OMSI Master Plan

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Snøhetta

Project Team

Property Owner: **Oregon Museum of Science and Industry (OMSI)**

Client Team: **OMSI Working Group**

Architecture / Landscape Architecture / Brand Design: **Snøhetta**

Planning: **Spencer Consultants**

Economic Analysis: **ECONorthwest**

Sustainability: **BuroHappold**

Local Landscape Architect: **Mayer / Reed**

Civil Engineering: **KPFF**

Transportation Engineer: **DKS**

Image Source: OMSI

Table Of Contents

01. Introduction

02. Boundaries

03. Design & Development Framework

04. Phasing, Uses & Massing

05. Transportation

06. Campus Sustainability Strategies

07. Campus Infrastructure

08. Campus Identity Framework

09. Appendix

Portland Winter Light Festival Lantern Parade Debut
Image Source: Mayer / Reed

01. Introduction

01.1 Overview

01.2 Guiding Principles

01.3 History

01.4 Site Conditions

01.1 Overview

Through a Request for Qualification (RFQ), the Oregon Museum of Science and Industry (OMSI) selected the Snøhetta team to assist in the creation of a Master Development Plan for the museum's 18+ acre waterfront property in Portland, Oregon. The resulting plan will serve as a guide for future development that supports OMSI's project goals and the community's interest. The property is owned by OMSI, a private non-profit 501(c)(3) organization, and is home to the museum, an exhibition production facility, an events venue and a variety of educational programs.

Located along the banks of the Willamette River, OMSI serves over 1 million people annually through educational opportunities delivered state-wide, through school visits, and as a featured attraction in the Portland community. OMSI is ranked as one of the top science centers in the United States and enjoys an international reputation for innovative exhibits and educational programs. Built around the historic Station L power plant, OMSI features a planetarium, a giant screen theater, the USS Blueback submarine, five interactive exhibit halls, and eight labs, together with other amenities.

Today, OMSI has a long-range vision and clear strategic plan, developed in concert with Portland's 20-year urban growth strategy and the input of the local community. The property, featuring 11+ undeveloped acres and over a quarter-mile of river frontage, provides an unprecedented opportunity to realize this plan. It is one of the largest remaining riverfront parcels in the Portland's central waterfront, located at a major transit hub and the new Tilikum Crossing bridge that affords a direct connection between Oregon Health and Science University (OHSU) and various mixed-use waterfront development on the west bank.

The OMSI property is located within the Southeast Quadrant of the City of Portland and is included within the designated boundaries of the Central Eastside District and the Central Eastside Urban Renewal boundaries.

The Central Eastside District is currently undergoing dramatic change, marked by an influx of newly completed and proposed developments, including mixed-use, high-rise structures and hotels. These new uses are interspersed amongst legacy industries, pockets of creative industries and knowledge-sector businesses, including a branch of Portland Community College.

For its own underdeveloped property, OMSI seeks to foster a mix of complementary uses. Committed to retaining ownership of its property, OMSI plans to grant long-term ground leases for development which will support the institution's strategically planned growth, assure its financial standing and cultivate a vibrant presence along the waterfront and nearby transit stations. Future tenants should complement OMSI's vision by creating a campus that will promote sustainable growth and market diversity.

Mission

At the heart of OMSI's mission is a commitment to inspiring curiosity through science-based learning experiences, fostering experimentation and the exchange of ideas, and stimulating informed action.

Vision

OMSI's vision describes how the institution will put its mission into motion over the next 20 years. In collaboration with partners, OMSI will ignite a regional educational transformation at the intersection of science, technology and design. The intention is to forge a thriving innovation district into the fabric of Portland, with the goal of spreading opportunities across the Northwest.

At the heart of this vision is the notion of an expanded, invigorated OMSI campus—alive day and night with learning activity. The OMSI vision is dedicated to creating a vibrant bicycle and pedestrian-friendly campus that integrates the natural and built environments and serves as a community destination.

These enhancements will expand OMSI's role as a center of learning and will extend complementary development with strategic partners. The campus is at the heart of an emerging district within the Central Eastside, which has been emerging as a forum for the exchange of ideas and creative expression; where scientists, makers, artisans, engineers, and inventors from diverse backgrounds and cultures work, live, and play. It is an Eastside anchor for the larger "Innovation Quadrant," which spans the river, connecting research, education, and infrastructure while stimulating economic investment and job creation.

Image Source: OMSI

Chapter Summaries

The following pages document the research, narratives and design strategies crafted by Snøhetta, BuroHappold, DKS, ECONorthערst, KPFF, Mayer/Reed, Snøhetta Design, and Spencer Consultants as part of the OMSI master planning process.

Chapter 2 sets the stage by positioning the OMSI campus within the greater context of the Central Eastside area. The extents of the OMSI Master Plan are established, with consideration of additional adjacent properties in the Master Plan study area.

Chapter 3 introduces OMSI's core guiding principles regarding sustainability, market conditions, the public realm, aesthetics and parking—all of which served as the foundation for the Snøhetta team's design process. These principles informed the team's project narrative and design concept, which in turn helped shape the site plan itself. This site plan is also presented in Chapter 3, along with a series of focus areas that elaborate on the design of public open spaces throughout the campus and waterfront.

Strategies for the development of the Master Plan are presented in Chapter 4, including diagrams articulating project phasing, tract areas in relation to build-able areas, studies on floor area ratio (FAR), and elevations illustrating maximum building heights.

Chapter 5 presents an overview of all transportation systems related to the OMSI campus, including pedestrian, bicycle, vehicular, and transit networks. Diagrams highlighting these respective circulation vectors are complemented by a study of parking needs, with proposed areas for visitor and bus parking. In addition to these studies, Chapter 5 introduces four street typologies deployed throughout the campus. In accordance with OMSI's commitment to sustainability, Chapter 6 explores detailed strategies for a sustainable campus, including analysis of existing conditions, a sustainability framework rooted in OMSI's guiding principles, and recommended strategies for three unique scenarios.

Strategies for the development of campus infrastructure are examined in Chapter 7, in accordance to project phasing established in Chapter 4. Locations for proposed sanitary sewers, stormwater catchment and water service are identified and connect to existing infrastructure where possible.

Finally, Chapter 8 explores possibilities for a new OMSI campus identity through the concept of "Reveal." This framework is rooted in the notion of "personal discovery," and defines a proposed wayfinding strategy to be deployed throughout the campus.

01.2 Guiding Principles

Guiding principles are the foundation for great plans and great places. They are "North Stars" that shape the strategies, physical plans, and implementation efforts that follow. OMSI has adopted the following principles to guide the master planning effort.

The expaned OMSI campus will be:

in science learning and teaching as OMSI expands its current programs and creates pathways for learners from diverse backgrounds to develop the skills needed to thrive in the 21st century.

for public engagement and creative problem solving, using science and technology to understand and design solutions for today's critical global and local issues.

in its design and as a center for public education through demonstrations of alternative energy systems and techniques, use of innovative and appropriate technologies to solve problems, and opportunities for public dialog on science policy.

to support OMSI's educational mission and build financial strength.

01.3 History

OMSI had its beginnings in the early history of Portland, whose settlers were fascinated by the natural beauty of the Oregon Country. Buchtel and Cardwell's photography studio had a "cabinet museum" in 1862, featuring a comprehensive display of preserved specimens or Oregon marine life, botany, birds, reptiles and animals. In 1889, The Oregon Alpine Club started a similar collection, including geological specimens. By the 1890s there was growing interest in creating a real natural history museum in Portland. Many prominent Portlanders were fascinated by the natural history of the area, and had their own collections. Unfortunately, funds were unavailable to create such a museum. Col. L. L. Hawkins, an avid naturalist on the City Council, managed to persuade the city to help purchase an important collection of marine specimens and put them on display in City Hall. With the Mayor's support, Hawkins opened the Portland City Free Museum in City Hall, in December 1897.

By the early 1900s, Portland's City Hall was rapidly filling with thousands of exhibits, now including Native American and pioneer history, and a large forestry exhibit featuring examples of every type of tree in Oregon. The energetic Hawkins acted as the museum's first curator. In 1936, the city museum was forced to close, to make room for needed office space in City Hall. Its 35,000 artifacts were put into storage. An effort in 1930 to start a Portland Museum of Natural History was soon derailed by the Great Depression. Then, in 1938, Portland civil engineer J.C. Stevens joined the museum effort when he was appointed chairman of the Geological Society of the Oregon Country's museum committee. Stevens remained one of the museum's strongest advocates for the rest of his life, serving as both President and Board member throughout the years.

Due to delays caused by the Second World War, it was not until 1944 that the idea of a museum began to take shape with the incorporation of the Oregon Museum Foundation. In 1946, the first display of natural history objects was exhibited by the Foundation at the Portland Hotel. Support for the museum continued to grow and in 1949, businessman Ralph Lloyd allowed the Foundation to set up a temporary museum in a house he owned on NE Hassalo Street. It was in this location that the museum was first given the name "Oregon Museum of Science and Industry." The stored collections of the old city museum were uncrated and put on display, along with new exhibits. Within a year, the Pacific Northwest's first public planetarium opened on the site, giving visitors the chance to take a 20-minute trip to the stars under its dome.

By 1955, annual attendance at the Hassalo House had swelled to more than 25,000 but the house was set to be demolished to make way for a new hotel. The house had always been considered a temporary home and there were very early plans to build a dedicated museum building, but the museum had no land to build on. The City Council stepped forward and agreed to lease land in Washington Park to OMSI for the sum of one dollar per year.

Now that a location had been found, a group of civic-minded business and education leaders began a state-wide fundraising campaign to build the new museum of science and technology. In the spirit of pioneer barn-raisings of the 19th century, more than 400 volunteer union brick layers and hod carriers laid 102,000 bricks to raise the walls of OMSI's new Washington Park site in one day on August 17, 1957. On June 7, 1958, J.C. Steven's dream of a dedicated hands-on museum of science and technology became a shining reality with the opening of the Washington Park location. Over the next 35 years as a non-tax based private institution, OMSI's interactive science exhibits and educational programs introduced millions of visitors to the wonders of our world.

By the mid-1980's, OMSI's popularity with visitors surpassed the size of its facility in what is now the Children's Museum at 600,000 people per year attending a museum built to accommodate only 100,000. A new group of community leaders began a campaign to build a state-of-the-art science center, complete with a 315-seat OMNIMAX Dome Theater (the first in the Northwest) and an expanded 200-seat planetarium. Five years later, over $32 million had been donated by business, foundations, and individuals to construct a new museum. The project came together when long-time OMSI supporter, Portland General Electric Company (PGE), generously donated an 18.5-acre site that held a historic sawdust-fired power generation plant. The plans for the new museum incorporated the original smokestack and turbine buildings to blend together technology of the past, present, and future.

Figure 1.3.A PGE Station L

On October 24, 1992, the new 217,000 square-foot OMSI building opened. In 1994, OMSI opened the USS Blueback for public tours, providing a unique look at the people, history, and technology associated with the last non-nuclear powered submarine built by the U.S. Navy. OMSI has continued to grow over the years and currently has five exhibit halls with hundreds of interactive exhibits and displays. Today, the museum serves over 1 million visitors at the museum and through off-site education programs. OMSI is ranked as one of the top science centers in the United States and has an international reputation for its innovative exhibits and educational programs.

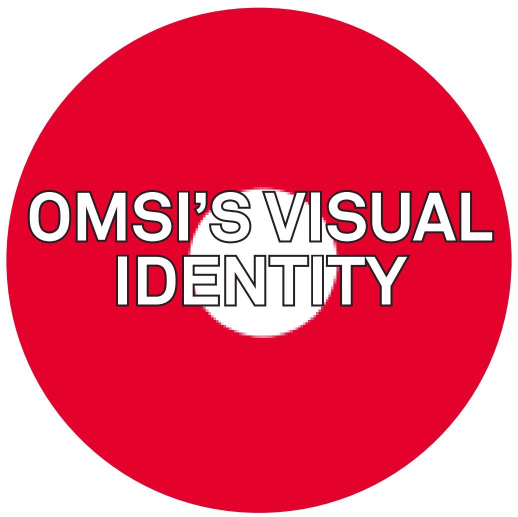
At this time OMSI is contemplating its future and the role the museum will play as science education has become one of most critical issues in the United States. As a vital educational element, leading our region's students to inspiration around science and mathematics, OMSI works closely with teachers and superintendents in Oregon and Southwest Washington to elevate programs in science education and learning through experimentation. The goal of this chapter is to examine the history, existing conditions, and future land needs of the institution in order to fulfill the OMSI mission and to serve future generations with inspired learning experiences and unique educational opportunities and advantages in learning.

01.4 Site Opportunities & Constraints

The OMSI campus is located on the east bank of the Willamette River and extends from Market Street on the north to Sherman Street on the south—located at 1945 SE Water Avenue, Portland, OR 97214—the property is a complex site due to its physical composition. Consisting of North and South Campuses, the property is bifurcated at the Bull Run Right-of-Way, located north of the Planetarium Building of the OMSI Main Campus Building.

The east boundary of the property is defined by Water Avenue, a secondary corridor consisting of one north and one south bound lanes, a bike lane at each curb and planted medians at the north end of the corridor. Water Avenue has been assigned “Designated Truck Corridor” in the SE Quadrant Plan. This designation will dictate future street enhancements and availability to funding resources for vehicular infrastructure improvements in the area.

The site’s complexity is compounded by the history of diverse land uses on the property, which include single family homes situated on the Willamette River, Stephen’s Slough, and numerous industrial uses. The property’s contemporary use as OMSI’s Main Campus carries with it reflections of the property’s historical legacy and decisions related to development over time.



Strongest from across river yet obscured by the Marquam Bridge

Prominent site along Water Avenue; slated for decommissioning

Bisects north campus; in need of seismic upgrades; not recommended to build beneath it

Site bifurcated by many transit corridors but proximity affords diverse access

Underutilized opportunity; agency regulations must be met

Slough covers large portion of site; filled with remnants of woodchip piles; heightens development costs

Limited vehicular & pedestrian activity; few connections to surrounding neighboorhoods

Willamette River Water Activities
Image Source: Google Images

02. Boundaries

02.1 Central City Master Plan

02.2 Master Plan Boundary

02.1 Central City Master Plan

The OMSI property is located in the Central Eastside District adjacent to the Willamette River, between the Marquam and Tilikum Bridges. The site is located within the Central City Plan District boundary and is identified as a location requiring a Central City Master Plan.

Land holders included in the OMSI area are Portland Community College (PCC), Oregon Department of Transportation (ODOT), 1800 Water Avenue Partners (privately owned), Portland General Electric (PGE), and Portland Opera.

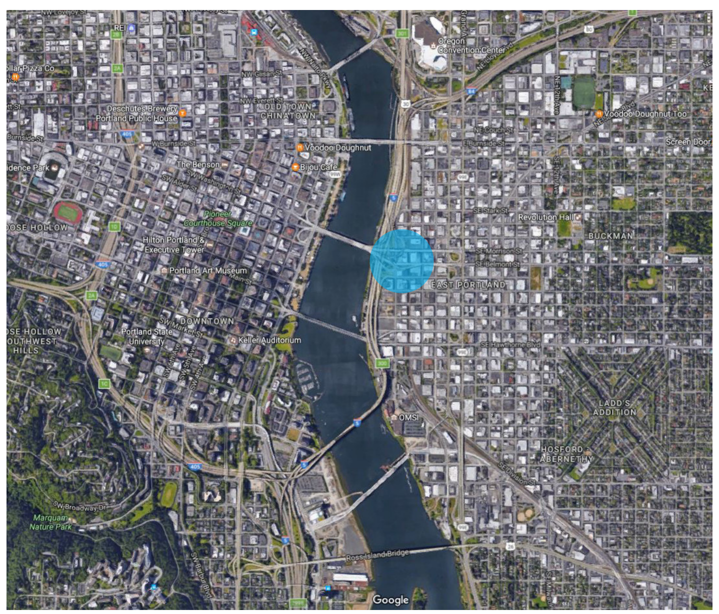


Figure 2.1.A - Portland Aerial Map
Image Source: Google Maps

Legend

Central City Plan District boundary

Required Central City Master Plan

Proposed right-of-way

Proposed accessway

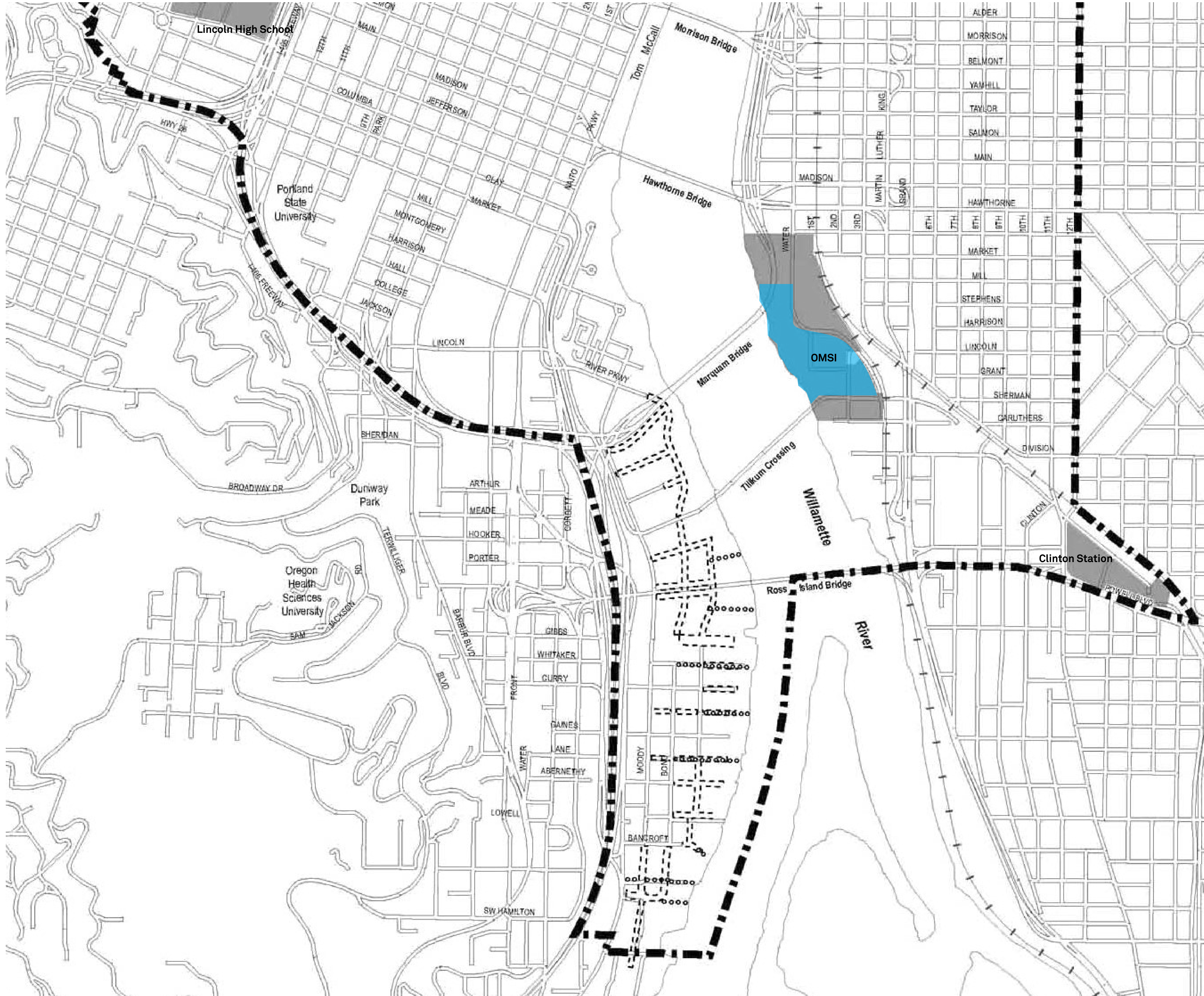


Figure 2.1.B - Central City Plan District Boundary identifying three of the five development sites requiring master planning

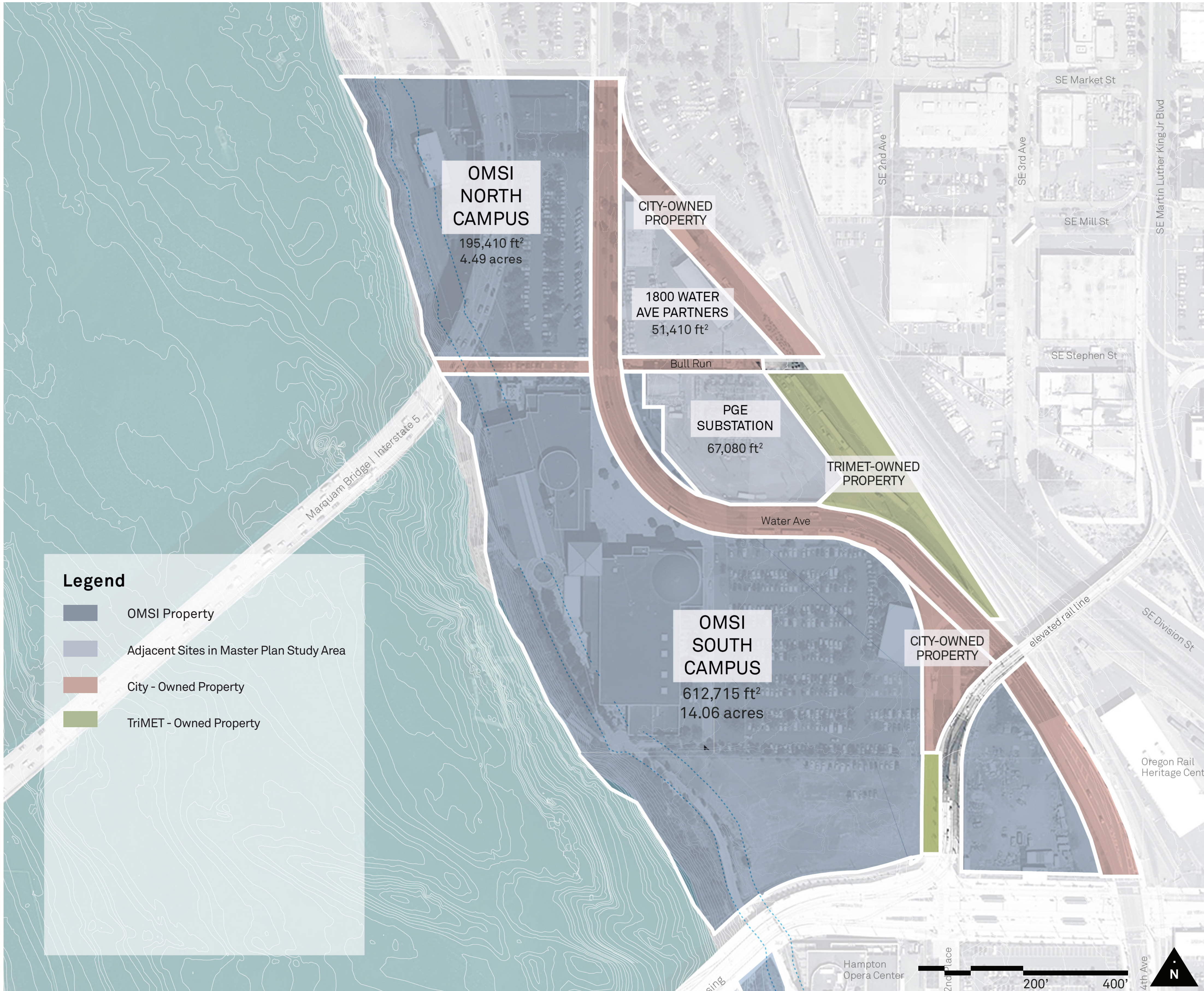


Figure 2.2.A - Central City Plan District Boundary identifying three of the five development sites requiring master planning

02.2 Master Plan Boundary

Figure 2.2.A describes the limits of the site to be considered for this Master Plan application. The proposed Master Plan boundary is inclusive of the property highlighted in the plan and legend below.

All of the parcels shown in dark blue are presently owned and controlled by OMSI the aggregate site area contained within these limits, excluding current right-of-ways, is 807167 sq. feet, or 18.53 acres.

The aggregate developable site area contained within these limits, excluding current rights-of-way, is 925,650 sq. feet, or 21.25 acres.

Tilikum Bridge
Image Source: Mayer /Reed

03. Design & Development Framework

03.1 Design Framework

03.2 Project Narrative

03.3 Master Plan Concept

03.4 Open Space Plan Details

03.1 Design Framework

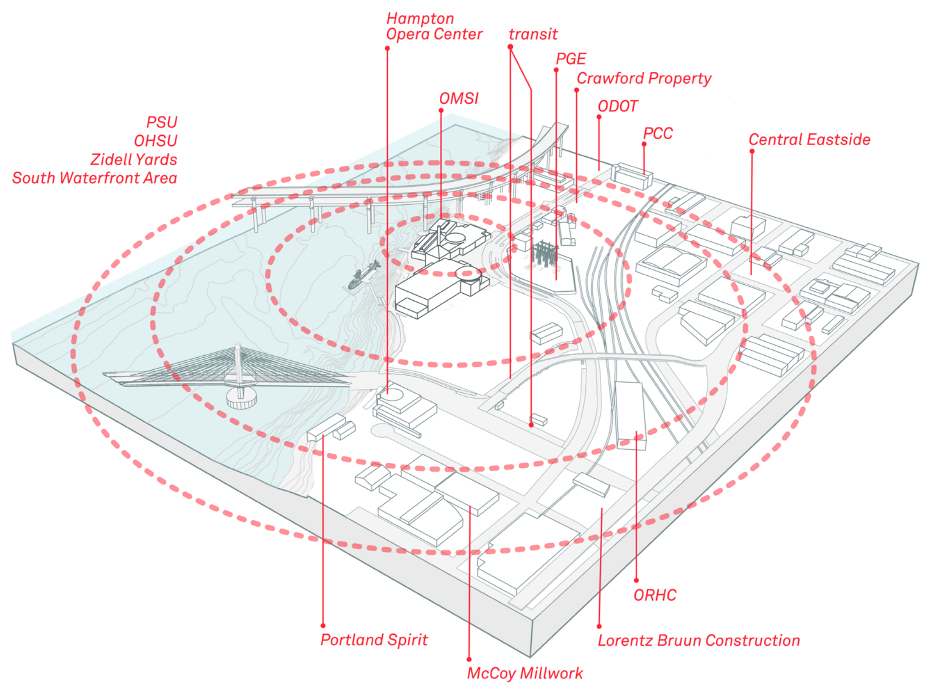
In addition to OMSI's guiding principles the following drivers were studied in the development of the master plan outlined in this document.

