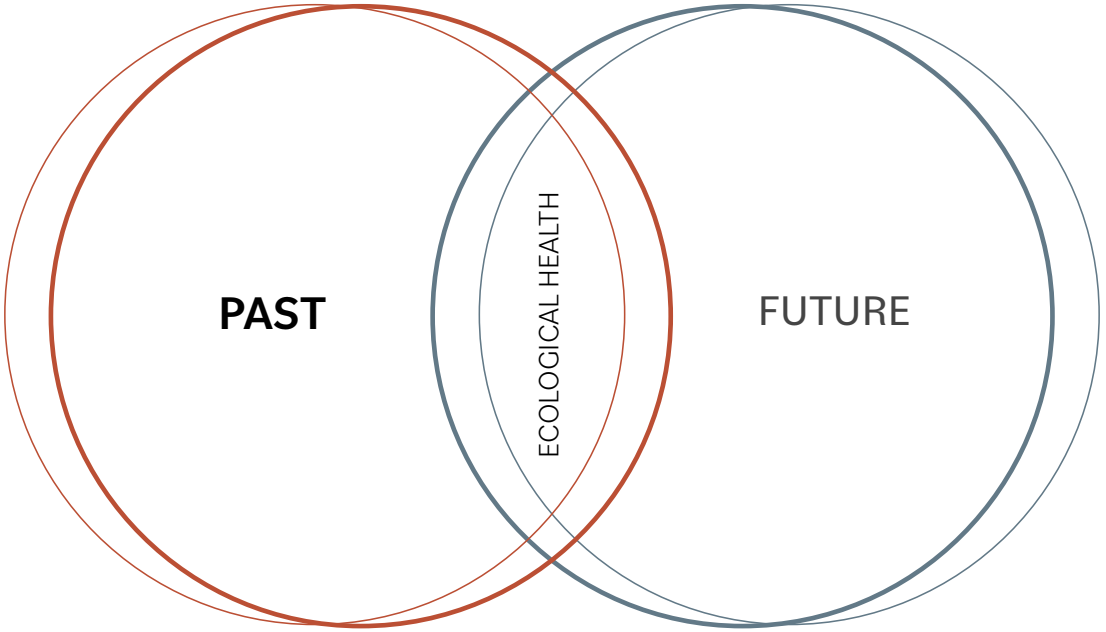
PROJECT PHASING

Across the five moments, phasing overlaps in periods of seeding, infrastructure & construction, programming and adaptation. **Seeding** processes involve policy & implementation required for the housing exhibition, site activation for the future development of the village and preparation for phytoremediation. **Infrastructure & construction** may include the construction of major built elements including the connection, the neighborhood and the stormwater infrastructure systems. **Programming** illustrates when the moments have reached their intended level of public use, such as harvesting camas on the connection, and the established communities within the village and neighborhood. Finally, **adaptation** shows these interventions responding to environmental changes and climate impacts, including the accommodation of sea level rise with climate mitigation, carbon sequestration over the long term at the connection and the estuary, and the neighborhood reaching net-zero by 2030.

FILL IN, GROUND UP

+ Rhys Coffee
+ Emily Saeger
+ Will Prescott
+ Matt Olzewski

Working from the ground up, our project implements land-based interventions to restore ecological health while providing economic and recreational opportunities for Bellingham's new downtown waterfront. This complicated site necessitates a phased approach to mitigate its unique hazards and to sustainably fulfill the needs of Bellingham's residents.

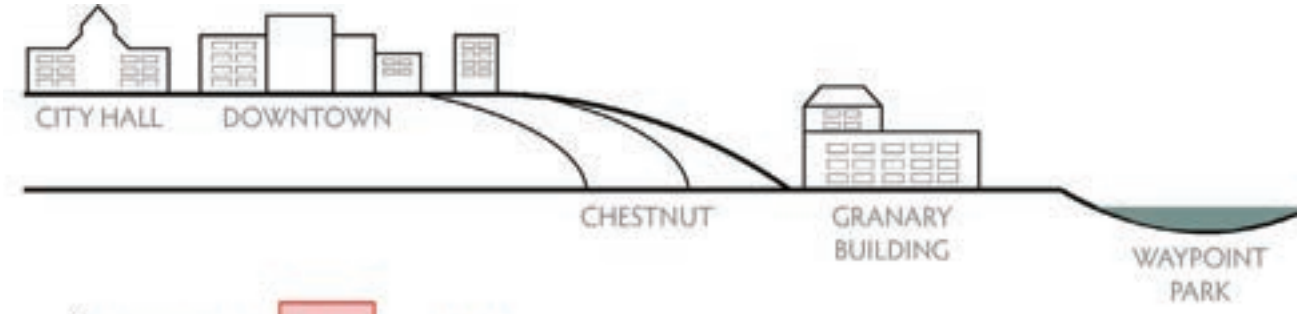


VALUES

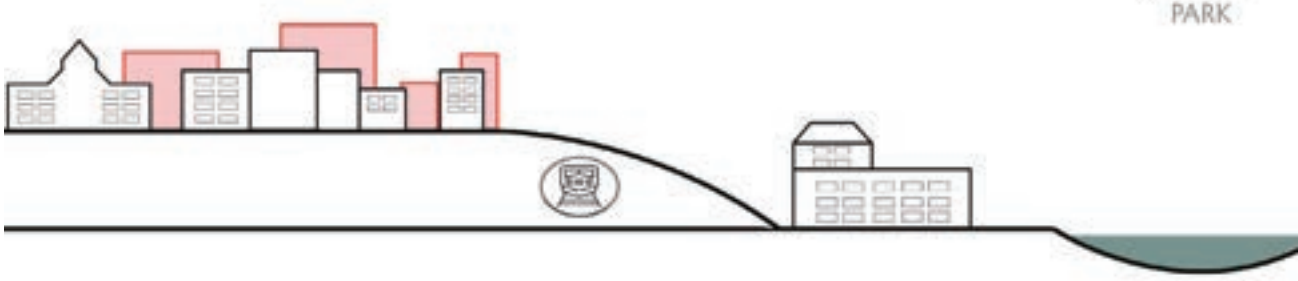
- Remnants of industrial past are our responsibility
- Prioritize ecological remediation first before bringing people to the site
- Sea level rise and severe storms are future realities that we must plan for today
- Healthy communities can exist at increased density, but must retain human scale
- Global climate change can be addressed locally through carbon sequestration, limiting emissions, and local circular economies

EXPLORATIVE SECTIONS
Phasing Timeline

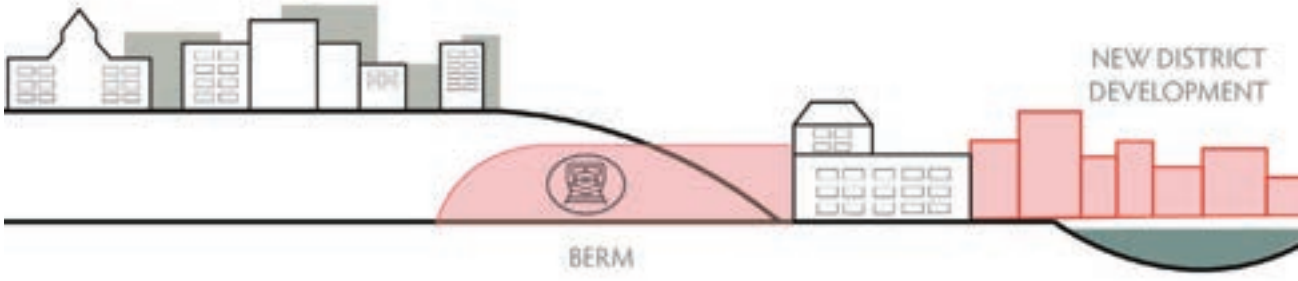
EXISTING CONDITIONS



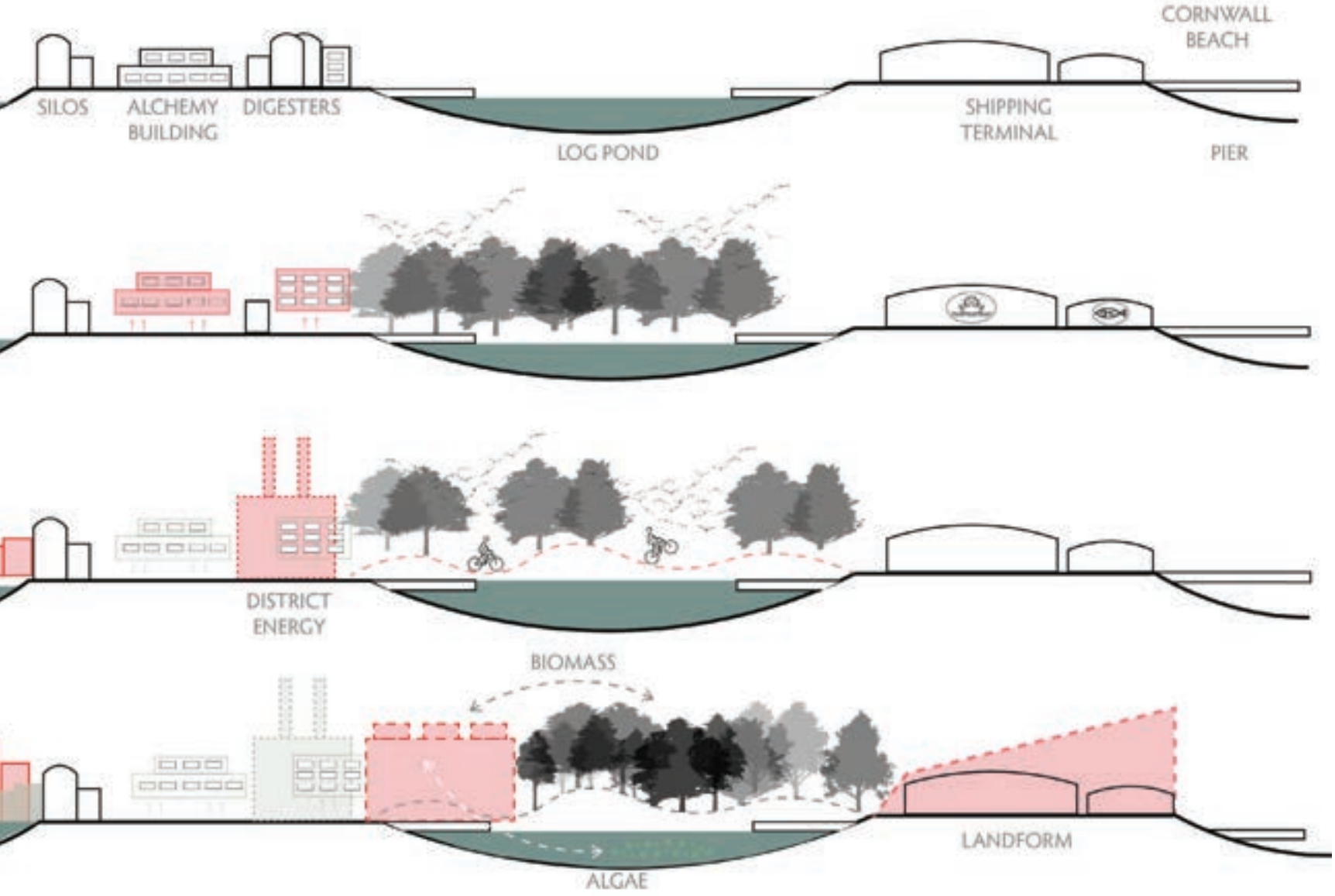
PHASE 1
RESTORE HEALTH
0-10 YEARS

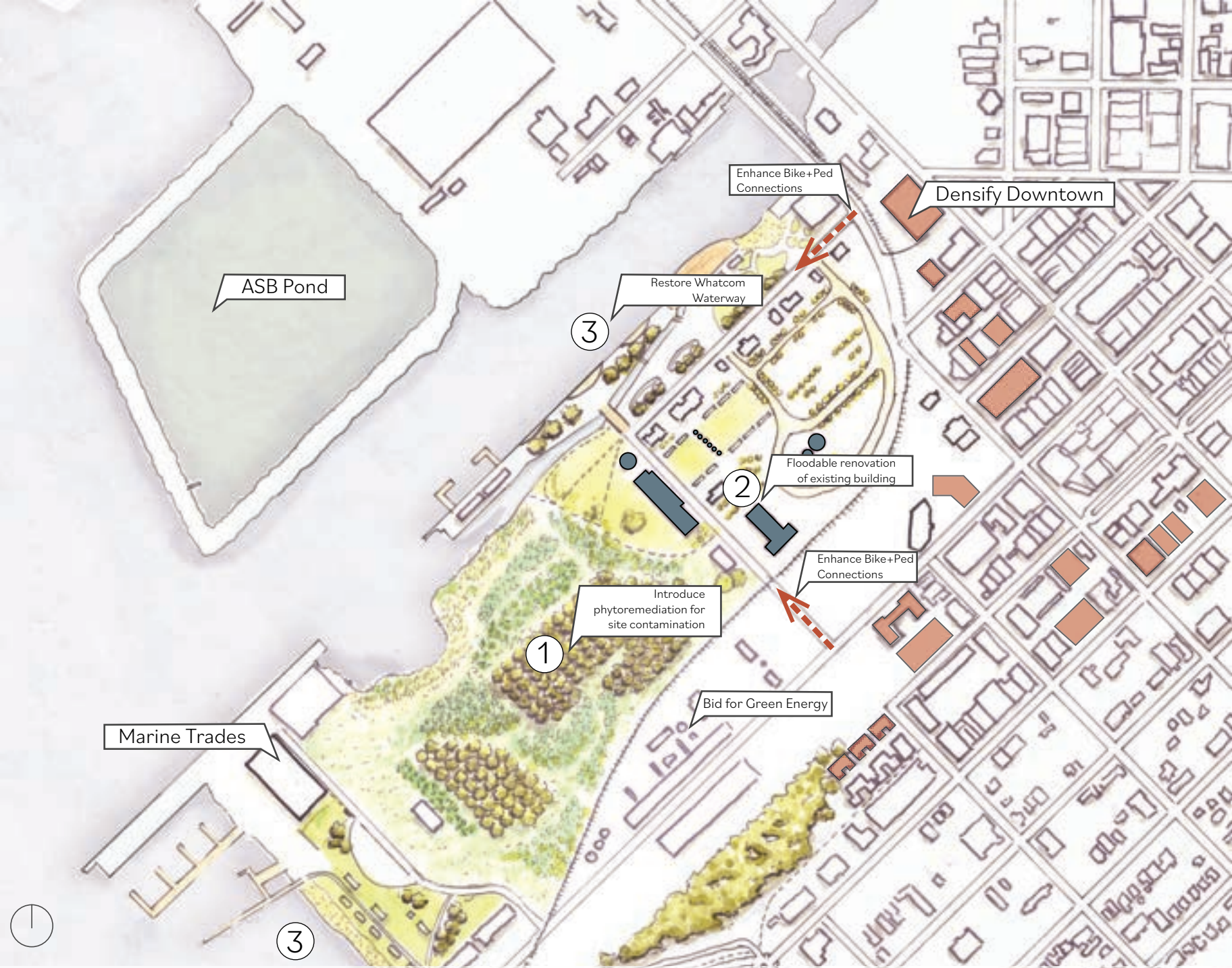


PHASE 2
RESTORE VITALITY
10-30 YEARS



PHASE 3
SUSTAIN RESILIENCE
30-50 YEARS

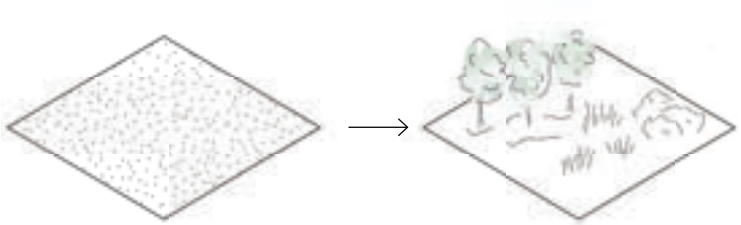

CORNWALL
BEACH
SILOS
ALCHEMY
BUILDING
DIGESTERS
LOG POND
SHIPPING
TERMINAL
PIER
DISTRICT
ENERGY
BIOMASS
LANDFORM
ALGAE


Enhance Bike+Ped Connections
Densify Downtown
ASB Pond
Restore Whatcom Waterway
3
Floodable renovation of existing building
2
Enhance Bike+Ped Connections
Introduce phytoremediation for site contamination
1
Bid for Green Energy
Marine Trades
3

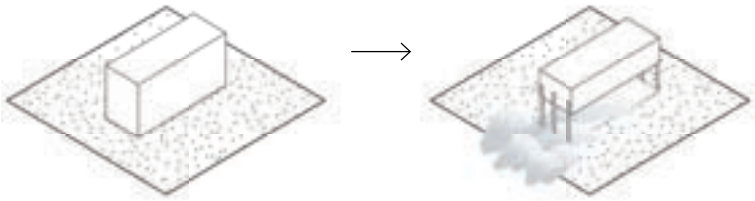
0-10 YEARS

RESTORE HEALTH

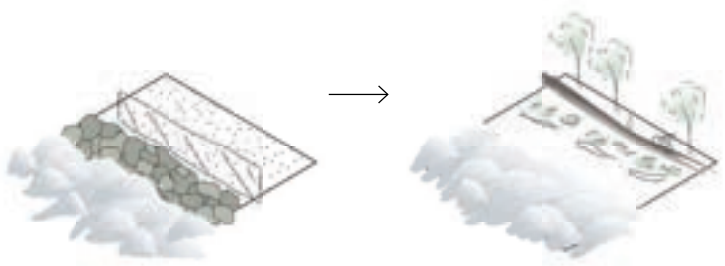
① Introduce phytoremediation as a component of the Port of Bellingham's remediation strategy.



② Restore and future-proofing existing building on site by creating a floodable first floor.



③ Restore the Whatcom Waterway for recreation and marine/terrestrial habitat.



CARBON WINS

- Embodied carbon from renovated Boardmill and Alchemy buildings
- Carbon sequestered by expanded wetland habitat

ECONOMIC WINS

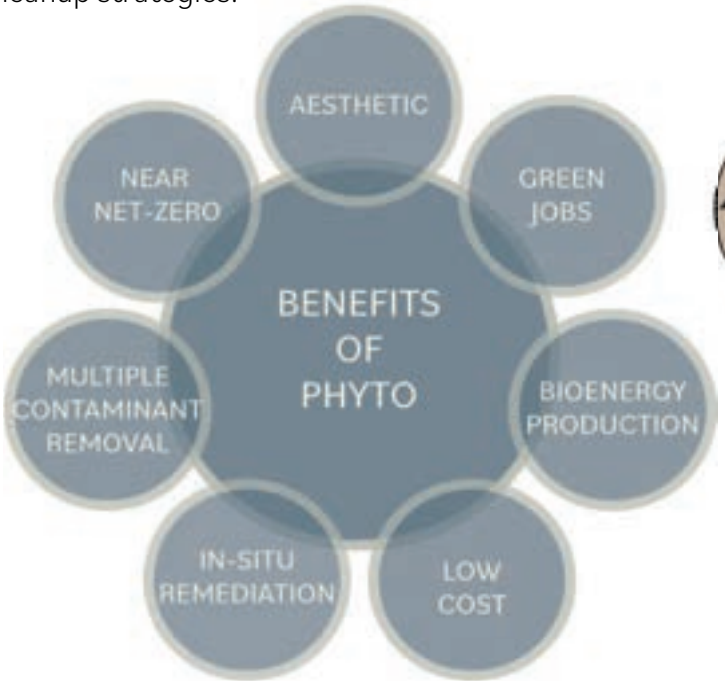
Employment from:

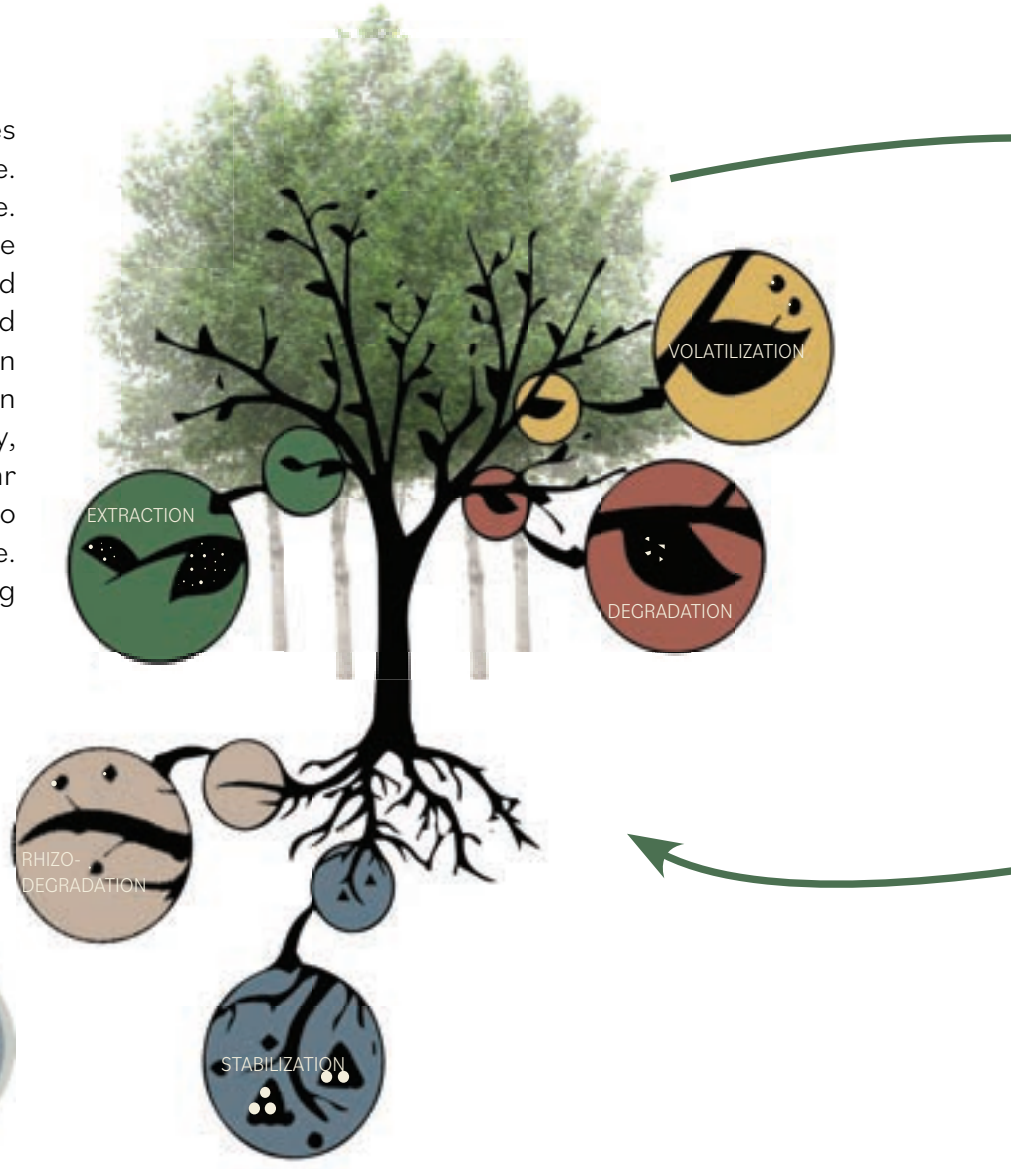
- Phytoremedation maintenance and research
- Landscape maintenance of new waterfront recreation spaces
- Exploratorium museum
- Full time staff and new small business startups at Millworks

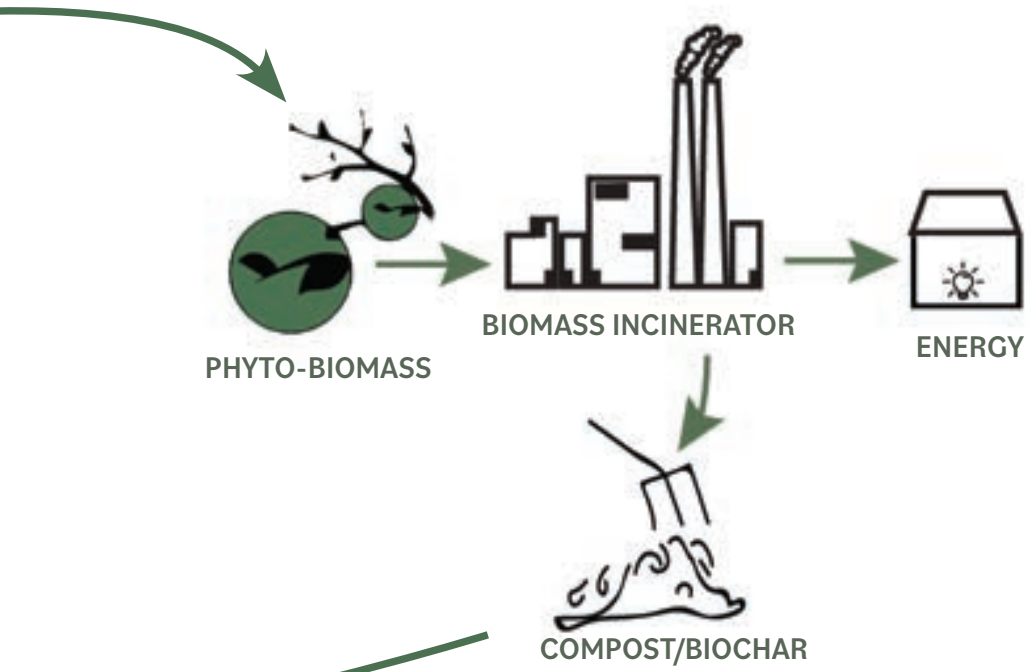
RE-EVALUATING REMEDIATION

Phytoremediation

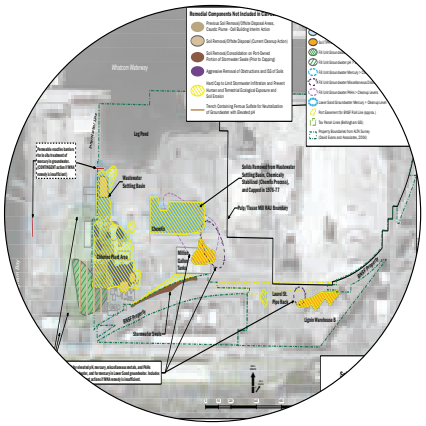
Phytoremediation is a growing science that uses the natural abilites of plants to uptake organic (ie. excessive nutrients) and inorganic contaminants (ie. heavy metals.) The technology could be used on the Bellingham Waterfront to help remove, degrade and contain remaining contaminants such as PAHs and mercury. The benefits of utilizing phytoremediation is that it offers a low cost near net-zero remediation strategy than can be employed quickly. Additionally, it would generate biomass for bioenergy and biochar for the site, and provide a unique opportunity to generate habitat and beauty while remediating the site. Phytoremediation could be used in addition to existing cleanup strategies.







The above graphic shows the various ways plants process contaminants (ie. phytotechnologies.) In the case of the Bellingham Waterfront the primary phytotechnologies that would be used are extraction - where contaminants are extracted into the upper plant tissue which can then be harvested and processed; degradation or rhizo degradation - where the plant is able to degrade the organic contaminant within the cell wall or by the bacteria at the root zone; and stabilization - where the roots of the plants act as a living cap. As well as the potential for bioenergy through phytoremediation.