- Market Conditions
- Aesthetics
- The Public Realm
- Parking
- Sustainability
- Identity

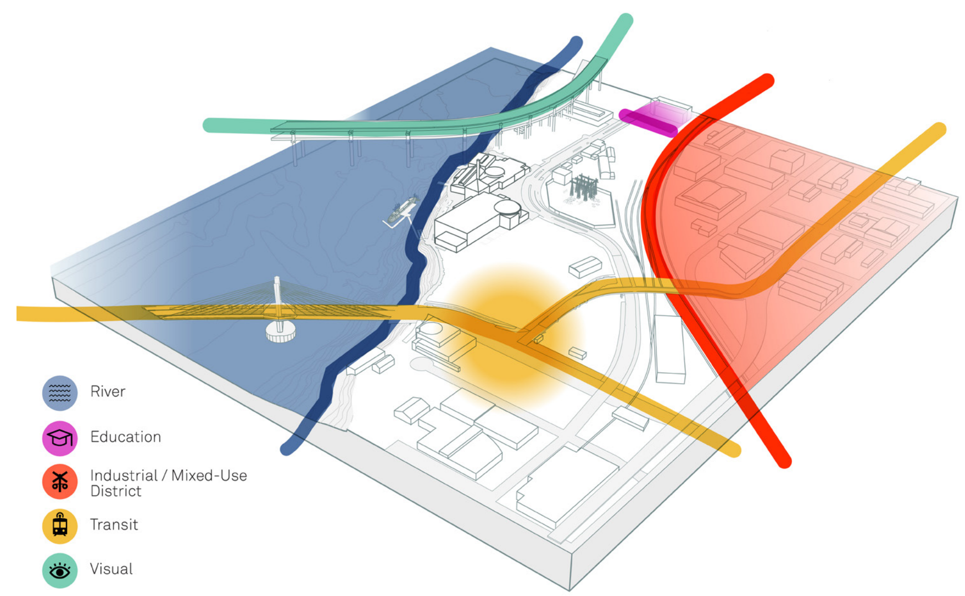
The master planning team used these drivers to establish a design framework that will be instrumental in guiding the development of the OMSI campus from master planning concepts through implementation.

From these studies the five framework diagrams on the following page were developed to illustrate five key ideas and relationships that are foundational to the master plan.

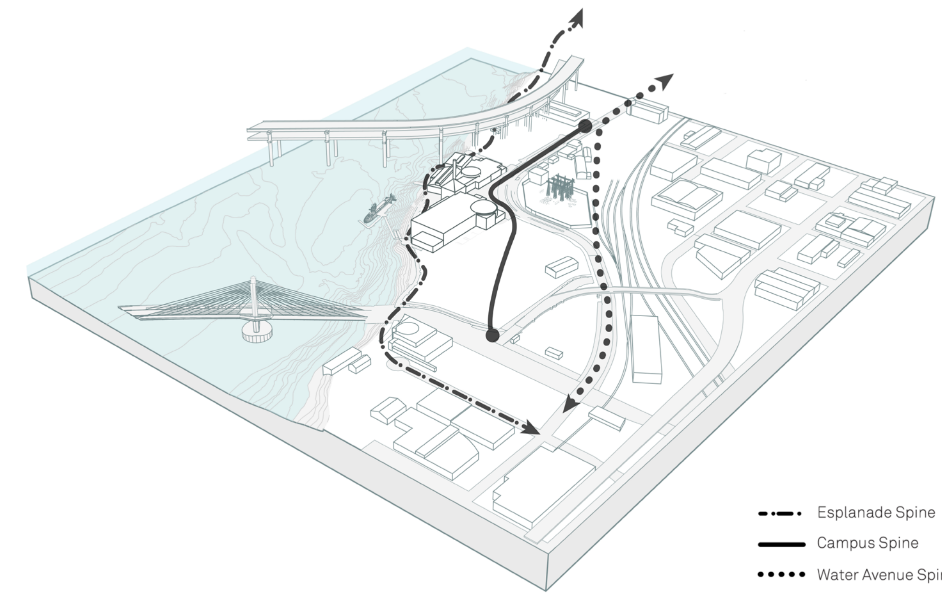
03.1 Framework Diagrams



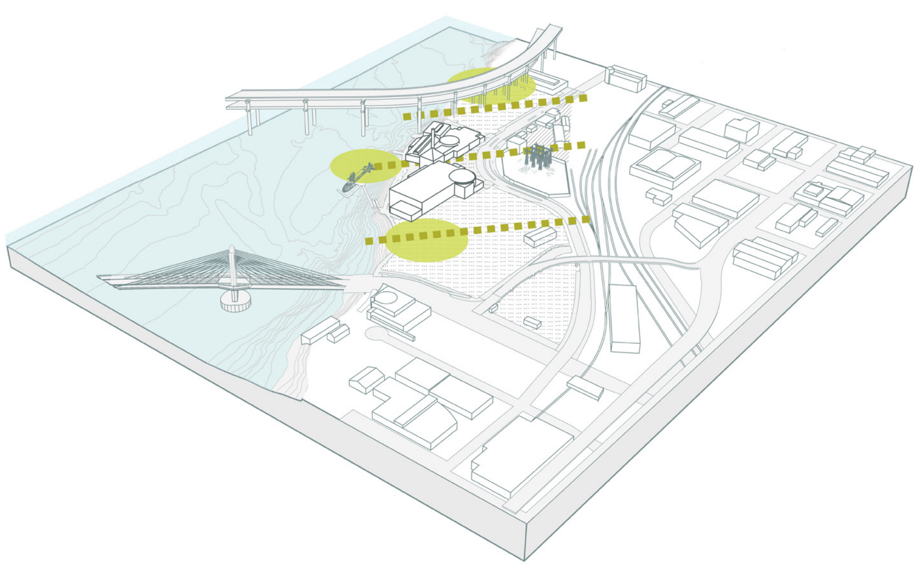
1. Neighbors - Foster partnerships with neighbors and future tenants



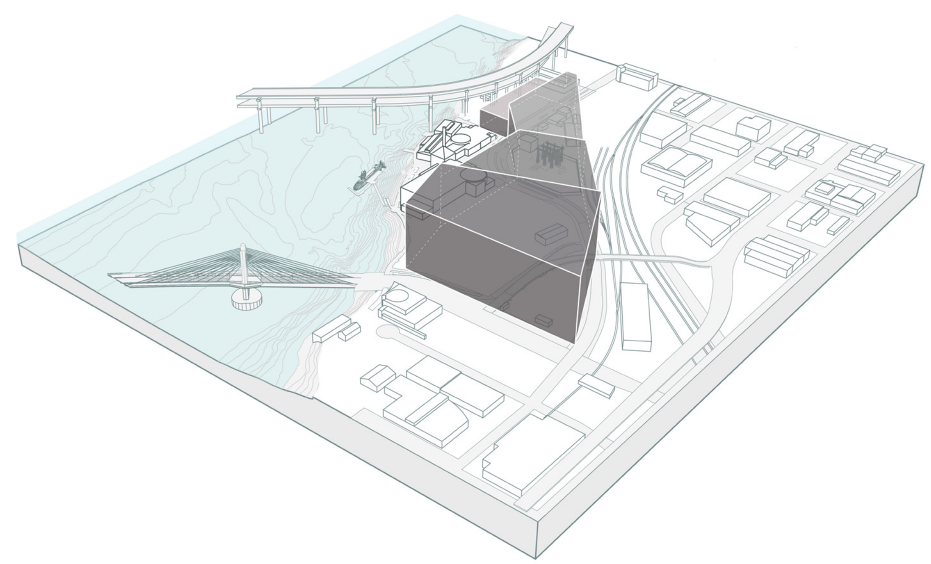
2. Fronts - Respond to existing site adjacencies



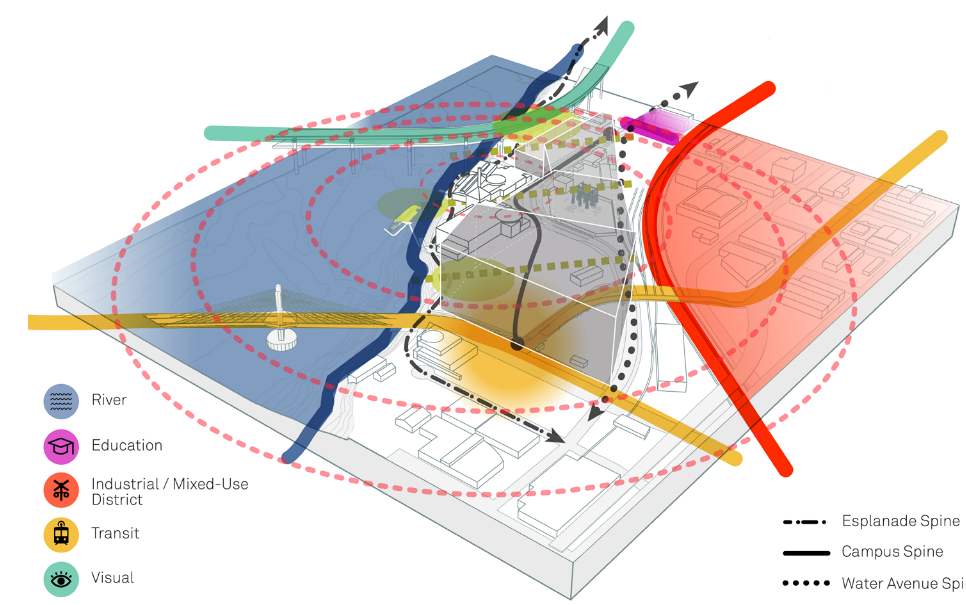
3. Circulation - Organize the campus along 3 dynamic north -south spines



4. Cross Connections - Create a green network that stitches the campus to the river and expands public space on the riverfront



5. Development - Promote development that activates the ground plane, reinforces adjacent uses and respects the presence of OMSI



6. Overlay Diagram - The overlap and intersection of the framework diagrams create an underlying structure that will serve as the basis for the OMSI campus Master Plan.

03.2

Project Narrative

The OMSI Master Plan is unique to the characteristics of the OMSI campus and the development opportunities evident by the land configuration, adjacency to the Willamette River, the OMSI Station and Water Avenue. The Master Plan vision as detailed in this chapter outlines a strategy that creates a safe and vibrant public realm, supported by active ground floor uses, open space areas and community/event spaces. Detailed phasing and massing studies can be found in Chapter 4.

The OMSI Master Plan identifies a range of themes and design elements that unify the district and create a campus environment focused on OMSI. Design elements include streets, sidewalks and pedestrian accessways, street furnishings and landscaping, the Willamette riverfront and associated open spaces, stormwater management features, smaller public spaces and squares, building massings and design. OMSI programs, exhibits, art and events will extend from the current building to these public places throughout the district, and into significant lobby and other building spaces when opportunities arise. Signage and wayfinding will further unify and help define the district.

The OMSI Master Plan area is unique because it doesn't connect to the surrounding block structure. The area fronts the Willamette River to the west, the main rail lines to the east, and the MAX/Lightrail lines to the south. SE Water Avenue is the only link to adjacent districts to the north and south. The Master Plan defines a series of blocks or tracts based on OMSI's development objectives and the unique conditions of the site. The initial phase maintains SE Water Avenue's existing alignment and creates development tracts by creating a new loop street linking properties east and south of the OMSI building to Water Avenue. These

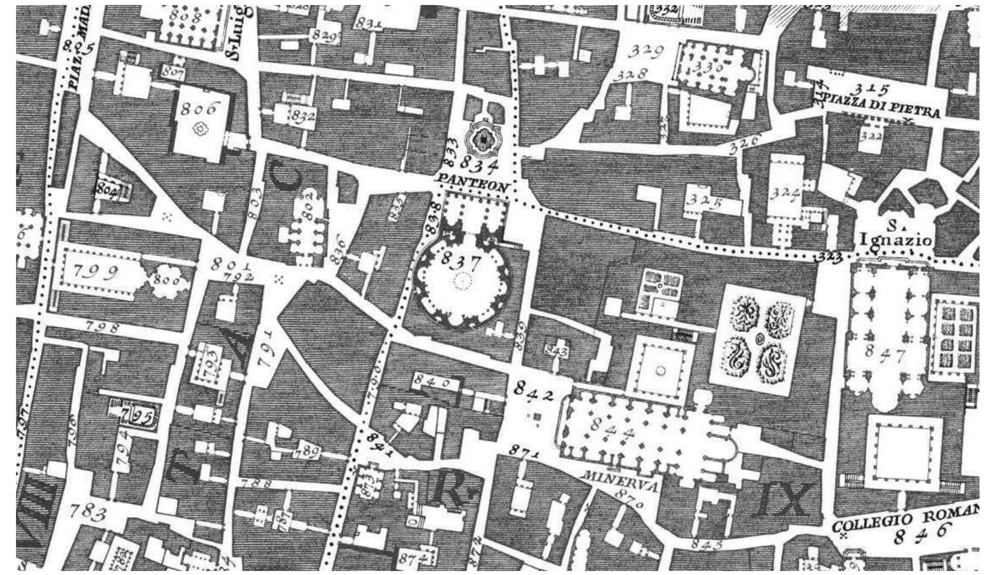
Figure 3.2 - Proposed site plan identifying four enlargement areas (North Riverfront, OMSI Gateway Plaza, Tilikum Plaza and Central Spine

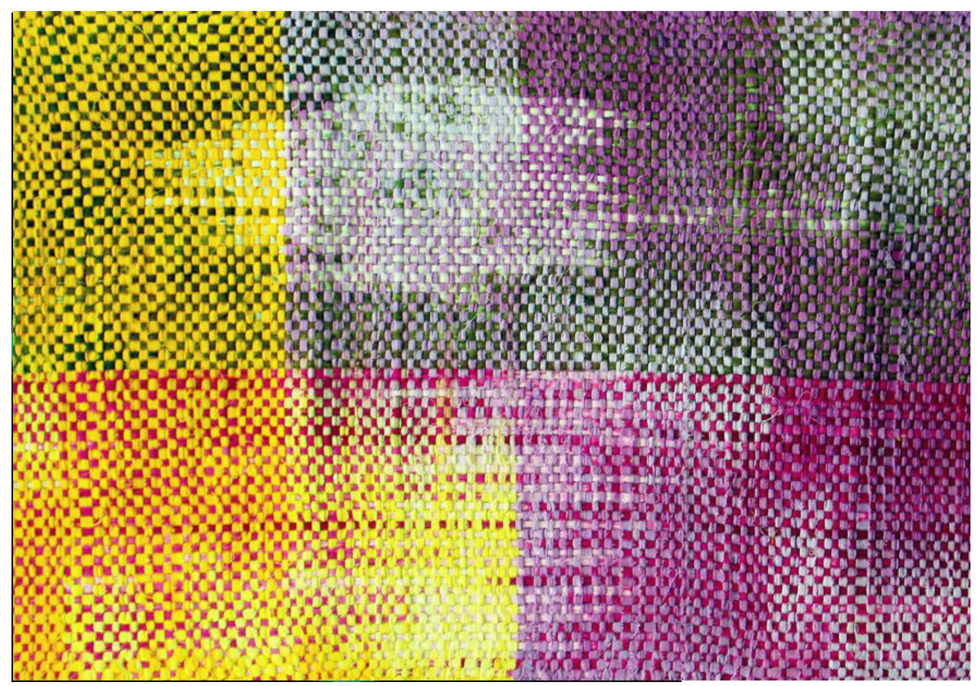
tracts are further divided by pedestrian accessways that create parcels of various sizes and unique shapes. OMSI North Campus and Tract D, east of the Streetcar bridge, remain as they are currently configured. A future phase, outlined in Chapter 4 realigns SE Water Avenue to the east along the railroad right-of-way, and incorporates three new tracts to the west of the realigned street fronting a new internal street section on the rough alignment of the original Water Avenue. These new tracts also vary in size and shape and are formed by new east-west pedestrian accessways. While not replicating the historic Portland block structure, the OMSI Master Plan creates its own unique block structure based on the conditions present on the site.

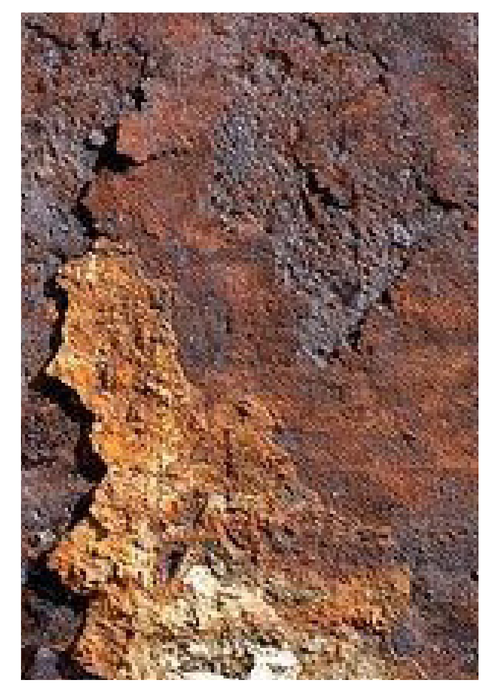
There are two primary gateways for this district. The OMSI Master Plan provides a gateway for transit riders arriving from MAX and Streetcar at a small square adjacent to the station platforms. The square contains wayfinding information about the district, and has pedestrian connections to the riverfront and to OMSI. The second primary gateway, in the final phase, is a new vehicular/pedestrian/bicycle entrance off the realigned SE Water Avenue. There are opportunities for entrance structures, art/technology, and signage at this gateway that leads into the heart of the OMSI campus.

There are two significant exisiting buildings within the OMSI property and each will be retained and upgraded. The OMSI building will continue to house most OMSI exhibits and events. A remodel of the entrance pavilion is anticipated. The PEPCO building north of the OMSI building will be retained and repurposed for a new use.

03.3 Master Plan Design Concept







The concept of texture relates to the contextual “fronts” that exist at each of OMSI’s “edges”. The significance of these fronts is rooted in the idea of integrating OMSI into the greater context of Portland. By nurturing these relationships, we forge a unified entity (or in this case, a campus) woven together from disparate parts. Just as OMSI promotes the intersection of science, technology and design, the design concept celebrates the intersection of difference as a method of creating a rich, multi-layered fabric.

03.4.1 Plan Detail North Riverfront

The OMSI Master Plan complies with the Willamette Greenway Plan through the development of three new open spaces along the river, as well as expanded pedestrian and bicycle access to and along the greenway path. New development, particularly to the south of OMSI's existing building, will feature building entries, outdoor and terrace spaces and active ground floor uses as described in section 4.3 that are oriented towards the river.

One of the primary themes of the OMSI Master Plan is to celebrate and enhance the 1,900 feet of Willamette riverfront connected to the OMSI property. The river is linked into development to the east through the inclusion of stormwater management features and fountains, and through connection to multiple east-west pedestrian and bicycle pathways. Opportunities to outwardly express stormwater management, water quality and treatment, water recreation and water flow are all fundamental to OMSI's educational mission and the OMSI Master Plan.

Figure 3.4.1.A - The Edge /Brooklyn, NY / W Architecture & Landscape

Figure 3.4.1.B - Vera Katz Eastbank Esplanade / Portland, OR / Mayer/Reed

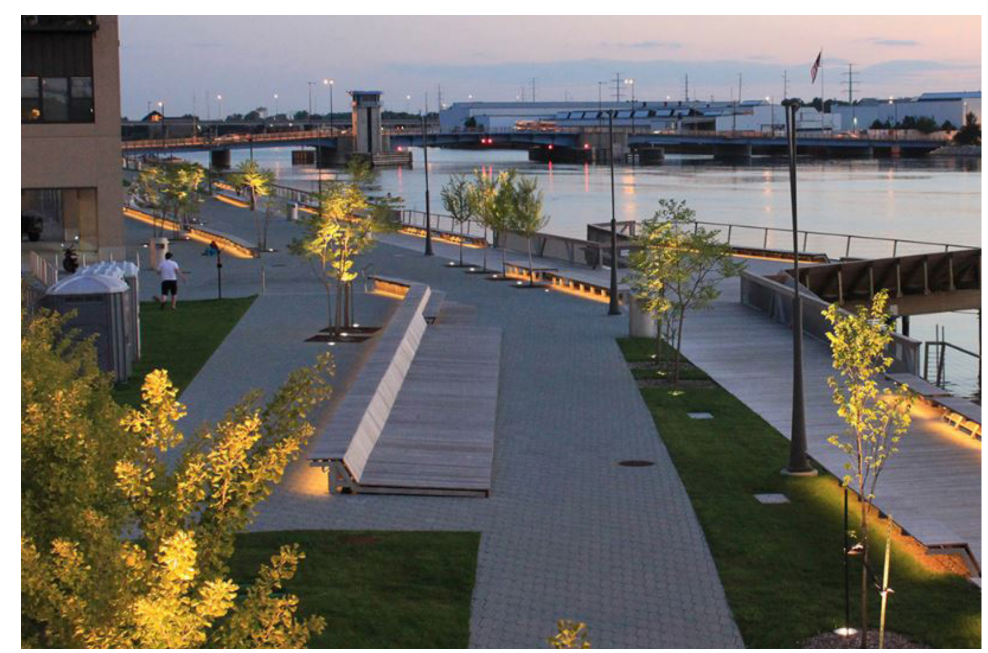
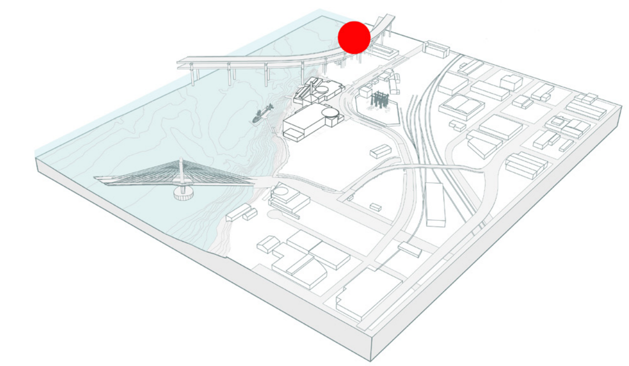


Figure 3.4.1.C - The City Deck / Green Bay, WI / Stoss

Figure 3.4.1.D - North Riverfront Plan



The design of the Northern Riverfront features allocation for significant water related uses, water access and upland lawn areas for informal gathering and play. The passive park-like spaces are designed for flexible use by campus tenants and visitors separating the Greenway Esplanade and water related uses to reduce potential user conflicts. These spaces include lush tree canopies and shaded areas, energy-efficient lighting, fixed seating, stormwater features and a potential dedicated play area. The area may also be punctuated by OMSI outdoor exhibitions and public art.

Physical access to the river is provided through a water related use located within the Greenway which could connection to and share dock space with a community dock for light water craft located to the north of OMSI. Visual connectivity to the river is enhanced through the creation of multiple viewing platforms and overlooks which provide moments for pause and seating. A flexible surface parking area for service access into the tract can be used for both parking and events. Clear paths of circulation are defined through improved access points, which cross the upgraded pedestrian and bicycle lanes at clearly designated points.

03.4.2 Plan Detail

OMSI Gateway Plaza

The OMSI Gateway Plaza consists of two public spaces joined by the existing OMSI atrium lobby. The plaza on the east side is proposed in this plan to be reconfigured to create a stronger sense of welcome and identity, while providing flexible space for events and exhibits. The western plaza invites entry into OMSI from the Willamette Greenway Trail, and can also serve as an open space for public or private events, public art and interpretive exhibitions. A secondary boardwalk over the riverbank is proposed to improve the flow of circulation and to provide a choice of trails for pedestrians. The riverbank habitat will be improved.

The uppermost gangway to the existing submarine dock will be relocated to land at the Gateway Plaza. This relocation will enhance access and create a distinct gathering space for tour groups, while simultaneously relieving the “pinch point” along the Willamette Greenway Trail.

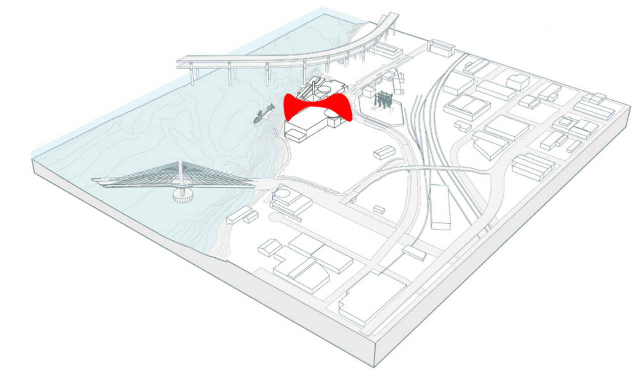
Figure 3.4.2.A - Rendering of OMSI Gateway Plaza looking South

Figure 3.4.2.B - Bicycle Snake / Copenhagen, DK / Dissing + Weitling

Figure 3.4.2.C - Punggol Waterway / Sentual Crescent, SG

Figure 3.4.2.D - Swarovski Crystal Worlds / Wattens, Austria / Snohetta

Figure 3.4.2.E - Detail plan of OMSI Gateway Plaza and surrounding context



The re-design of OMSI's eastern plaza supports the flow of museum visitors through the creation of distinctive zones for gathering and queuing. Seating areas beneath a grove of trees and an architectural canopy provide protection from rain and sun and help to organize large and small groups alike. The space incorporates high-quality paving, stormwater features, energy-efficient lighting as well as improved bus and car drop-off areas.

The plaza also features a small pavilion for ticketing and /or concessions, allowing for the reconfiguration of the atrium space, which currently poses both physical and visual blockage to and from the esplanade path. No longer needed as a lobby space, the atrium can be adapted into a vertical playground, to be enjoyed from within and to be seen from outside. The western plaza, with it's riverfront views and flexible layout, lends itself to temporary programming and outdoor exhibitions.