EXISTING SITE CONTAMINANTS

EXISTING SITE CONDITIONS

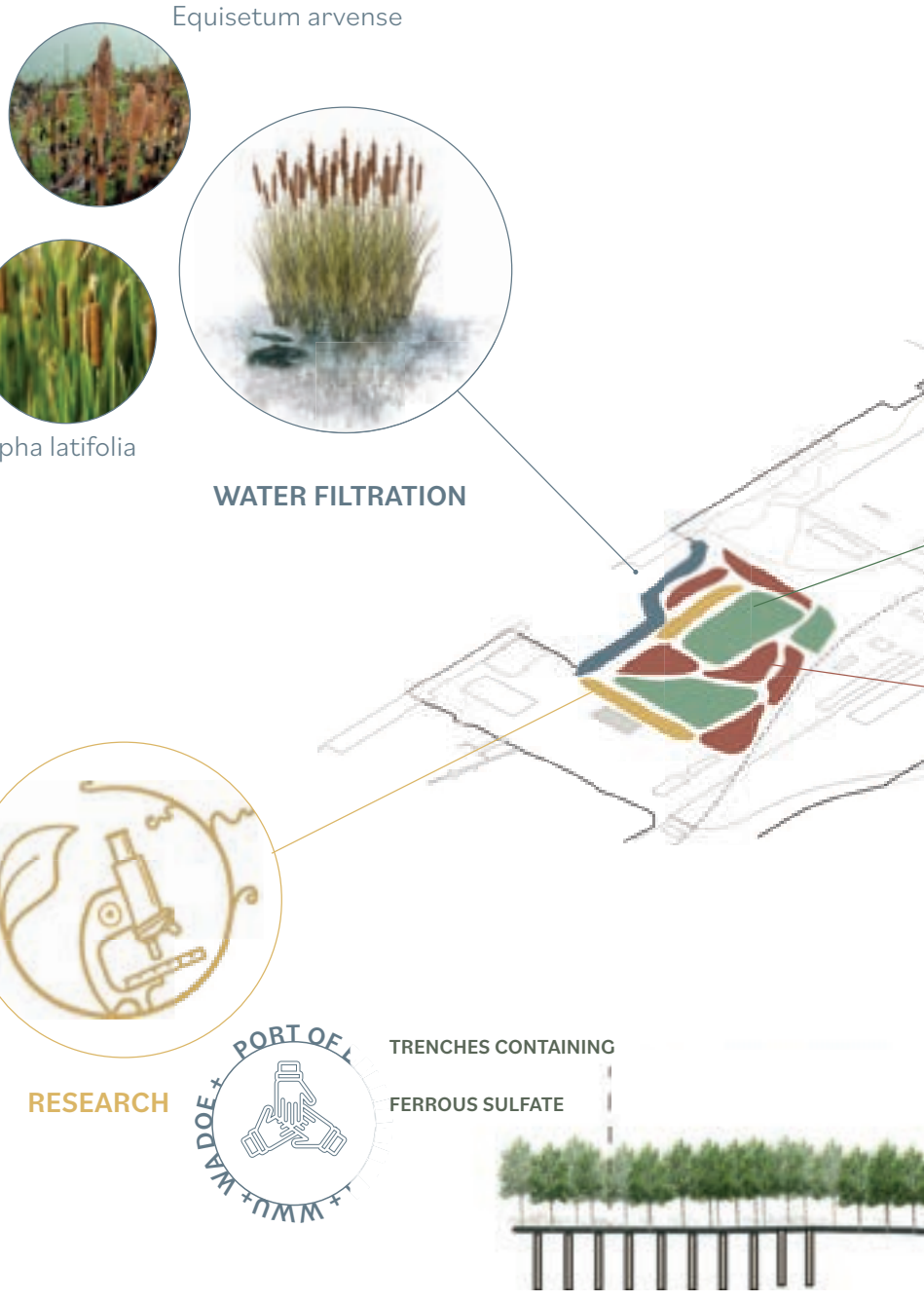
FUTURE WITH PHYTO

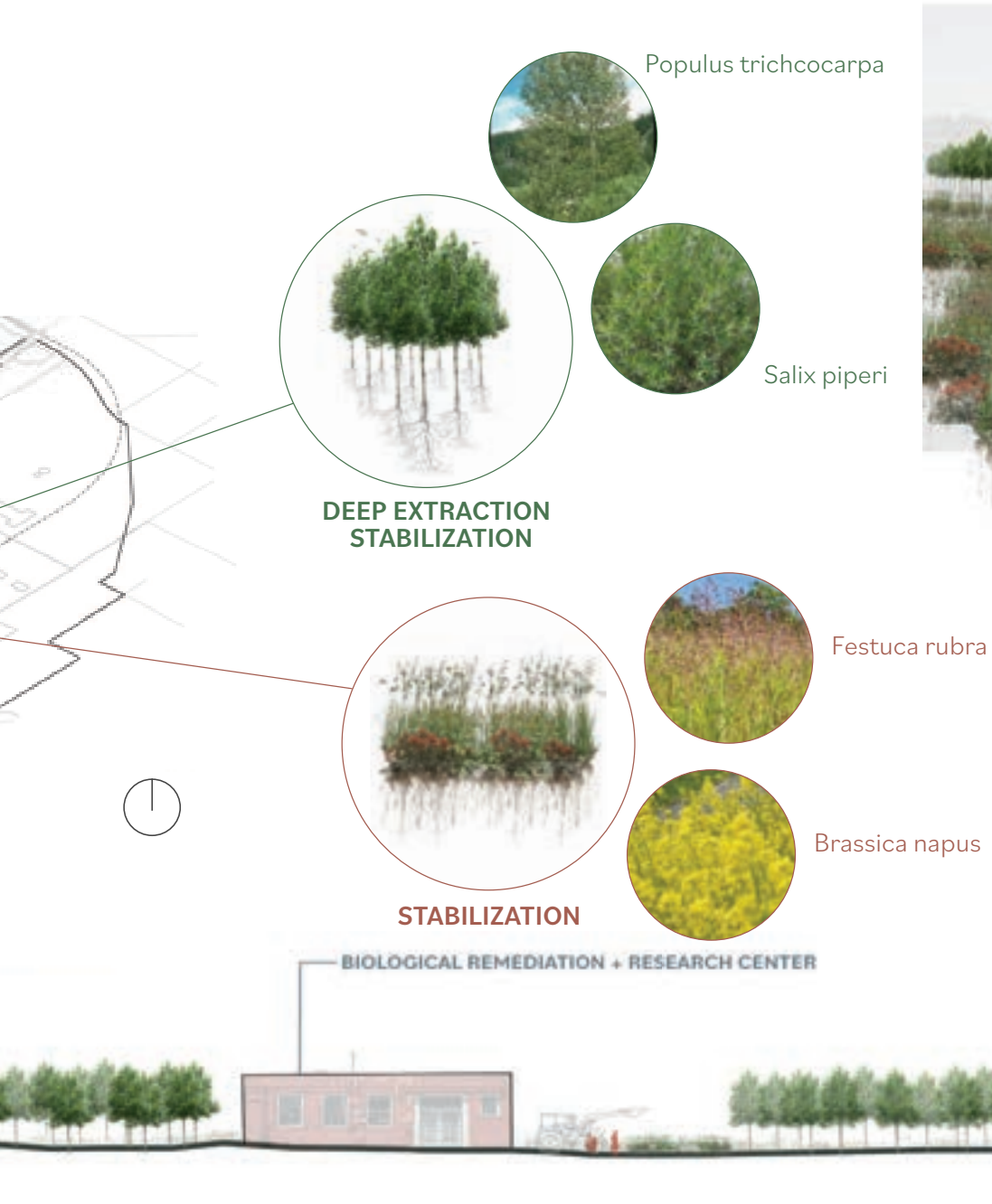
PHYTOREMEDIATION

Implementation

PHYTOTYPOLOGIES

There are four primary phytotypologies that could be implemented on-site: water filtration with cattails and horsetails to reduce runoff; deep extraction and stabilization through fast growing shrubs and trees; stabilization with perennial shrubs; and research of native and non-native plants currently inhabiting the site.



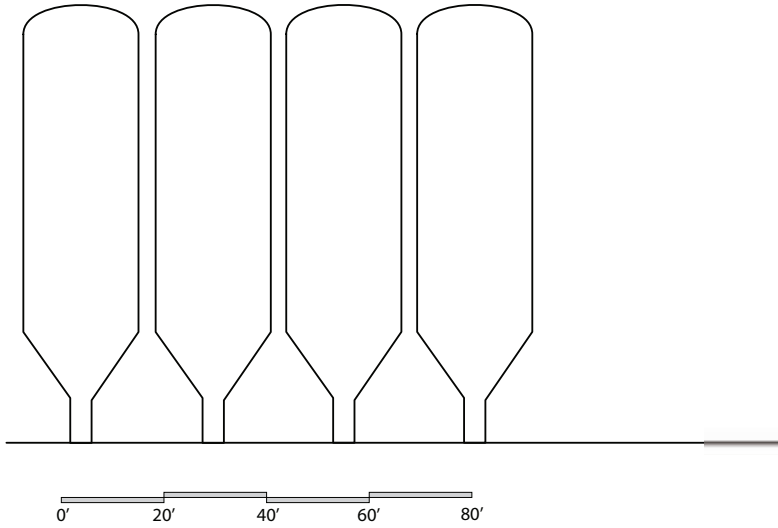


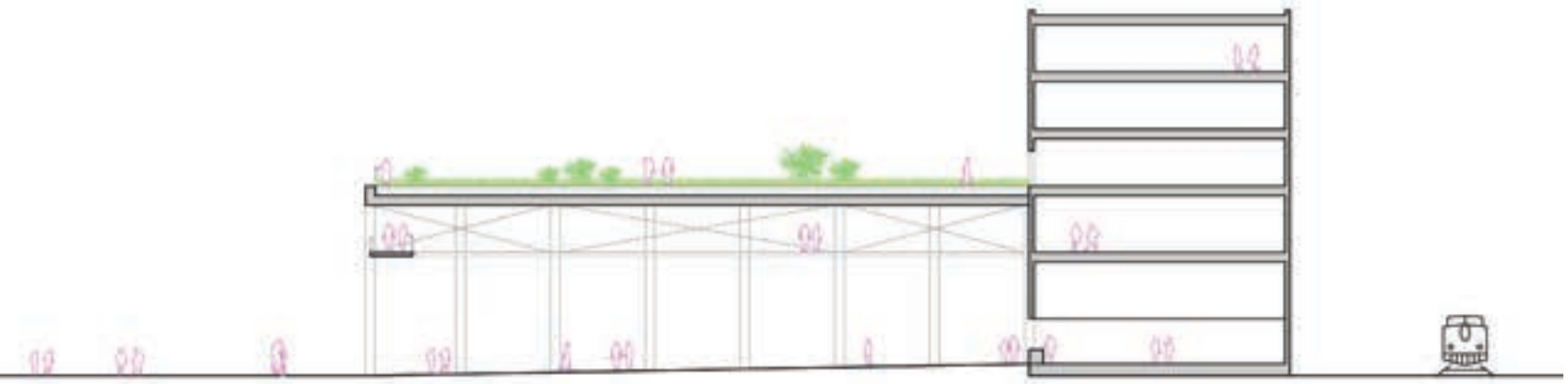
These four primary phytotechnologies would be implemented along with some of the Port's existing remediation plans, shown in the section below. These combined remediation efforts would afford new partnerships and generate green jobs for the Port and City of Bellingham, while providing habitat and a greener landscape.

PRESERVING INDUSTRIAL REMNANTS

Alchemy Building

The former Georgia Pacific alchemy building will play host to The Millworks, a community center focused on bringing components of the food production system under one roof. It will provide space for farmers, producers, food buyers and educators, with shared facilities to help incubate small businesses. A large covered area will create a 4-season gathering space that will attract visitors.





Covered Public Terrace

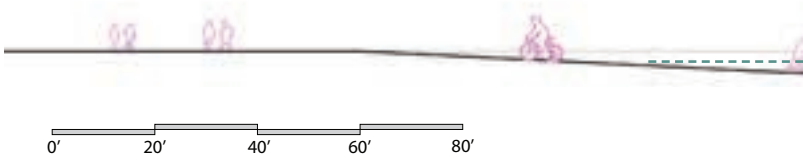
The Millworks

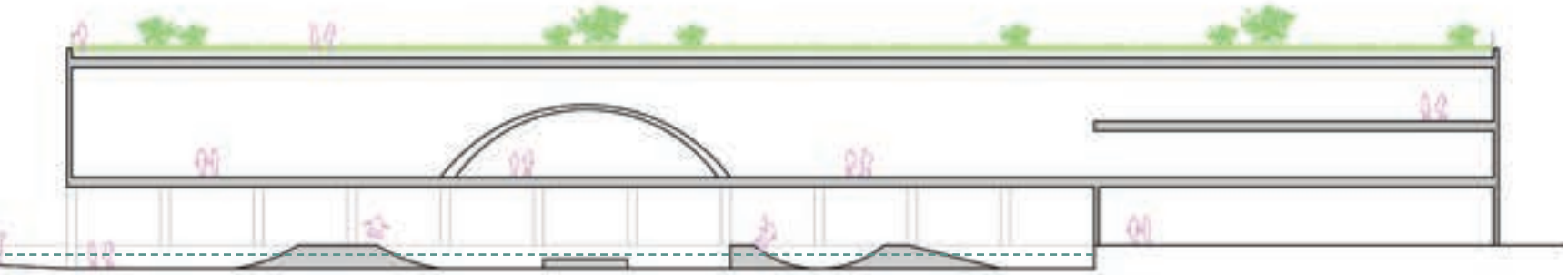
Railroad

PRESERVING INDUSTRIAL REMNANTS

Boardmill Building

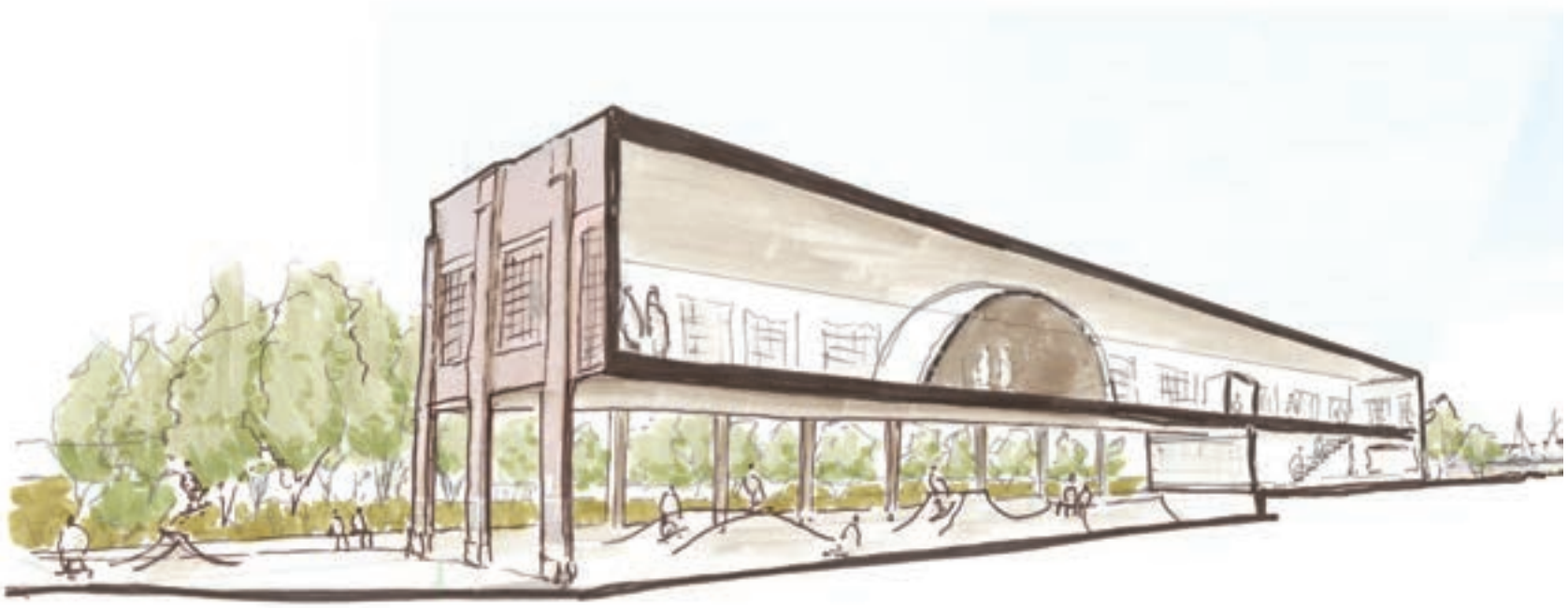
The former board mill manufacturing building will house the Exploratorium - a museum focused on creating interactive experiences with the natural sciences. A skatepark at the first level provides a permanent location for an amenity already desired by the community. It's sunken profile provides space for stormwater detention during flood events.





4-Season Skatepark / Stormwater Detention Zone

Exploratorium Entry



RECREATIONAL WATERFRONT EDGE

Schematic Design

The historic Bellingham Waterfront has suffered from severe industrialization, contamination and low-quality hazard mitigation. Our aim for the waterfront edge was to **create a magnet of interest** for the rest of the site while **acknowledging both human and non-human users**.

Building off the success of the existing Waypoint Park, our first intervention was to continue the playscape theme **along the northern portion of the waterfront.** This includes a splash park for children and families, a revamped pedestrian promenade and elevated dock that fills the void between existing pathways.

The southern portion of the waterfront edge includes an ambitious move to restore habitat and ecological **function through an integrated salt marsh channel.** This, along with elevated pathways to the east provide **barriers for potential sea level rise** while daylighting water activity for everyday users.