60' 120' N

03.4.3 Plan Detail

Tilikum Plaza

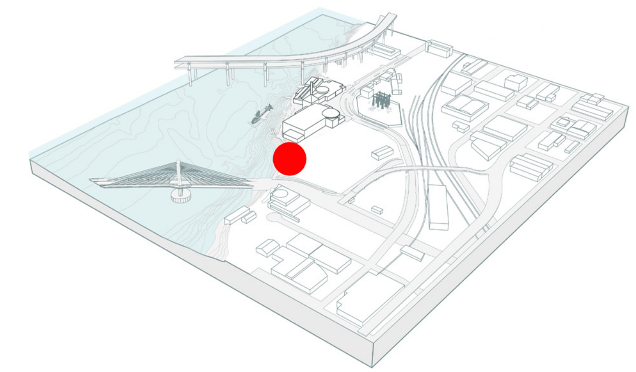
The new Tilikum Plaza is located north of the Tilikum Crossing Bridgehead. As a central plaza open to the public, it will be used as a flexible, public gathering space and exhibition area. This river-oriented plaza is the foreground to development to the east and will include kiosks, indoor and outdoor activity areas, rooftop terraces and pedestrian connections. River access will be informal, with a stepped terrace, overlooks and paths to the water. A seasonal, floating in-water performance barge may be moored in front of this area. A public, ADA-accessible, fixed fishing pier may be investigated as a waterfront amenity. The ramps leading down to the fishing dock are designed to incorporate seating, creating additional opportunities for passive waterfront engagement.

Figure 3.4.3.A - Rendering of Tilikum Plaza looking northwest

Figure 3.4.3.B - Avon River Precinct / Christchrurch, NZ / Otakaro

Figure 3.4.3.C - Brooklyn Bridge Park / Brooklyn, NY / MVVA

Figure 3.4.3.D - Detail plan of Tilikum Plaza and surrounding context



The central open space of Tilikum Plaza is designed to accommodate large-scale, temporary events such as festivals, galas, markets and fairs. High-quality paving, improved lighting and seating areas create a rich public space along the Greenway Esplanade Trail. Stormwater treatment gardens connected to upland development as well as riverbank habitat restoration will also be incorporated as educational tools.

03.4.4 Plan Detail

Central Spine

The OMSI Master Plan is anchored by the Central Spine, a north-south corridor that creates clear, pedestrian-oriented connections between multiple transit hubs and OMSI. Punctuated by small-scale squares and plazas, the Spine is designed to foster vibrant public life throughout the OMSI campus. This network of streets features covered walkways, allowing for all-weather promenading, and many opportunities for outdoor seating. Development along this corridor may consist of active ground floor uses that serve to activate pedestrian life, such as the uses outlined in Section 4.3.

Figure 3.4.4.A - Rendering of central spine looking northwest

Figure 3.4.4.B - New Brighton Road / Brighton, UK / Jan Gehl

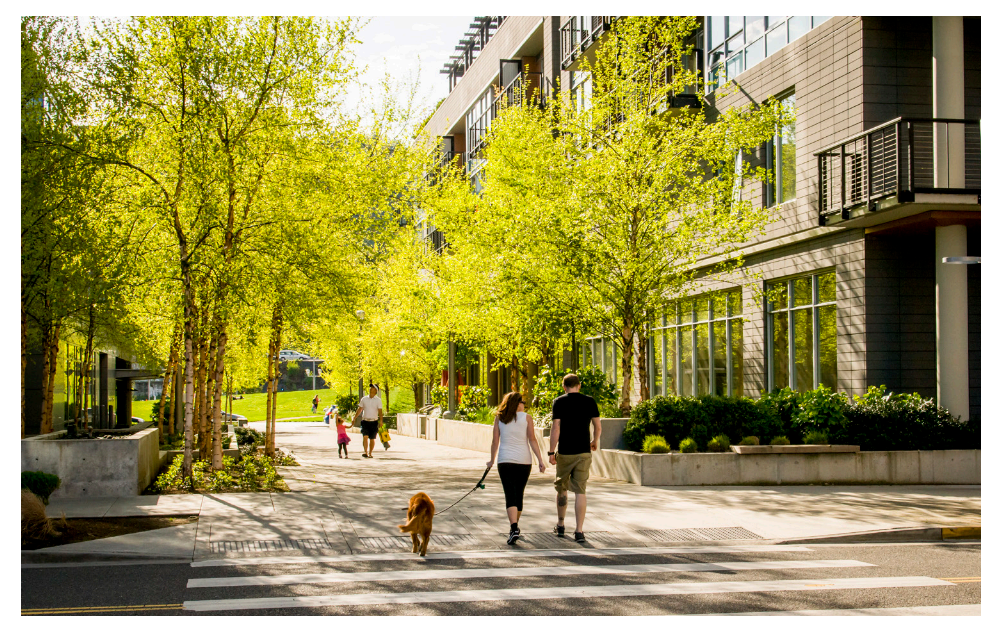


Figure 3.4.4.C - Pennoyer Street / Portland, OR / Mayer/Reed

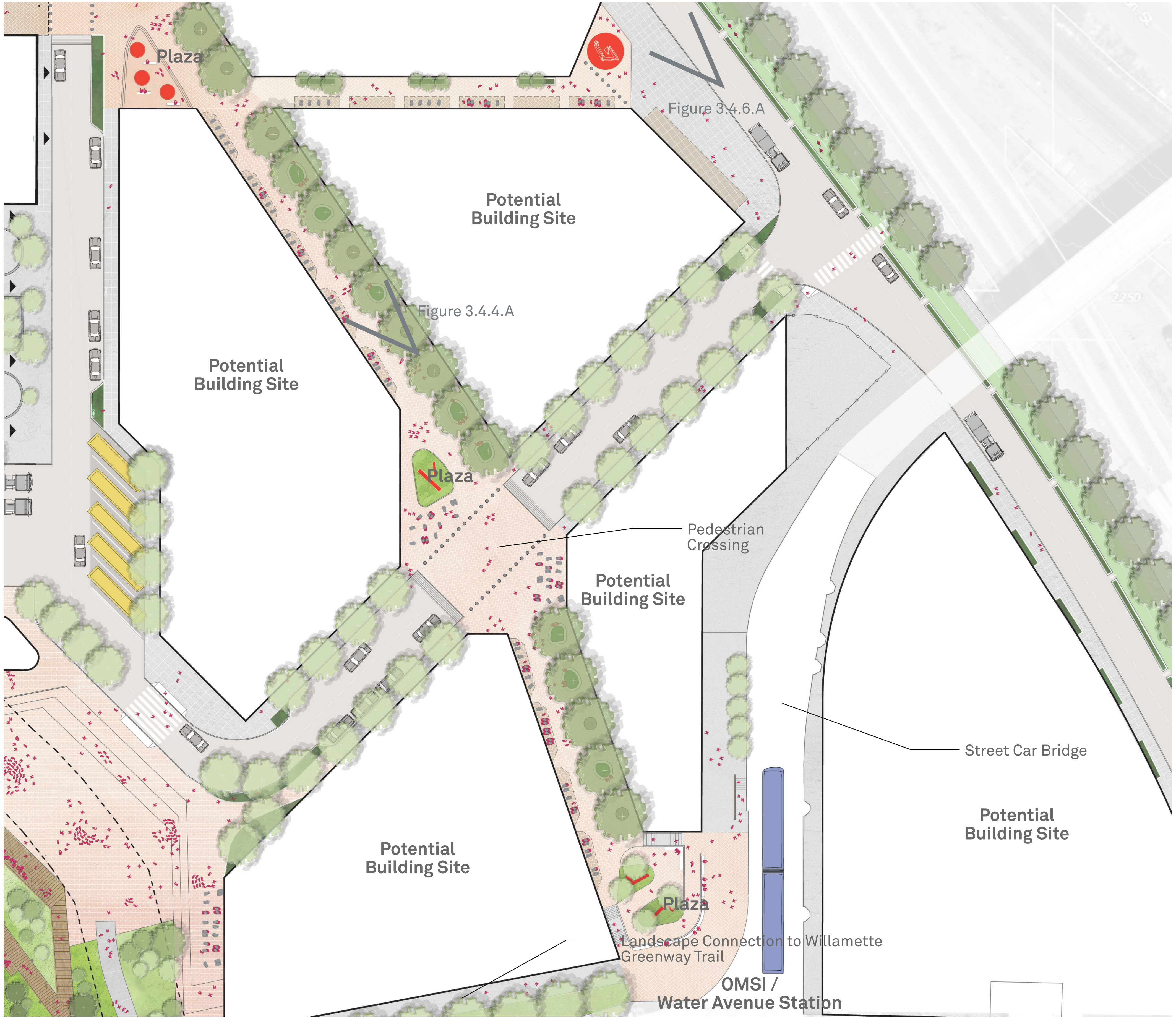
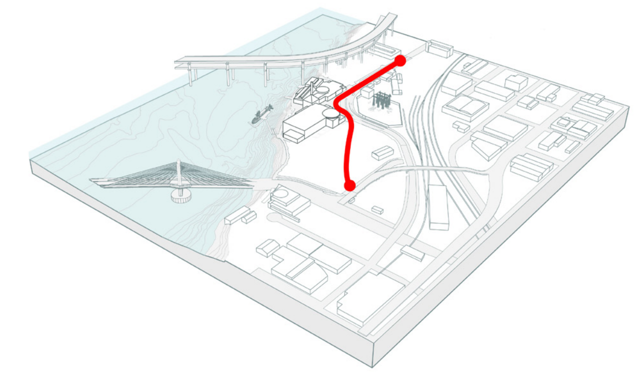


Figure 3.4.4.D - Detail plan of Central Spine and surrounding context



Prioritizing the pedestrian experience, the streets of the Central Spine feature high-quality paving, planted areas and improved lighting. Small-scale plazas may consist of OMSI wayfinding and exhibitions, creating a distinct campus brand and forging the idea that one enters through “OMSI’s front door” upon disembarking the street car, bus or light rail. A series of east-west-running green streets serve as appendages to this Central Spine, and allow for connections to realigned Water Avenue. Green streets are primarily pedestrian ways featuring lush planting and stormwater management. Though they are not intended for everyday vehicular use, they are designed to accommodate both service and emergency vehicles. Additional details regarding the streets are outlined in Chapter 5.

03.4.5 Plan Detail
Public Squares

The development parcels are laid out with small dedicated public squares that will be activated by active ground floor uses and foot traffic from the transit hub as well as from the various parking garages located through-out the campus. Each square or plaza will be an opportunity for exterior OMSI exhibits or campus wide sustainable systems that can be externally expressed and contribute in the facilitation of OMSI identity further enriching the environment with learning opportunities.

Figure 3.4.5.A - Central Wharf Plaza / Boston, MA / Reed Hilderbrand

Figure 3.4.5.B - Johans Gate Plaza / Oslo, Norway / Snøhetta

Figure 3.4.5.C - Assembly Row / Boston, MA / Copley Wolff Design Group

03.4.6 Plan Detail

Water Avenue

Realigned Water Avenue celebrates the rich legacy of Portland's Central Eastside. The architectural character and streetscape of realigned Water Avenue supports the development of a multitude of occupant oriented active uses as outlined in Section 4.3, while also creating opportunities for rich public life and interaction.

The ground floor and streetscape of Water Avenue is imagined with largely glazed ground floors and generous sidewalks activating this important front to the planned future campus development along Water Avenue. In addition to the uses outline in Section 4.3 opportunities for educational buildings or future expansion of OMSI exist along this circulation spine.

The street realignment also includes a designated two-way cycle track buffered by a continuous stormwater management system. To the east, visual connectivity to the railyard speaks to the history of the area.

Figure 3.4.6.A - Rendering of realigned Water Avenue looking northwest

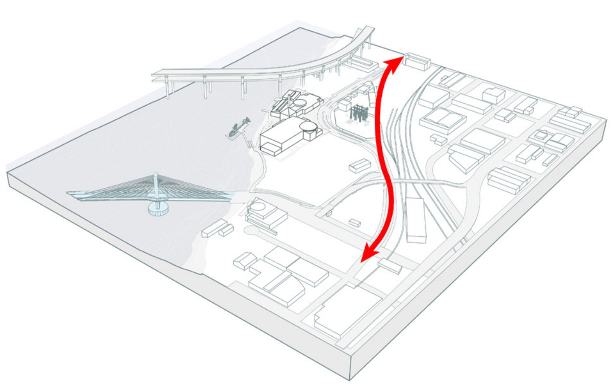


Figure 3.4.6.B - Brew Pub / Philadelphia, PA

Figure 3.4.6.C - Salon / France

Figure 3.4.6.D - Cremorne Showroom / Australia

OMSI Master Plan Public Engagement
Image Source: OMSI

04. Phasing, Uses & Massing

04.1 Phasing

04.2 Development Plan

04.3 Ground Floor Use Plan

04.4 Massing

04.5 Height

04.6 Massing Studies

04.1.1 Phasing - Phase 1

The Master Plan defines a series of blocks or tracts based on OMSI's development objectives and the unique conditions of the site. Phasing is shown on Figures 4.1.1.A and 4.1.2.A The initial phase, Phase 1, maintains SE Water Avenue's existing alignment and creates tracts B and C by creating a new private loop street linking properties east and south of the OMSI building to Water Avenue. These tracts are further divided by pedestrian accessways that create parcels of various sizes and unique shapes. Tracts A and D remain as they are currently configured.

Figure - 4.1.1.A - Phase 1 Plan

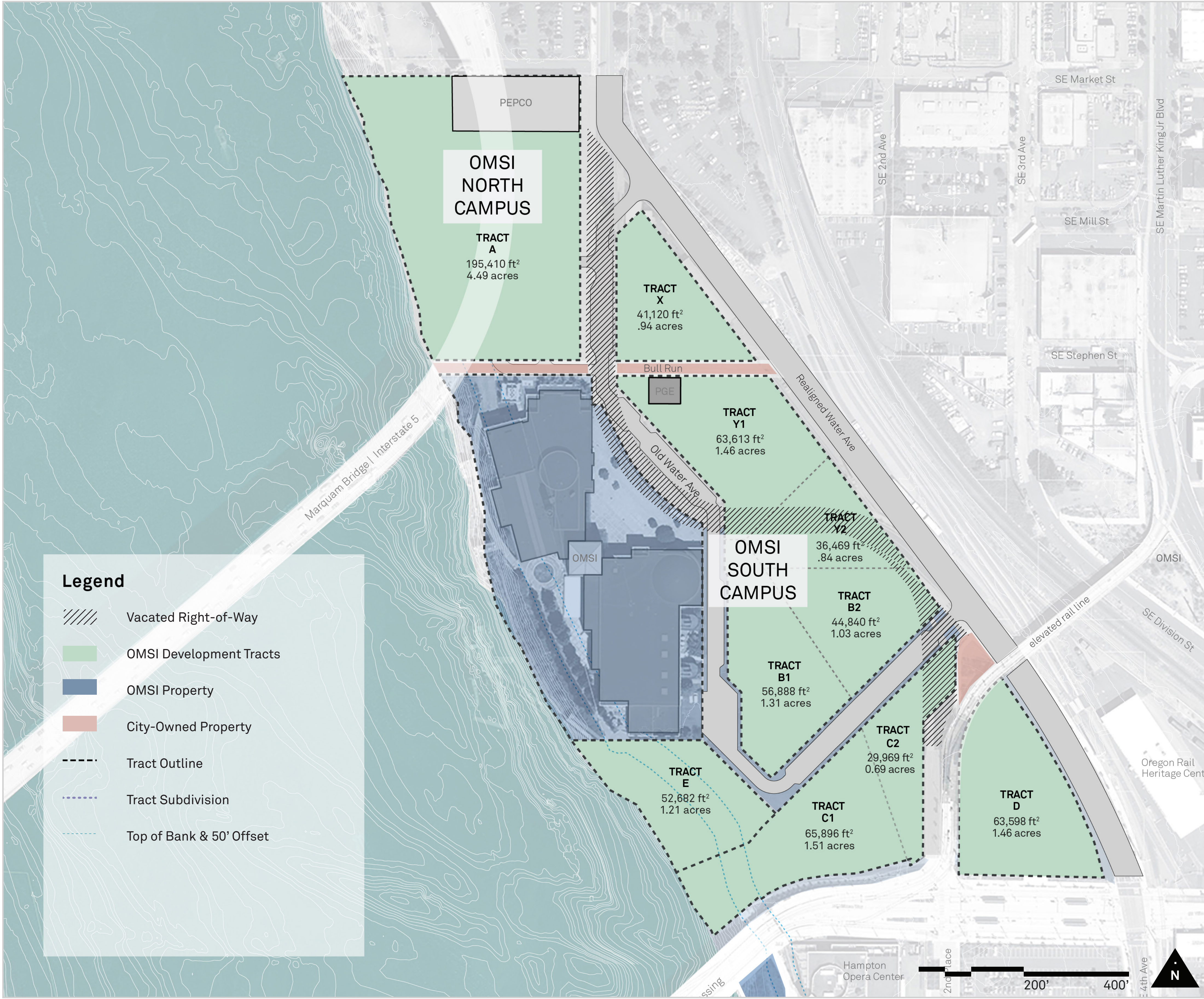


Figure 4.1.2.A - Phase 2 Plan

04.1.2 Phasing - Phase 2

A future phase, Phase 2, realigns SE Water Avenue to the east along the railroad right-of-way, and incorporates three new tracts to the west of the realigned street fronting a new internal street section on the rough alignment of the original Water Avenue. These new tracts also vary in size and shape and are formed by new east-west pedestrian accessways. The future phase, Phase 2, may be deployed at any time and is not dependent on the completion of the initial phase, Phase 1.

Phased development on individual tracts, and on adjacent tracts is als o permitted. When development is proposed on a portion of a tract, and the remaining area of that tract is currently used for surface parking, the surface parking area may remain until that portion of the tract is developed. Similarly, if sub-tracts are created, for example tracts B1 and B2, and development is proposed for only tract B1, existing surface parking on tract B2 may remain until that sub-tract is developed. In all cases, the remaining surface parking areas may be reconfigured in order to function safely and efficiently considering the development activities occurring nearby.

04.2 Development Plan

The OMSI Master Plan sets an urban design framework for the district, but does not include specific building design proposals. Building-specific elements that address each of the Project Design Guidelines will be developed when individual buildings are proposed for design review approvals by investors.

All uses permitted in the EXd zoning classification (Central Employment) are permitted in the OMSI Master Plan. The intent of the EXd zone is to promote and conserve areas within the city with scenic, architectural, or cultural significance. Applying the Design Overlay Zone and establishing development guidelines ensures that the vitality of these spaces is protected. The zone serves a wide range of industrial and commercial uses which need a central location, and though residential uses are allowed, they are not intended to predominate or set development standards for other uses in the area.

The site is designated for a Central City Master Plan (CCMP) district in the proposed Central City Plan 2035 Zoning Code Amendments. Major changes to the allowed uses in the EX zone that apply within the CCMP district are:

Residential uses will only be allowed through a CCMP. The main emphasis of the planning requirement is to ensure the residential use will not have impacts on the surrounding existing industrial uses, and vice versa. Applicant must also demonstrate that the residential use will not impact the local transportation system, and meet all of the approval criteria in PCC 33.510.255(G) (Conditional use). Design should enhance access to river and use riverfront as the key site feature. The plan will require a Type III review by the Portland Design Commission, appealable to City Council.

Retail Sales and Service uses are allowed up to 40,000 SF net building area per use. Uses between 40,000 and 50,000 SF require a conditional use permit, and uses over 50,000 SF are prohibited. A minimum of 20% of the Master Plan area must be open space.

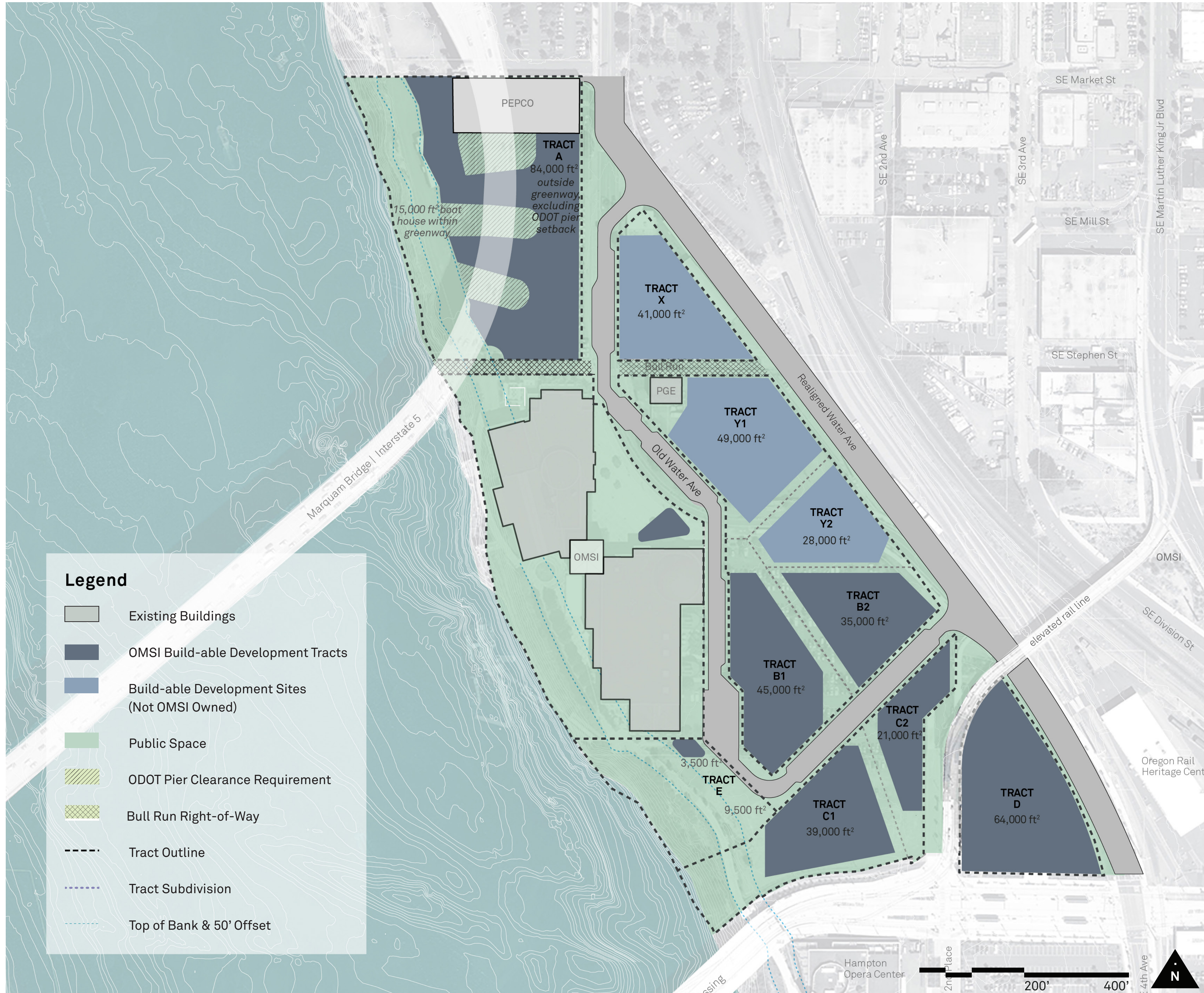


Figure 4.2 - Development plan

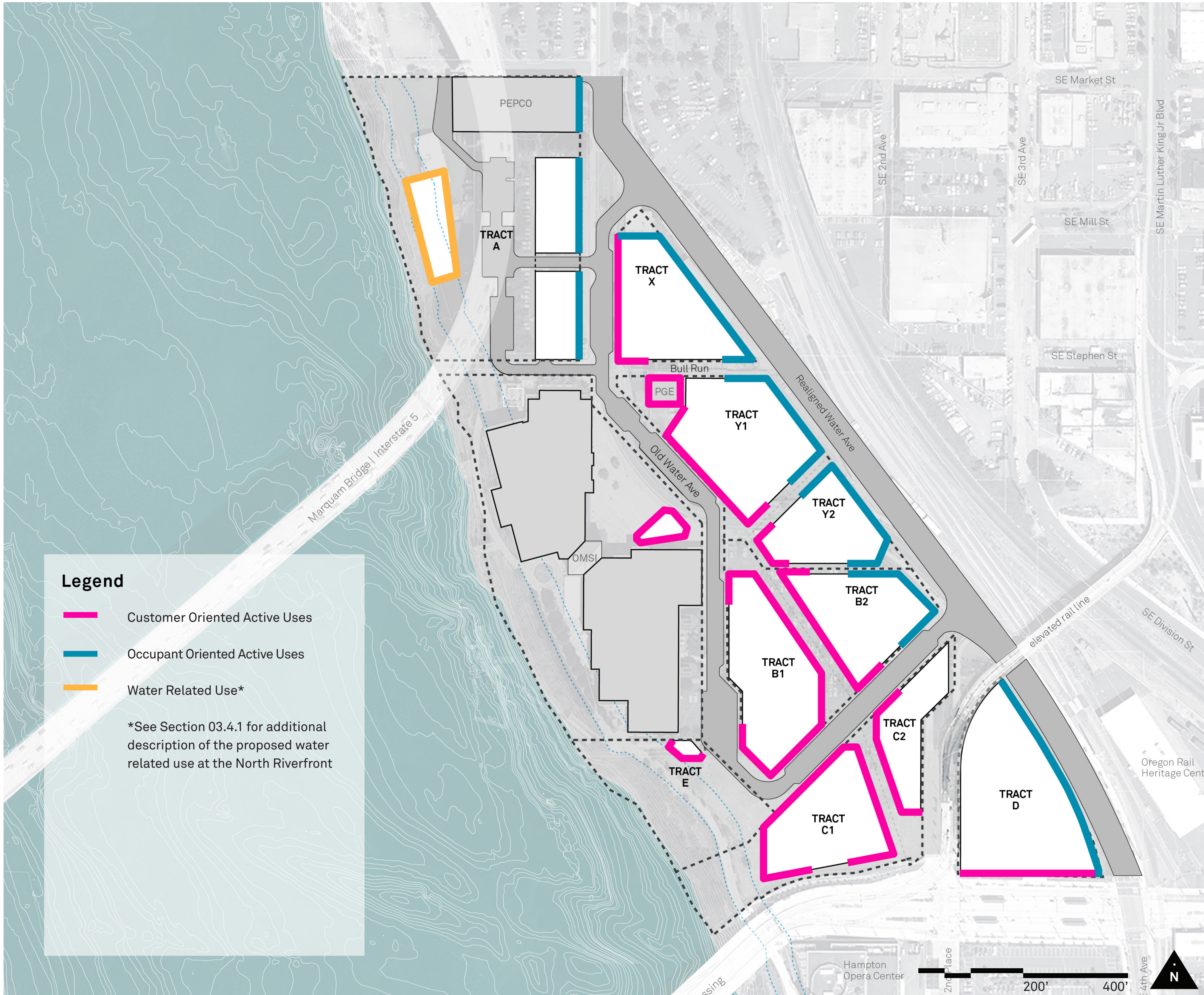


Figure 4.3 - Ground floor use plan

04.3 Ground Floor Use Plan

The Figure opposite shows specific street and accessway frontages where "active ground floor uses" are required. The intent of active ground floor uses is to provide visible human activities through windows along the sidewalk. Shops, restaurants, cafés, and personal services clearly accomplish this even if they do not occupy large amounts of space (i.e. frontage is more important than area). The goal is to create visible activity inside and provide users a visual connection with the outside. It is not only the use that matters, but seeing social activity, "eyes on the street," visual transparency, and human connectivity. This also requires an entrance directly from the sidewalk, not merely from an interior space.

Two active use emphases are shown:

Customer Oriented Active Use is designed for the central pedestrian spine, adjacent to the MAX Platforms, and fronting Tilikum and OMSI Plazas. These ground floor areas should contain uses that attract and serve customers, such as retail sales and services, restaurants, cafés, exhibit spaces, showrooms and building lobbies. The emphasis here is on the customer interaction with ground floor uses.

Occupant Oriented Active Use is shown for the SE New Water Avenue street frontages and for eastern facing frontages on tract A. Any active use that is customer oriented is encouraged here, as are uses where ground floor occupants are visible from the sidewalk. The emphasis is on the occupants of various businesses working in settings where they can be seen from the sidewalk, but where these spaces are not necessarily accessible to the general public. Customer Oriented Active Uses are not excluded from this use type.

04.4.1 Development Plan

The overall development program is based on the proposed 2:1 FAR plus the riverfront open space bonus option that allows an additional 3 square feet of building area for each square foot of open space provided adjacent to the required river setback. Both the existing OMSI building and the PEPCO building are proposed to remain. This baseline development program is summarized below:

Total Phase 1 Site Area:
807,167 Square Feet (18.53 acres)

Total Development @ 2:1:
1,614,334 Square Feet

Existing Buildings to Remain:
244,000 Square Feet

Net New Development @ 2:1:
1,370,334 Square Feet

Riverfront Open Space Bonus 41,091 SF Open Space @ 3:1:
123,273 Square Feet

Base New Development + OS Bonus:
1,490,607 Square Feet

The ultimate plan anticipates the relocation of SE Water Avenue to the east, and the acquisition of both the 1800 Water Avenue Partner Property (tract X) and the PGE Substation (tract Y). The development program for these tracts is summarized below, a small existing building on the PGE Substation tract is assumed to remain.

Total Tract X & Y Site Area:
118,483 Square Feet (2.72 acres)

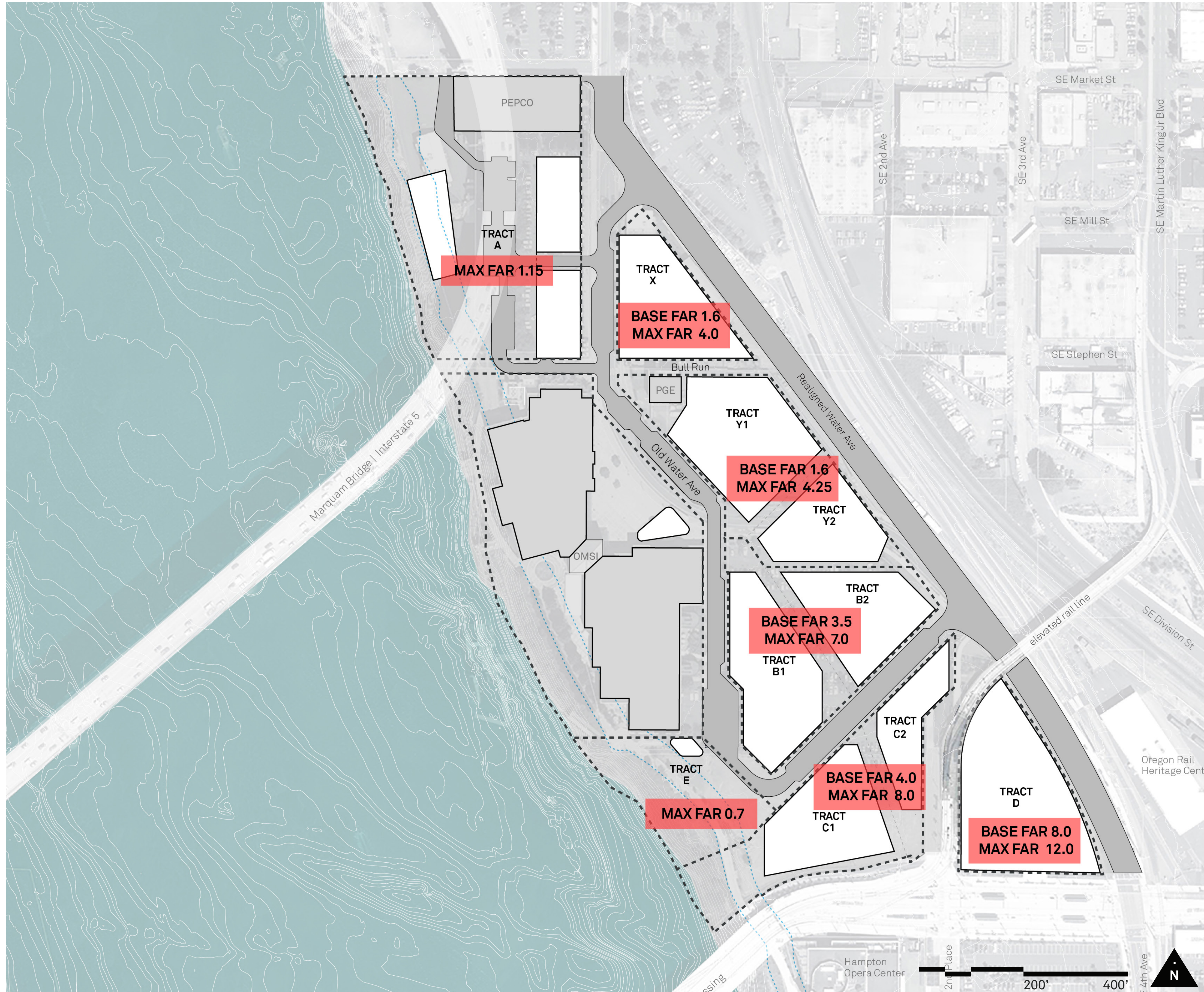


Figure 4.4.1 - Development plan illustrating base and max FAR

04.4.2 Development Plan

Total Development @ 2:1:
236,966 Square Feet

Existing Building to Remain:
6,000 Square Feet

New Development @ 2:1:
230,966 Square Feet

The total base development plan at 2:1 FAR and with the open space bonus calls for 1,724,573 square feet of new development.

Figure 4.4.2.A shows the proposed transfer of the base floor area among tracts. The highest FAR by tract is at the southern end of the site adjacent to MAX and Streetcar platforms. The tract FAR is gradually reduced for tracts to the north in the vicinity of the existing OMSI and PEPCO buildings. Both base and maximum FAR by tract are shown in the following table. If additional FAR is earned or transferred to individual tracts, the FAR for that tract may be increased as appropriate not to exceed the maximum.

When specific development proposals are brought to the City for approval, the applicant will be required to demonstrate how the proposal complies with the requirements shown above, and what adjustments, if any, are necessary to maintain the overall development plan at 2:1 FAR with open space bonus. Additional FAR earned or transferred to individual tracts, if any, should also be noted.

			Development				
Phase	Tract	Tract SQ FT	Base SQ FT @ 2.15 FAR w/ Greenway Bonus	Existing SQ FT	Total SQ FT	Base FAR Development Plan	Max FAR with Bonus or Transfer
1	**A**	195410	224722	27000	251722	**1.15**	**1.15**
	B1	*56888*	*199108*	*NA*	*199108*	*3.50*	*7.00*
	B2	*44840*	*156940*	*NA*	*156940*	*3.50*	*7.00*
	B	101728	356048	NA	356048	**3.50**	**7.00**
	C1	*65896*	*263584*	*NA*	*263584*	*4.00*	*8.00*
	C2	*29969*	*119876*	*NA*	*119876*	*4.00*	*8.00*
	C	95865	383460	NA	383460	**4.00**	**8.00**
	D	63598	508784	NA	508784	**8.00**	**12.00**
	E	52682	3500	NA	3500	**0.07**	**0.07**
	OMSI	297884	8550	217000	225550		
	Totals:	**807167**	**1485064**	**244000**	**1729064**		
			1493607	Maximum new development not to excede			2.15 Site FAR
			2421500	Maximum total with bonus or transfer not to excede			3.00 Site FAR
2	X	41120	65792	NA	65792	1.60	4.00
	Y1	63613	101780.8	6000	276355.25	1.60	4.25
	Y2	36469	58350.4	NA	154993.25	1.60	4.25
	Y	100082	160131	6000	431349	1.60	4.25
	Totals:*	**141202**	**225923**	**6000**	**497141**		
			230966	Maximum new development not to excede			2.00 Site FAR
			592415	Maximum total with bonus or transfer not to excede			5.00 Site FAR

*Note Parcels X and Y reconfigured with Water Avenue realignment pick-up some additional OMSI property SQ FT.
(SQ FT total for X and Y reflects SQ FT total as recorded from portlandmaps.com pre re-alignment)

Figure 4.4.2.A

04.5 Height

The current maximum building height within the OMSI Central City Master Plan area is proposed at 250 feet with adoption of a Master Plan. This Master Plan proposes refinements to maximum building heights; retaining the 250 feet maximum at the southern end of the site adjacent to MAX and Streetcar platforms, and stepping down to the north gradually reducing the maximum heights in the vicinity of the existing OMSI and PEPCO buildings. Figure 4.5.B shows proposed maximum heights for each tract.

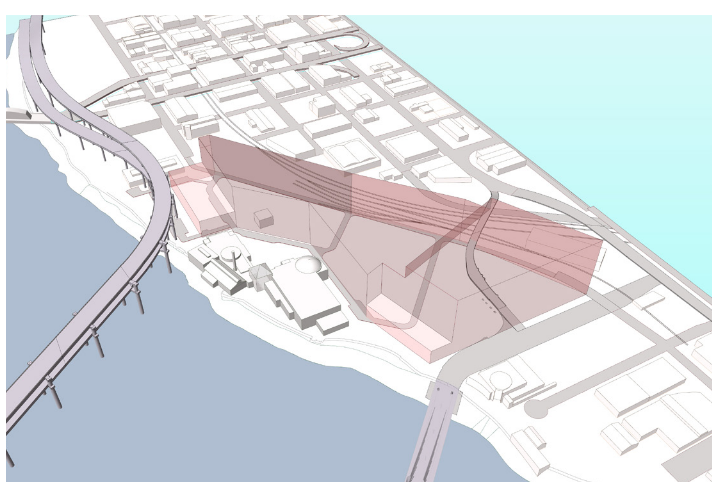


Figure 4.5.A - Massing envelope and set-back birds-eye view

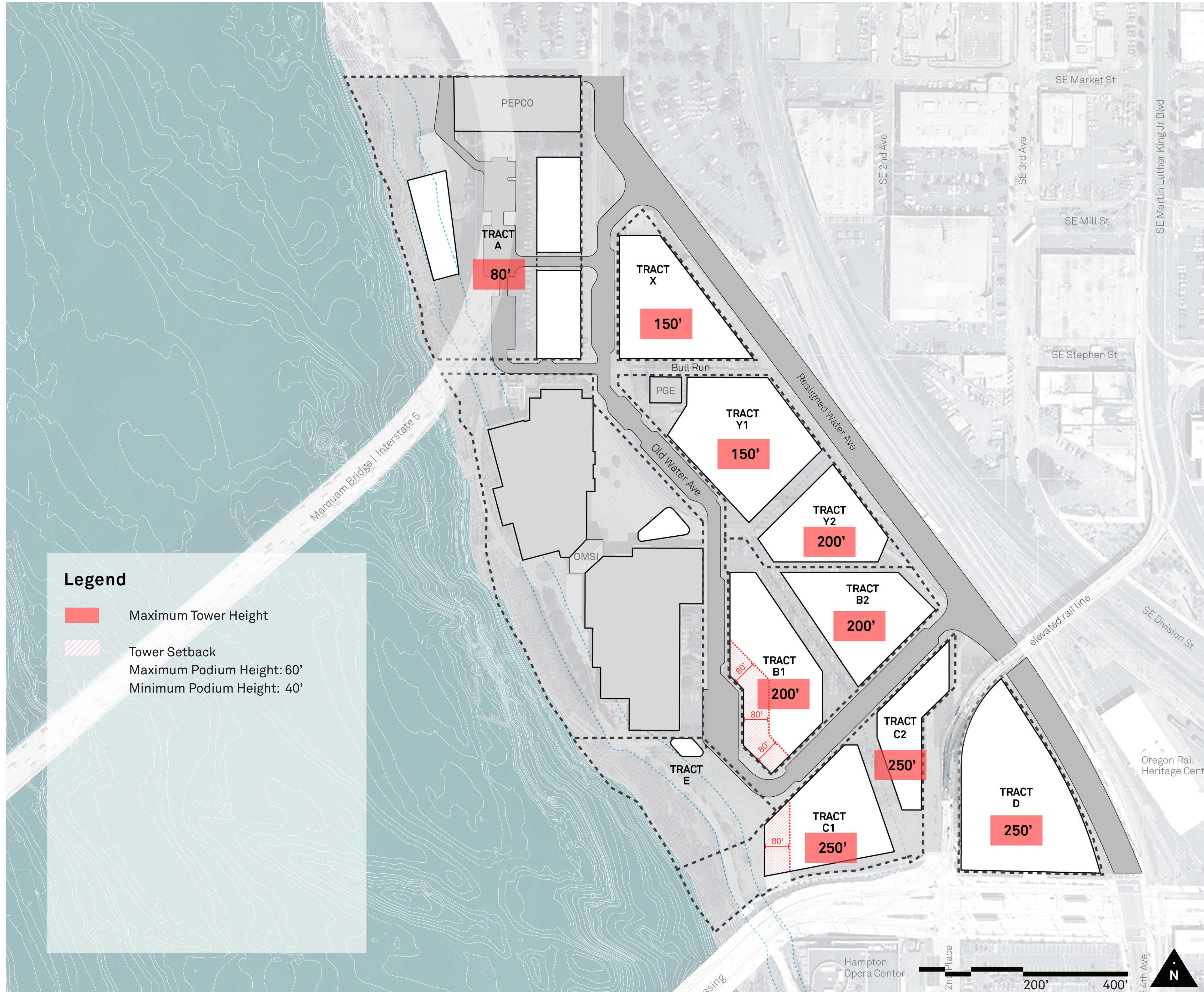


Figure 4.5.B - Maximum Height Diagram

04.6 Massing Studies

Using the massing envelope established for the OMSI campus there are many possible acceptable massing configurations that the future buildings can take on. Considerations for harmonious composition, relationship to context, light, air and views should be taken into consideration as each parcel is developed.

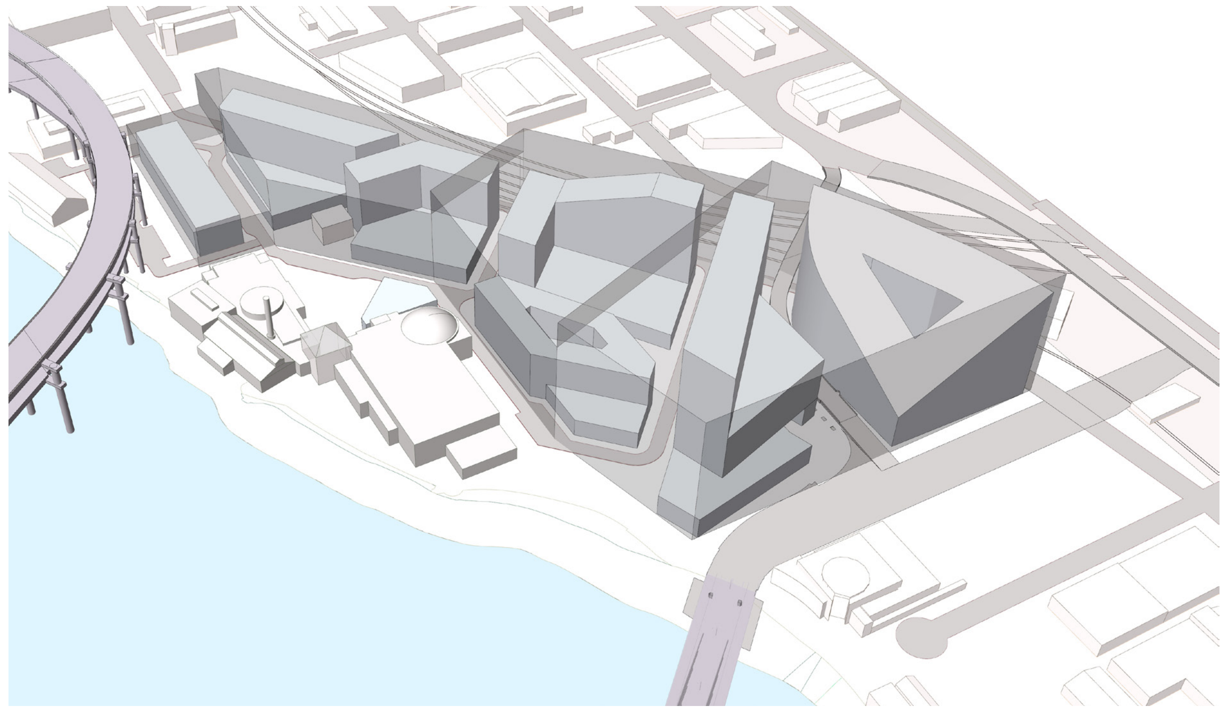


Figure 4.6.A - Study 1: Approximately FAR 3.00

Figure 4.6.B - Study 2: Approximately FAR 3.00

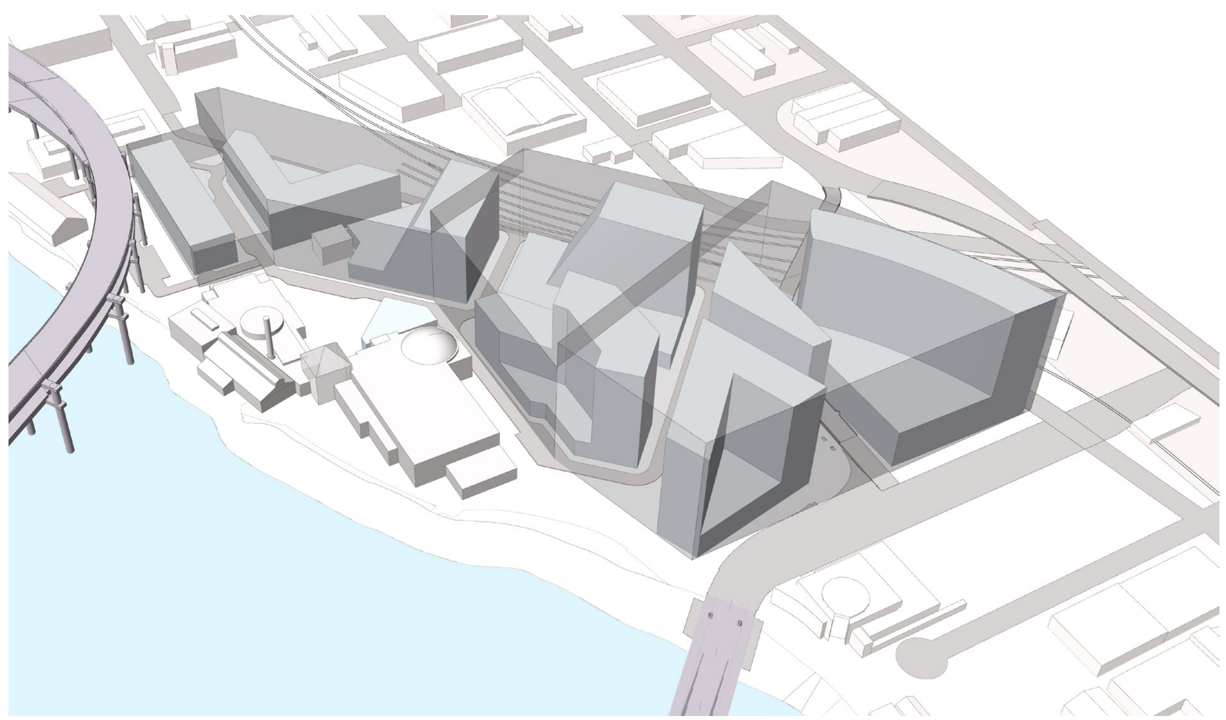


Figure 4.6.C - Study 3: Approximately FAR 3.00

Figure 4.6.D - Study 4: Approximately FAR 3.00

04.6.1 Massing Studies

Base FAR

Total Phase 1:
2.15 Site FAR (as of right)

New Development:
1,493,607 SQFT

Total Phase 2:
2.00 Site FAR (as of right)

New Development:
230,966 SQFT

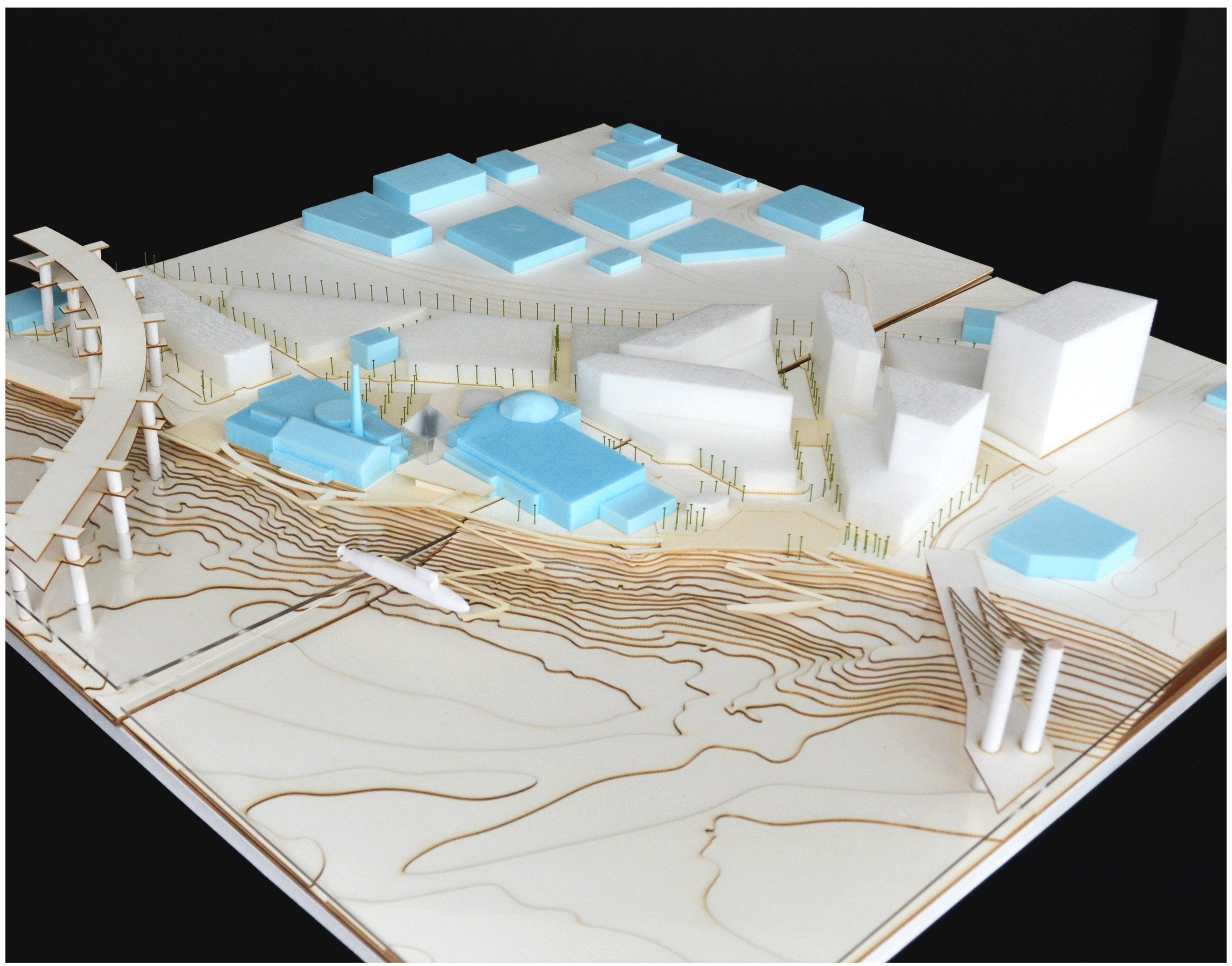


Figure 4.6.1.A - Base FAR view from River

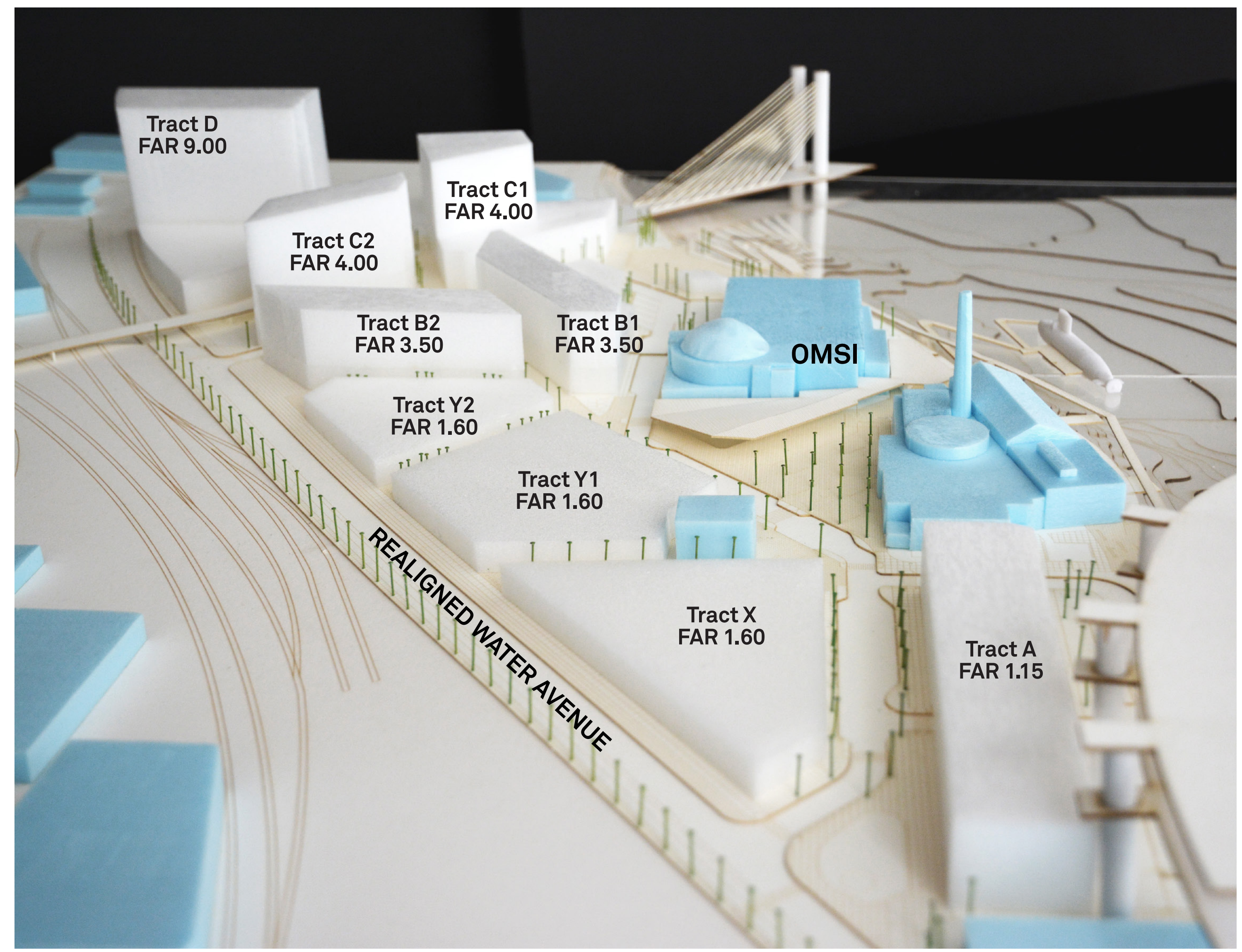


Figure 4.6.1.B - Base FAR view toward Tilikum

04.6.1 Massing Studies
Max FAR

Total Phase 1:
3.00 Site FAR (with bonus)