EXISTING CONDITIONS

RIP RAP EDGE

WATERFRONT PIER

WAYPOINT PARK

SITE PLAN

SECTION AA

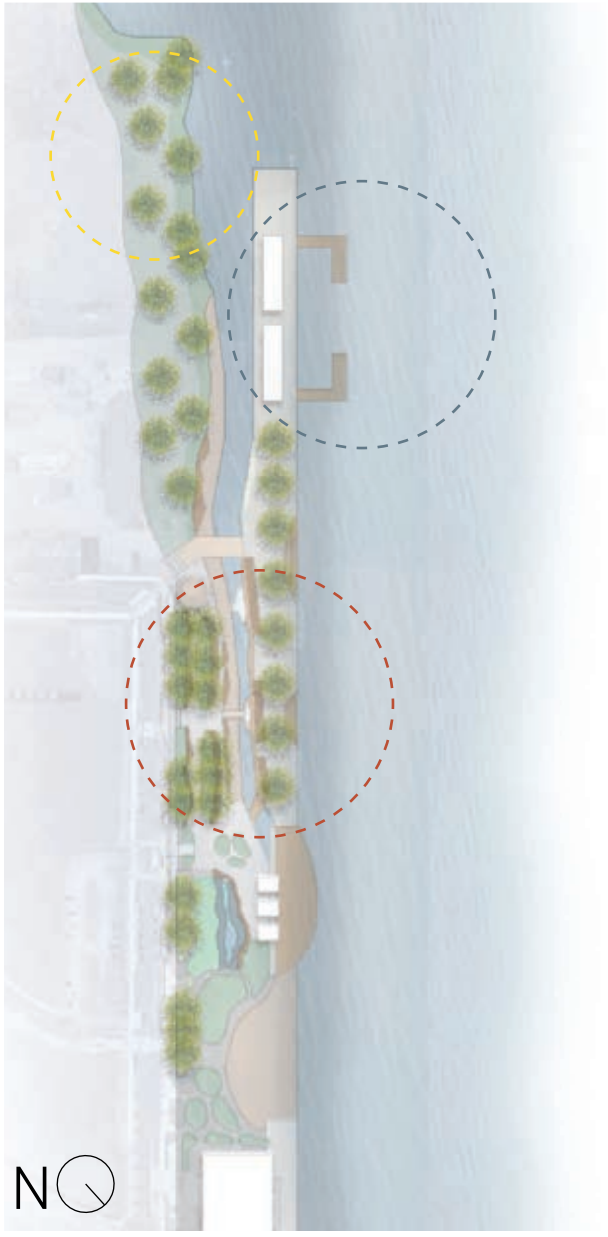
UPLAND THICKET PATHWAY SPLASH PARK PROMENADE PICNIC PAVILION ELEVATED DOCK

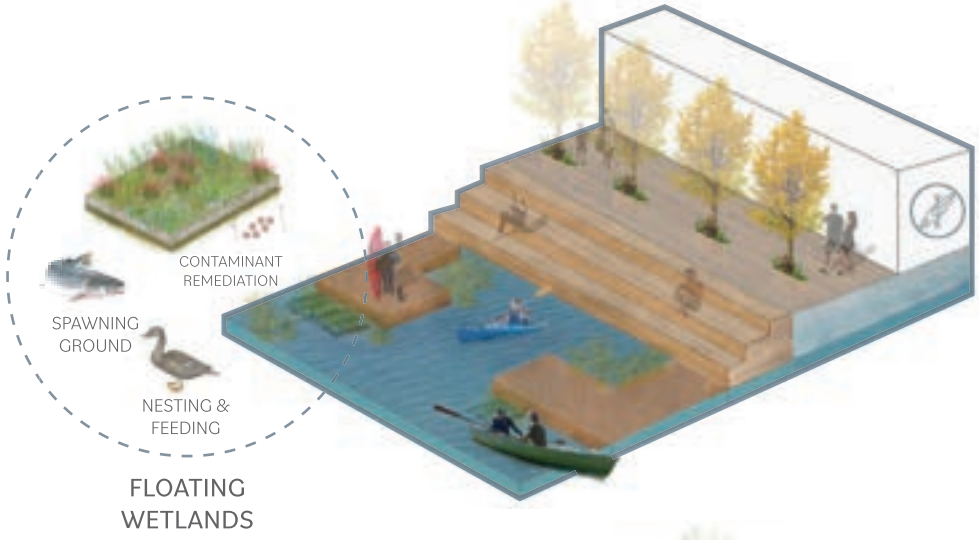
SECTION BB

UPLAND THICKET PATHWAY SALT MARSH CHANNEL SOFT EDGE PROMENADE TERRACED SEATING

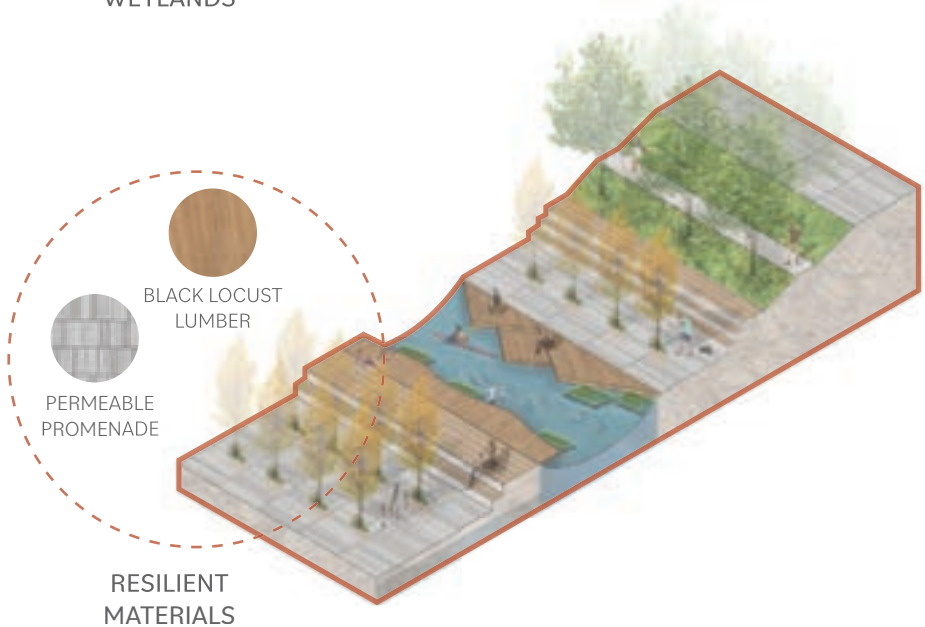
RECREATIONAL WATERFRONT EDGE

Moments

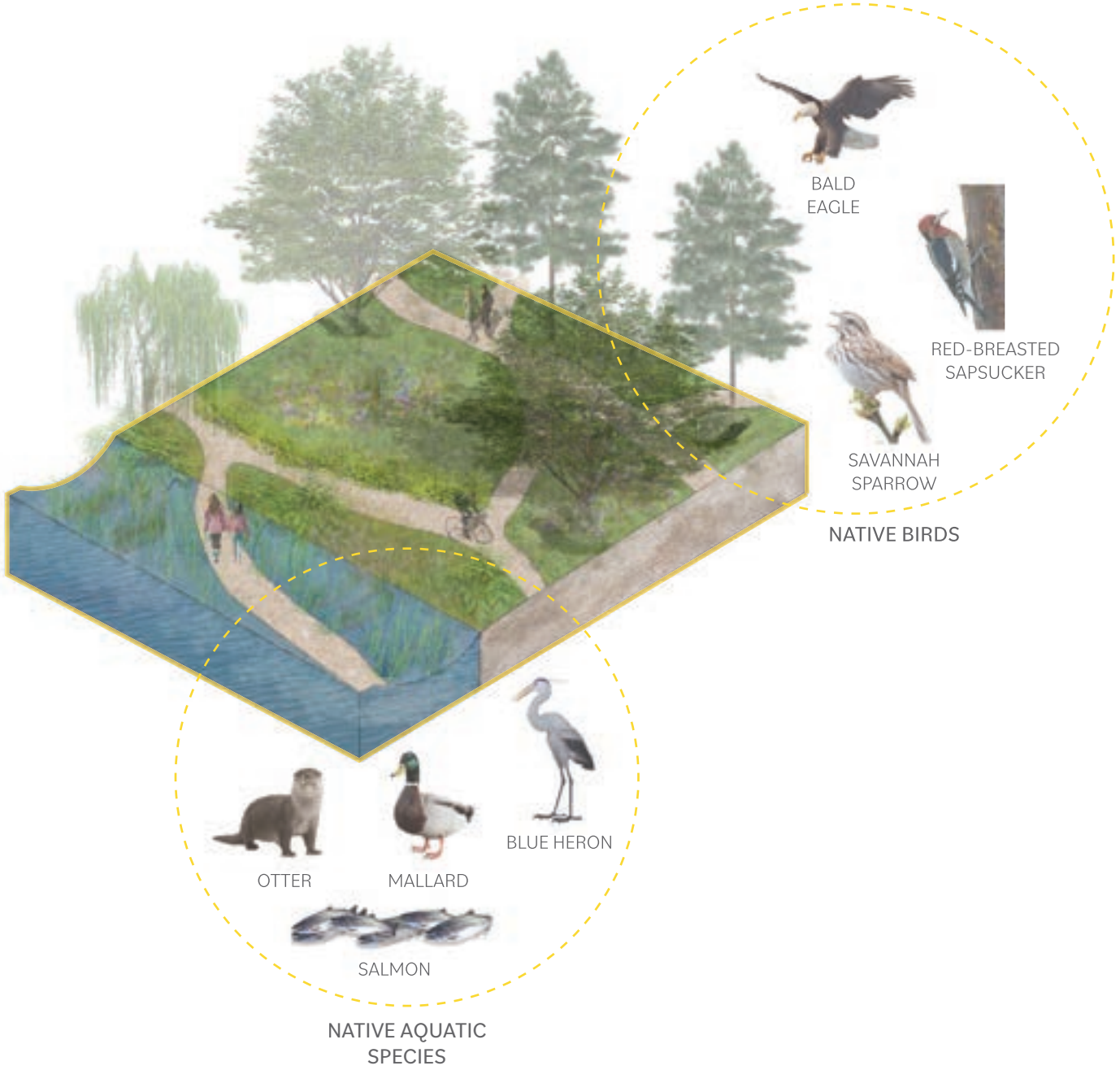




FLOATING WETLANDS

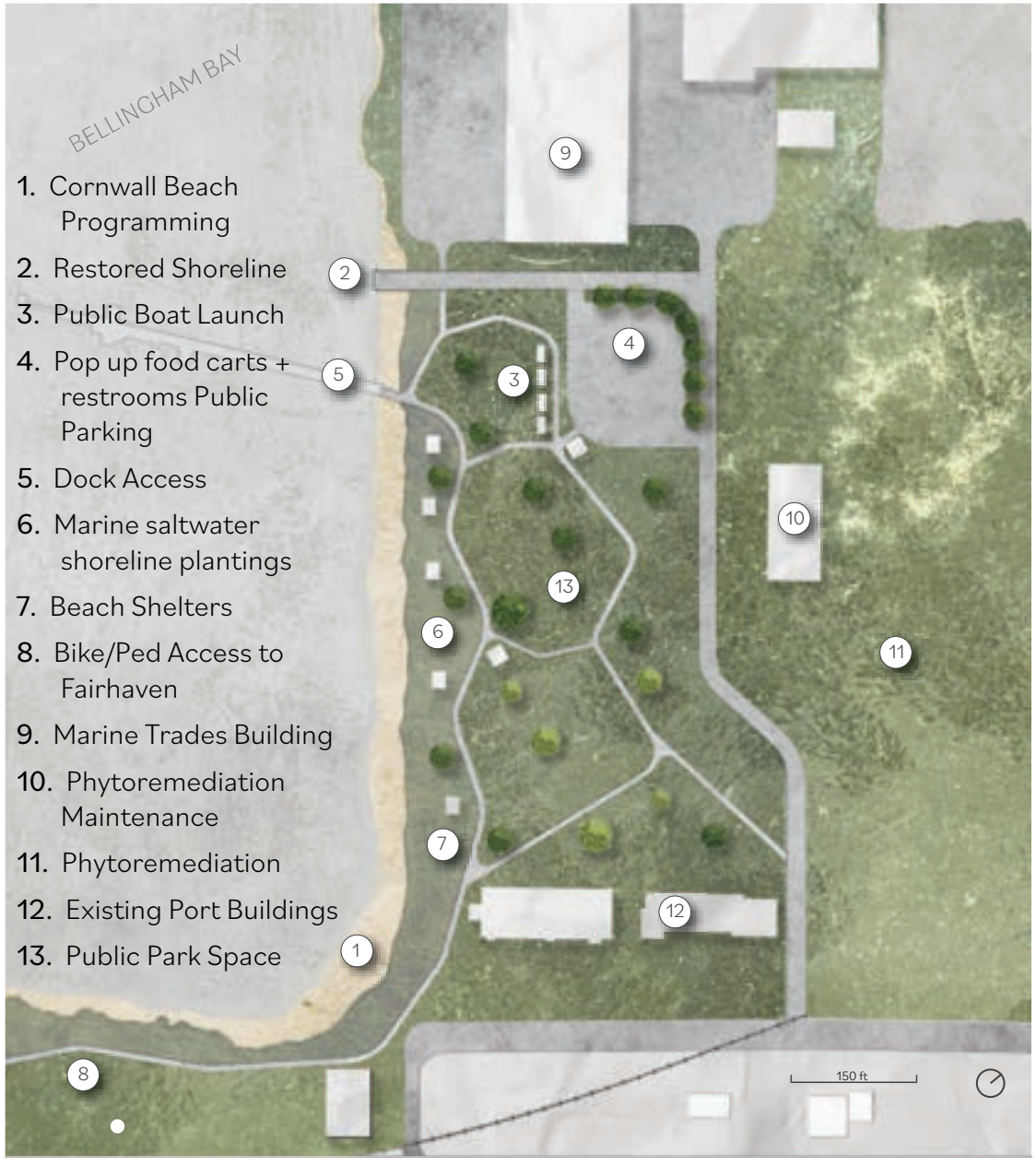


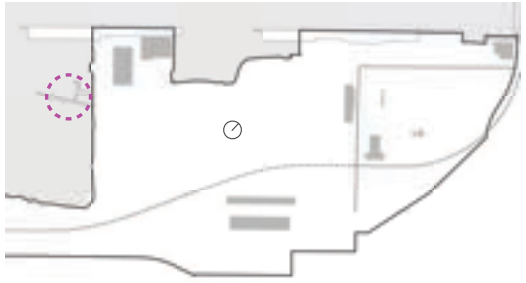
RESILIENT MATERIALS


BALD
EAGLE
RED-BREASTED
SAPSUCKER
SAVANNAH
SPARROW
NATIVE BIRDS
BLUE HERON
OTTER
MALLARD
SALMON
NATIVE AQUATIC
SPECIES

RESTORING CORNWALL BEACH

Circulation, Amenities, and Restoration



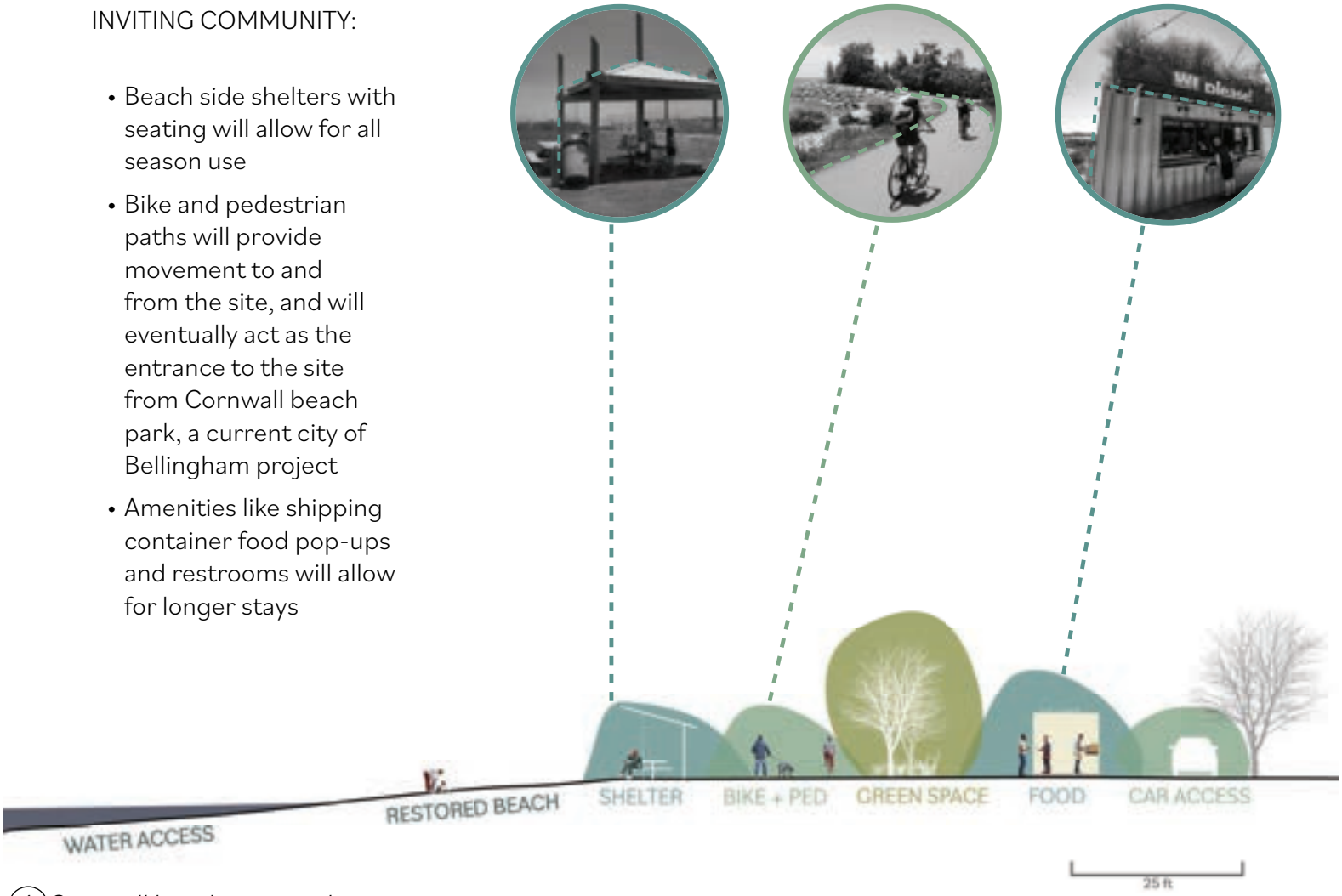


Extending and restoring Cornwall beach by removing the existing rip rap and concrete will invite both non-human and human activity.

Existing Conditions
Photo credit: Kyra Taubel-Bruce

INVITING COMMUNITY:

- Beach side shelters with seating will allow for all season use
- Bike and pedestrian paths will provide movement to and from the site, and will eventually act as the entrance to the site from Cornwall beach park, a current city of Bellingham project
- Amenities like shipping container food pop-ups and restrooms will allow for longer stays



(1) Cornwall beach, restored.

RESTORING CORNWALL BEACH

Circulation, Amenities, and Restoration

sea-watch
Angelica lucida

silverweed
Potentilla anserina

dunegrass
Elymus mollis

Hendersons checker mallow
Sidalcea hendersonii

madrona
Arbutus menziesii

broad-leaved stonecrop
Sedum spathulifolium

tufted hairgrass
Deschamsia cespitosa

beach strawberry
Fragaria chiloensis

Lyngbye's sedge
Carex lyngbyei

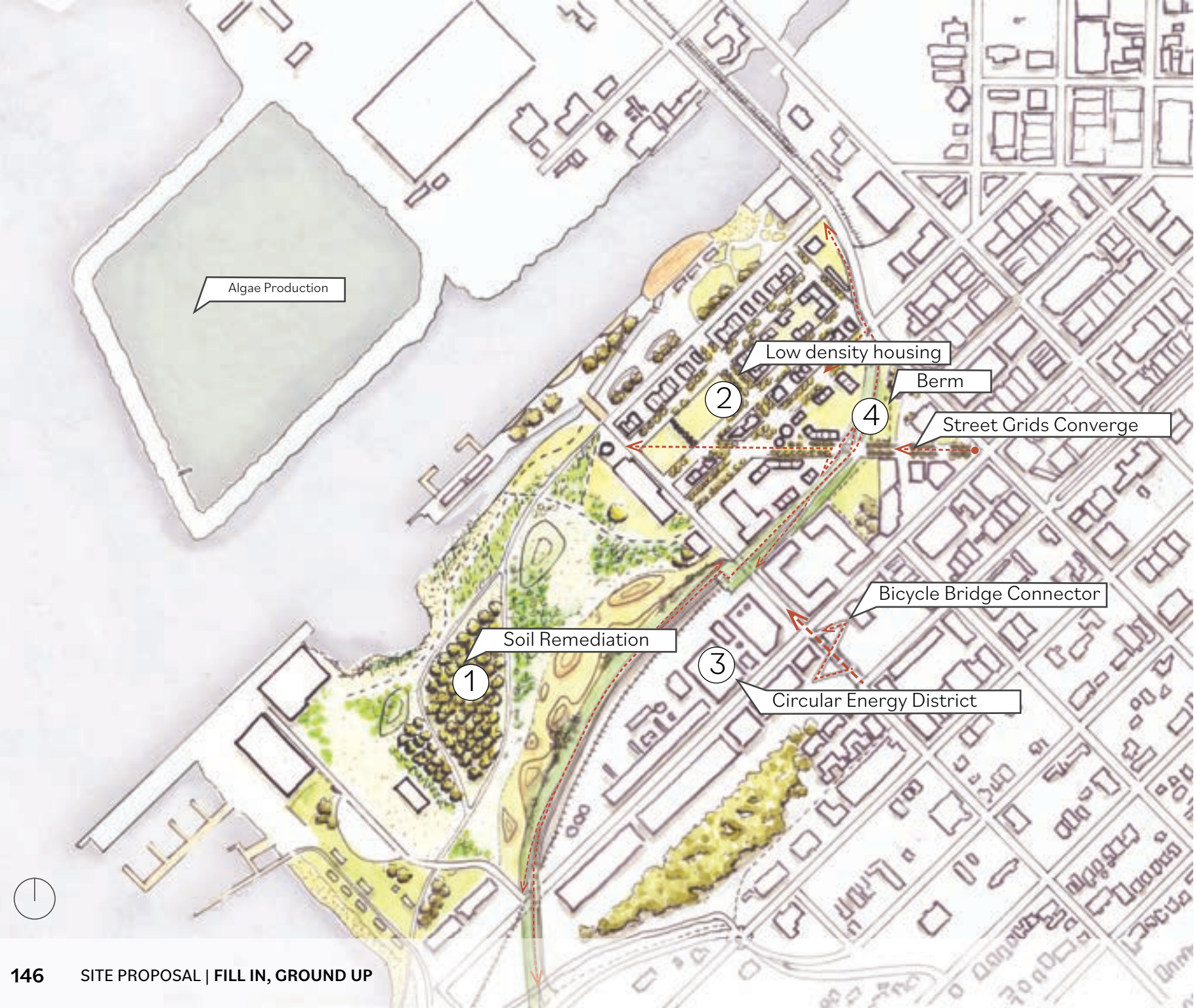
sea thrift *Armeria maritima*

shore pine
Pinus contorta

seviceberry
Amelanchier alnifolia

A marine shoreline planting palette of native salt water tolerant dune grasses, flowers, shrubs, ground cover, and trees will invite native fauna to the previously uninhabitable shoreline.

Cornwall Beach Imagined: Looking northwest toward the Nooksack River Estuary.


Algae Production
Low density housing
Berm
Street Grids Converge
Bicycle Bridge Connector
Soil Remediation
Circular Energy District
1
2
3
4

10-30 YEARS

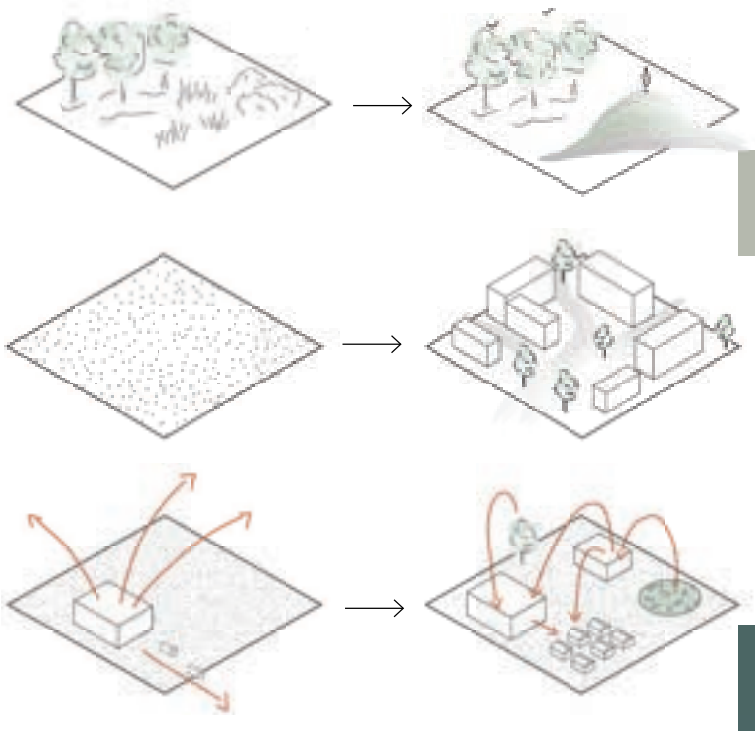
ESTABLISH VITALITY

① Soil remediation reaches a safe level for introducing human access. Berms made of the site's concrete offer safe circulation and new views of the site.

② A vibrant low-rise high-density housing district is built using green materials produced on site.

③ The circular energy district creates a closed loop renewable energy and green material system.

④ A berm made of reused concrete from site is built around the railway, reducing noise pollution, increasing safety, connects to downtown and treats stormwater



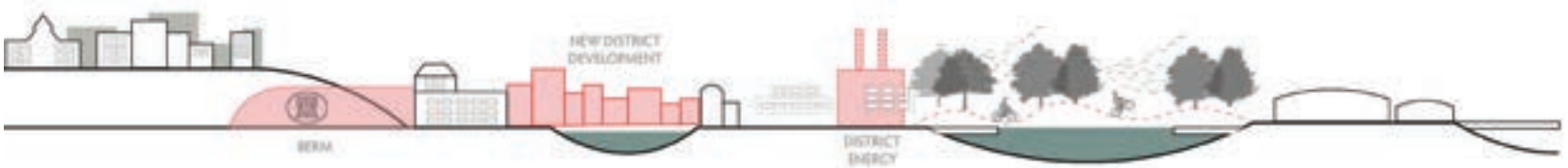
CARBON WINS

- Local renewable energy production and use eliminates dependence on natural gas for peak hours
- Embodied carbon in locally produced building materials

ECONOMIC WINS

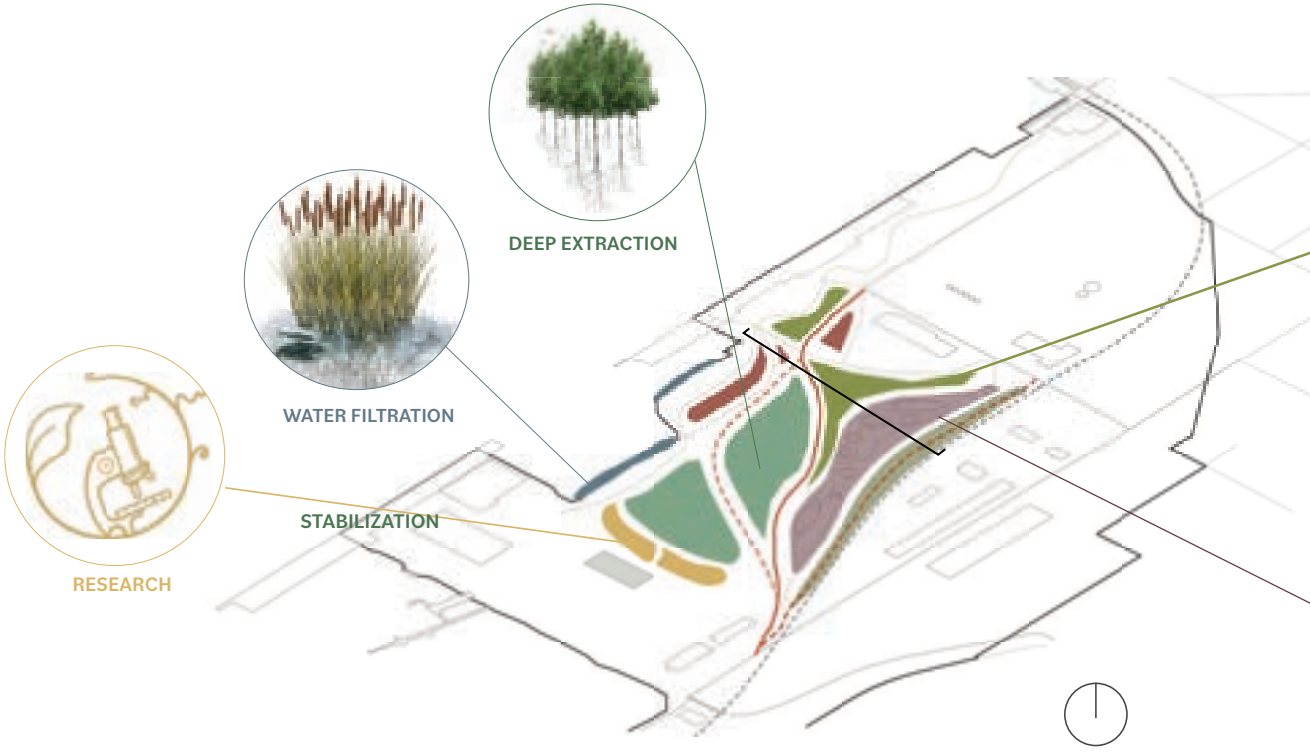
Employment from:

- Green jobs created by circular energy district: solar, algae, biochar
- Green material production
- Commercial space in new waterfront housing development

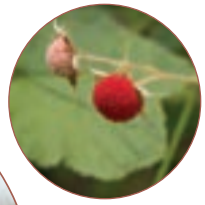


RESTORING ECOLOGY

Expanding Access



Once phytoremediation vegetation has been established and has been in process for at least 10 years access to the southwestern end of the site would be safely expanded. This newly restored access is an opportunity to restore ecological function and play to the formerly paved site. The park's new vegetation serves as a carbon sink and community resource.



Rubus parviflorus

Ribes sanguineum

Mahonia aquifolium

NATIVE PLANTS

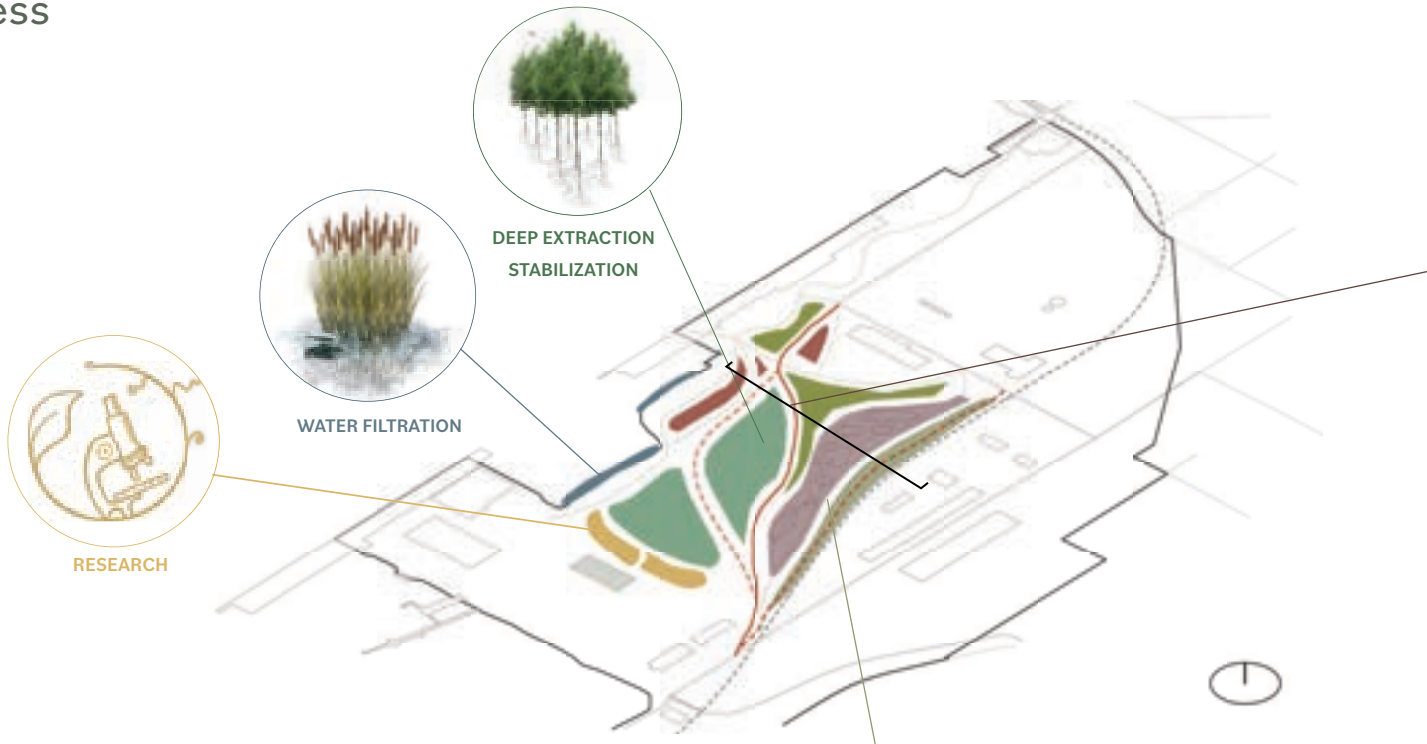
As soils are remediated and phytotechnologies get phased out, native plants with an eye towards carbon sequestration and climate resilience will be phased in, helping to restore native ecology including seasonally wet zones.

Access to the southwestern region will also be expanded. An existing temporary pump track located on site will be moved to a permanent location in the southeastern edge of the park and expanded in size.

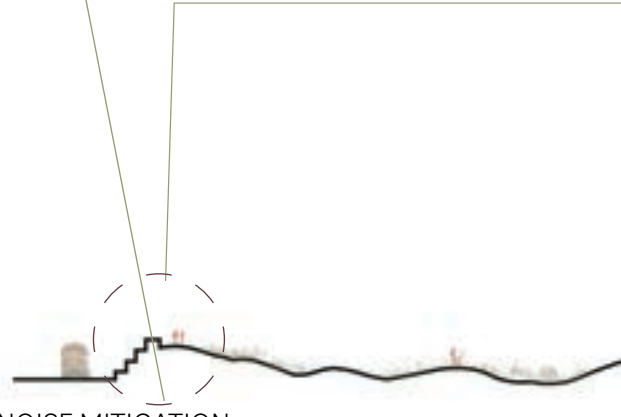
NATIVE PLANTINGS

RESTORING ECOLOGY

Expanding Access



Additional permanent channels of circulation are established safely through the midsection of the site, offering year round multi-modal access for Bellingham residents and tourists alike. These new points of access become an opportunity for material reuse and innovation.



BERM FOR TRAIN NOISE MITIGATION

GABION WALL

TRAIN NOISE MITIGATION

RECYCLED CONCRETE PATHWAY

FLOOD PROTECTION

RECYCLED CONCRETE FILL

CIRCULATION WITH VIEWS

The concrete that was removed from the southwestern site to make way for phytoremediation plantings gets reused to create varying sized berms, which not only establish permanent connections through the site but mitigate several site hazards such as noise from the train and future possible flooding. These multi modal pathways offer new views of the waterfront.