New Development:
2,421,500 SQFT

Total Phase 2:
5.00 Site FAR (with bonus)

New Development:
592,415 SQFT

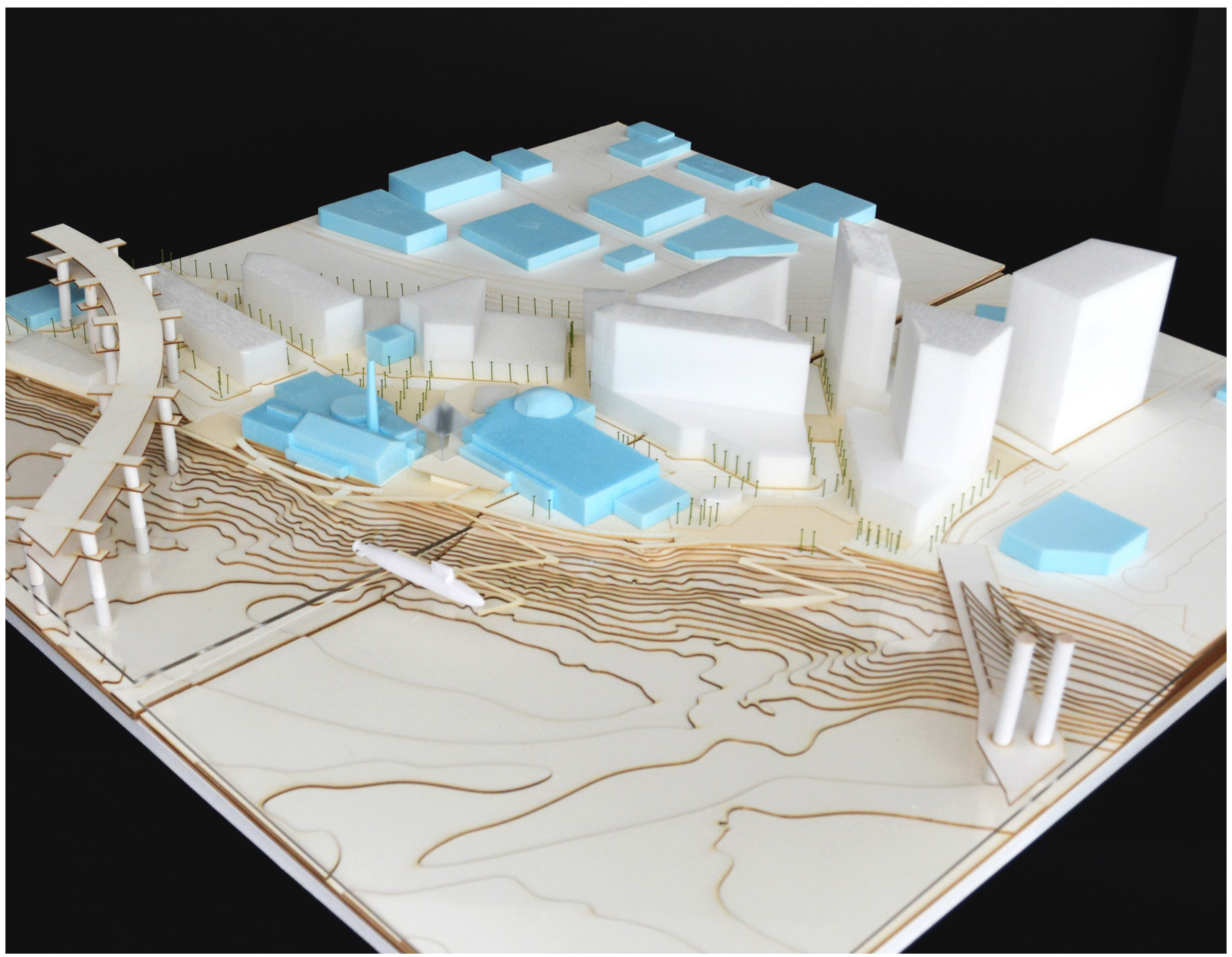


Figure 4.6.1.C - Max FAR view from River

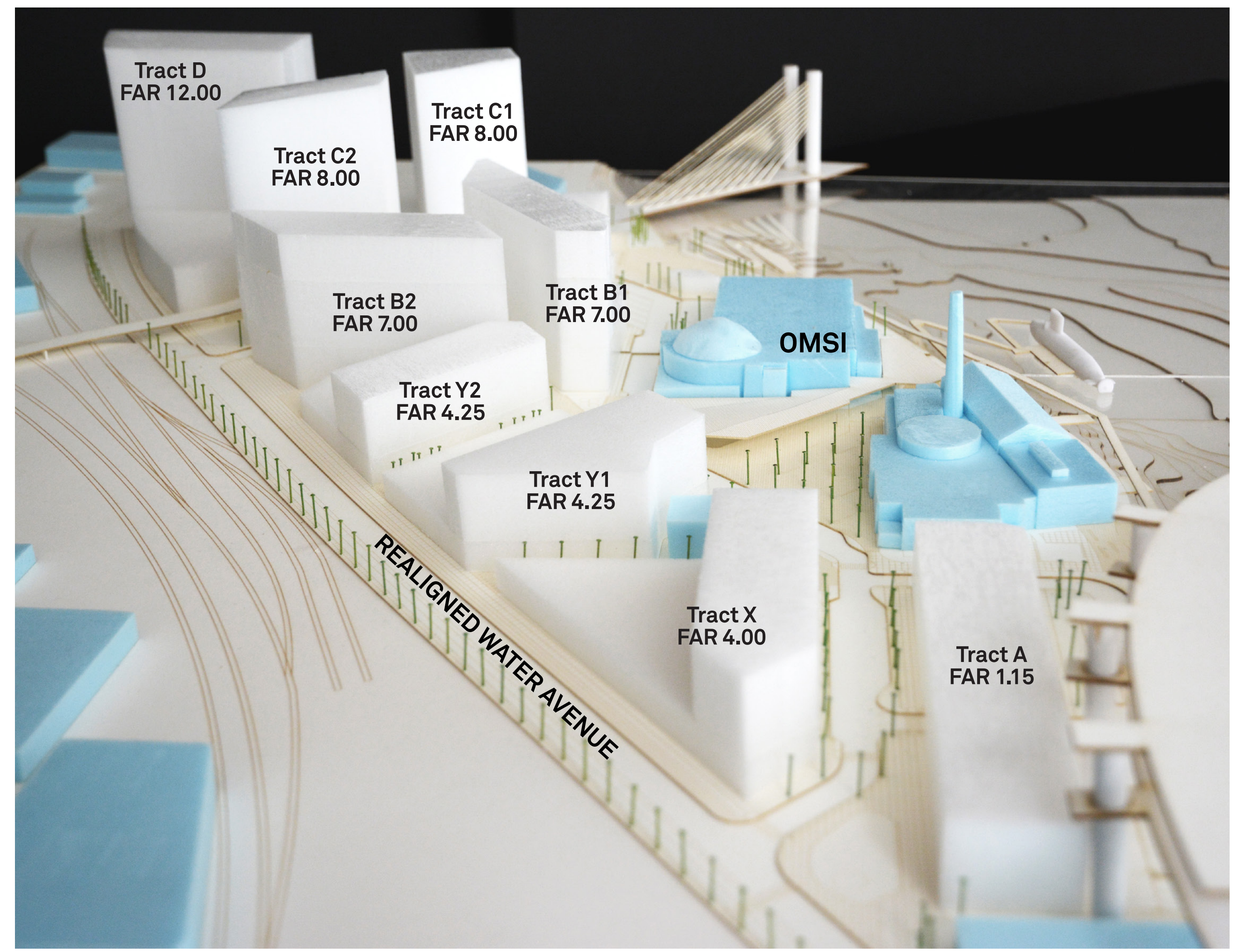
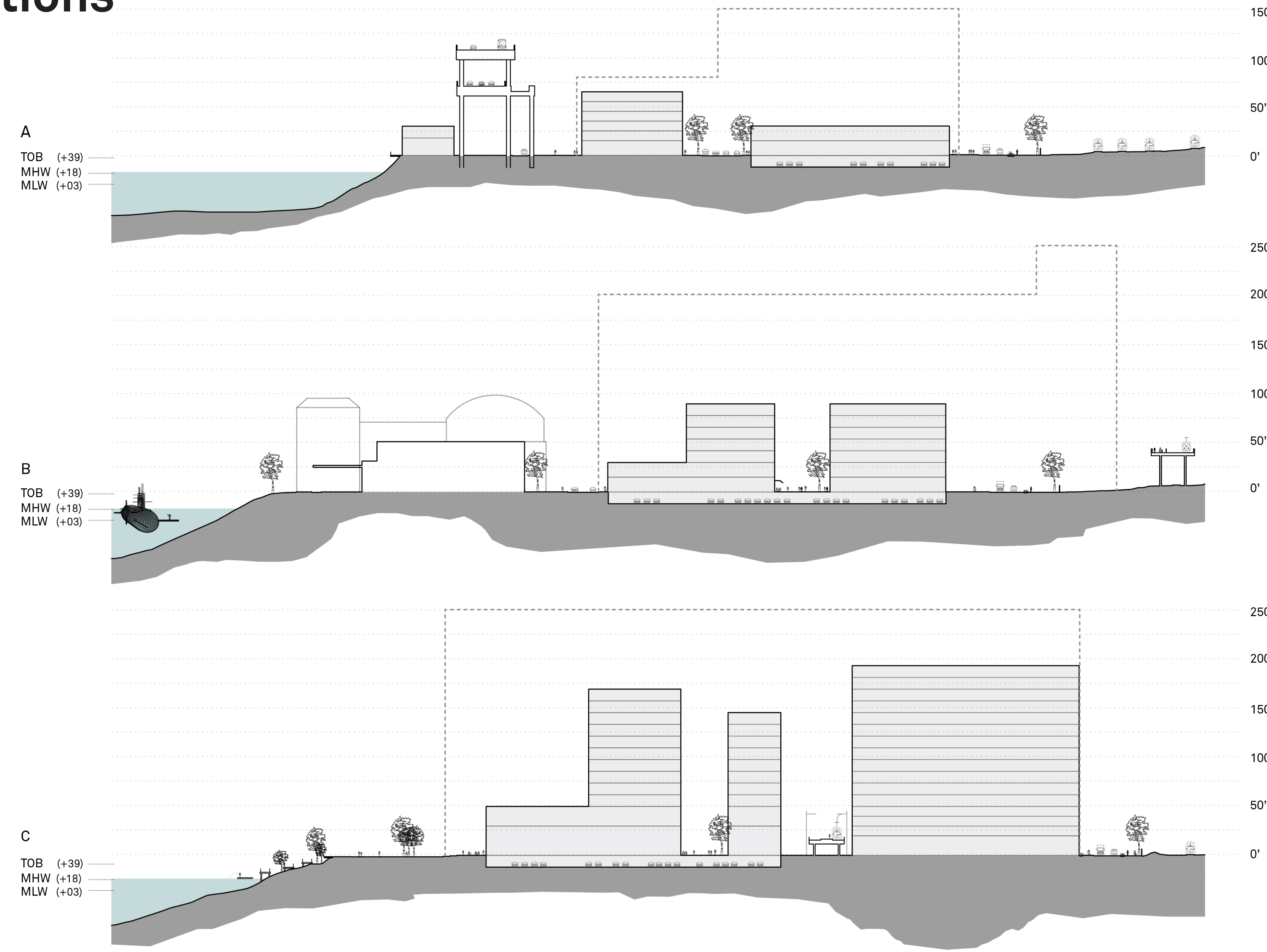


Figure 4.6.1.D - Max FAR view toward Tilikum

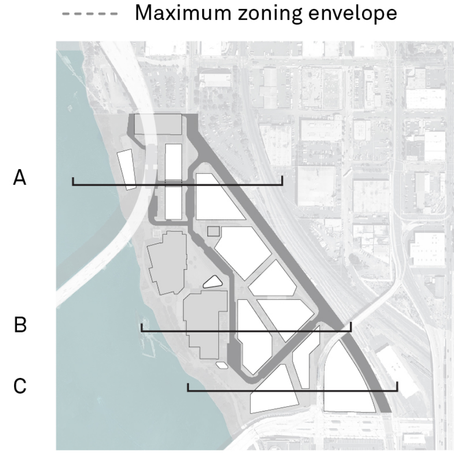
04.6.2 Site Sections

Base FAR



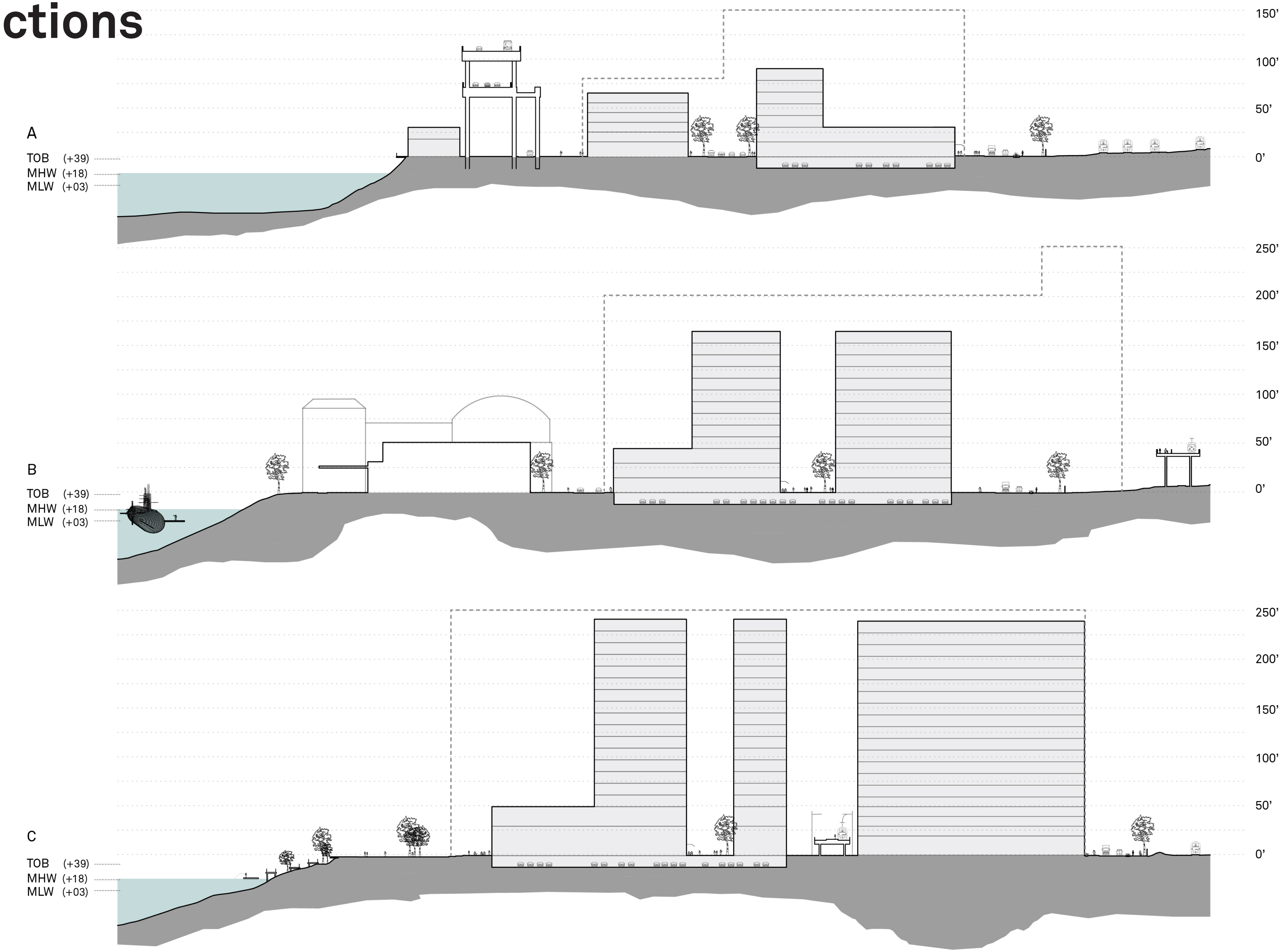
MAX FAR
1" = 100'

----- Maximum zoning envelope



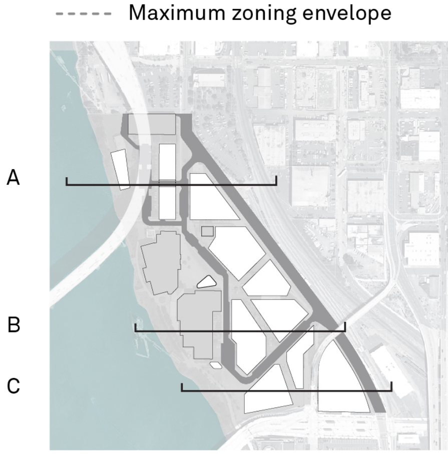
04.6.2 Site Sections

Max FAR



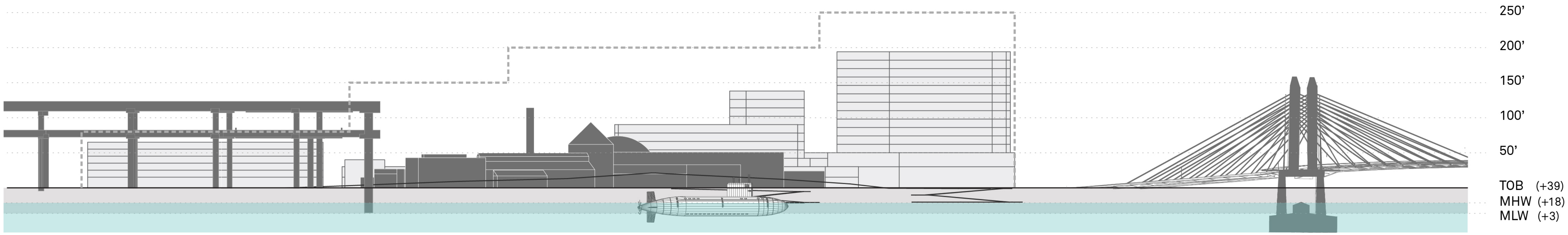
MAX FAR
1" = 100'

----- Maximum zoning envelope



04.6.3 Site Elevations

Base FAR

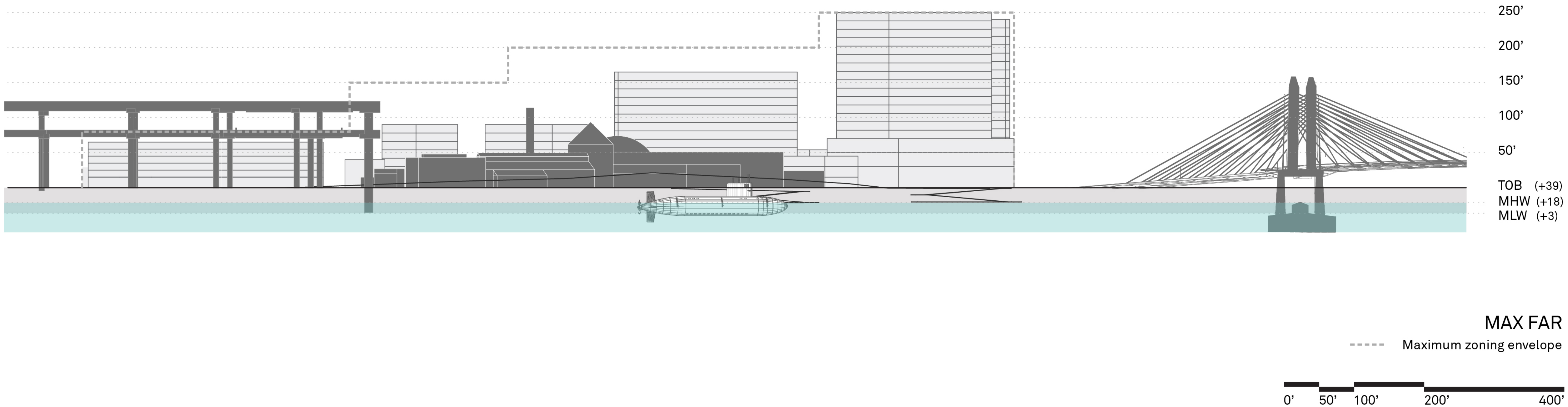


BASE FAR

Maximum zoning envelope

04.6.3 Site Elevations

Max FAR



Water Avenue Station
Urban Design: Mayer / Reed
Image Credit: Bruce Forster

05. Transportation

05.1 Transportation Overview

05.2 Travel Conditions Assessment

05.3 Transportation Demand Management

05.4 Circulation Systems

05.5 Street Sections

05.6 Parking Assessment

05.7 Parking Management Solutions

05.8 Future Garage Locations & Access

05.9 Future Vehicle & Bicycle Parking Counts

05.10 Future Bus Parking

05.1 Transportation Overview

The OMSI campus is located along the east bank of the Willamette River, in Portland's Central City. Access is provided via Water Avenue, which traverses the Central Eastside District between Stark Street and Division Place (near McLoughlin Boulevard) and SE Clay Street as an east/west access to the site. Additional street connections to the east are hindered by the railroad tracks.

Existing transportation infrastructure includes a range of facilities for people who walk, ride bikes, use transit, or drive. The following sections summarize the existing infrastructure for the pedestrian, bicycle, transit and roadway systems.

Pedestrian Network

The OMSI campus is very accessible to pedestrians. The Eastbank Esplanade extends through the campus, along the Willamette River. This multi-use path extends for nearly two miles along the Willamette River, from the Streel Bridge to Caruthers Street. This route connects pedestrians to several crossing opportunities to the west side of the river, including the Tilikum Crossing, Hawthorne Bridge, Morrison Bridge, Burnside Bridge and Steel Bridge.

Water Avenue provides sidewalks on both sides and is classified as a City Walkway[1]. It connects pedestrians to other City Walkways, including Clay Street (located just north of the campus) and Division Place (located just south of the campus).

Bicycle Network

The Eastbank Esplanade provides bicyclists an off-street connection between the Steel Bridge and Caruthers Street (just south of the Tilikum Crossing), and to the multi-use path crossings to the west side of the Willamette River on the Tilikum Crossing, Hawthorne Bridge, Morrison Bridge and Steel Bridge.

Water Avenue provides bike lanes and is classified as a City Bikeway[2]. It connects bicyclists to other City Bikeways, including Clay Street (located just north the campus) and Division Place (located just south of the campus). Water Avenue, which turns into 4th Avenue south of Caruthers Street, provides bicyclists a connection to the Springwater Corridor trail. Bike parking is provided near the front entrance to the OMSI museum off Water Avenue.

Transit Network

Transit service is provided in the vicinity of the OMSI campus by the MAX Orange Line, the Portland Streetcar- A and B Loop, and TriMet Route 9 – Powell Boulevard and Route 17 – Holgate/Broadway. All of these transit options utilize the Tilikum Crossing with stops near Tilikum Way, a four-minute walk from the entrance to the OMSI museum.

The MAX Orange Line connects transit riders from the OMSI campus to downtown Portland and Milwaukie, with service every 15 minutes for most of the day, every day. The Portland Streetcar- A and B Loop, connects riders to the Pearl District, Lloyd District and Portland State University. The A Loop runs clockwise while the B Loop runs counter-clockwise, with service every 20 minutes, most of the day, every day.

TriMet Route 9 provides bus service down Powell Boulevard between downtown Portland and Gresham. Service is offered every 15 minutes for most of the day, every day. TriMet Route 17 provides bus service along Holgate Boulevard between north Portland and Powell Butte Nature Park. Service is offered every 20 minutes for most of the day, every day. In addition, the Division Street Rapid Bus Corridor is currently being planned for 2020.

All of these routes provide transfer opportunities to other MAX light-rail and TriMet bus routes in downtown Portland along the 5th and 6th Avenue transit mall.

[1] Portland Transportation System Plan, Pedestrian Classifications, Southeast District, Map 6.38.4

[2] Portland Transportation System Plan, Bicycle Classifications, Southeast District, Map 6.38.3

Figure 5.1.A - Urban Design: Mayer / Reed Image Credit: Bruce Forster

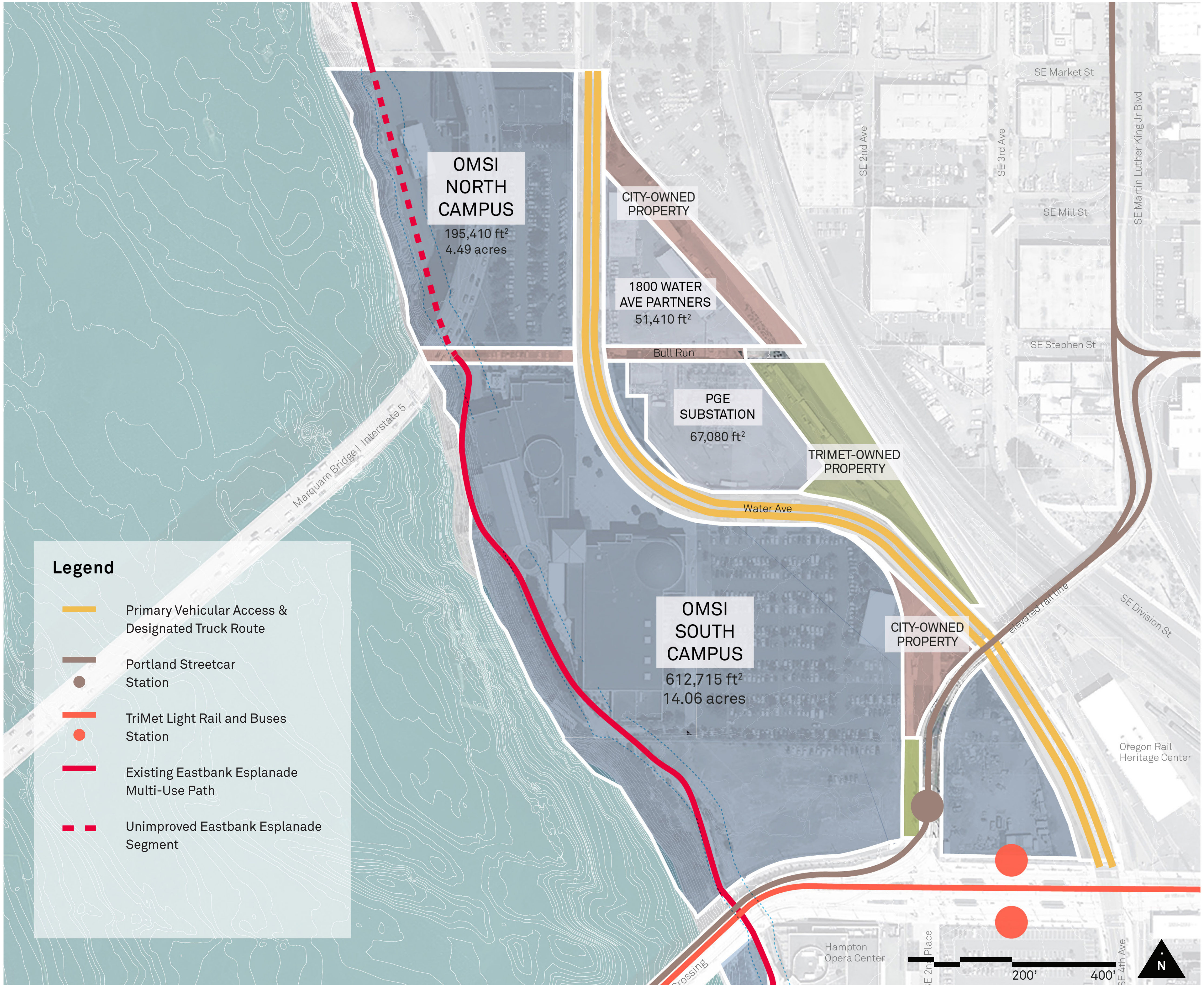


Figure 5.1.B - Network of motor vehicle and transit circulation

Motor Vehicle Network

Water Avenue provides access to the OMSI campus and adjacent parking lots. It provides north-to-south motor vehicle movement through the campus, connecting Stark Street with Division Place (near McLoughlin Boulevard). It is classified by the City of Portland as a Traffic Access Street[3]. Supporting pedestrian access and the pedestrian environment, accommodating bicycles and transit and maintaining on-street parking is given priority along Traffic Access Streets over reducing motor vehicle congestion. It maintains a continuous two to three-lane cross-section (i.e. one through lane in each direction, with an intermittent center turn lane/median). There is currently no on-street parking along Water Avenue at OMSI.

McLoughlin Boulevard (which becomes Grand Avenue northbound and Martin Luther King Jr Boulevard southbound north of Division Street) parallels Water Avenue to the east. The railroad tracks between these two streets prohibit frequent east-to-west street connections. The closest east-to-west connections are Division Place, located approximately 0.33 miles (1,750 feet) to the south of the OMSI campus, and Clay Street, located approximately 0.15 miles (900 feet) to the north of the OMSI campus.

Water Avenue is also classified as a Freight District Street, which provides local truck access and circulation to industrial and employment land uses. Freight District Streets should be designed to facilitate the movement of all truck types and over-dimensional loads, as practicable.

[3] Portland Transportation System Plan, Traffic Classifications, Southeast District, Map 6.38.1

[4] Based on City of Portland 2015 manual trail counts.

05.2 Travel Conditions Assessment

Recent and historical motor vehicle, pedestrian and bicycle count data was reviewed. This information indicates where and when travel demand is highest for each mode of travel. It also provides a basis for assessing how well existing transportation facilities are able to meet the needs of users.

Pedestrian and Bicycle Volumes

Approximately 850 pedestrian and bicycle users travel along the Eastbank Esplanade near the OMSI campus during the evening peak period (5 to 7 p.m.) of an average weekday[4]. Of these users, 580 are on bikes and 270 are walking. Over the weekend, approximately 1,180 users (240 on bikes and 940 walking) travelled along this segment during the morning (9 to 11 a.m.), one of the highest count totals in Portland.

An estimated 2,800 cyclists pass by the OMSI campus along the Eastbank Esplanade during an average day, and approximately 1,600 cyclists travel along Water Avenue adjacent to the OMSI campus during an average day .

Motor Vehicle Volumes and Speeds

Motor vehicle count data was collected along Water Avenue, near Market Street and Tilikum Way, between a Tuesday morning and Wednesday evening during the winter of 2016[5]. The count data indicates that approximately 4,200 vehicles pass the OMSI campus along Water Avenue during an average weekday. Of these vehicles, 1,400 travel northbound and 2,800 travel southbound. The highest amount of trips along Water Avenue occurs during the p.m. peak hour, with 675 vehicles passing the OMSI campus (130 northbound and 545 southbound). 10 percent of the traffic along Water Avenue is trucks.

Nearly 75 percent of vehicles in the northbound and southbound directions are traveling at speeds greater than the posted 20 miles per hour speed limit. However, approximately 60 percent of vehicles are within five miles per hour of the posted speed. 10 percent of vehicles are traveling at speeds of more than 10 miles per hour over the posted speed limit.

Forecasted Motor Vehicle Volumes

The travel demand forecasting process generally involves estimating travel patterns for new development based on the decisions and preferences demonstrated by existing residents, employers and institutions around the region. Travel demand models are mathematical tools that help us understand future travel patterns. Model forecasts are refined by comparing outputs with observed counts and behaviors on the local system.

Metro has a regional travel demand model (base year 2010 and future year 2040) that covers the Portland metropolitan area. Future year (2040) travel demand on Water Avenue adjacent to the OMSI campus was estimated based on these travel demand models. The purpose of the 2010 model is to calibrate the network and to provide a baseline for estimating growth in the 2040 model.

An estimated 225 additional motor vehicle trips are forecasted through 2040 on Water Avenue adjacent to the OMSI campus during the p.m. peak hour (125 northbound, 100 southbound). Total 2040 volume is estimated at nearly 900 p.m. peak hour trips (255 northbound, 645 southbound), or 5,600 daily trips[6].

[4] Based on City of Portland 2015 manual trail counts.

[5] Based on tube counts conducted December 6th to December 7th, 2016.

[6] Determined based on the proportion of existing p.m. peak volume to daily traffic volume along Water Avenue.

05.3 Transportation Demand Management

Transportation Demand Management (TDM) strategies to reduce reliance on single-occupant vehicles will be implemented by the OMSI Master Plan. These measures are intended to increase the use of alternative transportation modes in the OMSI Master Plan area and include the following:

- Providing outdoor bicycle racks
- Providing bicycle storage lockers
- Providing carpool spaces
- Instituting resident and employee parking fees
- Distributing transit and carpool information to residents, employees and customers
- Providing monthly subsidy to employees for transit passes
- Partnering with various agencies to implement programs and events that encourage increased use of the OMSI Station Area transit options

In addition, the OMSI master plan area will be served by high quality pedestrian and bicycle facilities, and transit service. Pedestrian and bicycle connections to the surrounding area will be convenient and comfortable. Transit service will be frequent and will provide easy access to the entire Portland region. Section 5.4 of this chapter outlines in detail all of these strategies.

05.4.1 Circulation System: Bikes

The new Water Avenue alignment will continue to serve as a City Bikeway. It will be enhanced with a two-way cycle track along the east side of the new alignment and will serve as the primary bikeway through the OMSI Master Plan area. The cycle track will provide for convenient and comfortable bicycle travel between the Clay Street and Tilikum crossing traffic signals. Here the cycle track connects with on-street bike lanes and cyclists can link to the Eastbank Esplanade or Springwater Corridor Trail.

The Proposed upgrades to the Willamette Greenway trail allow for greater separation of pedestrians and bikes with the minimization of conflict points. Off-street bike accessways will also be provided along Smokestack Lane and OMSI Way.

The old Water Avenue will serve as a Local Service Bikeway. Given the relatively slow vehicular speeds, bicyclists will share travel lanes with vehicular traffic. In addition, bike racks and indoor storage will be provided at strategic locations within the development to facilitate increased bicycle use.

Legend

- Existing Bike Infrastructure
- Proposed Two-Way Cycle Track
- Proposed Future Connection to Springwater Trail
- Proposed Upgraded Willamette Greenway Trail Multi-Use Path
- Proposed Eastbank Riverfront Crescent Upgrades

Figure 5.2.1 - Bicycle circulation network

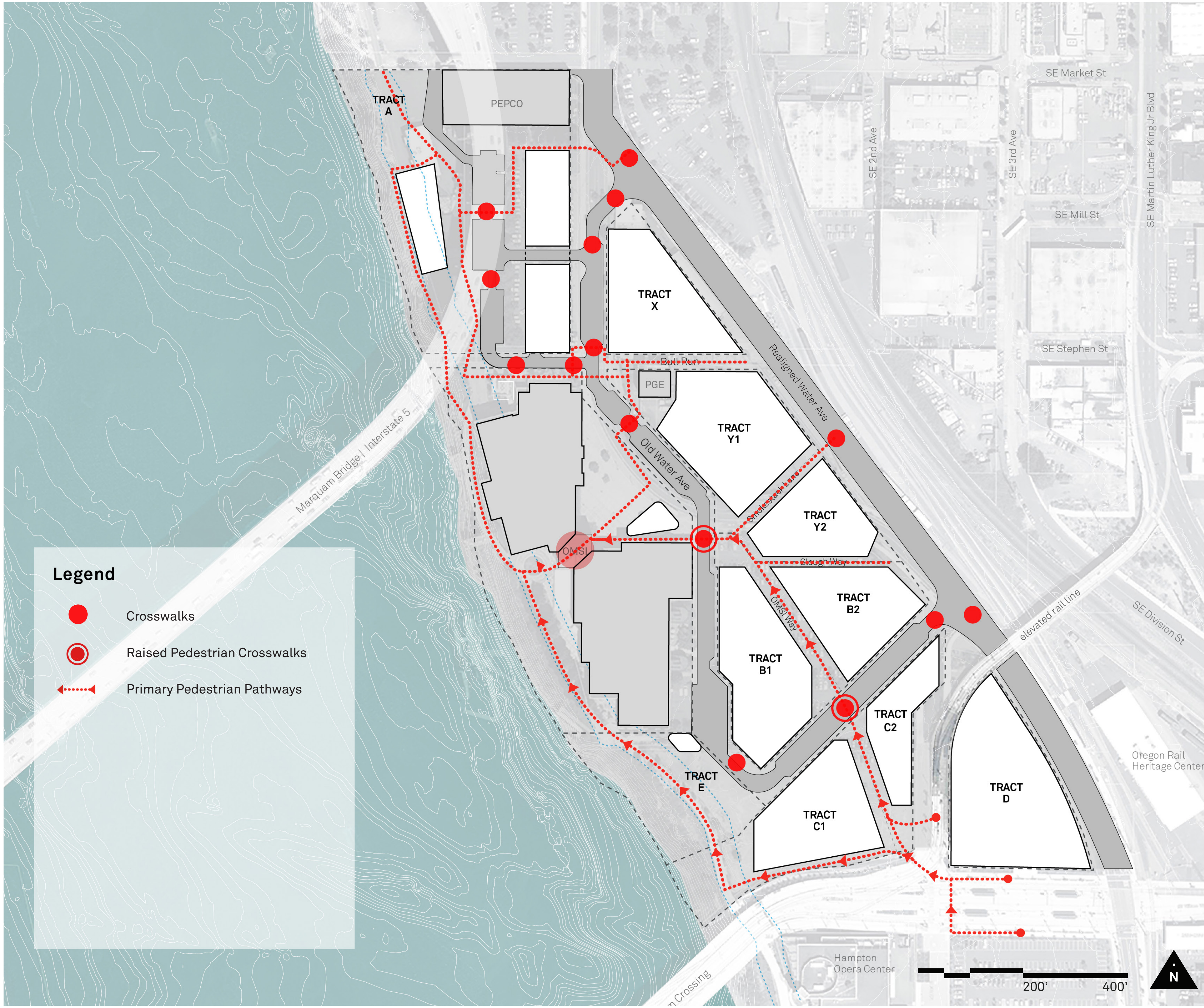


Figure 5.2.2

05.4.2 Circulation System: Pedestrian

Pedestrians in the OMSI Master Plan area will be able to safely and efficiently walk between destinations using a system of sidewalks, shared streets, pedestrian accessways and trails. As a City Walkway, the new Water Avenue will include wide sidewalks on each side. The old Water Avenue will serve as a Local Service Walkway. Since it will serve as the primary pedestrian access to the OMSI museum, it will include 12-foot sidewalks on each side.

In addition to wide sidewalks on all streets, the OMSI Master Plan is proposing an inter-connected system of pedestrian and bicycle corridors through both north/south and east/west public accessways and shared streets, including Smokestack Lane, Slough Way, OMSI Way and Bull Run. This network will provide shorter block lengths for the pedestrian and bicycle system than currently exists, and will increase pedestrian access to destinations.

Safe and comfortable pedestrian crossings will be provided where facilities cross streets. This will include curb extensions and marked cross-walks where appropriate.

05.4.3 Circulation System: Transit

OMSI Way and the Eastbank Esplanade will serve as the primary pedestrian and bicycle paths to the OMSI station. Wide on-street sidewalks and public accessways will connect transit users from these facilities to other key destinations. Pedestrians and cyclists can access the MAX Orange Line, Portland Streetcar and TriMet Route 9 and Route 17 at the OMSI station. A new enhanced bus service line between downtown Portland and the Gresham Transit Center will also serve the OMSI station. In addition, the Division Street Rapid Bus Corridor is proposed to commence in 2020.

If a shuttle loop though the Central Eastside is added to service transit commuters working the in the district opportunities for route drop-off and pick-up zones exist on OMSI's campus.

Transit Oriented Development

The OMSI station area will be served by high quality pedestrian/bicycle connections. The fine grain of blocks are oriented towards pedestrian and bicycle users, with active and inviting public accessways connecting directly to the station. The OMSI Master Plan area will also include a supportive mix of uses and amenities for encouraging transit ridership.

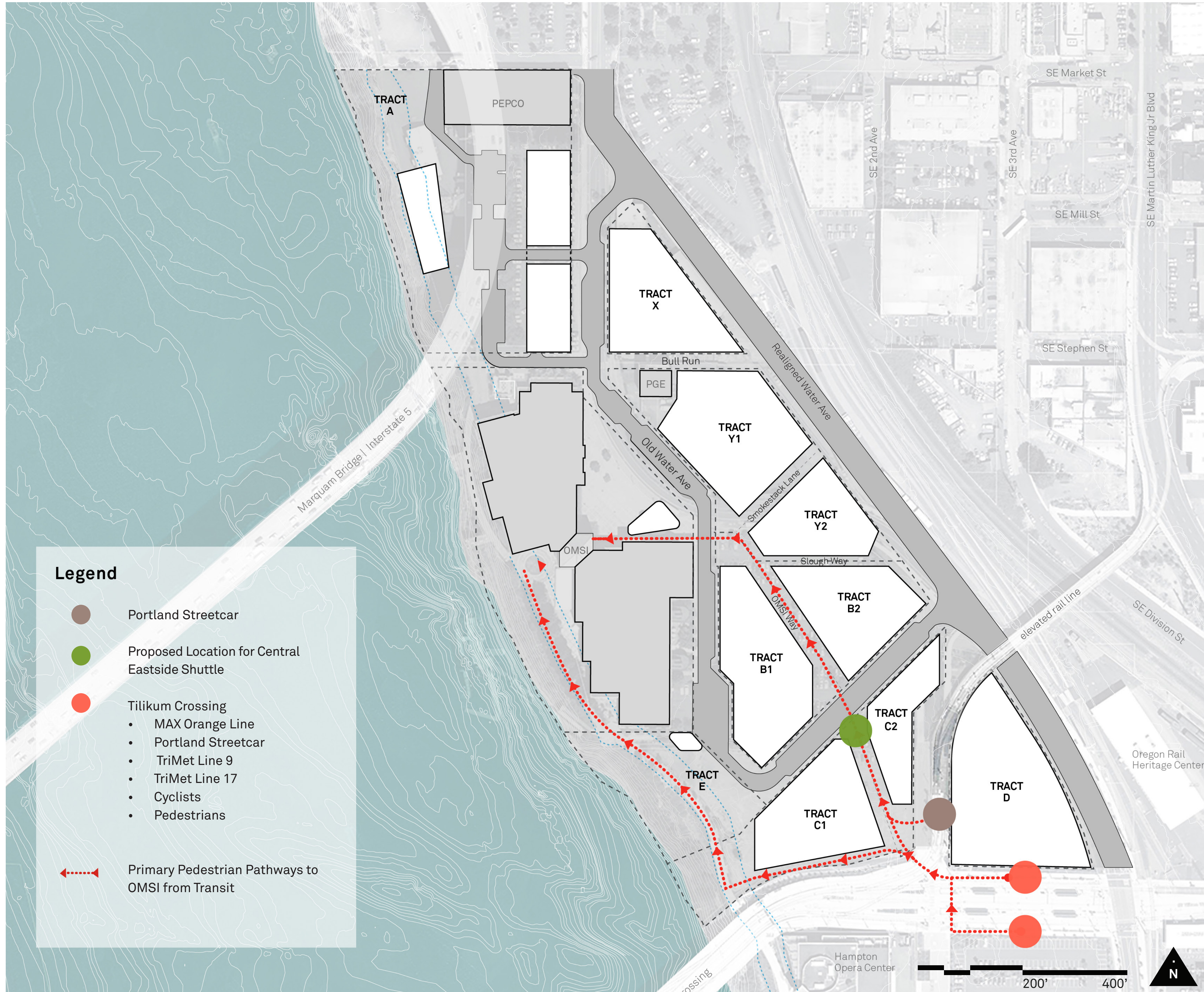


Figure 5.2.3

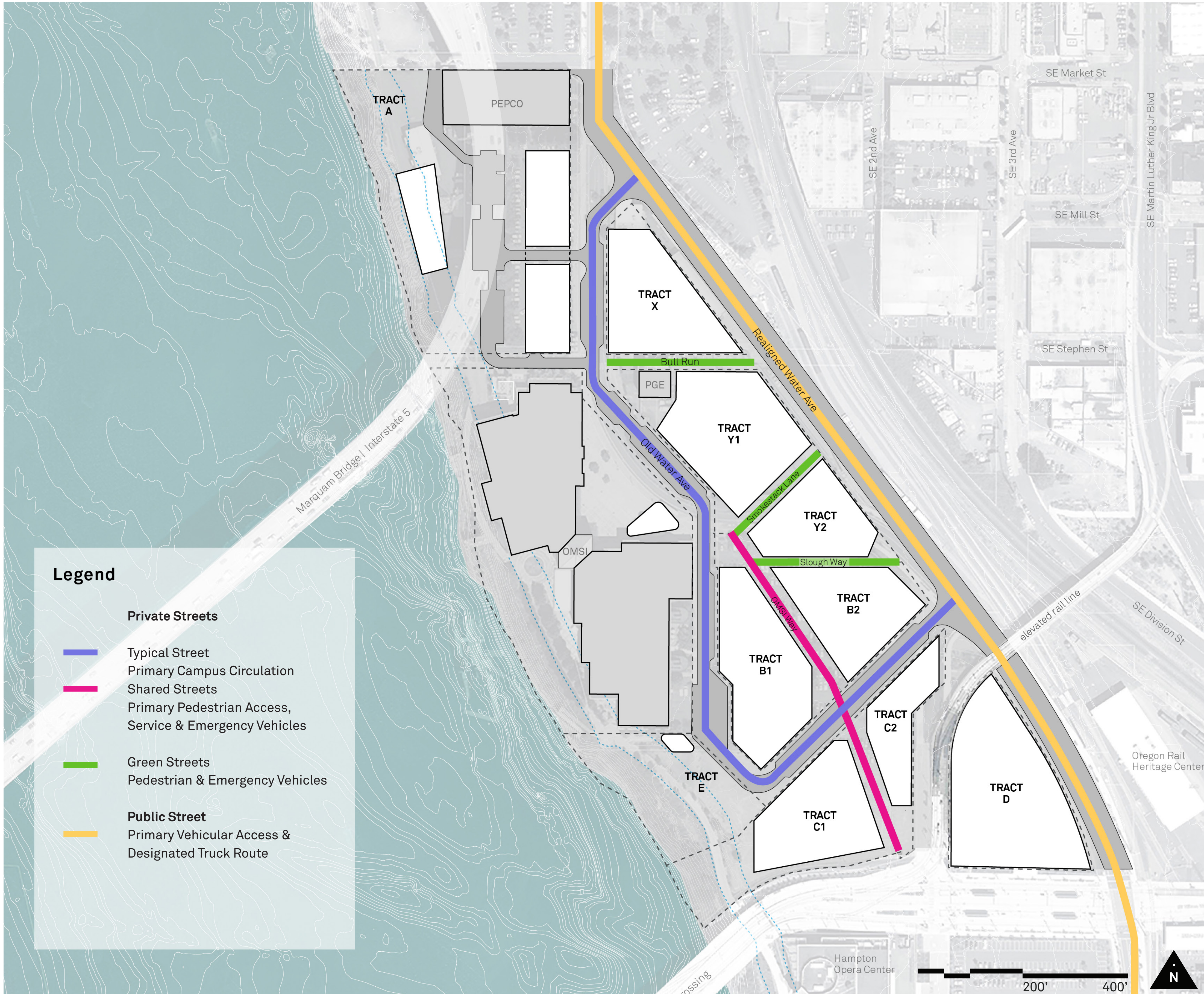


Figure 5.2.4

05.4.4 Circulation System: Vehicular

A key assumption of the OMSI Master Plan is the realignment of Water Avenue. This proposed alignment will provide a continuous connection along the west side of the railroad tracks, between the Tilikum Crossing and Market Street. This proposed alignment removes the roadway barrier through the center of the OMSI Master Plan area and will help to encourage walking and biking.

The Old Water Avenue alignment will be extended south, before connecting back with realigned Water Avenue south of Slough Way. This street will provide much of the local access to the OMSI Master Plan area. Separate left-turn lanes may be needed along New Water Avenue at the intersections with Old Water Avenue.

The proposed street system maintains the classifications of the Portland Transportation System Plan. Realigned Water Avenue will serve as a Traffic Access Street, and Old Water Avenue will serve as a Local Service Traffic Street. These streets will operate consistent with their classifications, with total 2040 volume along Realigned Water Avenue estimated at nearly 900 p.m. peak hour trips (255 northbound, 645 southbound), or 5,600 daily trips. Total 2040 volume along Old Water Avenue is estimated at around 400 p.m. peak hour trips, or 2,500 daily trips.

New Water Avenue will also maintain the Freight District Street classification. 10 percent of the traffic along this street is trucks, and it will be designed with 12-foot lanes to help facilitate their movement. Large trucks servicing the OMSI museum (typically occurs a few times each year) will enter Old Water Avenue at the north access and exit at the south access. The surface bus parking area adjacent to the OMSI loading docks will help facilitate truck movements into the loading area.

The proposed OMSI Way will be a shared street, to include a curbless paved area for pedestrian, bicycle and motor vehicle use. In addition, Smokestack Lane, Slough Way and Bull Run, between Old Water Avenue and Realigned Water Avenue, will be “Green Street” accessways, open to vehicle use only in case of emergency.

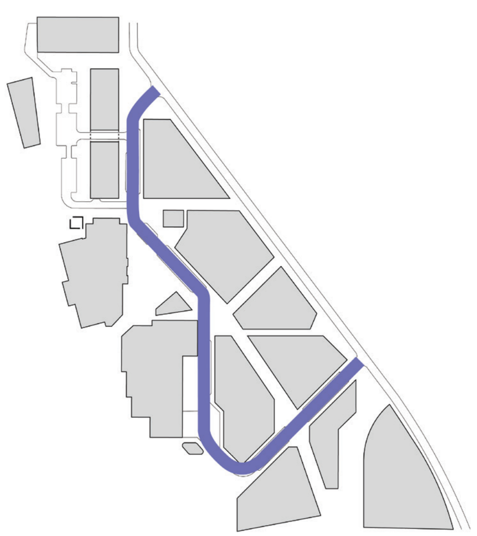
05.5.1

Street Section

Typical streets in the OMSI Master Plan will consist of two lanes of traffic and on-street parking. These streets will also feature stormwater management through swales located at the ends of bump-outs. Street trees and lighting will enhance the pedestrian experience, while improved cross-walks at all intersections will create safer, more fluid circulation opportunities.