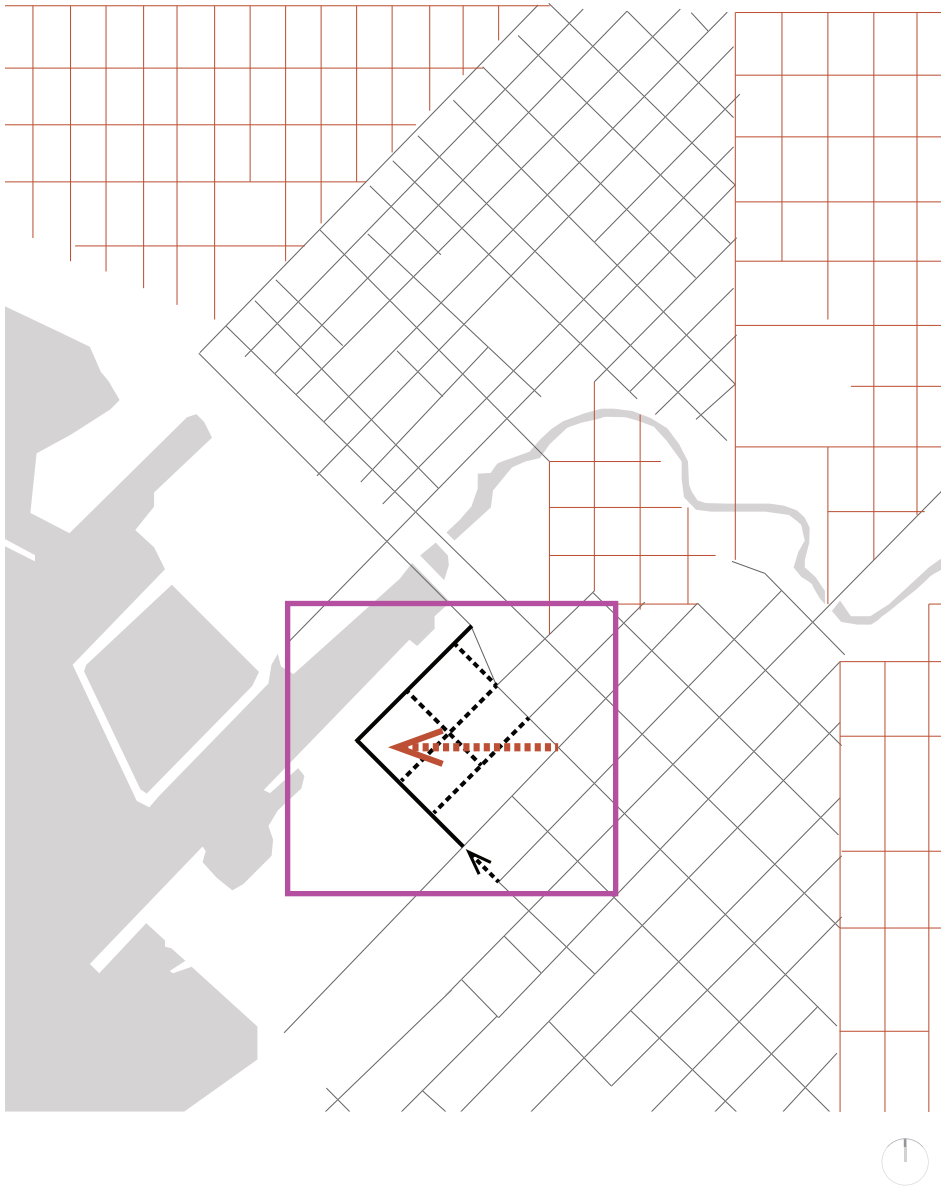
HIGH-DENSITY LOW-RISE DEVELOPMENT

Site Concept

The proposed development area takes cues from the convergence of two street grids in downtown Bellingham. The traditional cardinal direction grid at the north and east is broken along the waterfront, where the grid shifts to respond to the water's edge. While this original layout made sense from a planning standpoint, it limits the **view corridors to the surrounding Bellingham Bay**.

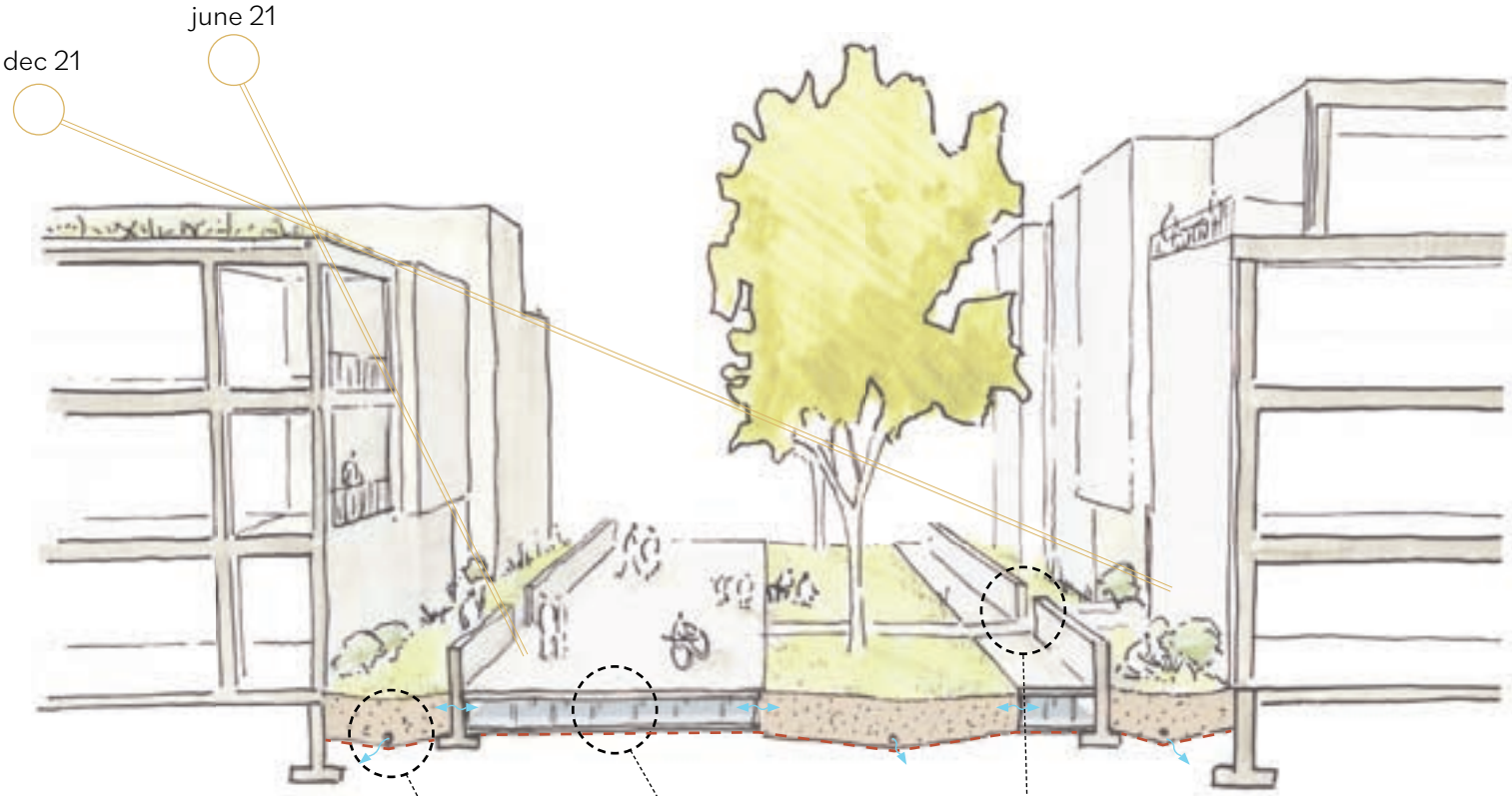
By introducing a new east/west axis at the corner of Cornwall Ave and Chestnut Ave, a new corridor opens up views to the surrounding Bay. It also moves along a corridor that **passes by the existing landmarks on the site**, terminating at the entrance to the new Exporatorium and the new location of the acid ball.

Streetscapes are designed specifically for multi-use and residential corridors, with widths that take special account of street tree health. Stormwater catchment basins beneath permeable pavers create treatment areas during storm events, with overflows connected to adjacent bioswales.

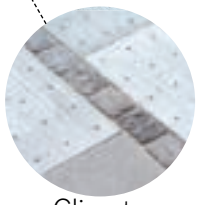


HIGH-DENSITY LOW-RISE DEVELOPMENT

Streetscape Design



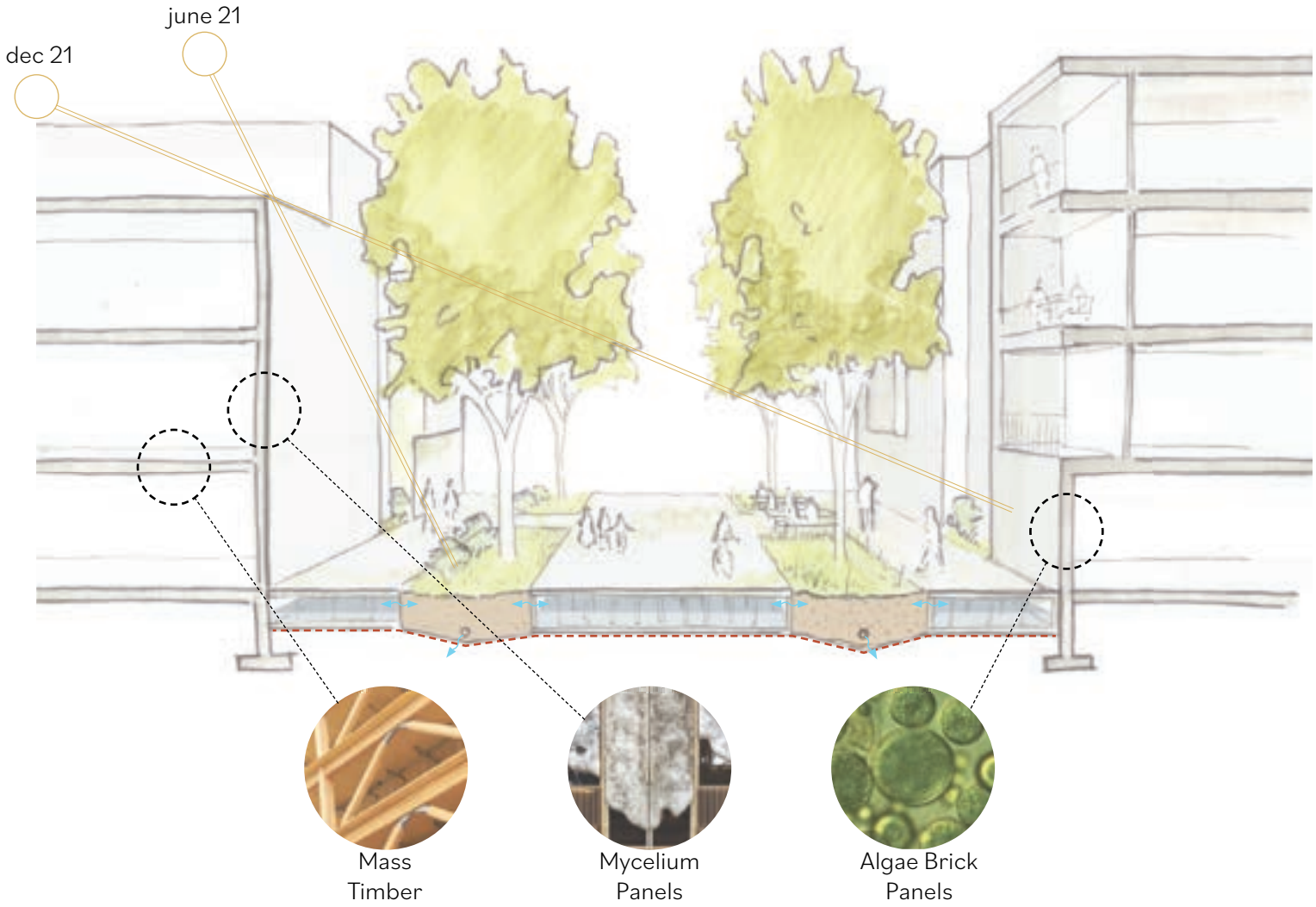
Bioretention Planters



Climate Tile

Retractable Flood Walls

RESIDENTIAL - STORMWATER MITIGATION



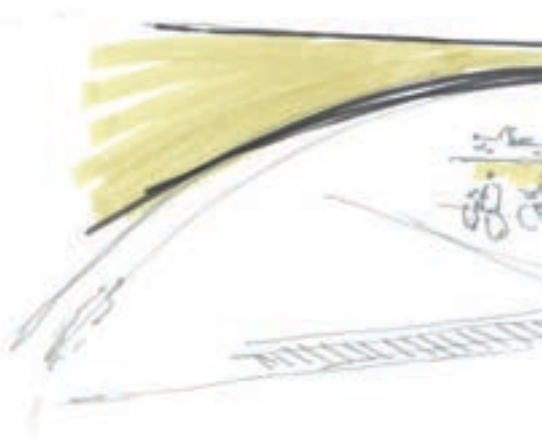
MIXED USE - SUSTAINABLE BUILDING MATERIALS

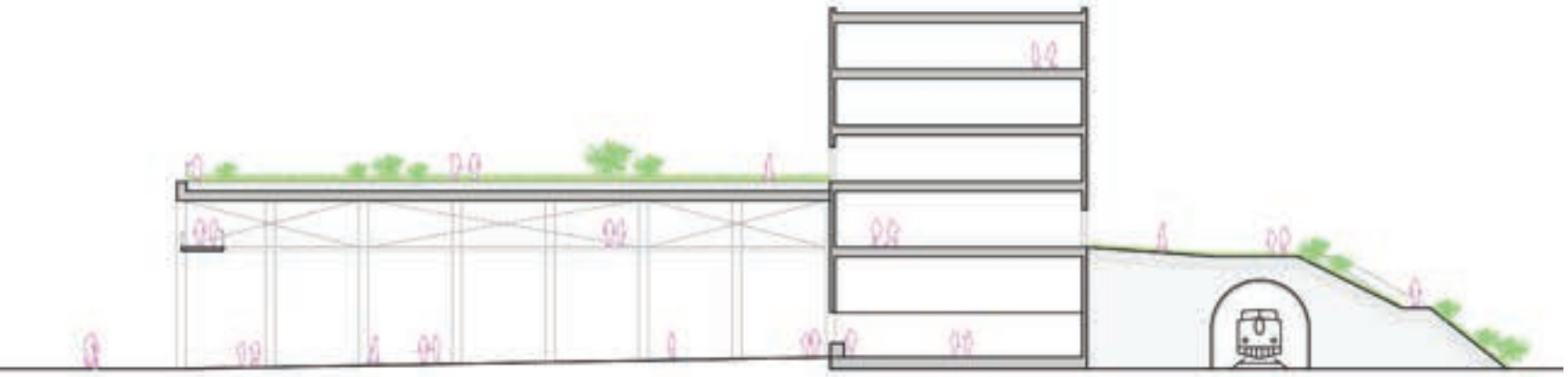
ENCOURAGING HEALTHY HOUSING & ADDRESSING SEA LEVEL RISE

Berm Bridge

The existing train is both a frequent acoustic nuisance and a physiological hazard from extended exposure. By creating a continuous landform bridge over the tracks adjacent to proposed housing and downtown, noise pollution will be limited, physical hazards from trespassing outside of crossings will be reduced, and a continuous rampart-like nature walk will provide a new perspective of the former port. This walkway will abut the new location of The Millworks, providing access to additional walk-up customers to future tenants.

In addition, the berm will provide a barrier to future sea level rise and protect the valuable new circular energy district from sea level infiltration.





0′ 20′ 40′ Covered Public Terrace The Millworks Berm Bridge

CIRCULAR ENERGY DISTRICT

Producing Local Energy with Local Inputs

Locally sourced materials are harvested to create energy on-site, which is distributed to new construction and the surrounding region. Algae from the adjacent ASB pond is refined into biofuels and used for **algae masonry** construction. Biomass from the new phytoremediation forest is incinerated for energy production at the district energy plant, and also used to create **mass timber** and plywood.

Raw water from the Lake Whatcom pipeline creates energy through the **micro-hydro system**, and the passed water is used to irrigate the plantings at the far south end of the site.

In addition to the energy benefits provided by this material cycling, research at the new green materials manufacturing centers may encourage **collaboration with the nearby Western Washington University** campus, and the facilities will offer **new jobs for a range of education levels**.

ALGAE PRODUCTION

LAKE WHATCOM UNTREATED WATER

PHYTOREMEDIATION BIOMASS

CROSS LAMINATED TIMBER PRODUCTION

ALGAE BRICKS

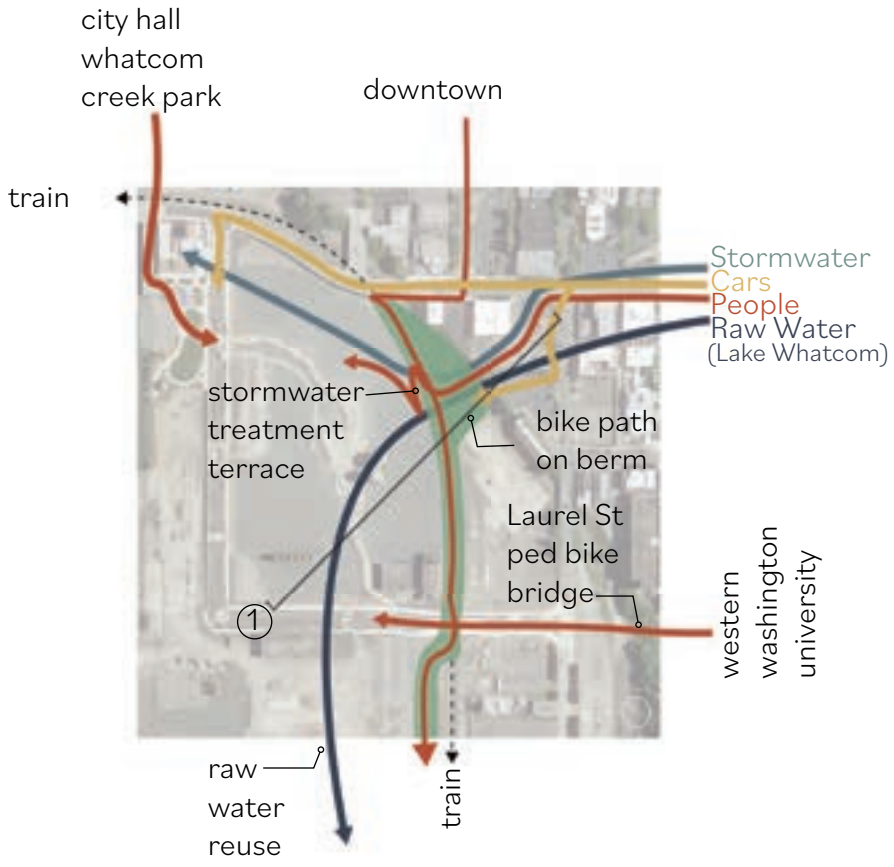
DISTRICT ENERGY PLANT

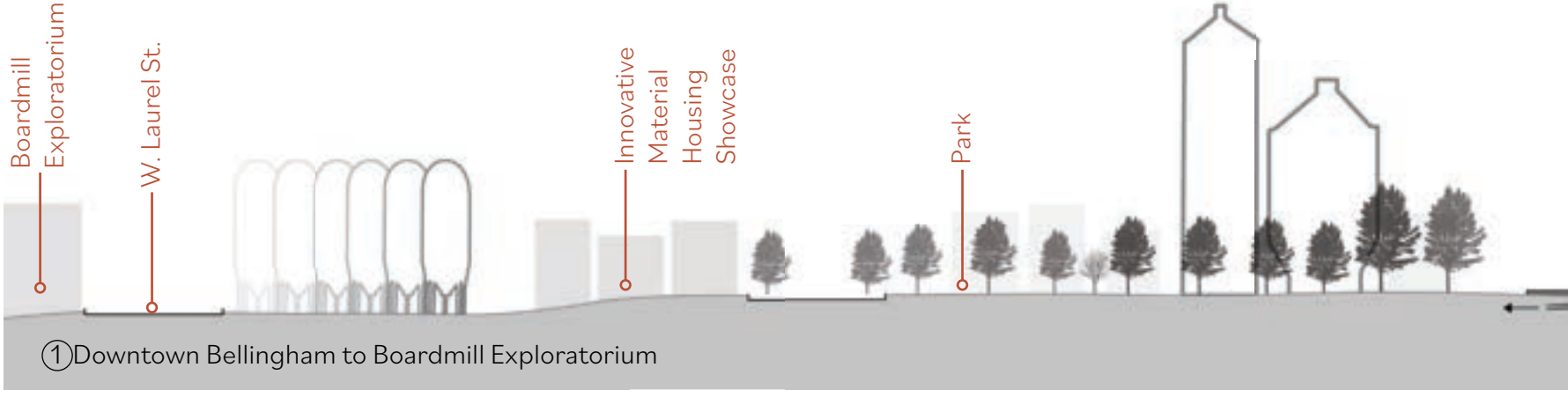
ALGAE REFINERY

BERM TO BAY

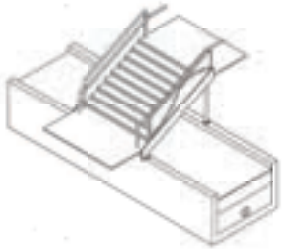
Connecting Downtown to the Waterfront District

To create a connection from downtown Bellingham to the waterfront, a berm will be built over the existing train line. The berm will cap the train until W. Laurel St., then will shift to the west, uncovering the train but still acting as a sound barrier and pedestrian/cyclist path. A pedestrian and bicyclist bridge will be made from E. Laurel St. to W. Laurel St. to improve the connection between Western Washington University and the waterfront.

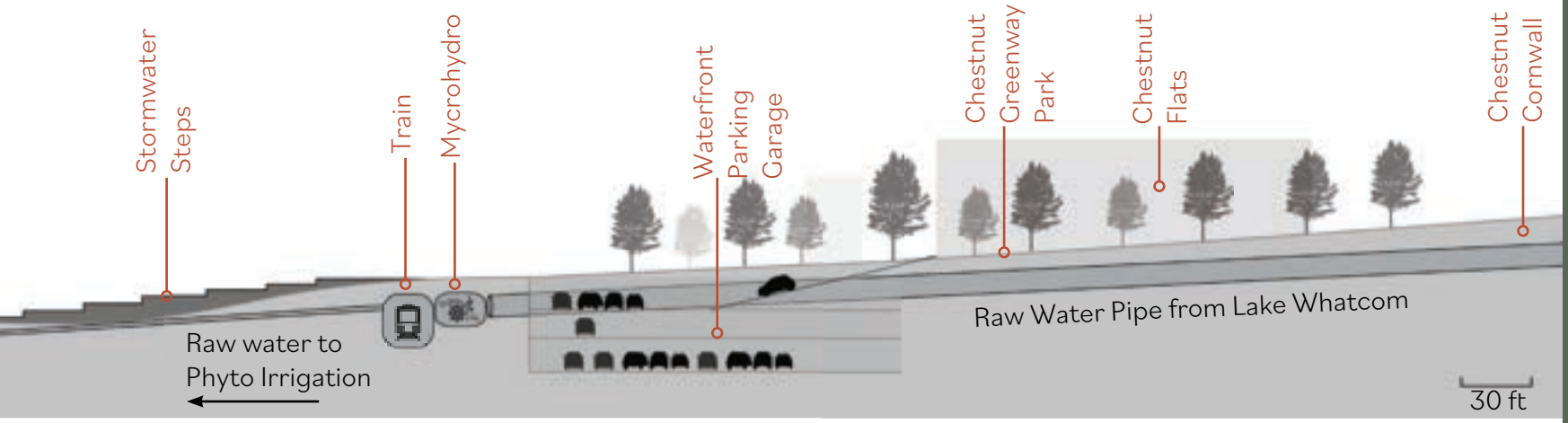




1 Downtown Bellingham to Boardmill Exploratorium



Stormwater steps: A bermed walkway will provide safe and direct access to the site from downtown and will also provide circulation within the site. The berm will be multifunctional: improving quality of life on the site (noise reduction), stormwater treatment, site of microhydo electricity generation, and underground parking. The stormwater treatment terraces will create a hillside that provides access, invitations to stay, and education about stormwater systems.

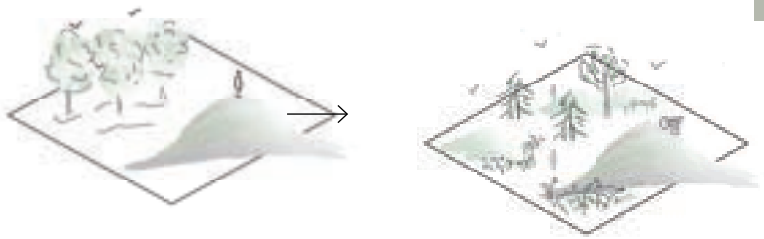



Algae Production
1
2
Circular Energy District

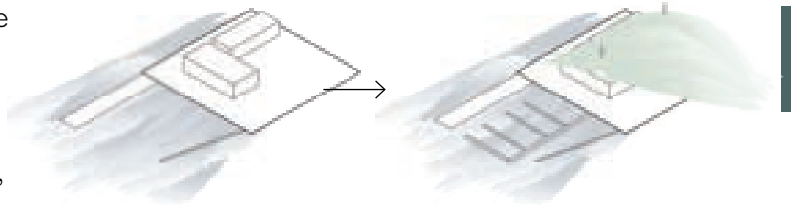
30-50 YEARS

SUSTAINED RESILIENCE

① Ecological health is restored to the site along with increased access to the rewilded log pond area.



② Water recreation, marine industry, and public greenspace exist in a layered waterfront. A cap is built over the existing buildings, providing both covered storage, public greenspace, and views of the active waterfront.



CARBON WINS

- Remediated areas have shifted to native plantings and established wetlands act as carbon sinks
- All electric harbor powered by biofuels

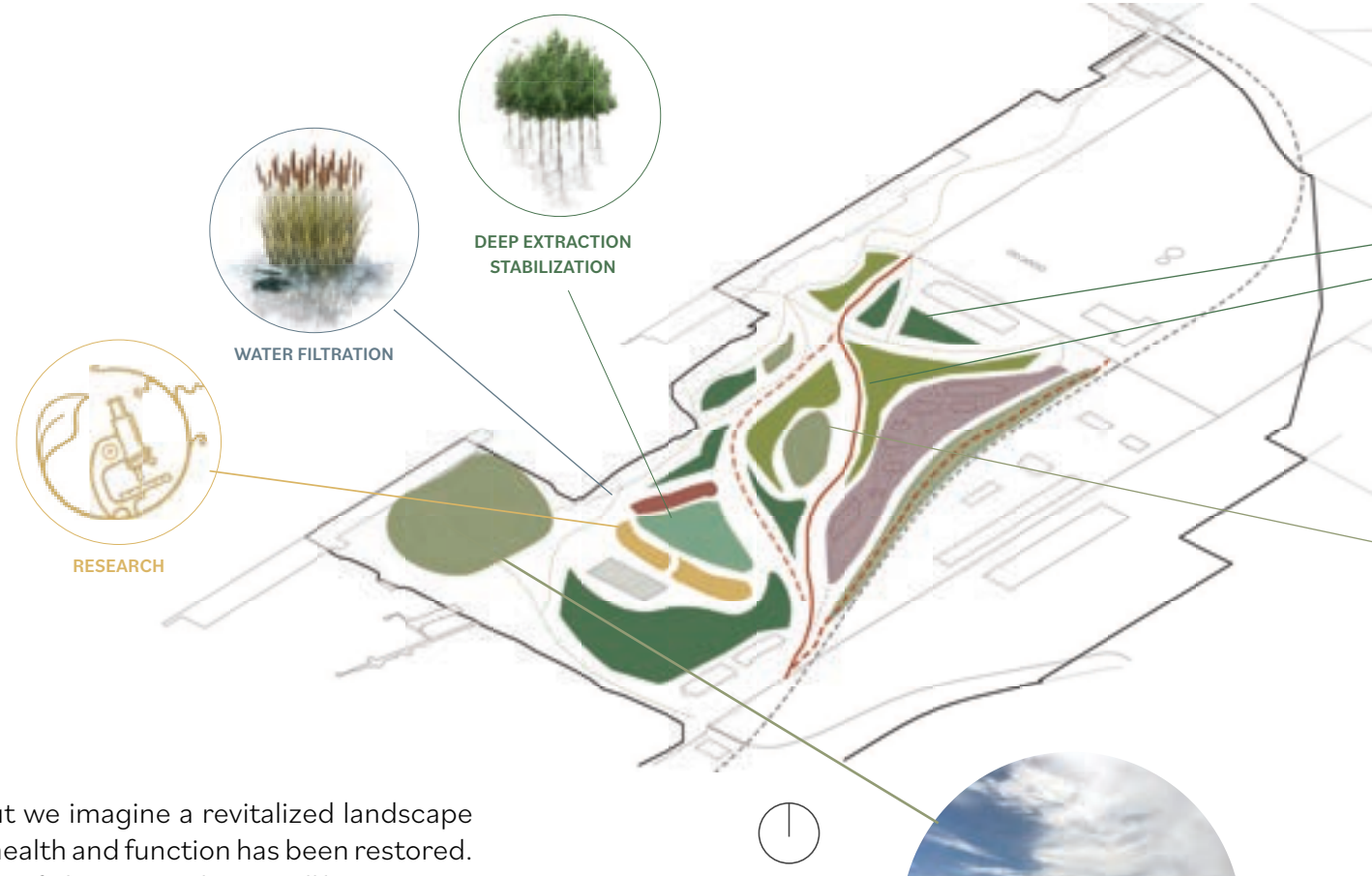
ECONOMIC WINS

Employment from:

- Expanded marine industry
- Marine market, kelp-kitchen, sea to table restaurant
- Recreational water activities

VIBRANT ECOLOGY

Engaging Landscapes



About 50 years out we imagine a revitalized landscape whose ecological health and function has been restored. While small pockets of phytoremedation will be ongoing, the park will have re-wilded feel, meandering trails, opportunities for rest and reflection, along with new undulating landforms for play, providing dry pockets and views among the restored wetlands.

EXPANDED TRAILS W/VIEWS

RESTORED ECOLOGY

Erysimum + Bee

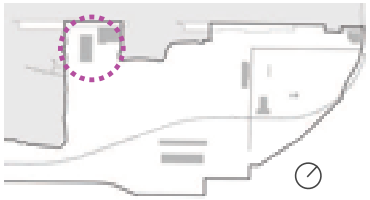
Huechera + Native Bee

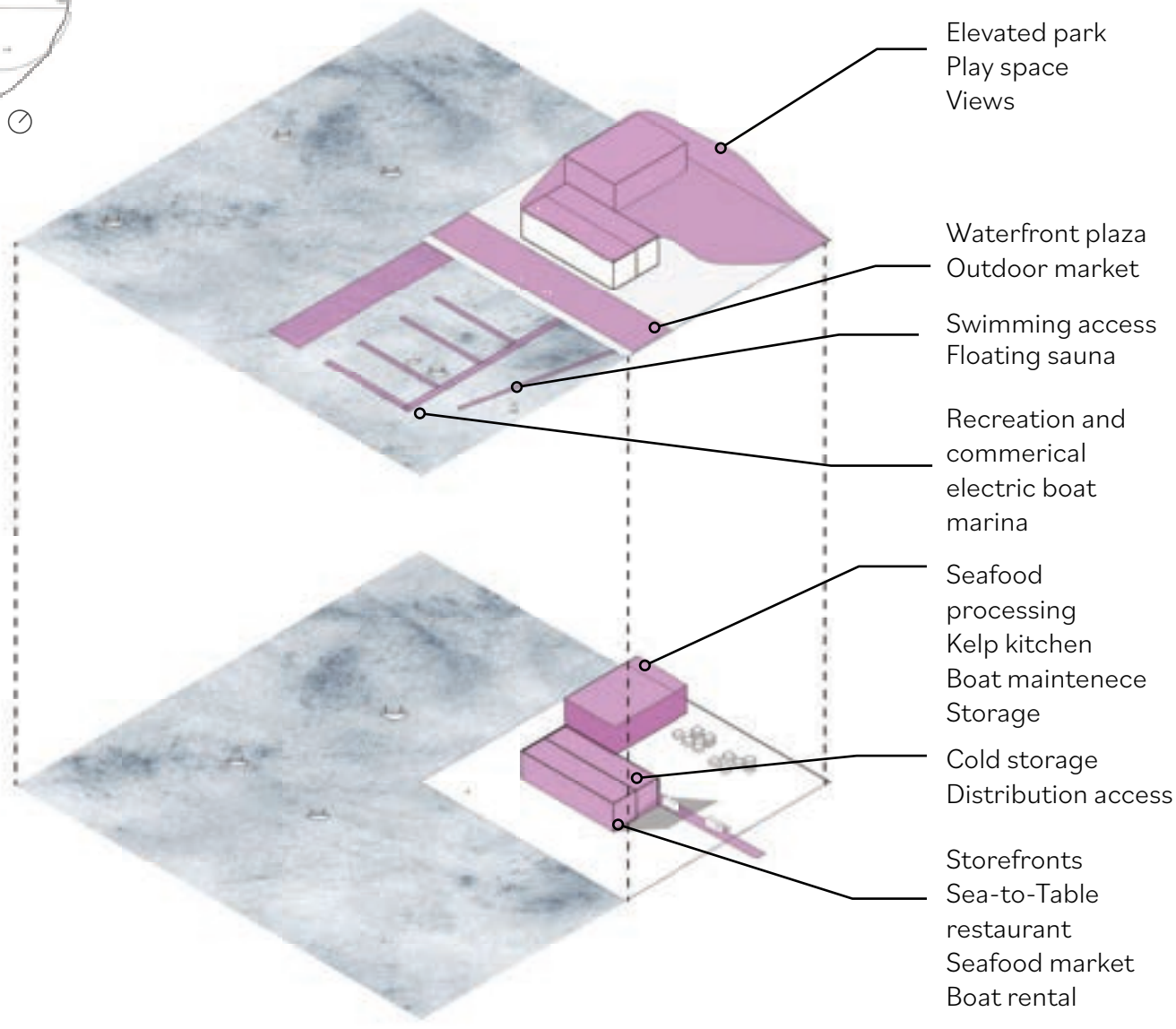
Ribes + Hummingbird

NEW LANDFORMS

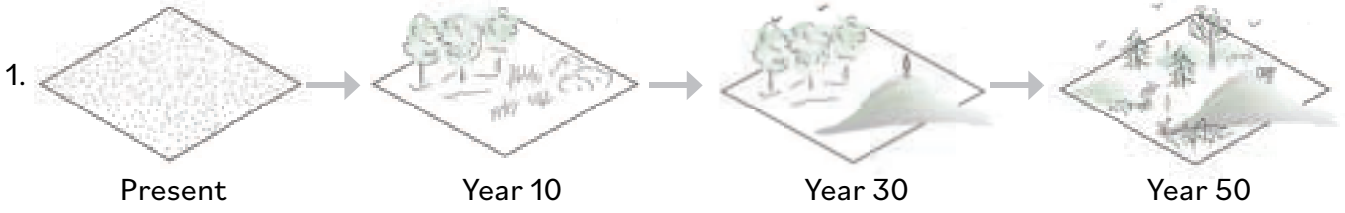
WHATCOM HARBOR

A Layered Waterfront

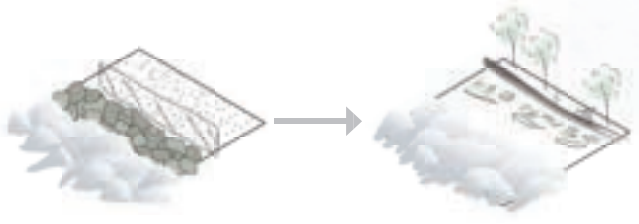


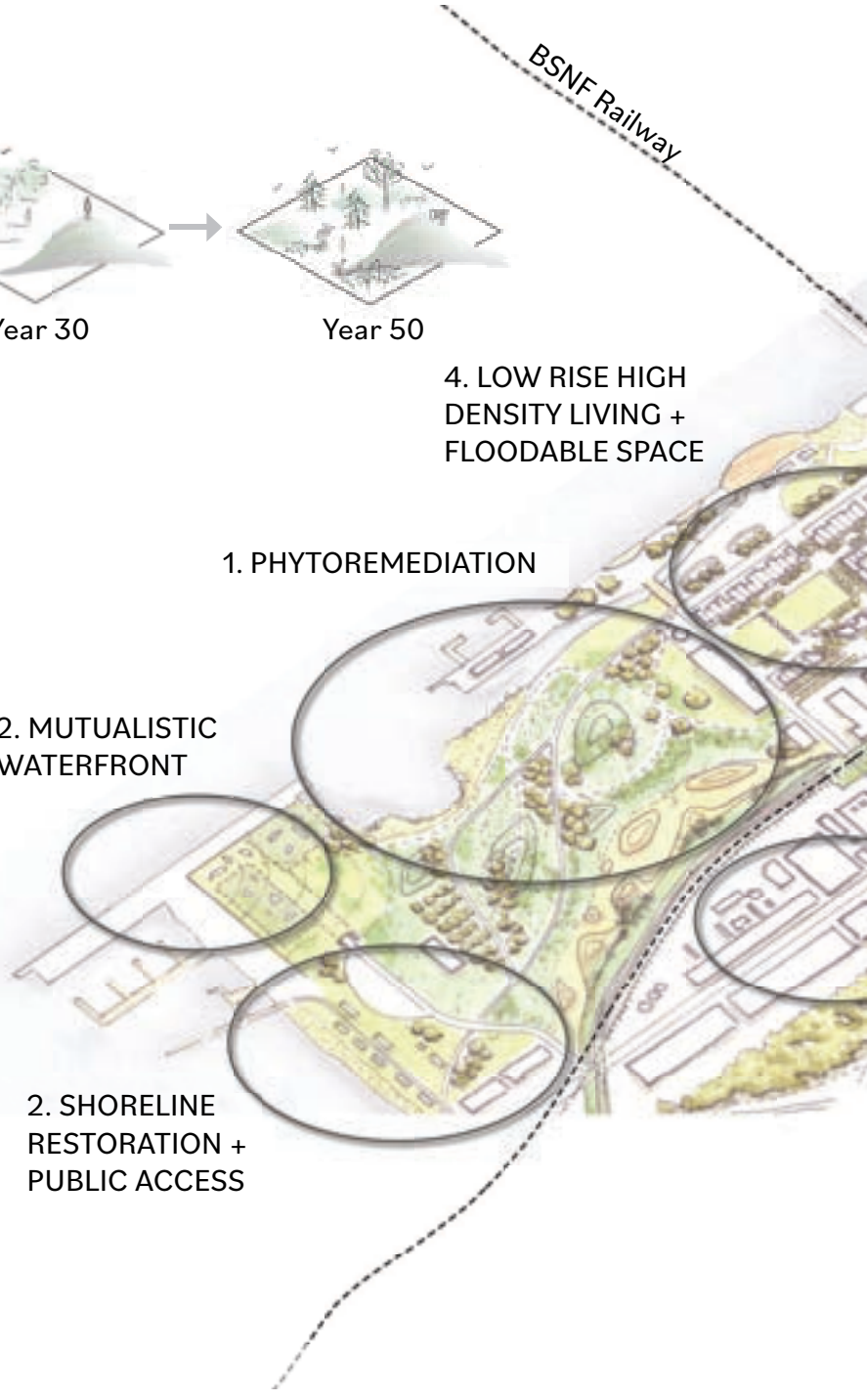


A MUTUALISTIC WATERFRONT: A vibrant and active waterfront provides space for marine industries, water recreation, and celebration of food from the sea to exist in a single space.


1.
Present
Year 10
Year 30
Year 50

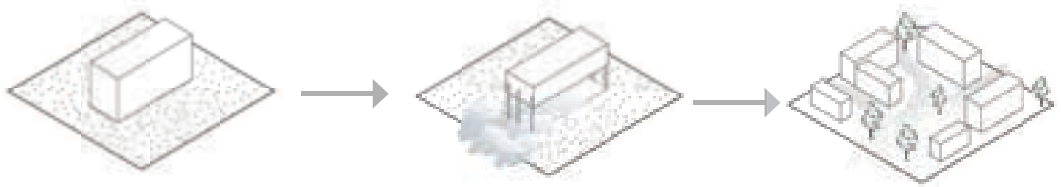

2.
Present
Year 30

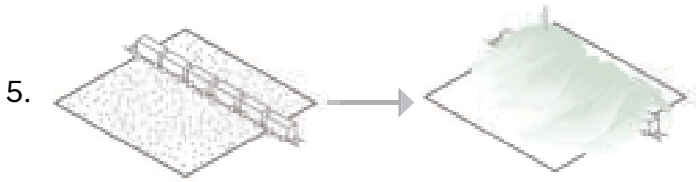

3.
Present
Year 10

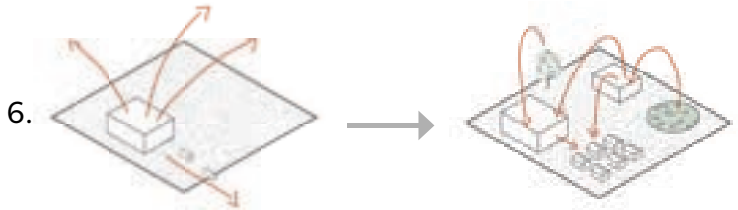

BSNF Railway
4. LOW RISE HIGH DENSITY LIVING + FLOODABLE SPACE
1. PHYTOREMEDIATION
2. MUTUALISTIC WATERFRONT
2. SHORELINE RESTORATION + PUBLIC ACCESS

5. BERMED TRAIN CROSSING + STORM-WATER STEPS

6. CIRCULAR ENERGY DISTRICT







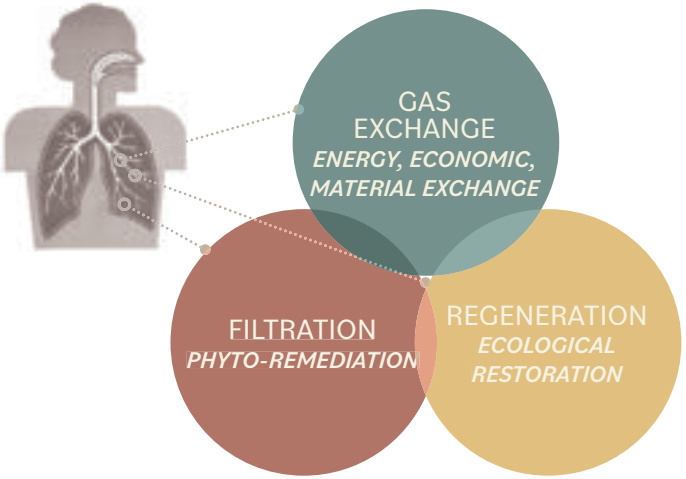
EXCHANGING FUTURES

+ Erin Irby
+ Drew Landis
+ Adam Koehn
+ Erynne Van Zee

Contending with climate change requires a drastic reimagining of our status quo relationships to our communities, environments, and economies. **Exchanging Futures** links waste, contamination, water, energy, economic growth, housing, knowledge generation, and ecological communities into nested, interdependent systems to propose futures for the Bellingham Waterfront that respond to the realities of a post-industrial site at sea level. These systems circulate through the site and, when strategically linked, help exchange a dire future for a more resilient alternative.

CONCEPTUAL FRAMEWORK

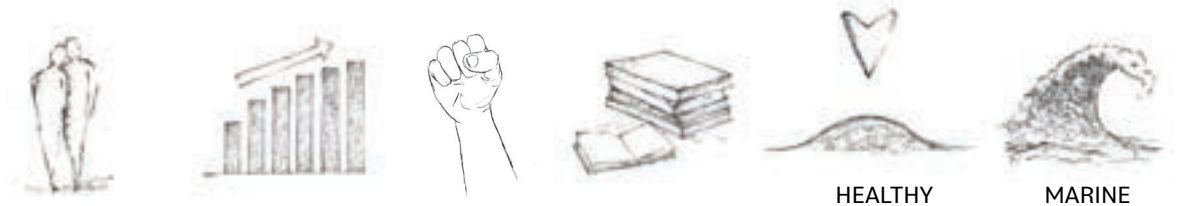
anatomical systems to exchanging futures



In the initial phases of design, Exchanging Futures was inspired by the dynamic processes of anatomy—respiration, the heart, and liver function—both due to similarities in form and exchange-based systems designed on-site. Our concept evolved to more broadly focus on exchanges, but remnants of applied anatomical terms like arteries and hearts remain.

VALUES

community & climate-based driving forces

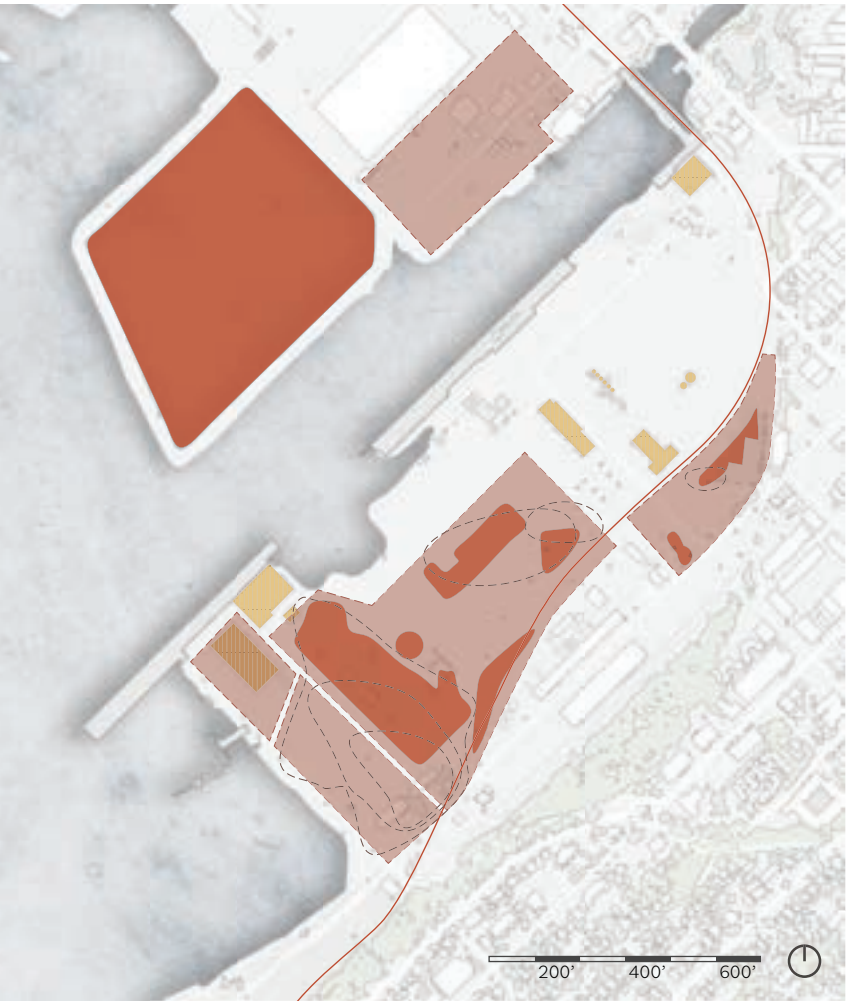


COMMUNITY VIBRANCY | ECONOMIC VITALITY | CREATIVITY & INNOVATION | KNOWLEDGE GENERATION | HEALTHY SOILS & ECOLOGY | MARINE HEALTH & RESOURCES

WHO ARE WE DESIGNING FOR?

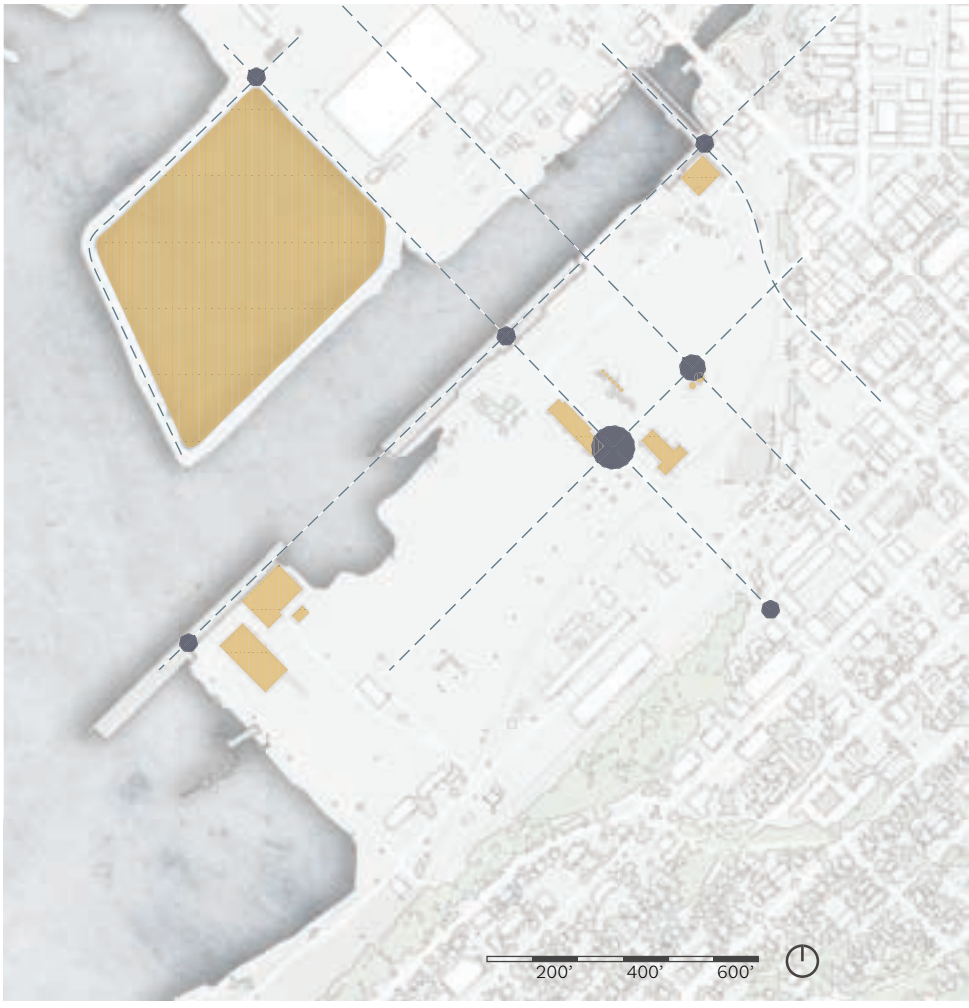
responsive & needs-driven design

STUDENTS | FAMILIES | FLORA & FAUNA | COMMUNITY MEMBERS | GREEN COLLAR WORKERS | RESEARCHERS



EXISTING SITE HAZARDS

The waterfront’s past can be represented on the site in the form of hazardous soil deposits. The map above shows existing hazardous deposits ranging from **petroleum pollution, to mercury contamination, to approximate ground water runoff contamination**. The majority of the pollution left on site exists on the southern end of the site and ASB pond.



AXES, NODES, & LANDMARKS

The existing structures on the site, as well as the ASB pond, provide the waterfront with important reminders of the past and landmarks for the city to celebrate (yellow highlights). The sight line from downtown create organizing axis (blue lines) through the site to organize future development. The interactions of these axes and landmarks from the sites primary nodes for gathering (blue dots).