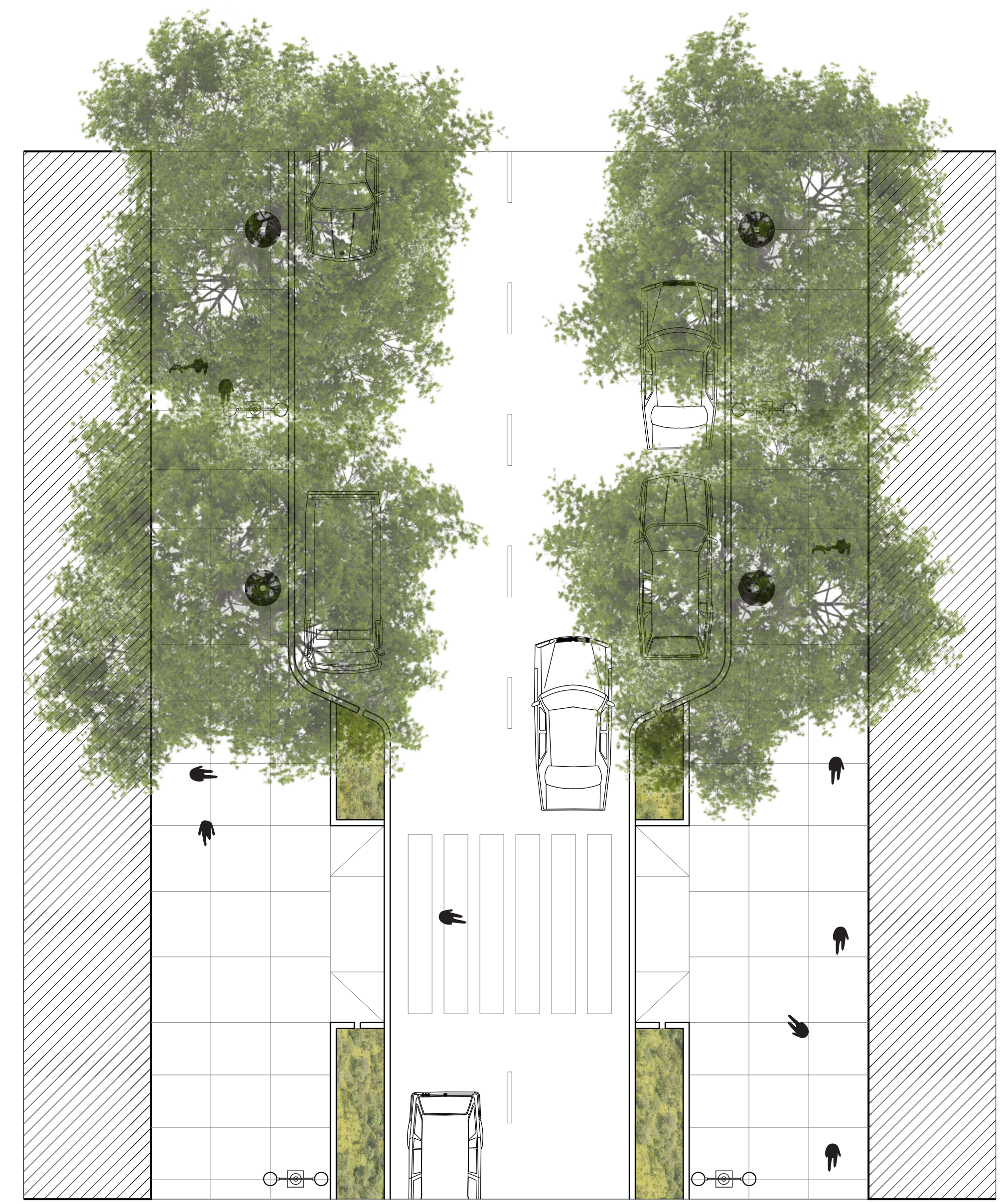
Typical Streets	
Right of Way	60'
Roadway	20'
Sidewalks	12'
Curbline	Extensions
Circulation	Two-Way
Parking	Both Sides
Lighting	Yes
Furnishings	No
Covered Walkway	No
Stormwater Management	Yes

Figure 5.3.A - Karl Johans Gate / Oslo, Norway / Snøhetta



Key Plan

Section Detail:
Scale: 1/16" = 1' - 0"

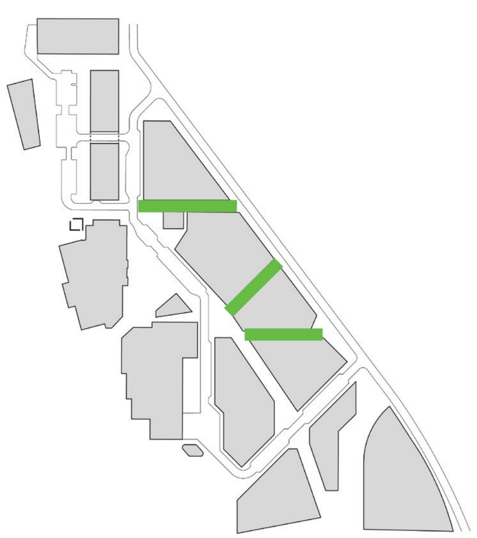


Plan Enlargement:
Scale: 1/16" = 1' - 0"

05.5.2

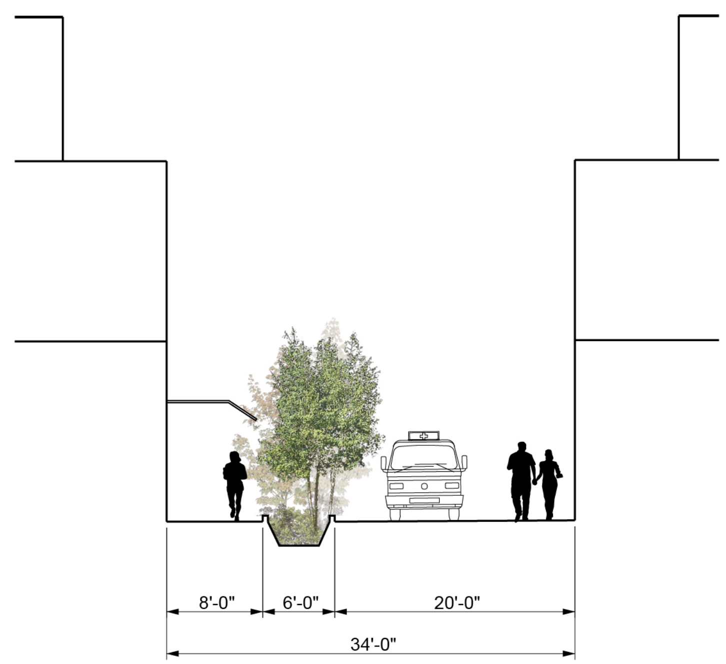
Street Section

Green Streets	
Right of Way	34’
Roadway	20’
Sidewalks	8’
Curbline	None
Circulation	Emergency Vehicles Only
Parking	None
Lighting	Yes
Furnishings	Yes
Covered Walkway	Yes
Stormwater Management	Yes



Key Plan

Figure 5.3.B - Industry City / Brooklyn, NY / Mathews Nielsen Landscape Architects



Section Detail:
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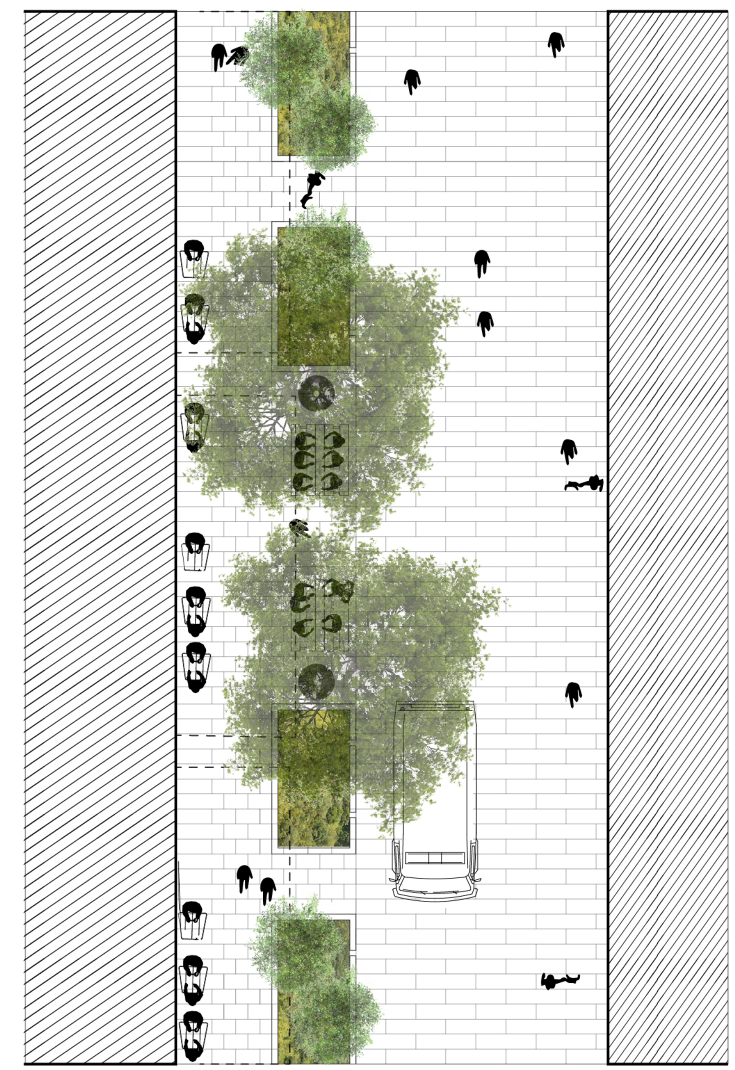
The green streets of the OMSI campus are primarily designed to create a unique pedestrian experience. Of a more intimate scale than other streets in the Master Plan, these private roads feature covered sidewalks, cafe seating and architectural canopies affording all-weather enjoyment. Running east to west, the green streets are the corridors that connect pedestrians on New Water Avenue to the center of the OMSI campus.

A 20’ roadway indicated by a change in paving allows for service and emergency vehicle access, while a series of rain gardens incorporating stormwater fountains and shaded areas create moments for pause and passive enjoyment. High quality paving and intimate street lighting throughout help shape the distinctive character of the green streets, each of which terminates in a small plaza area.



Plan Enlargement:
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05.5.3

Street Section

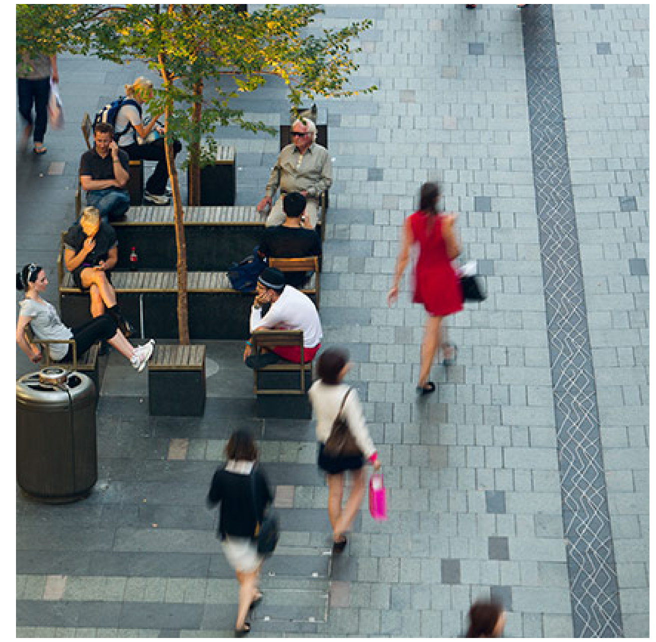
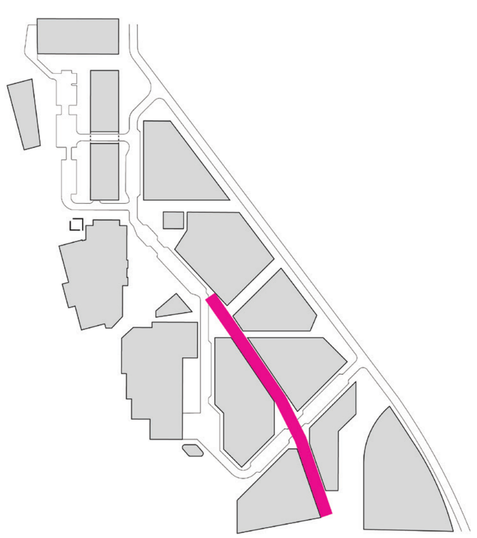


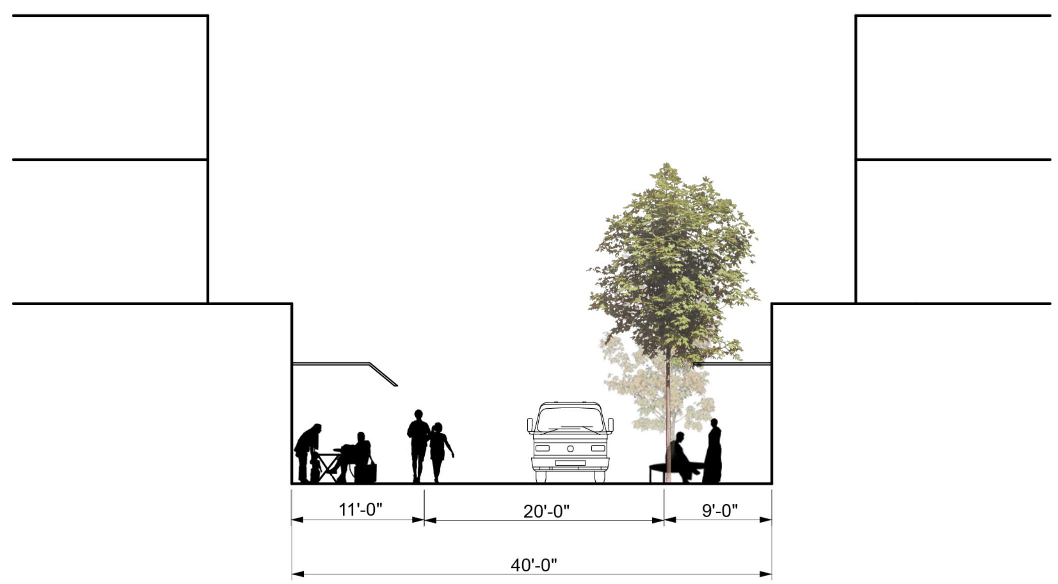
Figure 5.3.C - Pitt Street Mall / Sydney, AU / Tony Caro Architecture

The proposed OMSI Way will be a shared street, to include a curbless paved area for pedestrian, bicycle and service vehicle use, with divisions indicated through changes in pavement. Running north to south, the shared streets create a fundamental link between the transit hub at the south of the campus to the heart of OMSI. Running adjacent to restaurants and cafés, the streets are designed to accommodate outdoor seating areas and feature architectural canopies to ensure all-weather enjoyment. Planters with embedded benches and tree canopies create seating all along the streets, and help create vibrant, colorful street life.

Shared Streets	
Right of Way	40’
Roadway	20’
Sidewalks	N/A
Curbline	No
Circulation	One-Way
Parking	No
Lighting	Yes
Furnishings	Yes
Covered Walkway	Yes
Stormwater Management	No



Key Plan



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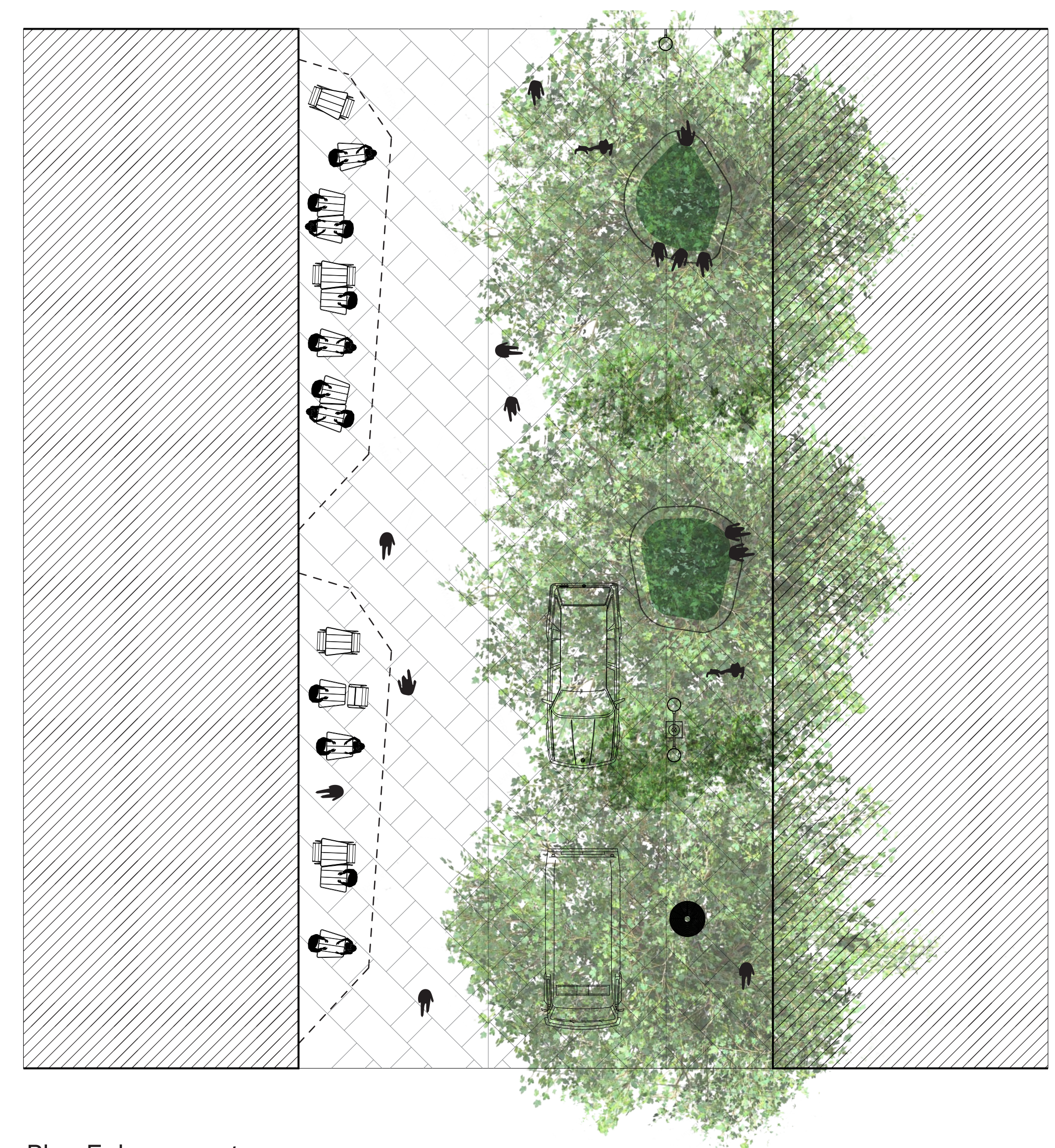


Plan Enlargement
Scale: 1/16” = 1’ - 0”

05.5.4

Street Section

Realigned Water Avenue (Phase 2)

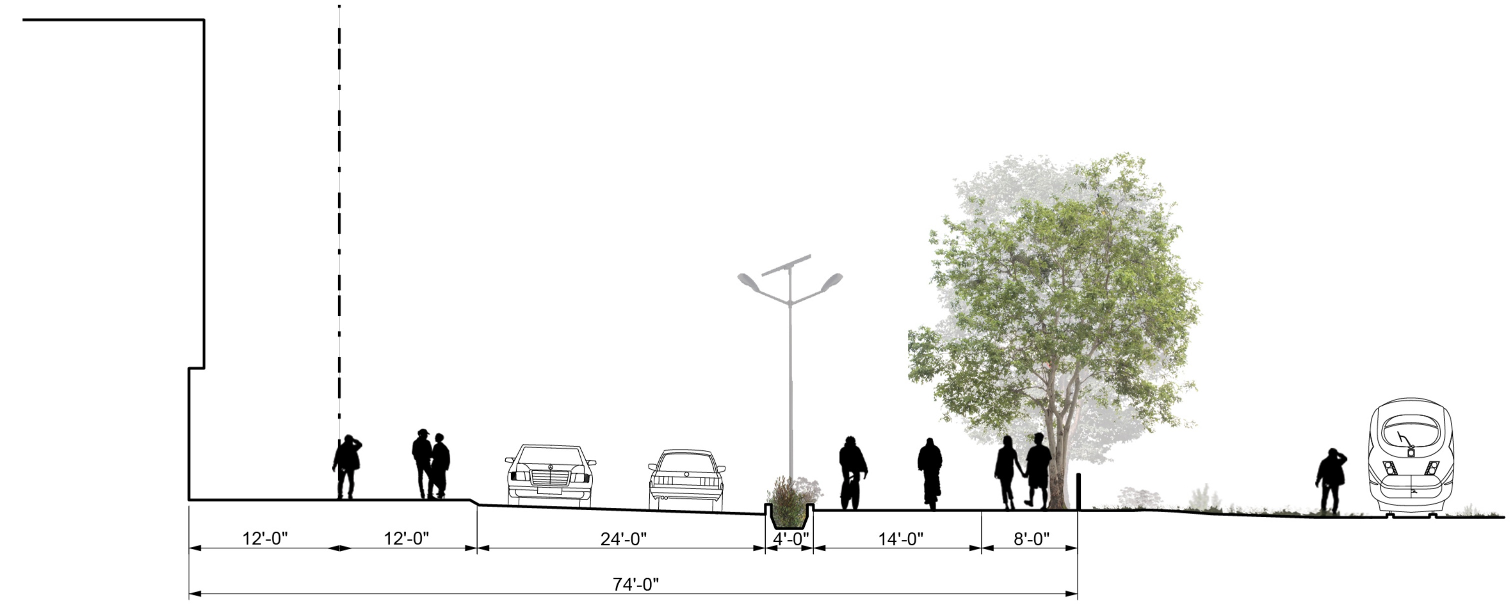
Right of Way	74’
Roadway	24’
Sidewalks	12 + 12’ & 8’
Curbline	Rolled
Circulation	Two-Way w/ Cycle Track
Parking	None
Lighting	Yes
Furnishings	No
Covered Walkway	Yes
Stormwater Management	Yes

Figure 5.3.D - Indianapolis Cultural Trail / Indianapolis, IN

Key Plan

The design of New Water Avenue creates rich opportunities for the intersection of disparate uses and experiences. Occupant oriented ground floor uses promote activity on the street level, while generous pedestrian sidewalks and covered walkways on the west side invite passers-by to engage and interact with ground floor occupants. Rolled curbs allow for easy, informal loading while large, rolling garage doors allow for production to spill out onto the sidewalk, contributing to the spectacle of street life.

Though Water Avenue serves as the primary thoroughfare for freight, the design also emphasizes bicycle circulation through the inclusion of a designated two-way cycle track. A vegetated strip traveling the whole length of the avenue serves as a buffer between vehicles and cyclists and while also collecting stormwater.



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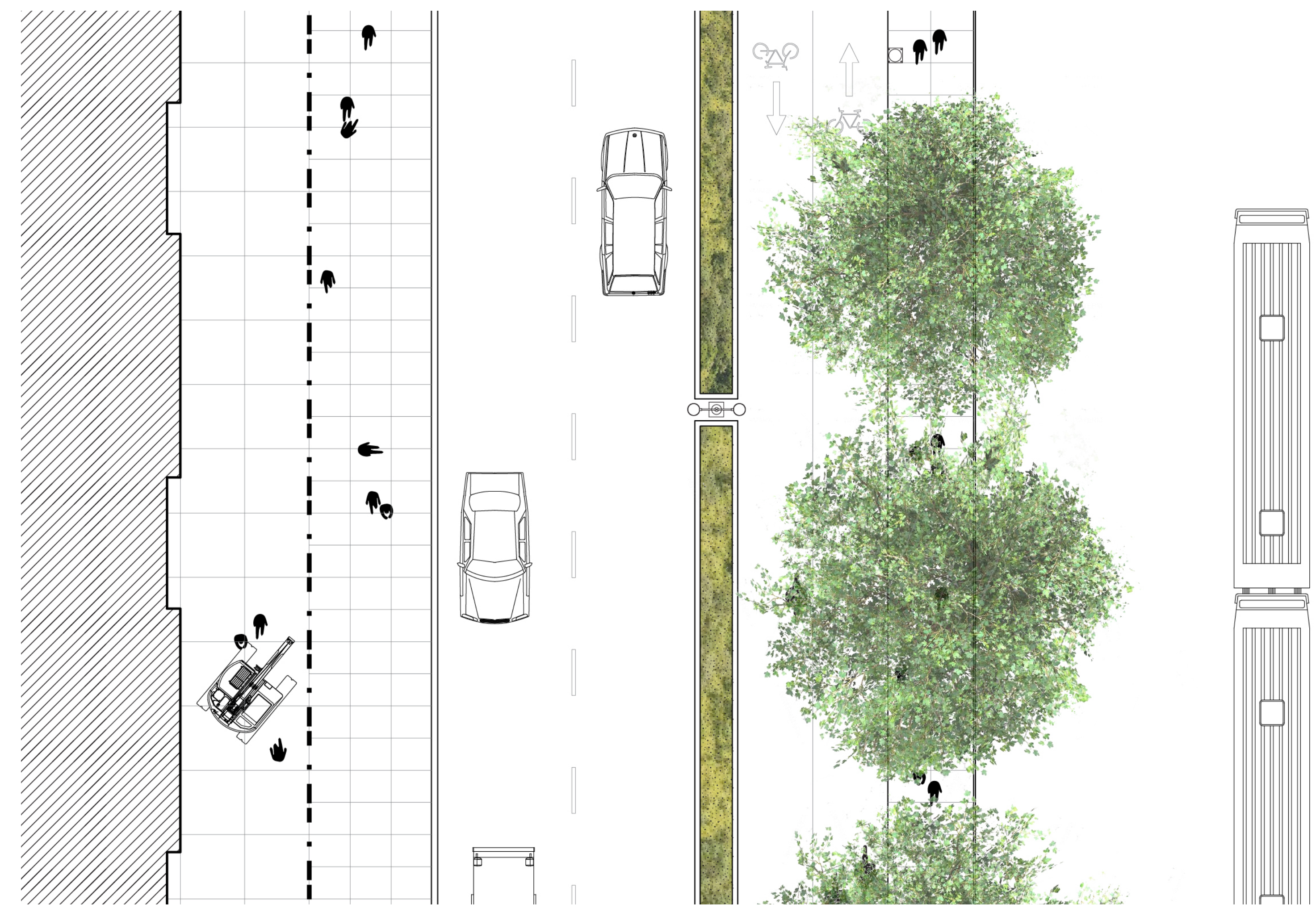


Plan Enlargement:
Scale: 1/16” = 1’ - 0”

05.6 Parking Assessment

A parking survey was conducted at the OMSI campus parking lots and at nearby on-street locations. The survey relied upon historical parking inventory and occupancy data provided by OMSI.