SITE PROPOSED PROGRAM AREAS

responding to the existing environment

PHYTOREMEDIATION

ASB LAGOON TRANSFORMATION

RESEARCH PLOTS & HUB

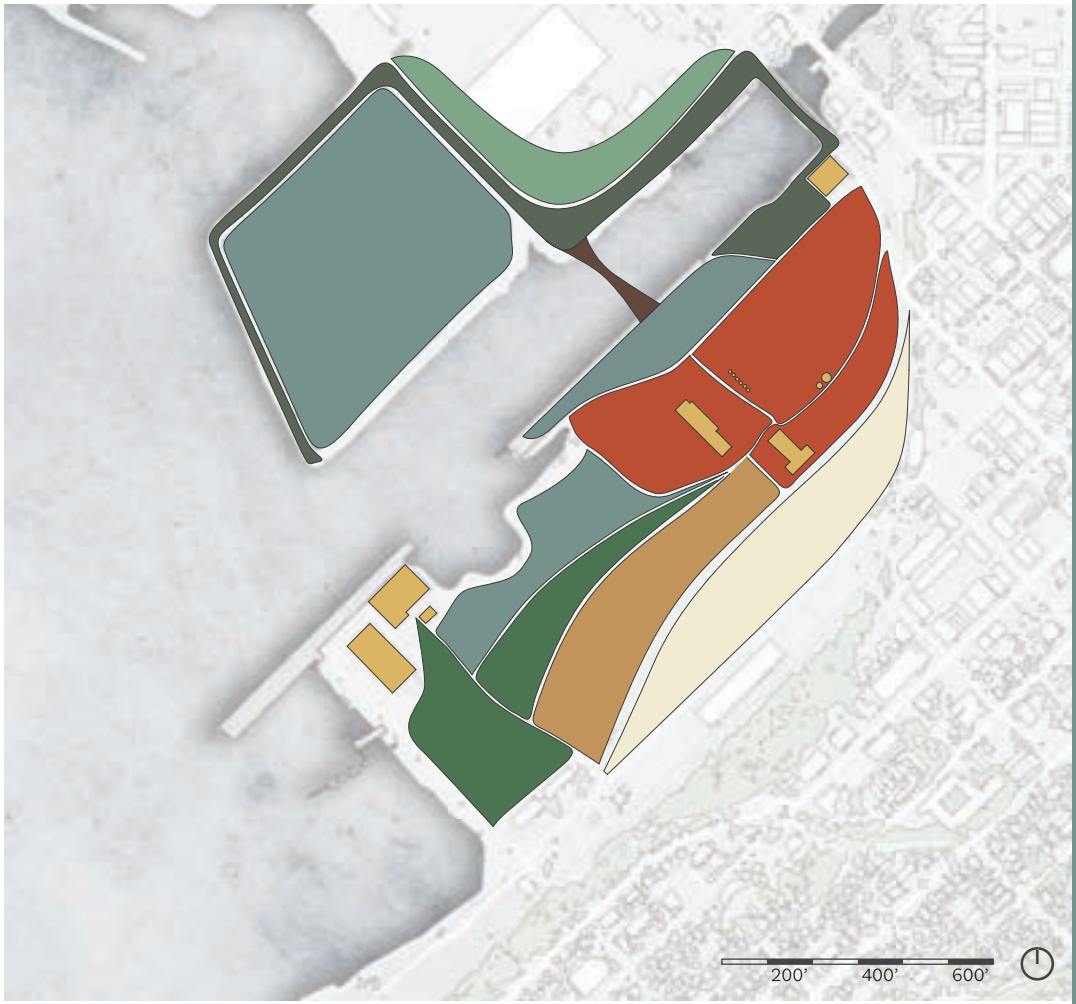
TIDAL ENERGY BRIDGE

URBAN HEART

CLEAN INDUSTRY EXPANSION

GREEN ARTERIES

EXISTING “LANDMARKS”

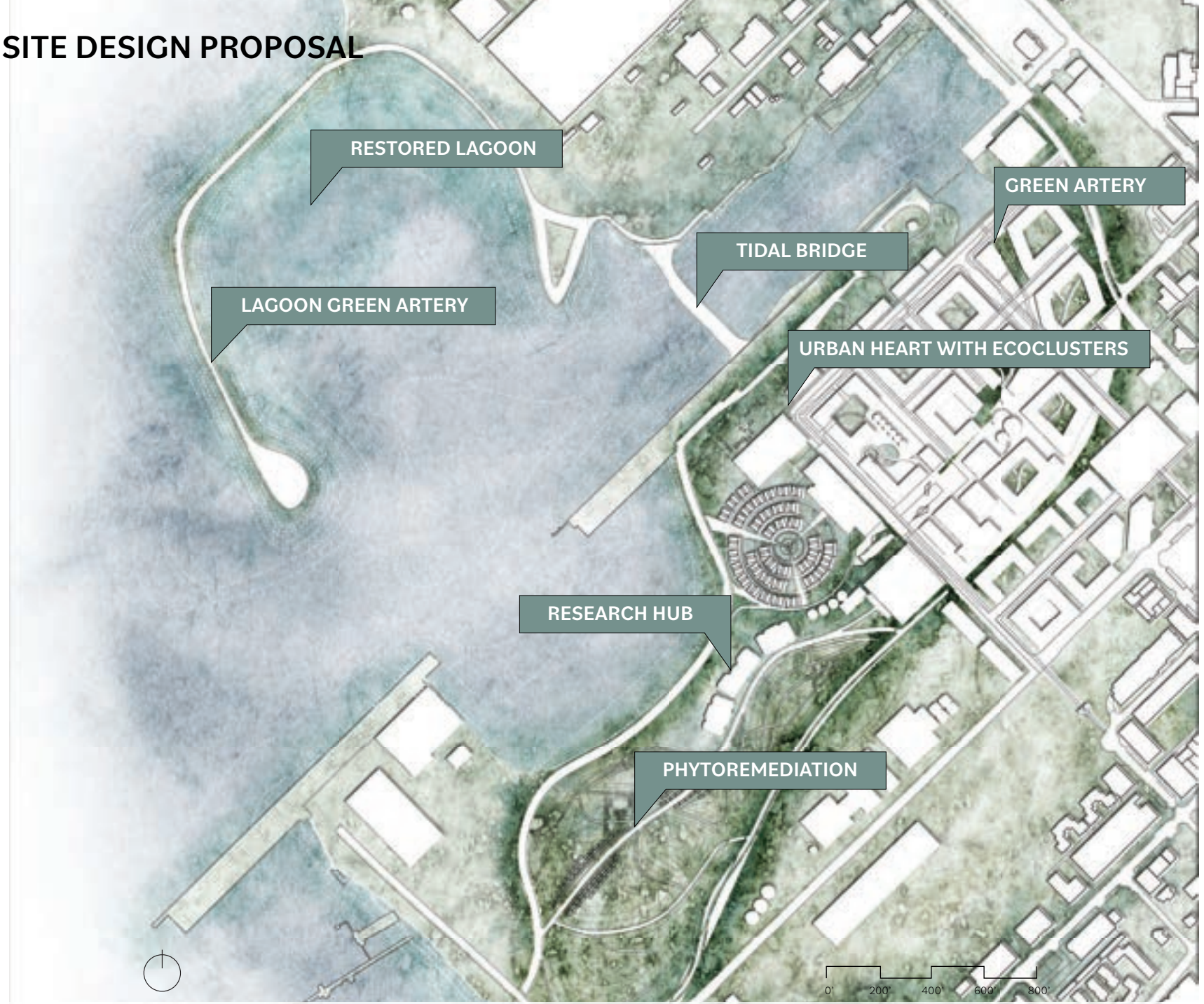


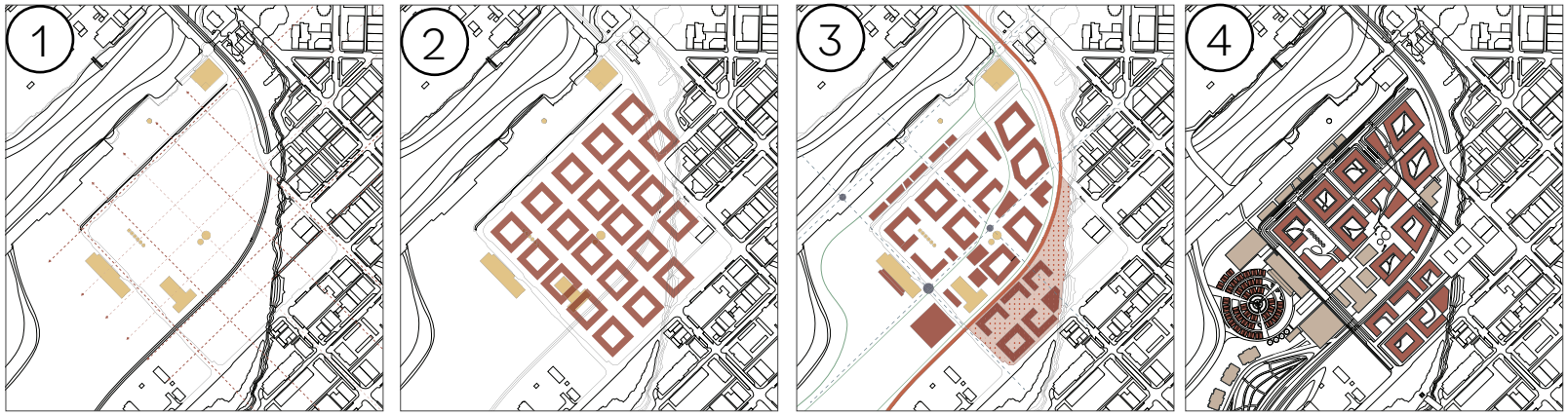
PROGRAM OVERVIEW

exchanges across the waterfront

The initial program above begins to place specific uses on the site as it responds to the existing elements on site. The heavy pollution on the southern end of the site prioritizes the need for phytoremediation and research plots. The landmarks and axes found on the site result in nodes that begin to shape the urban heart. Additional soil pollution to the east of the train tracks creates an opportunity to prioritize new clean industry, rather than residential, which could expand to the south of the site as it is cleaned up and potentially bring more jobs to the site. Finally, the sight lines across the water will pull visitors across a new bridge and into the repaired ecological habitat of the highly polluted ASB pond.

SITE DESIGN PROPOSAL



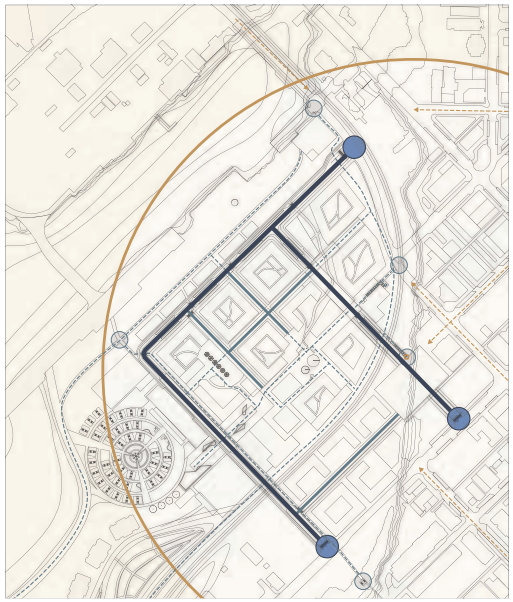


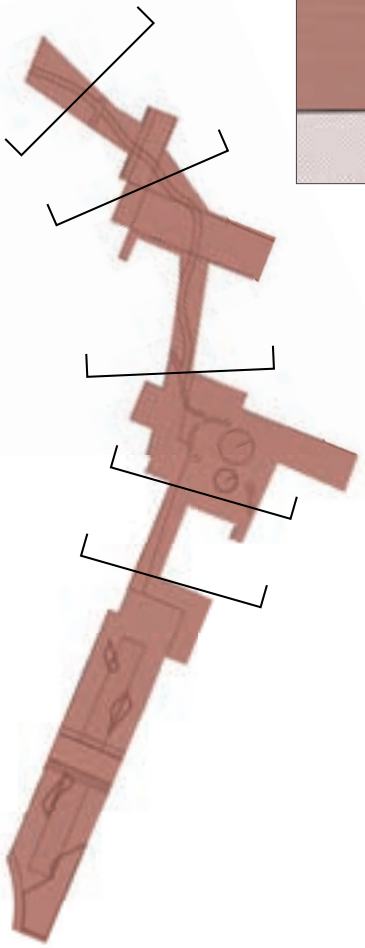
WATERFRONT GRID DEVELOPMENT

(1) The ***city grid*** is pulled from downtown Bellingham and across the site. This move organically connects the new development to downtown and maintains sight lines from the existing streets. (2) ***Courtyard blocks***, inspired by those of Sluseholmen, Denmark. The dual-aspect dwellings are approximately 40 feet deep and surround a 120 foot deep courtyard. (3) The blocks are then ***overlaid with the sites constraints*** - hazardous areas, sight lines, landmarks, and green arteries - and are manipulated and shaped to interact with the existing site elements. (4) The resulting layout ***organizes courtyard clusters around the development's landmarks and sight lines*** creating a series of public and privates spaces for residents and visitors to the waterfront site.

(left) **Public vs. Private Spaces.** New semi-private spaces within the courtyards fade into the waterfront's public network of plazas and green arteries. The site is encompassed by larger arteries connecting the site to the greater public realm.

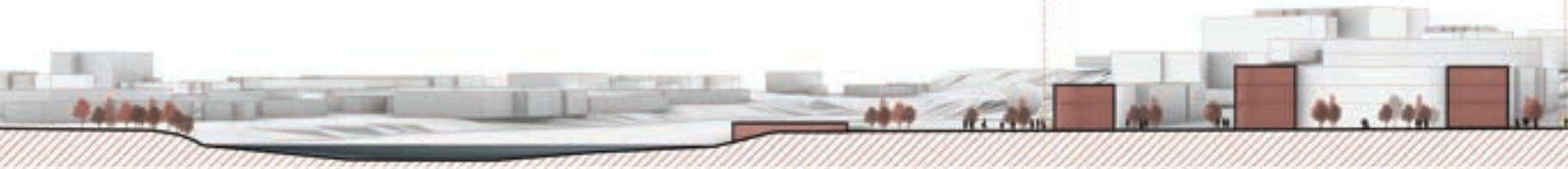
(right) **Site Walkability**. New connections to the site are created along Cornwall Ave connecting pedestrians to the site at key spots. new pedestrian prioritized streets connect courtyard developments with the four main vehicular streets.

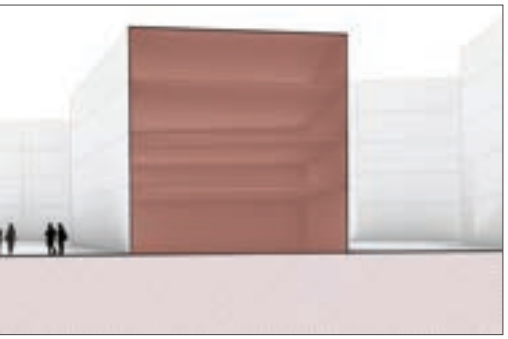




GREEN ARTERY WALKTHROUGH

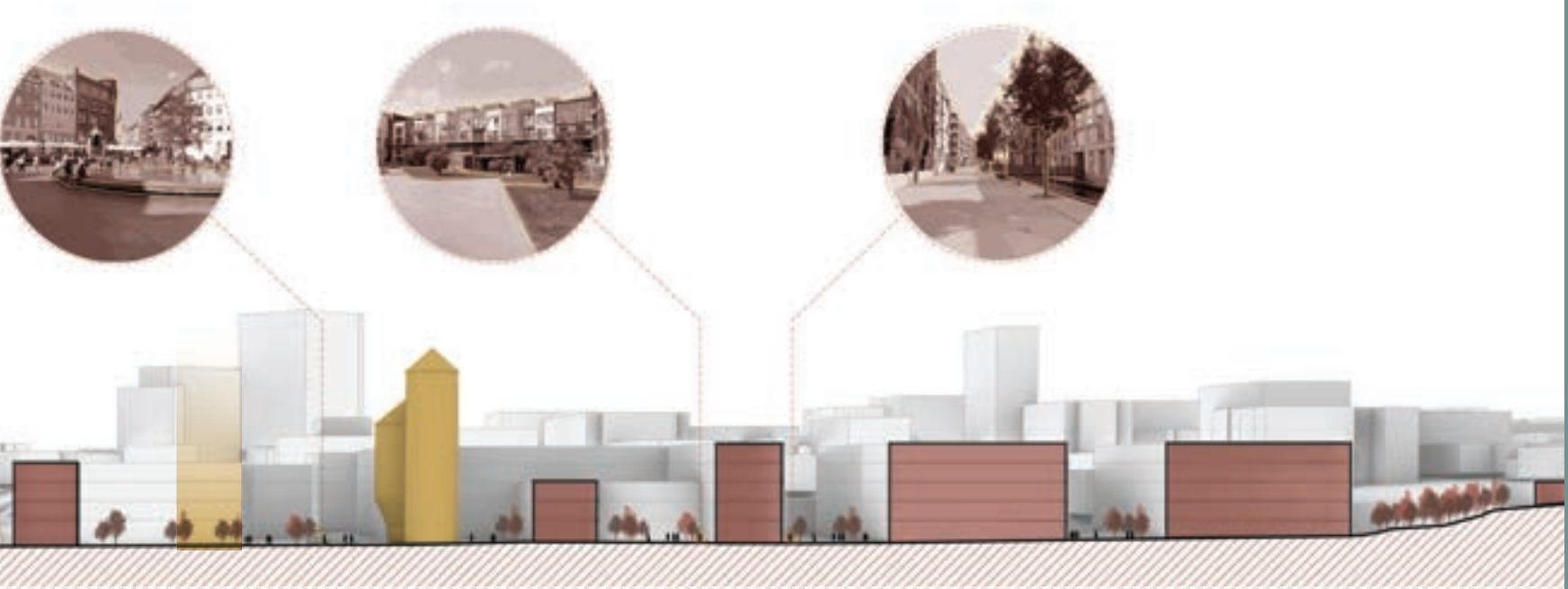
The development's green artery (left) runs through the center of the heart creating a series of compression and release points as visitors progress from one end to the other. The series of vignettes, seen above, provide a look at what these spaces might look and feel like.





SITE DENSITY AND BUILDING HEIGHTS

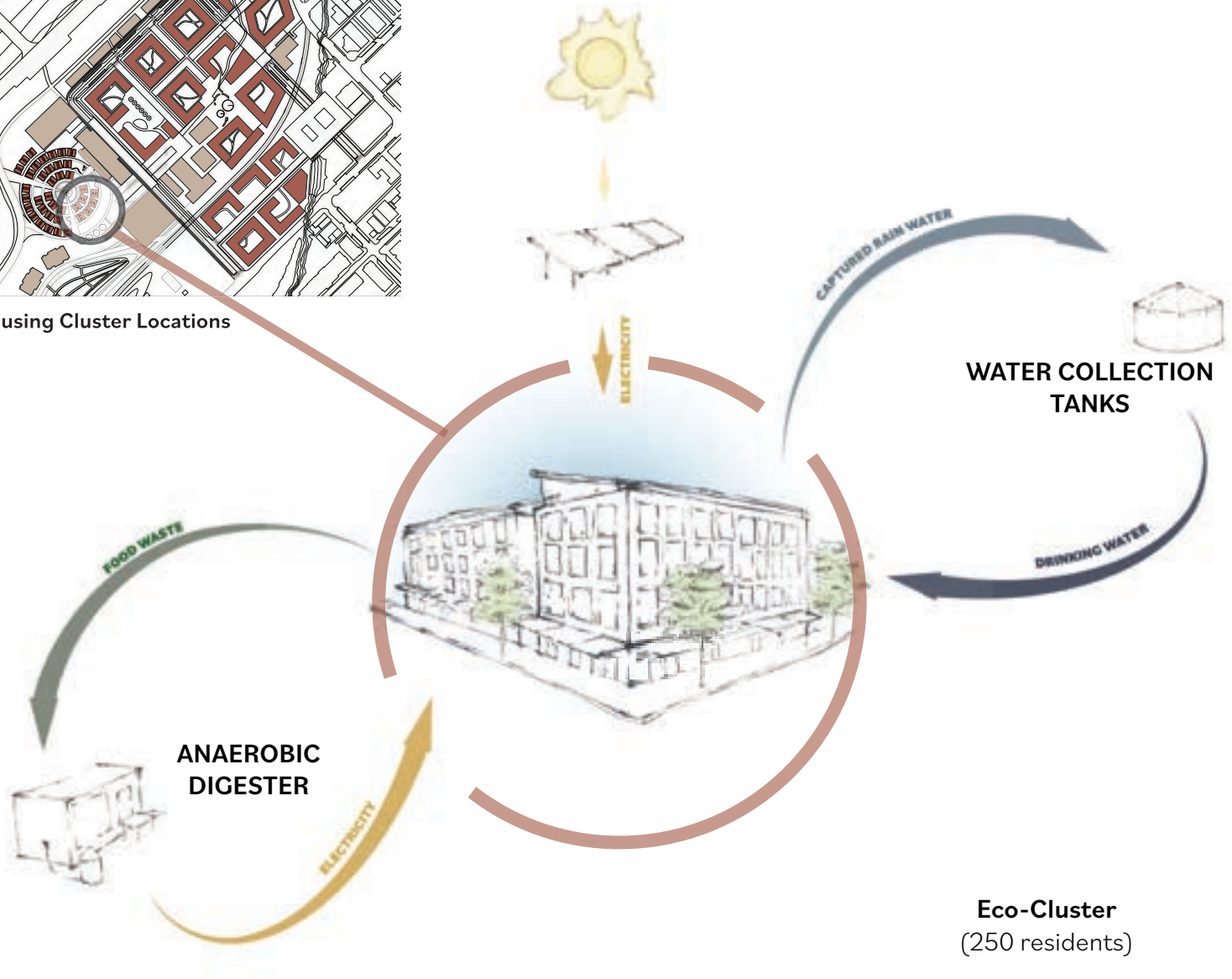
The section below depicts the vertical distribution through the site. Low density and low-height buildings hug the waterfront. Building density and height increase as the development crawls towards existing downtown Bellingham. This not only preserves views to the waterfront for residents of Bellingham but also helps mitigate wind corridors. The tallest of the buildings run along the train tracks and house more commercial and light industrial uses, like greenhouses, in an effort to mitigate sound pollution throughout the site.



ECO-CLUSTERS

The design strategies for the Waterfront District have been arranged into a multi-scalar system of exchanges and flows operating in closed loops. Housing in the urban heart has been organized into self-sustaining communities called Eco-Clusters. While each Eco-Cluster is laid out differently, all manage their own water demands, food waste, and energy flows using sustainable systems that are visible and celebrated on site.

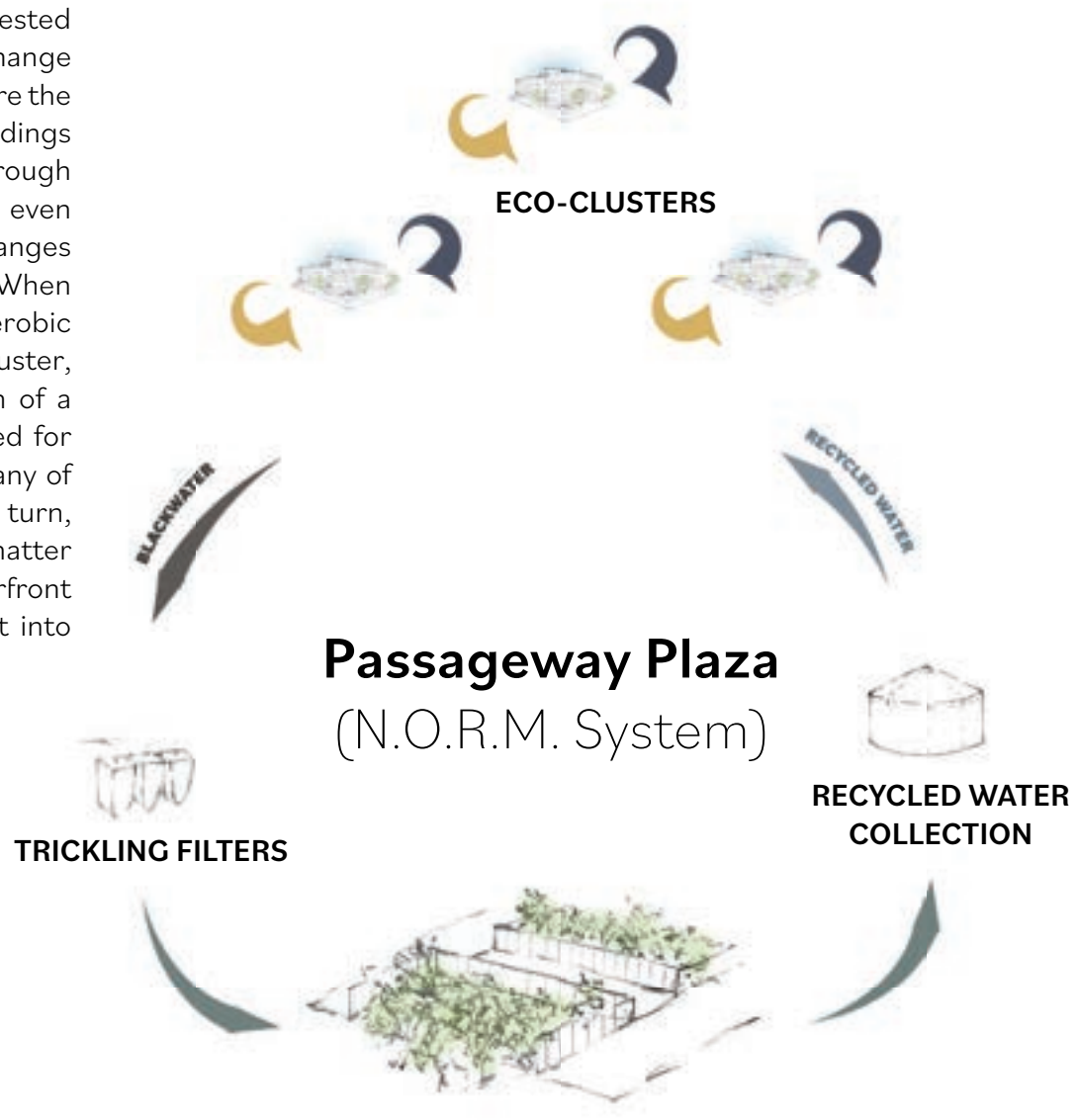
Housing Cluster Locations

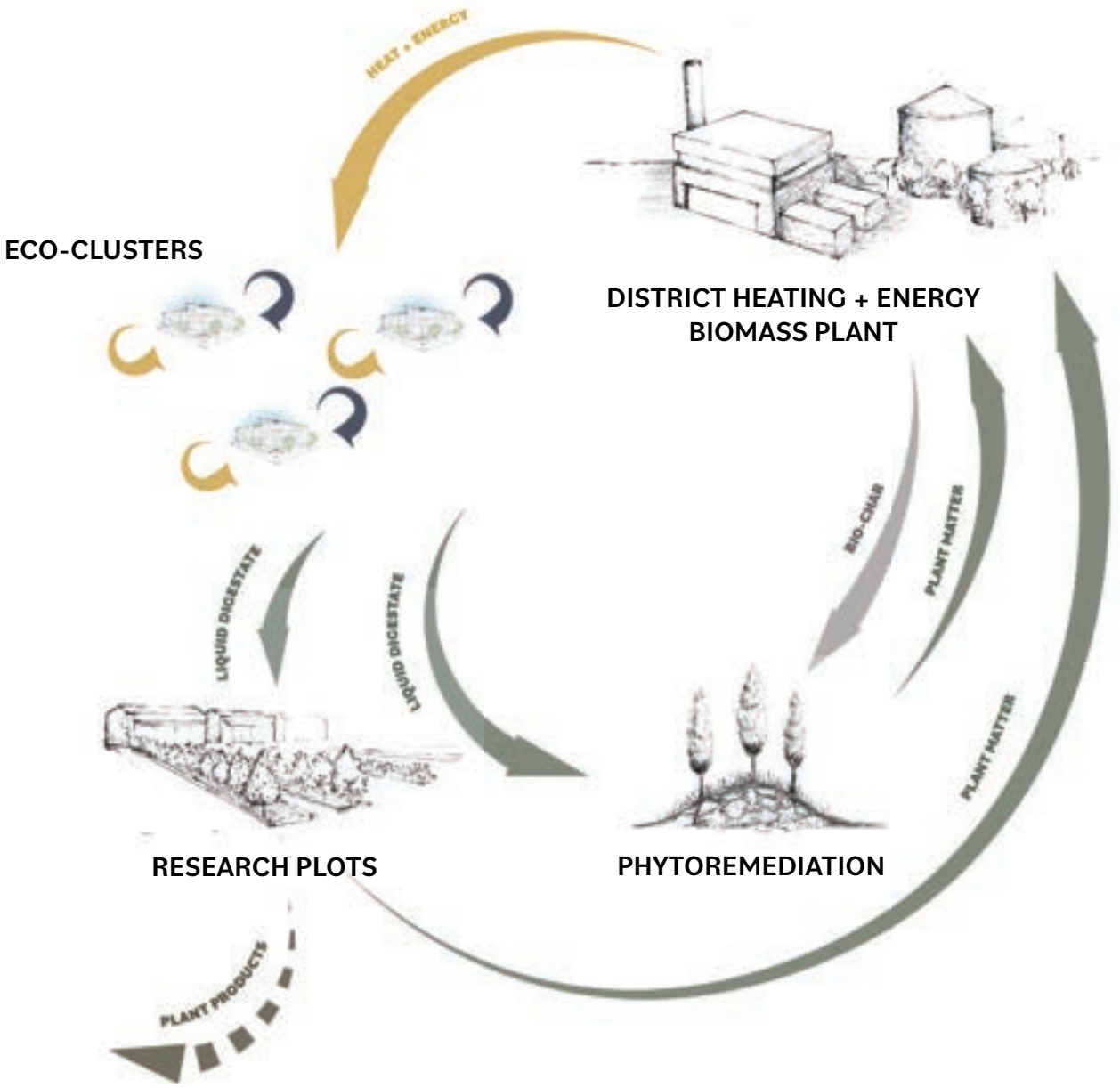


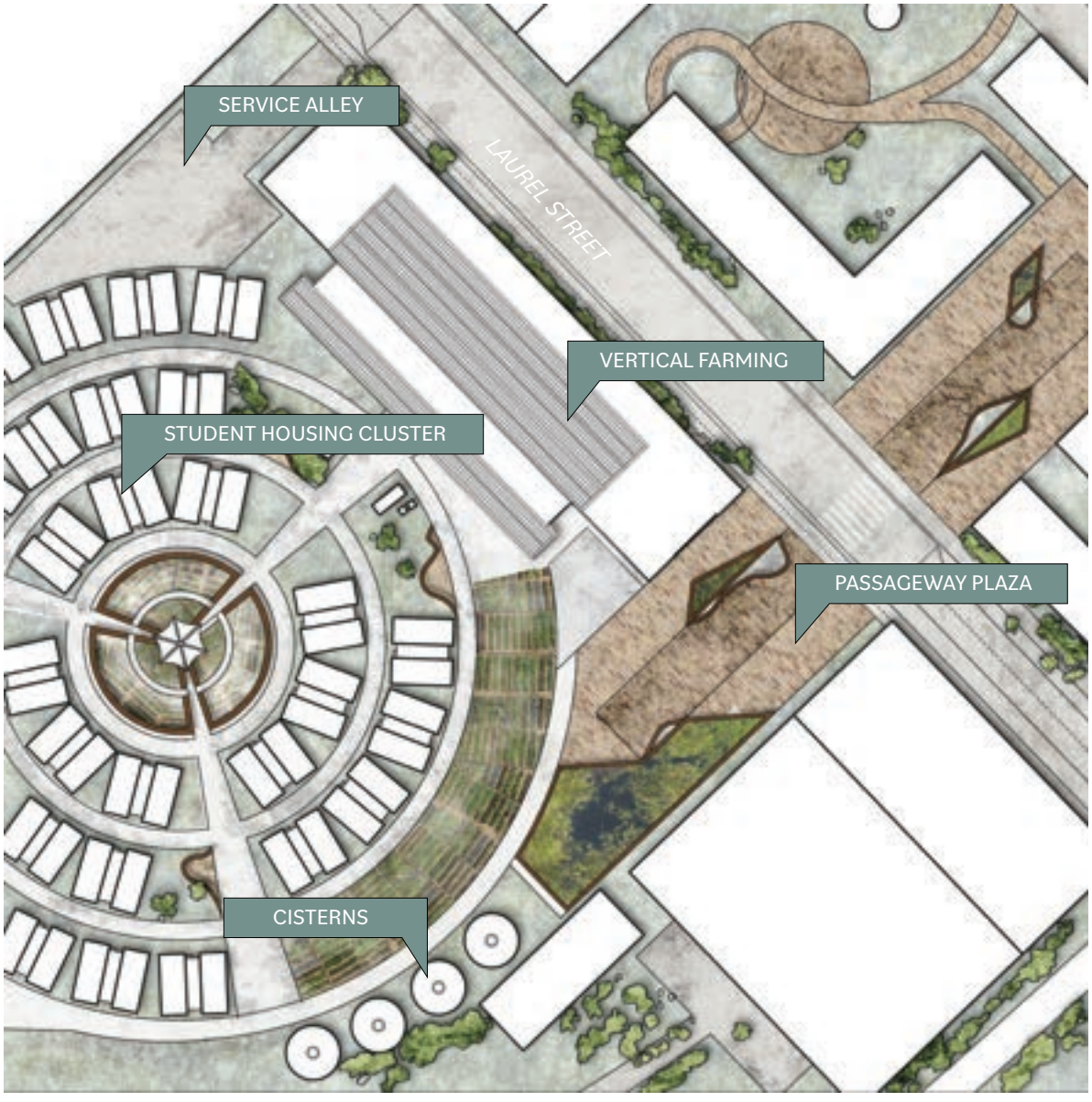
Eco-Cluster
(250 residents)

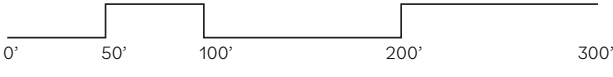
CIRCULAR EXCHANGES

While each individual Eco-Cluster operates as its own closed loop, together they contribute to a larger set of nested circular exchanges. One such exchange happens in the Passageway Plaza where the blackwater from all residential buildings in the Eco-Clusters is filtered through wetlands and able to be reused. At an even larger scale are the circular exchanges that occur across the entire site. When food waste is processed in the anaerobic digesters housed within each Eco-Cluster, residual organic matter (in the form of a liquid digestate) is collected and used for various fertilizing opportunities at many of the growing spaces across the site. In turn, these growing spaces supply biomatter that is transported to the Waterfront District's biomass plant converting it into heating and energy.




HEAT + ENERGY
ECO-CLUSTERS
DISTRICT HEATING + ENERGY
BIOMASS PLANT
BIO-CHAR
PLANT MATTER
LIQUID DIGESTATE
LIQUID DIGESTATE
PLANT MATTER
RESEARCH PLOTS
PHYTOREMEDIATION
PLANT PRODUCTS





PASSAGEWAY PLAZA

WETLANDS FILTRATION

The Passageway Plaza holds the Waterfront District’s Natural Organic Recycling Machine (N.O.R.M.) cleaning residential blackwater to be used for other non-potable purposes across the site including toilet flushing, building cooling, and irrigation. Elevated above a series of wetlands, which filter the blackwater, the plaza peels back to reveal the N.O.R.M. system in particular moments. The water, after being filtered cascades down a small waterfall before ultimately being stored in large way-finding cisterns.

GROW STREET

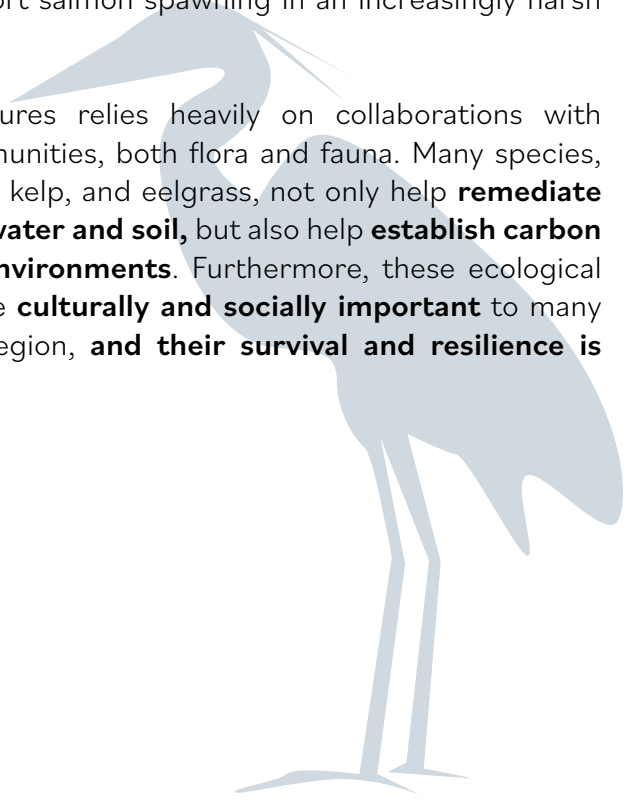
Orthogonal to the Passageway Plaza runs Laurel Street which acts as the district’s “Grow Street,” celebrating food production, experimentation, and consumption with growing spaces and food incubator kitchens.

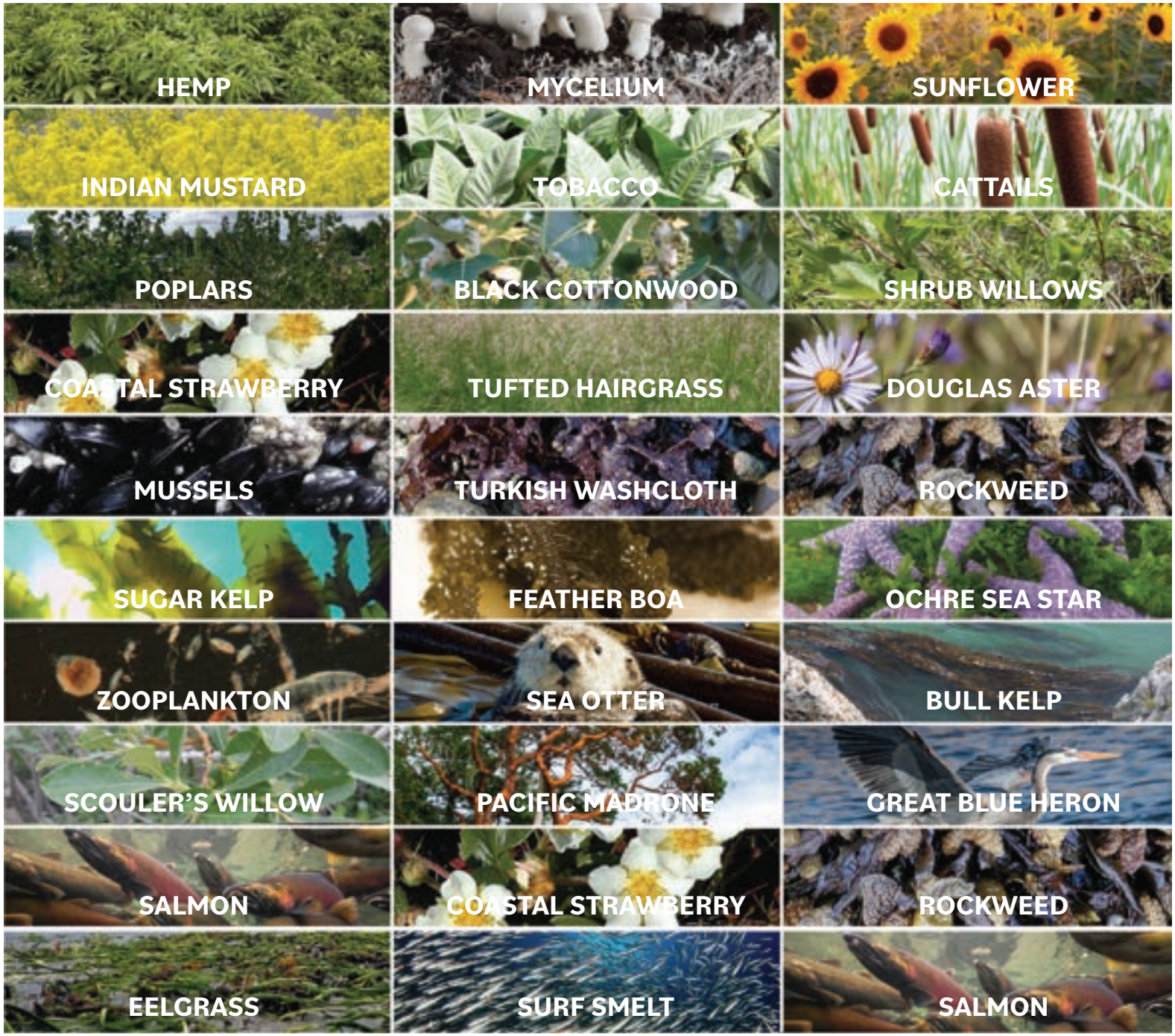
FLORA & FAUNA

collaborating with ecological communities

Despite harsh environmental conditions, a wide array of flora and fauna already live on the heavily contaminated site. A site visit in early October revealed willows hugging the interior edge of the ASB Pond and ducks splashing in the murky waters. In conversations with Bellingham stakeholders and a Lummi elder, we learned that Whatcom Waterway has been a critical salmon run for thousands of years. And that there are efforts to improve Whatcom Waterway's environmental conditions and habitat to support salmon spawning in an increasingly harsh climate.

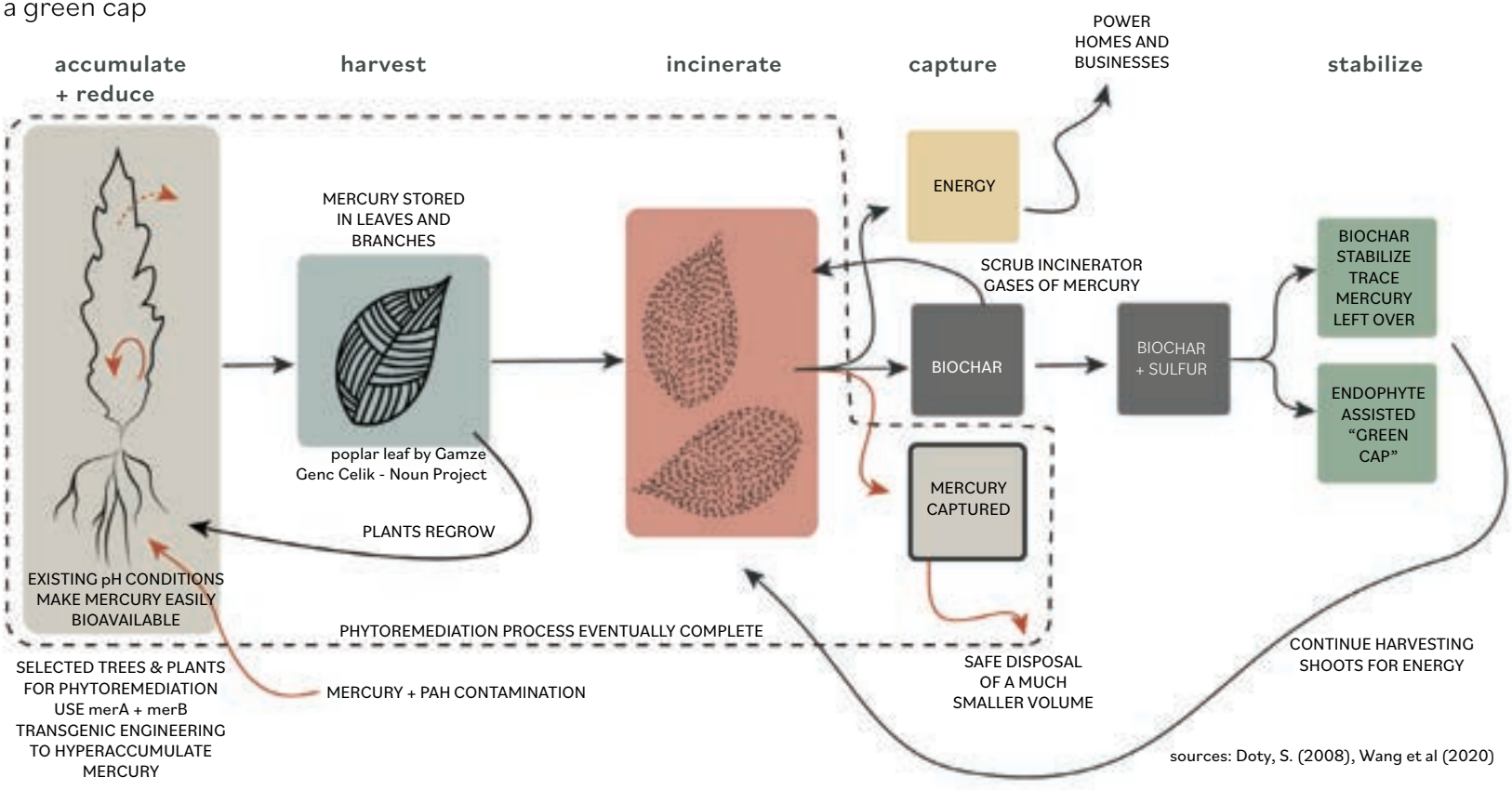
Exchanging Futures relies heavily on collaborations with ecological communities, both flora and fauna. Many species, such as poplars, kelp, and eelgrass, not only help **remediate contaminated water and soil,** but also help **establish carbon sequestering environments**. Furthermore, these ecological communities are **culturally and socially important** to many people in the region, **and their survival and resilience is essential.**




HEMP
MYCELIUM
SUNFLOWER
INDIAN MUSTARD
TOBACCO
CATTAILS
POPLARS
BLACK COTTONWOOD
SHRUB WILLOWS
COASTAL STRAWBERRY
TUFTED HAIRGRASS
DOUGLAS ASTER
MUSSELS
TURKISH WASHCLOTH
ROCKWEED
SUGAR KELP
FEATHER BOA
OCHRE SEA STAR
ZOOPLANKTON
SEA OTTER
BULL KELP
SCOULER'S WILLOW
PACIFIC MADRONE
GREAT BLUE HERON
SALMON
COASTAL STRAWBERRY
ROCKWEED
EELGRASS
SURF SMELT
SALMON

PHYTOREMEDIATION

a green cap

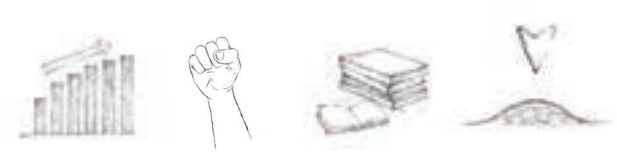


The proposed phytoremediation strategies counter traditional methods of remediation recommended for the Bellingham Waterfront in the Cleanup Action Plan, which largely rely on concrete caps and disposal off site (Dept. of Ecology 2021). Instead, **reconciling with the gravity of the soil contamination on the site** will lead to more environmentally just outcomes. Rather than a waste product, contaminated soil can also become a resource for processes like phytoremediation. Emerging strategies, including transgenic trees and endophyte inoculation of the root zone, improve the uptake and storage of mercury in trees and plants such as poplars, willows, and mustard (Doty 2008, Wang et al 2020). The biomass is routinely harvested and incinerated, during which the mercury is captured and disposed of, and useful byproducts—biochar and energy—are produced (Doty 2008). Phytoremediation offers an alternative strategy for treating the soil on site while also creating habitat, public space, and, eventually, land which can safely allow water to permeate through again.

Visitors recreate through meandering trails in the Phytoremediation Community Forest, many of which are lined with shipping containers of contaminated soil remediated by poplar trees

PHYTOREMEDIATION

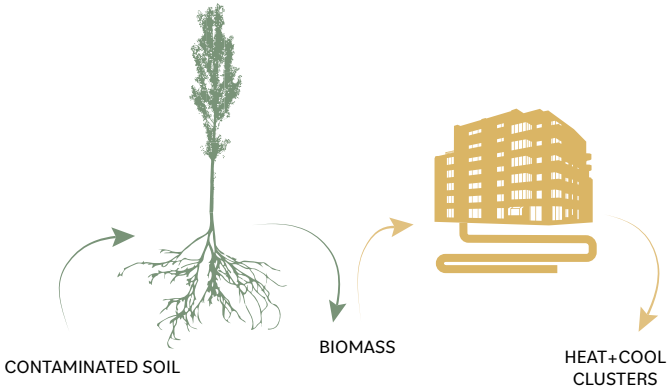
a green cap

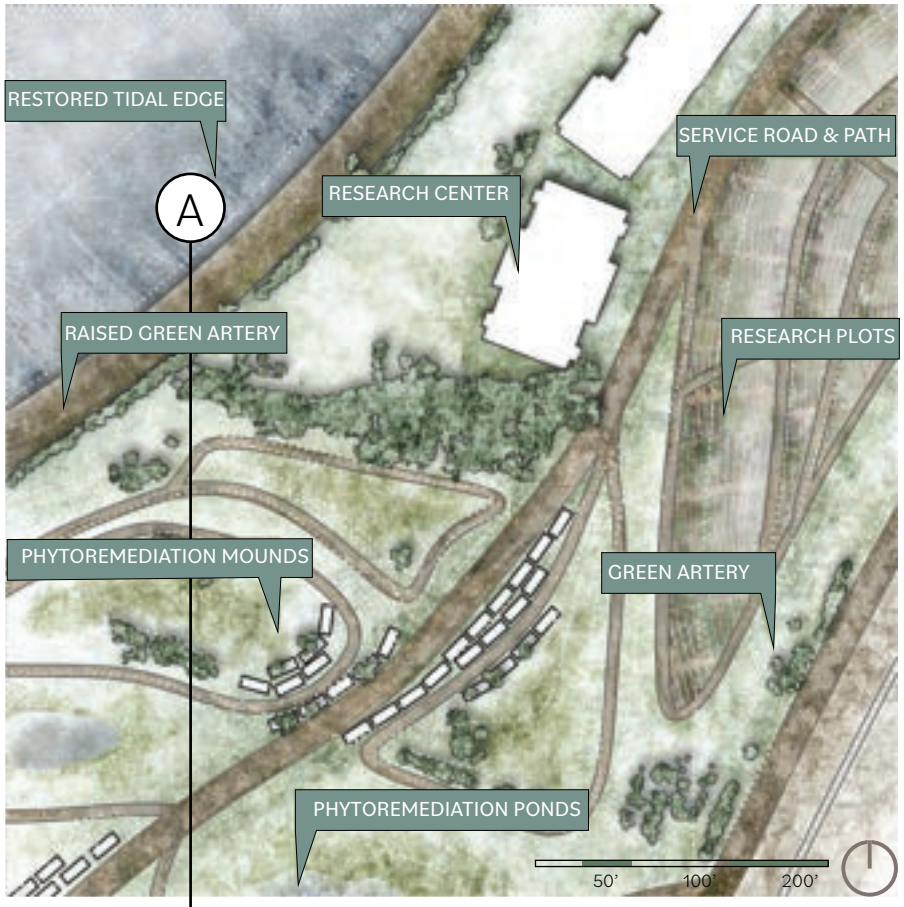


ECONOMIC VITALITY | CREATIVITY & INNOVATION | KNOWLEDGE GENERATION | HEALTHY SOILS & ECOLOGY

EXCHANGES

contamination, biomass, heating, biochar





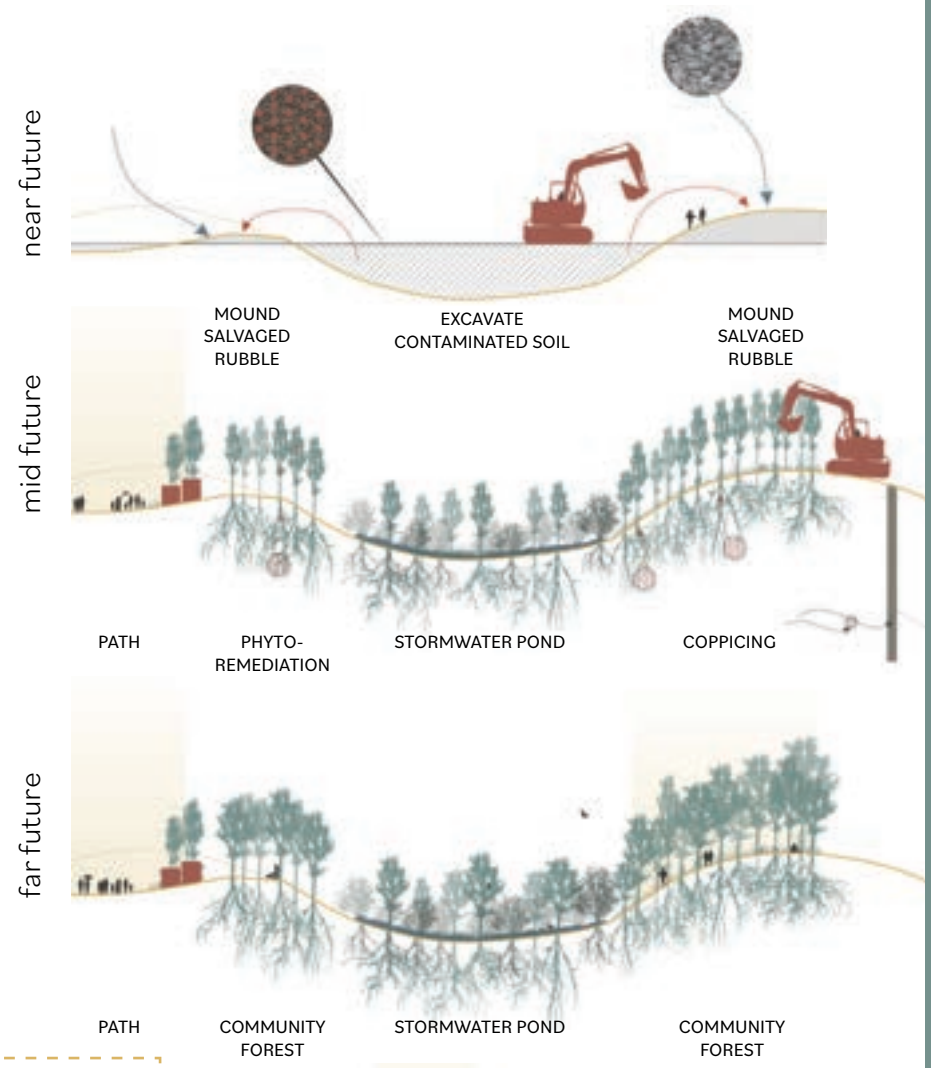
A SECTION A

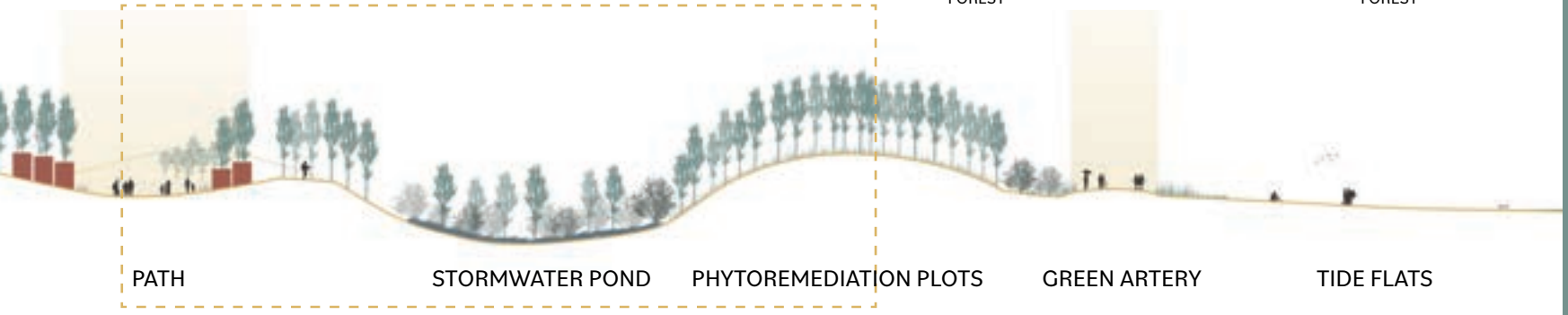
PHYTOREMEDIATION PLOTS | PUBLIC PATH | PHYTOREMEDIATION PLOTS

PHASED STRATEGIES

implementation over time

Phytoremediation strategies address the Mercury and polyaromatic hydrocarbon (PAH) contamination on site in a manner that prioritizes long-term ecological and public health. Contaminated soil is stored on site in mounds and planted with a diverse array of poplars, willows, and black cottonwood. Over time, these trees accumulate Mercury in their shoots and branches and degrade PAHs. Routine coppicing, or harvesting trees down to their stumps to then let them regrow, both completes the process of Mercury extraction and provides biomass for the district heating and cooling plant.





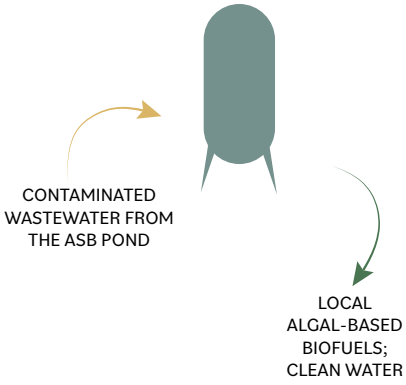
RESTORED TIDAL LAGOON

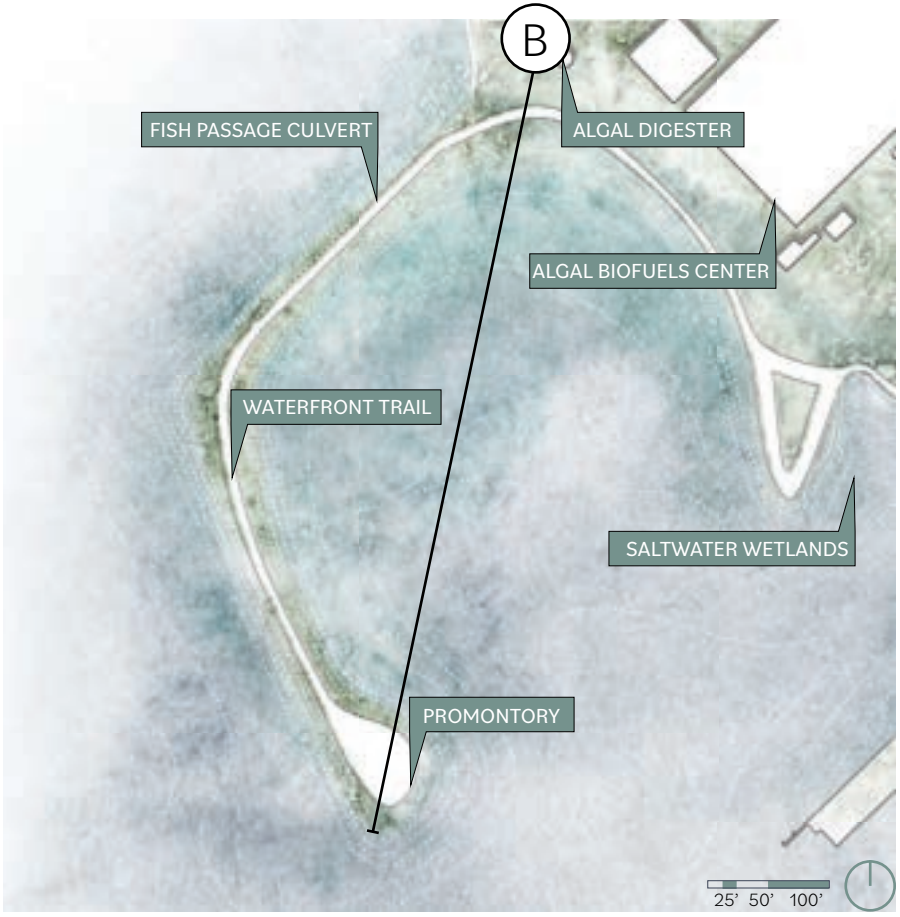
from wastewater to breakwater

ECONOMIC VITALITY | CREATIVITY & INNOVATION | KNOWLEDGE GENERATION | HEALTHY SOILS & ECOLOGY | MARINE HEALTH & RESOURCES

EXCHANGES

algal remediation, biomass, biofuel





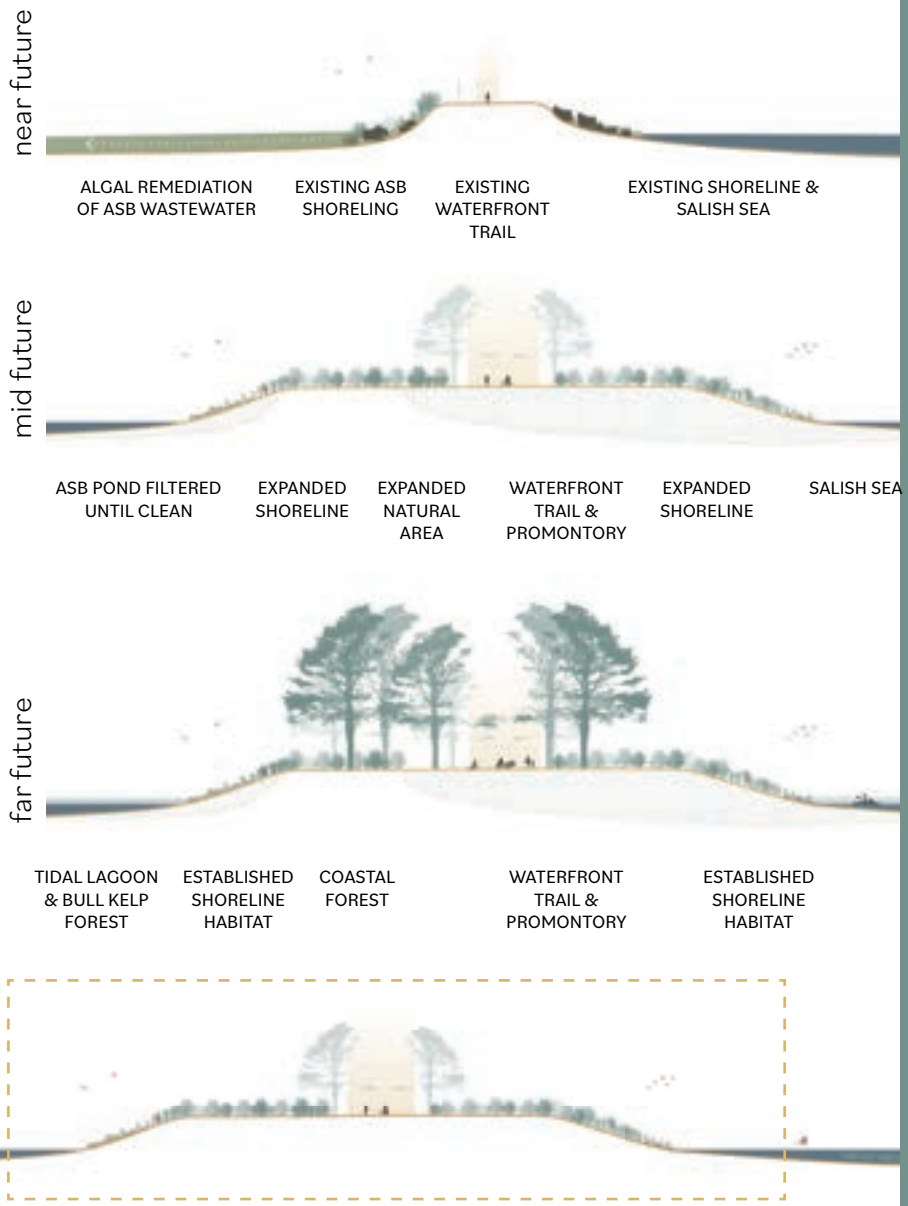
B SECTION B

ALGAL BIOFUELS CENTER | ALGAL WASTEWATER DIGESTER | WATERFRONT TRAIL | RESTORED LAGOON EDGE | TIDAL LAGOON

PHASED STRATEGIES

implementation over time

Transforming the aerated stabilization basin (ASB) is an important step to restoring critical marine habitat, nurturing salmon and shellfish populations, and strengthening ecological systems on the Bellingham waterfront. The adapted ASB Lagoon **transforms a former wastewater storage pond into a vibrant coastal habitat**. To treat the contaminated wastewater, water stored in the ASB pond is pumped through algae digester tanks and then back into the pond. The algae is harvested to produce a local source of algae biofuel. After the water is treated, crushed concrete from on-site is repurposed into marine mattresses to seed eelgrass and bull kelp and open up the SE edge of the former pond, transforming the pond into a breakwater lagoon. The Lagoon draws people along the walkway out to the Promontory to view Lummi Island, the San Juans, and the occasional orca whale.



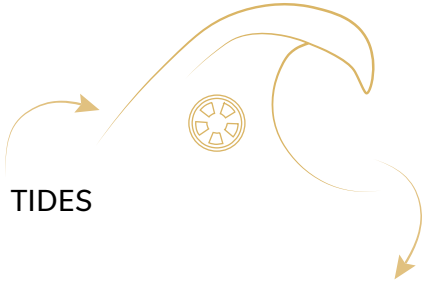
TIDAL BRIDGE

capturing marine energy on whatcom waterway

ECONOMIC VITALITY | CREATIVITY & INNOVATION | KNOWLEDGE GENERATION | COMMUNITY VIBRANCY | MARINE HEALTH & RESOURCES

EXCHANGES

tidal energy, decentralized energy, pedestrian connections

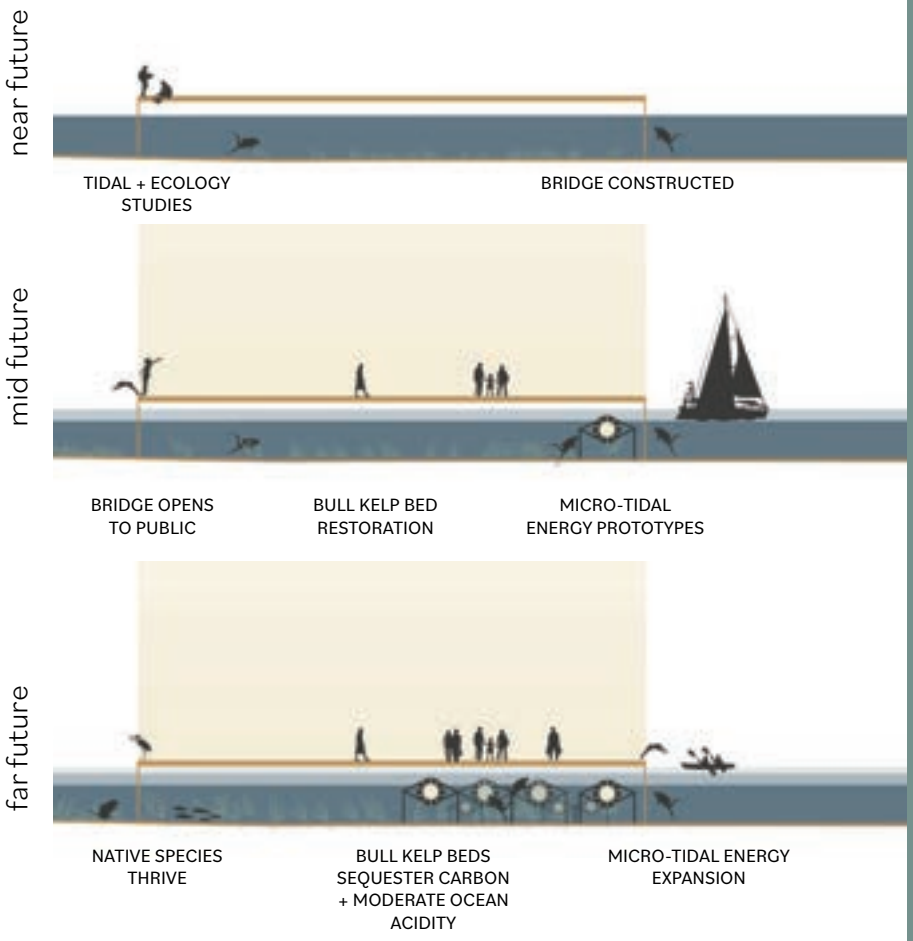


C SECTION C

PHASED STRATEGIES

implementation over time

The Tidal Bridge connects the urban Heart of Bellingham's waterfront district to the adapted ASB Lagoon. A new pedestrian connection across Whatcom Waterway, the Tidal Bridge dually serves as a research lab for micro-tidal energy prototypes and a lively pedestrian walkway. Bull kelp bed restoration, a powerful carbon sink, provide habitat for native aquatic species to return and thrive. Over time, the Tidal Bridge becomes a beloved walkway for intimate interactions with sea life, tidal shifts, and cutting edge research.

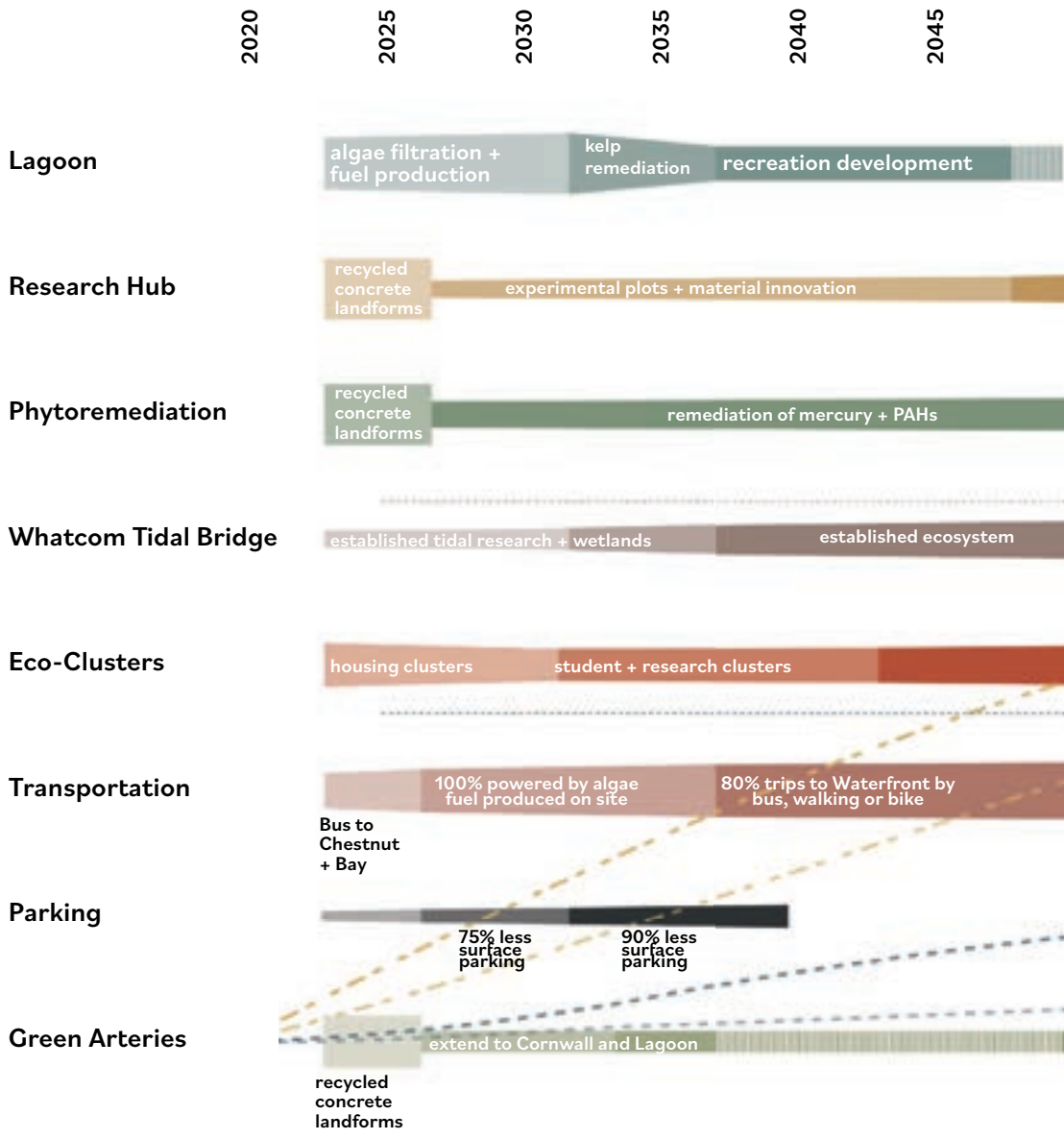


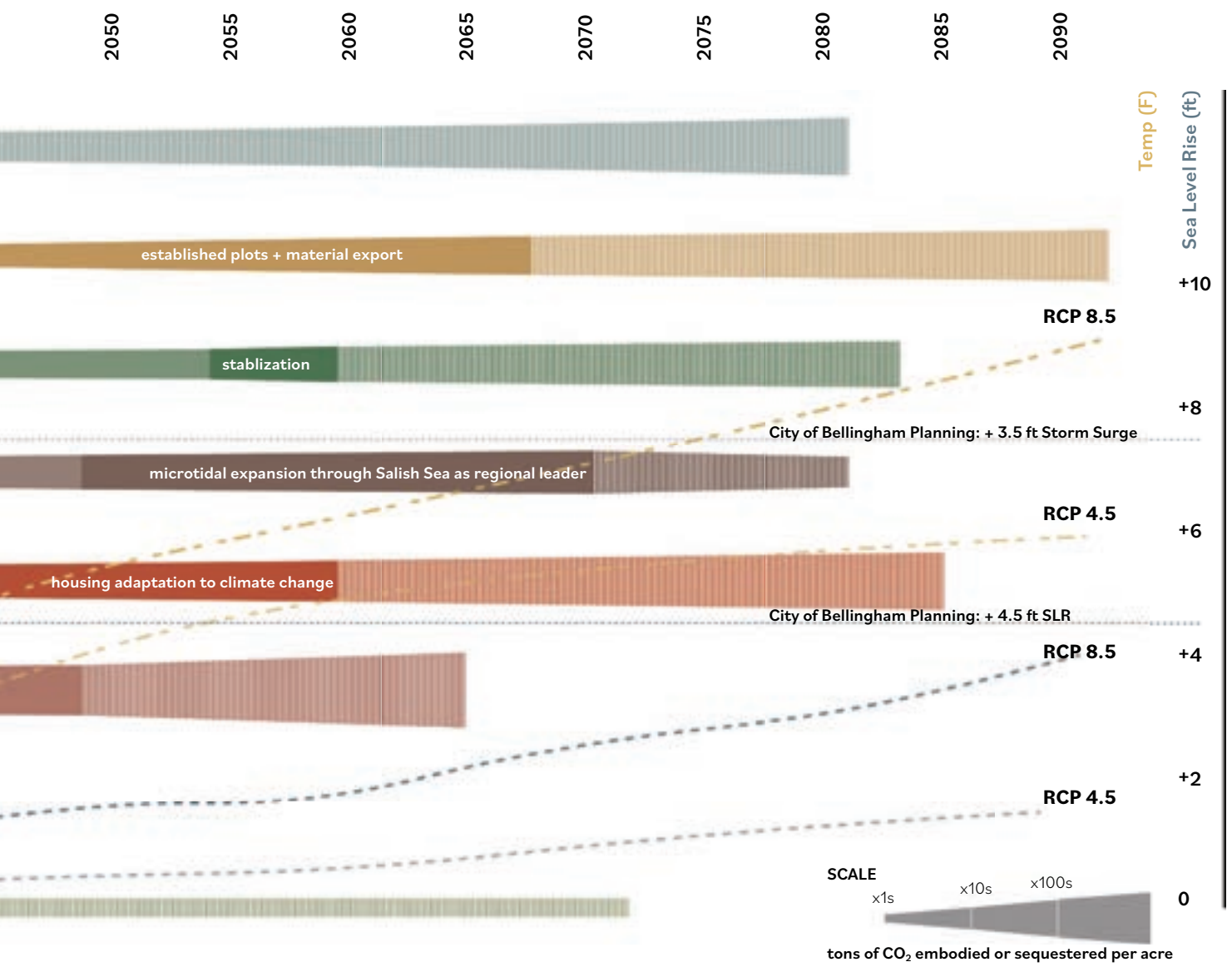
PUBLIC DOCKS + WATERFRONT ACCESS GREEN ARTERY ACCESS

DESIGN STRATEGIES

The proposed urban design strategies occupy nearly all corners of the future Waterfront District and occur along a series of phases. The above graphic outlines when phases for each strategy begins and roughly the impact that such activity has on climate change mitigation.

It is important to note that while the strategies have been articulated as discrete entities (both spatially and conceptually) they exist as a cohesive network of circular exchanges; each strategy informs and depends on the others. In this way, the Bellingham Waterfront District can be understood as a large climate-responsive system with many subsystems nested within it.




2050
2055
2060
2065
2070
2075
2080
2085
2090
Temp (F)
Sea Level Rise (ft)
established plots + material export
stablization
microtidal expansion through Salish Sea as regional leader
housing adaptation to climate change
RCP 8.5
RCP 4.5
RCP 8.5
RCP 4.5
City of Bellingham Planning: + 3.5 ft Storm Surge
City of Bellingham Planning: + 4.5 ft SLR
+10
+8
+6
+4
+2
0
SCALE
x1s
x10s
x100s
tons of CO_2 embodied or sequestered per acre

SITE VISITORS

daily trajectories

GREEN ARTERY + MARINE DOCKS

ALGAE BIOFUEL

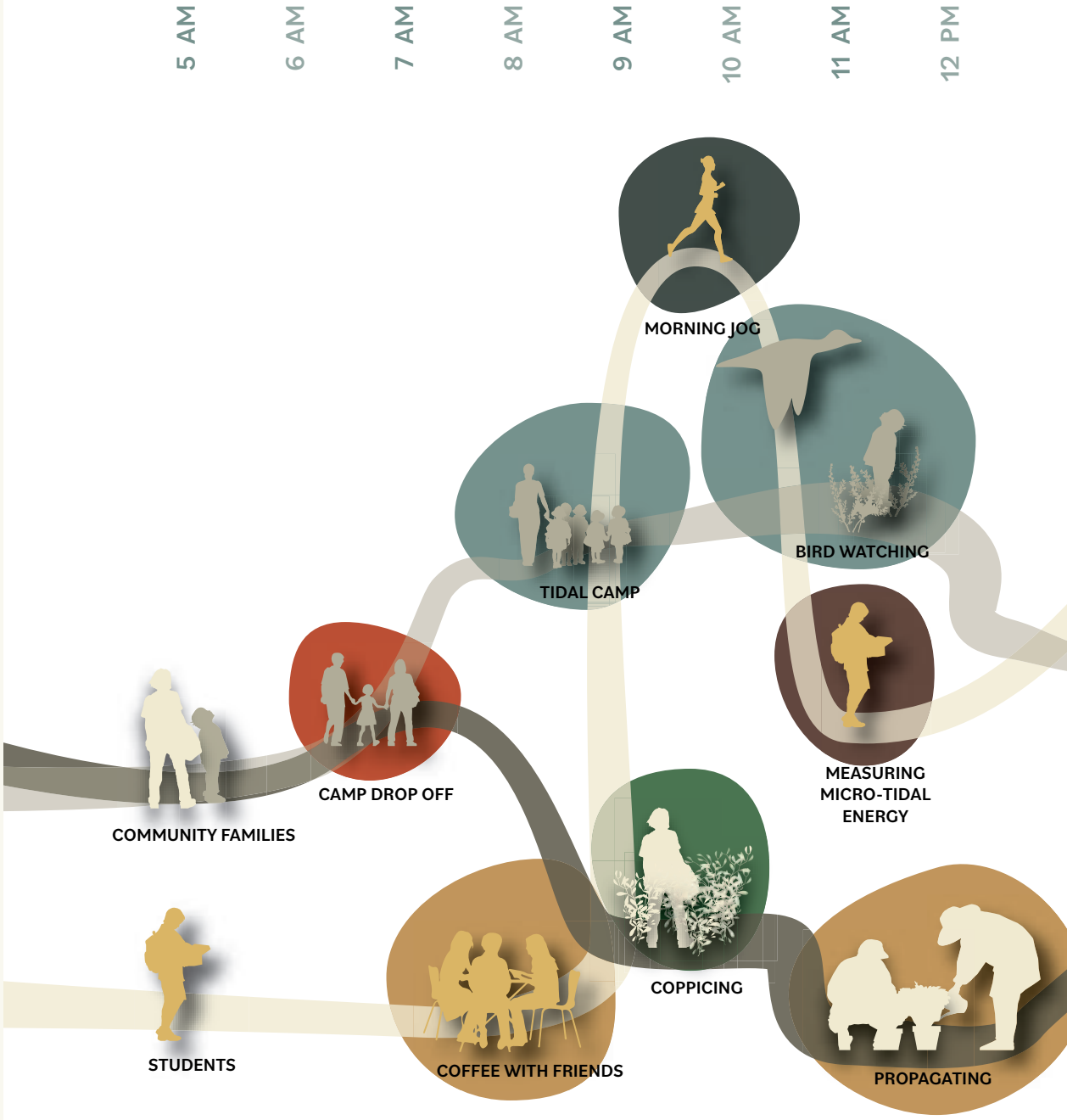
ASB LAGOON

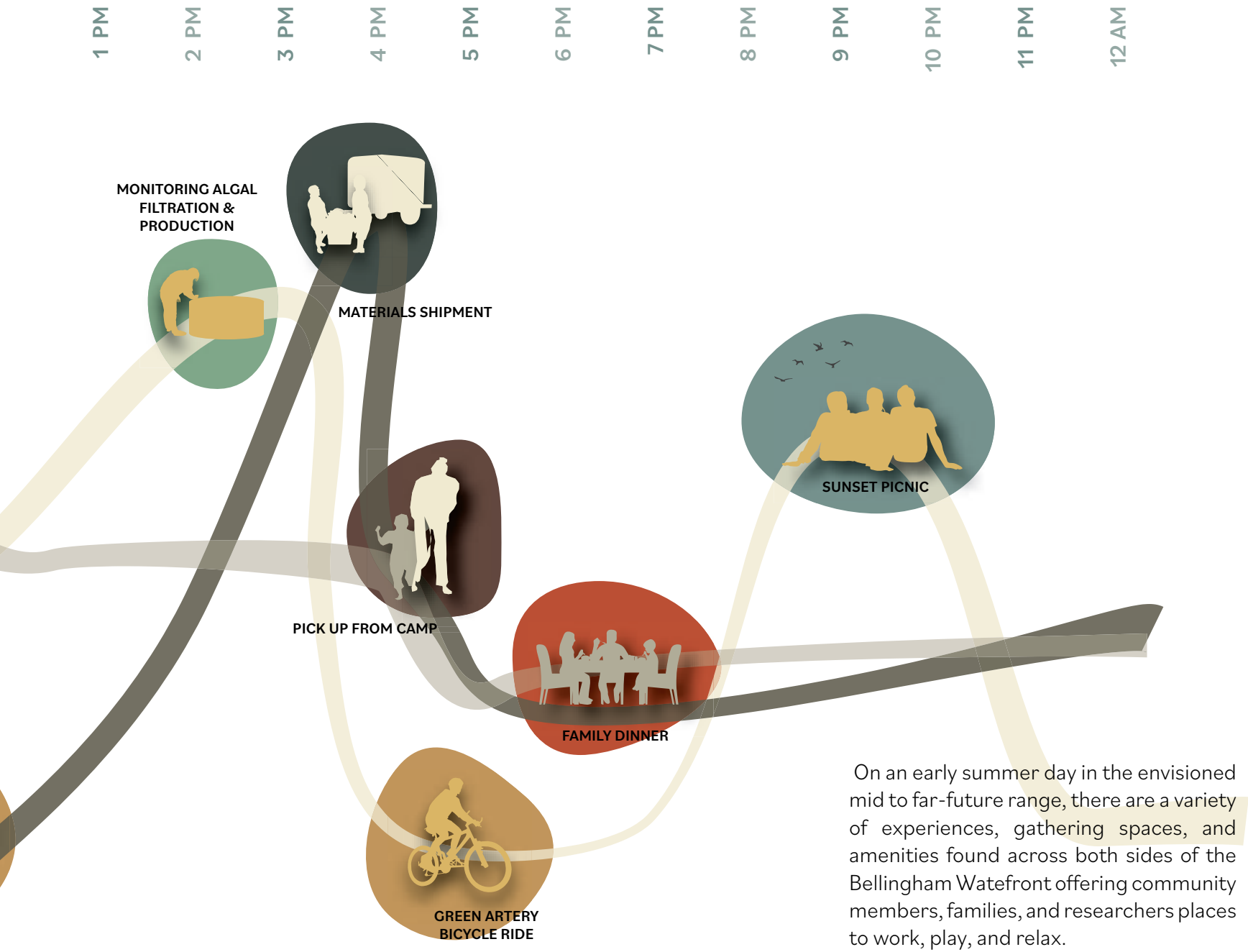
TIDAL ENERGY BRIDGE

URBAN HEART

PHYTOREMEDIATION

RESEARCH HUB





On an early summer day in the envisioned mid to far-future range, there are a variety of experiences, gathering spaces, and amenities found across both sides of the Bellingham Watefront offering community members, families, and researchers places to work, play, and relax.

OsterGRØ - Urban Farm on the roof of an adapted auto retailer // *Photo by Sarah Lukins*

"The task is clear: to create a culture of caretaking in which no one and nowhere is thrown away, in which the inherent value of people and all life is foundational."

~ Naomi Klein

SCAN DESIGN SDF FOUNDATION

coUrban

UW//LA

Bellingham Waterfront today// *Photo credit Harcourt Developments*