OMSI Parking Lots

The on-site parking supply was inventoried and summarized in the OMSI Parking Assessment[7]. OMSI has a total of 593 parking stalls within two separate lots. The lots just north and south of the main entrance are owned and managed by OMSI (221 in the north lot and 372 in the south lot). An additional leased lot, across Water Avenue from the main entrance, contains 45 stalls and is primarily used for staff parking or peak event parking.

The on-site parking lots reached capacity 88 times between June 2013 and May 2014[8]. This occurred on at least one occasion during each month of the year, but most commonly during the summer months and over spring break. The peak utilization averaged nearly 70 percent of the lot capacity, or about 460 spaces, on days when the OMSI museum was open. The highest peak parking demand was 883 (or 138 percent of parking capacity) which occurred during spring break.

Parking demand exceeded 85 percent of the lot capacity on 139 of the 334 days when the OMSI museum was open (42 percent of the open days). When parking occupancy routinely exceeds 85 percent in the peak hours the supply is considered constrained. For example, to keep the on-site lots below 85 percent capacity on 80 percent of the open days, OMSI would need an additional 152 spaces, or 790 total (assuming mode split remains the same). To keep it below 85 percent capacity on all open days, OMSI would need an additional 377 spaces, or 1,015 total (assuming mode split remains the same).

However, given the accessibility to transit and bike infrastructure, OMSI will likely see a higher utilization of these modes by guests and a lower parking demand in the future. For example, should OMSI increase the museum guest walking, biking or transit mode share by five percent, the peak parking demand could be reduced by about 25 cars per day.

Figure 5.5 - OMSI's parking lot at capacity

On-Street Parking

On-street parking supply was inventoried surrounding the OMSI campus and summarized in the Central Eastside District Parking Plan[9]. The study area included a large zone surrounding the OMSI campus, with a total of 186 on-street parking stalls. Only approximately 50 of these on-street stalls are within a comfortable walking distance of OMSI, which is generally a quarter mile or approximately a 10-minute walk. These stalls are primarily located north of the OMSI campus, along Water Avenue, Clay Street and underneath the Hawthorne Bridge, with a few stalls located south of the campus along Caruthers Street.

On-street parking was generally 60 to 70 percent occupied within the OMSI study area[10]. Utilization was typically highest during the morning and afternoon, with more open on-street parking stalls after 3 p.m. The typical user was parked in the study area for nearly five hours, with low turnover of the spaces. This may indicate employees are parking in these spaces for long periods throughout the day.

[7] OMSI Parking Assessment, April 6, 2015. Rick Williams Consulting.

[8] OMSI parking data. Emailed by Russ Repp.

[9] Central Eastside Parking Management Plan, June 2012. Portland Bureau of Transportation.

[10] Ibid.

05.7 Parking

Management Solutions

Parking management solutions could allow OMSI to operate its existing parking more efficiently, reducing the need for additional parking. These include:

Vehicle Detection Sensors

Vehicle detection sensors can be mounted in the surface of individual parking spots or at the entrance to a parking lot or garage to detect vehicle presence. This information can be relayed to dynamic message signs to guide motorists to available parking spaces. This information also be utilized to provide real-time parking occupancy data through the OMSI website.

Automated Guidance

As a driver enters a parking garage or lot, signs could indicate the total number of parking spaces available and the number on each level. On each level, there are additional signs that tell the driver how many spaces are available per row. A light over each space indicates whether it is available: green for open, red for occupied.

Automated/Stacked Parking Garage

An automated stacked parking garage can accommodate parking more efficiently than a conventional underground or above grade parking garage, when taking into consideration ramps and access needs. These structures can double parking capacity over comparably sized conventional garages, and therefore require less land and allow more space for other uses. A customer drives inside the garage's entry/exit room and receives a ticket upon activating the system on entry (from a kiosk they approach after dropping off their car). Their vehicle is transported on a pallet automatically to a vacant parking space. When returning, customers approach a pay-on-foot machine, insert the ticket, pay, and the vehicle is returned to them at the entry/exit point.

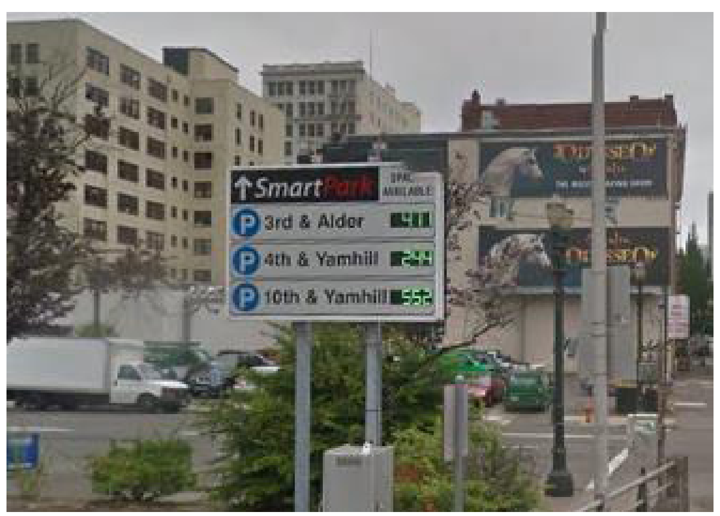


Figure 5.6.A

1. Parking occupancy data on Morrison Bridge

Figure 5.6.B

2. Automated parking guidance example

Figure 5.6.C

3. Automated parking system delivering vehicle to vacant parking space

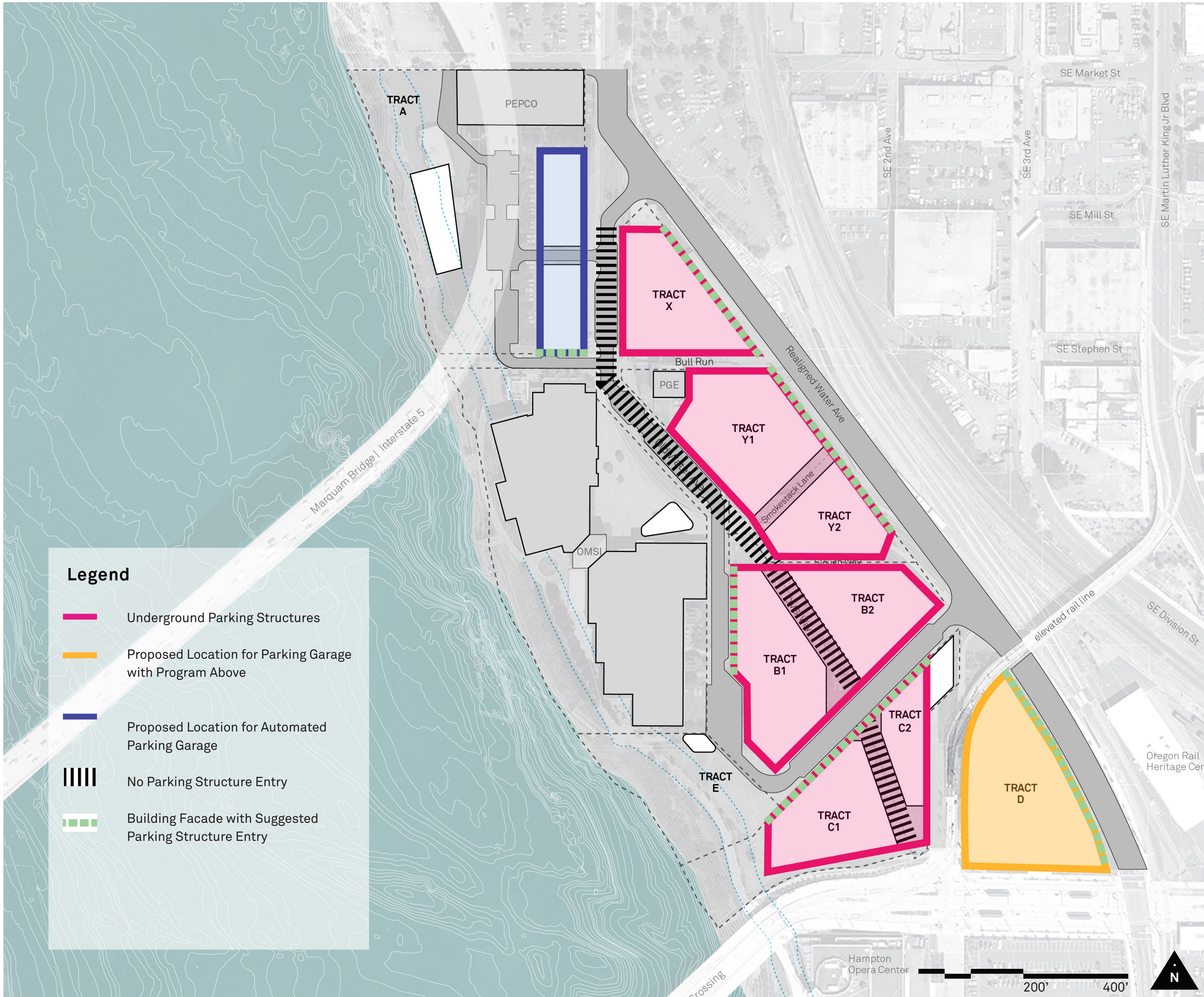


Figure 5.7

05.8 Future Garage Locations & Access

Underground parking structures are proposed for tracts X, Y, B and C. In the cases of tracts Y, B and C, if the respective tracts are divided and developed into two buildings, underground parking structures should be undivided for efficiency spanning the entirety of the tract.

Tract D is the proposed location for a parking garage podium with additional tower use programmed above. On the north end of the site, tract A is the proposed location for an automated parking garage. Parking garage entries may not be located anywhere along the central north-south spine of the OMSI campus. Entries to parking structures on tracts X, Y, and D are recommended to be located along realigned Water Avenue. Entry into the parking structures on tracts B and C are recommended to be located along OMSI Way. The automated parking garage on tract A is recommended to be entered via the passage just north of the OMSI building.

It is recommended that no parking garage entrances are located on the central campus spine to promote active ground floor uses and safe access to and from OMSI from main pedestrian circulation routes.

05.9 Future Vehicle & Bicycle Parking Counts

Vehicle Parking

Vehicle parking facilities will be developed on a project-by-project basis to support the proposed development for each block. Stall counts will comply with parking assumptions described in this section. Figure 5.8 is meant to illustrate how vehicular parking could be provided, although it may vary depending on development. OMSI will gradually develop structured parking to replace most of its current surface parking inventory with future development projects. Shared parking strategies will also be integrated as a key element of future developments. On-street parking will be provided along portions of Old Water Avenue. As outlined in Section 5.7 automated and stacked solutions are encouraged for their increased density.

Bicycle Parking

Bicycle parking facilities will be provided on a project-by-project basis in compliance with City of Portland requirements. OMSI currently has bicycle parking facility near the Museum entrance. OMSI plans to maintain and possibly expand this bicycle parking as the Master Plan builds out. The proposed pedestrian accessways will also serve as locations for above-ground, short-term bike parking and bike corrals.

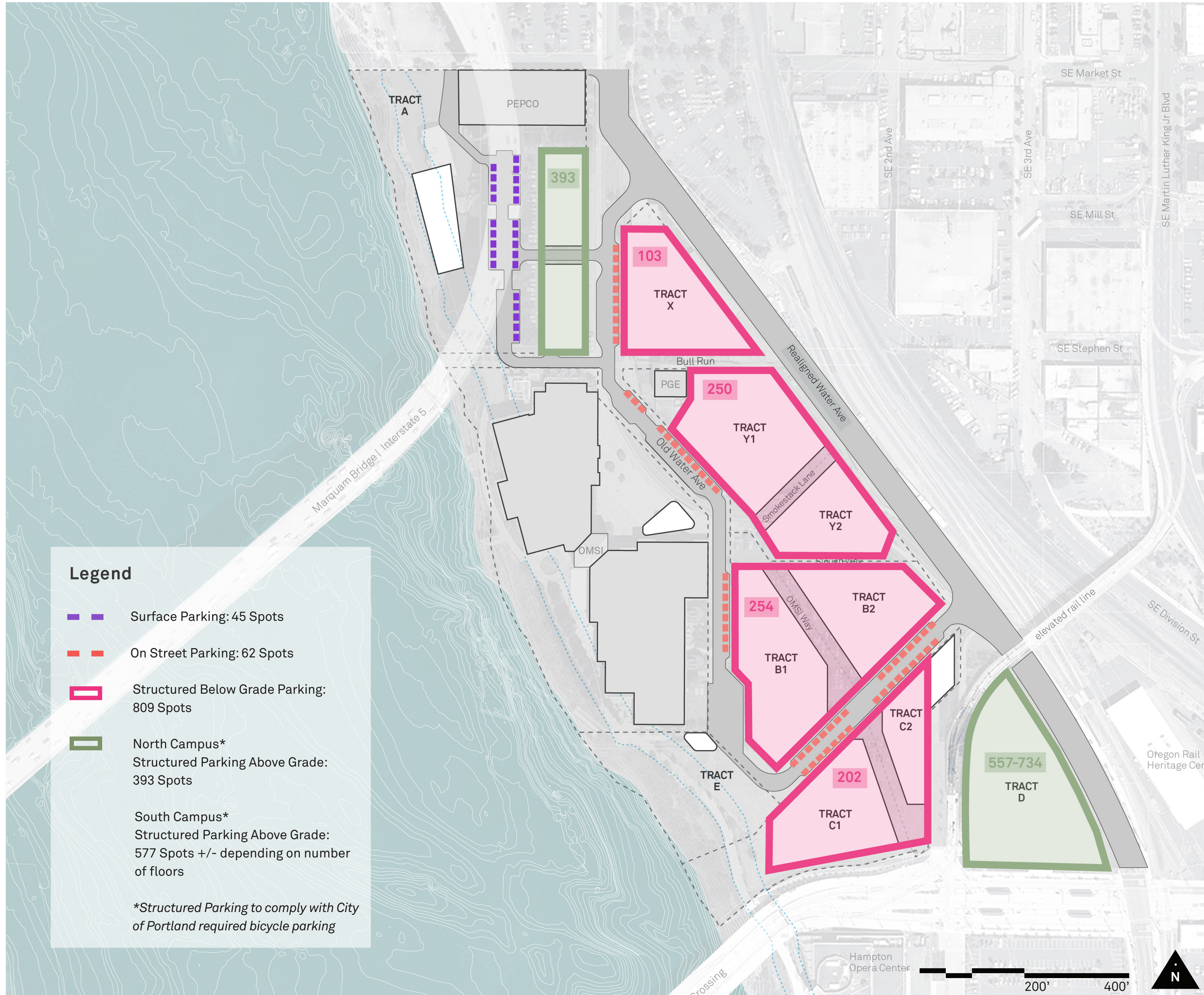


Figure 5.8

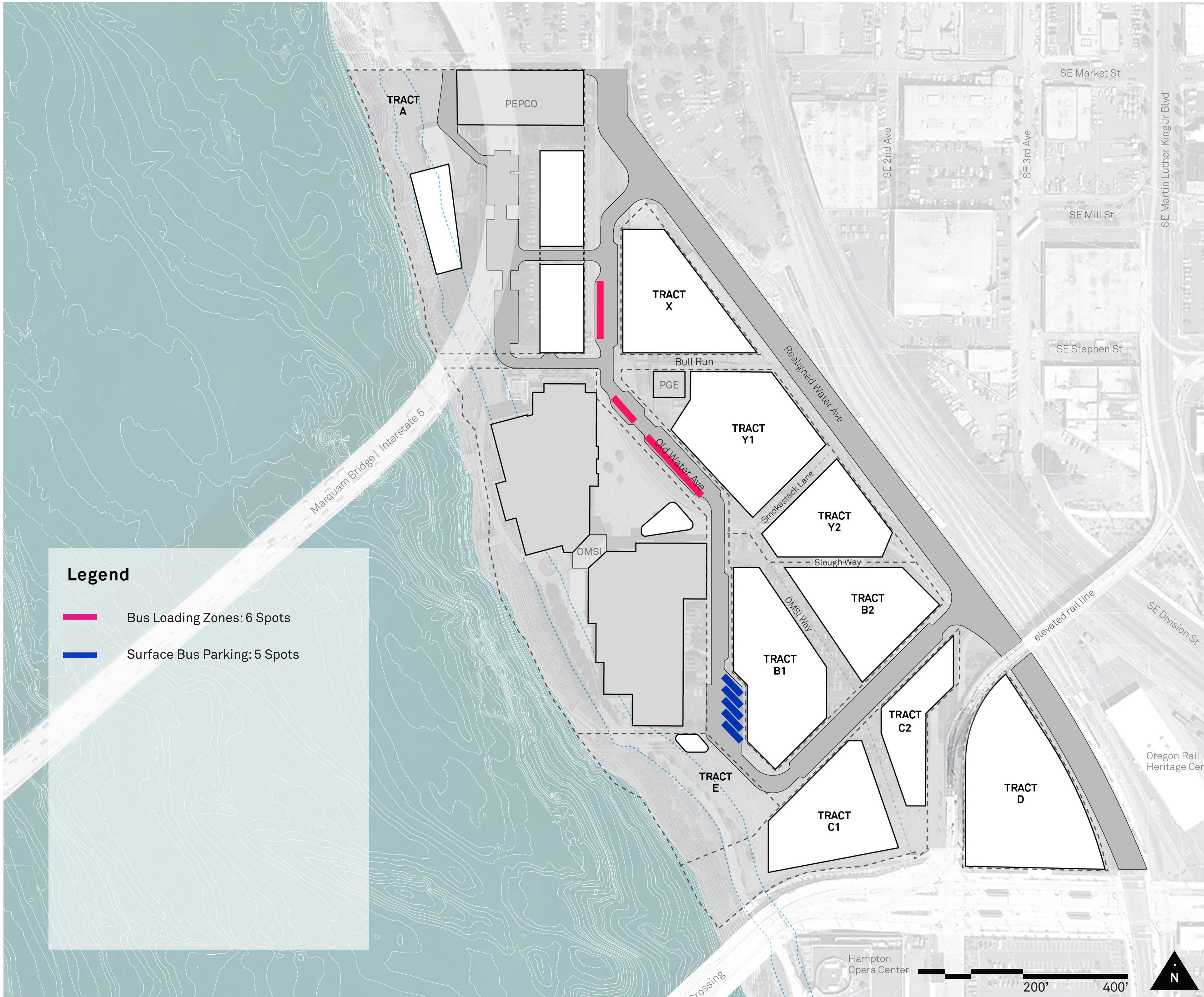


Figure 5.9

05.10 Future Bus Parking

In its reconfiguration, Old Water Avenue has been adjusted to accommodate 6 bus loading zones adjacent to OMSI Gateway Plaza. All bus loading zones are located on the west side in order to eliminate the need for large groups to cross the street. 5 spots of on-street bus parking have been created to the west of tract B1.

It is recommended that OMSI explore locations for additional bus parking off-site to service day to day needs.

OMSI Exhibit Renewable Energy
Image Source: OMSI

06. Campus Sustainability Strategies

06.1 Existing Conditions Analysis

06.2 Sustainability Framework

06.3 Sustainability Framework Matrix

06.4 Land Use Program Options & Resources

06.5 Detailed Strategies

06.1 Existing Conditions Analysis

BuroHappold performed a high-level existing conditions analysis on infrastructure, utilities, and environmental performance. This analysis resulted in the identification of site related issues and opportunities, deeper understanding of historical and current utility costs, and the evaluation of existing and future grid emissions and infrastructure capacity.

Energy: Portland General Electric (PGE) provides the electricity for OMSI and the OMSI owned land. The grid electricity is generated by a mix of purchased power through sale-leaseback agreements (26 percent), natural gas (25 percent), coal (22 percent), and renewables (16 percent hydroelectric and 11 percent wind/solar) (Figure 6.1.A). PGE has surpassed its goal for a 20 percent renewable mix by 2020 and anticipates a 40 percent renewable mix by 2040 (Figure 6.1.A). The 2040 target will be achieved through investing in energy efficiency for customers, the purchase

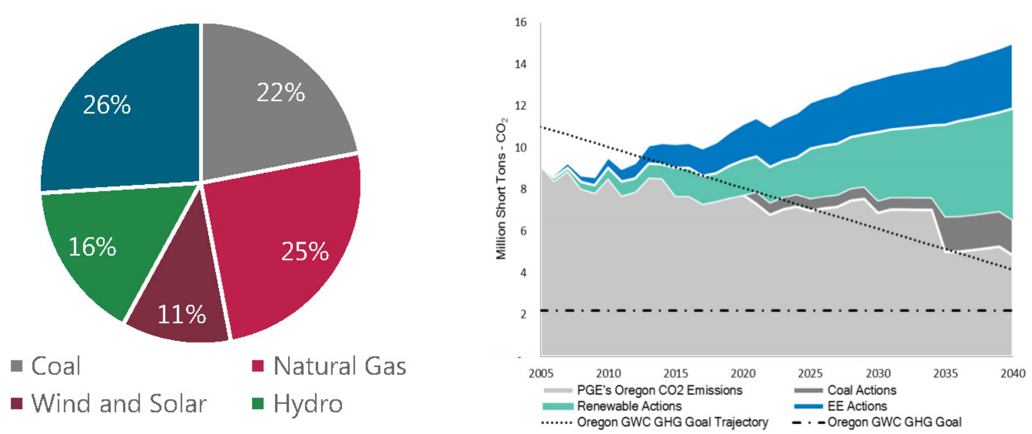


Figure 6.1.A - Existing Electric Grid Supply Mix[2] (left) and Future Grid (right)

and implementation of renewables, and the decommissioning coal fired power plants (or converting to biomass).[1] In addition, Portland (and Multnomah County) has recently made a commitment to achieving 100 percent renewable energy by 2050.[3]

NW Natural, through a Firm Service Agreement (uninterruptable natural gas supply), provides natural gas to the site. Both electricity and natural gas prices have remained stable over the last nine years, excluding some volatility

[1] PGE. (2016). Integrated Resource Planning: Preparing for Oregon's energy future. Retrieved from https://www.portlandgeneral.com/our-company/energy-strategy/resource-planning/integrated-resource-planning

[2] City of Portland and Multnomah County. (2017). Mayor Wheeler and Chair Kafoury 2017–2018 Climate Agenda. Retrieved from https://www.portlandoregon.gov/bps/article/635480#

in natural gas (Figure 6.1.B). The existing electric infrastructure supports future development in the OMSI-owned land since the site was originally zoned for industrial uses. Electricity costs ($0.08-0.09/kWh) are low compared to the national average ($0.12-0.13/kWh).[4] While the stability of electricity prices over the last decade reduces the cost-effectiveness of alternative/renewable energy technologies; the low cost natural gas and firm service agreement potentially supports the feasibility of a natural gas-fueled alternative energy technology such as

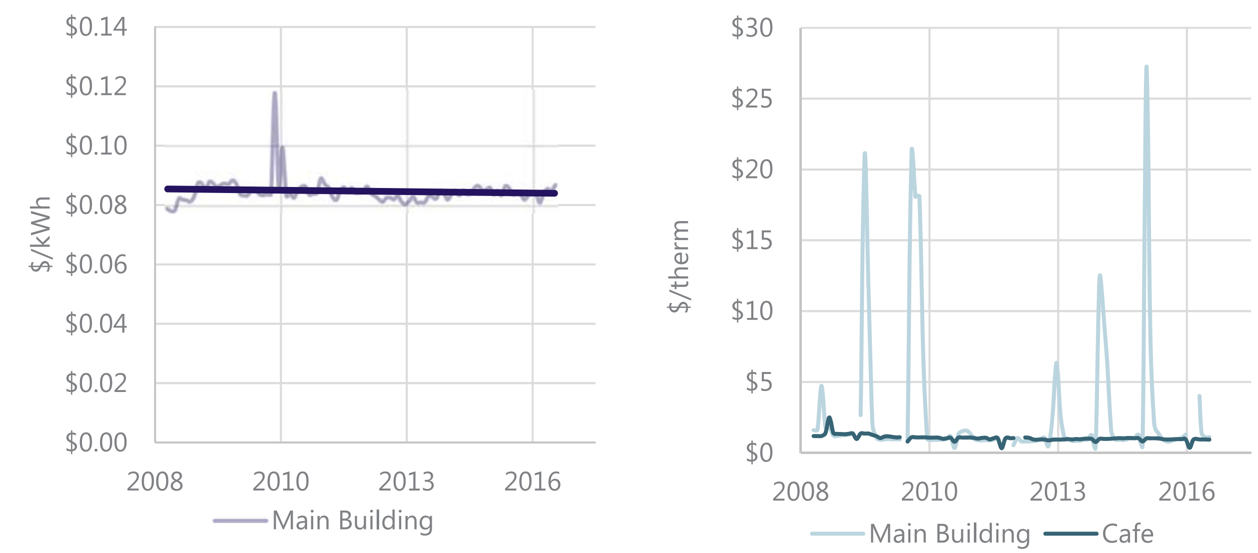


Figure 6.1.B - Main Building Electricity Costs (left) and Main Building and Café Natural Gas Costs (right)

district energy or combined heat and power (CHP) systems.
The OMSI site's history is tied to energy. The historic sawdust-fired power generation plant (now decommissioned and part of the museum) exemplifies the tradition. The site also has precedents for energy efficiency upgrades and renewable energy technologies. OMSI also had a free river cooling system at one time that was decommissioned due to ecological issues.

OMSI recently upgraded its heating and cooling system to an energy efficient hot water and chilled water circulation system servicing central air handlers and VAV boxes. For heating, the system uses two gas fired boilers and heat recovery chillers with high heating capacity. For cooling, it uses a magnetic baring centrifugal chiller and a heat recovery chiller.

[3] PGE (2016). How We Generate Electricity: A diverse mix for a dependable future. Retrieved from https://www.portlandgeneral.com/our-company/energy-strategy/how-we-generate-electricity#

[4] EIA (2017). Electric Power Monthly. Retrieved from https://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_3

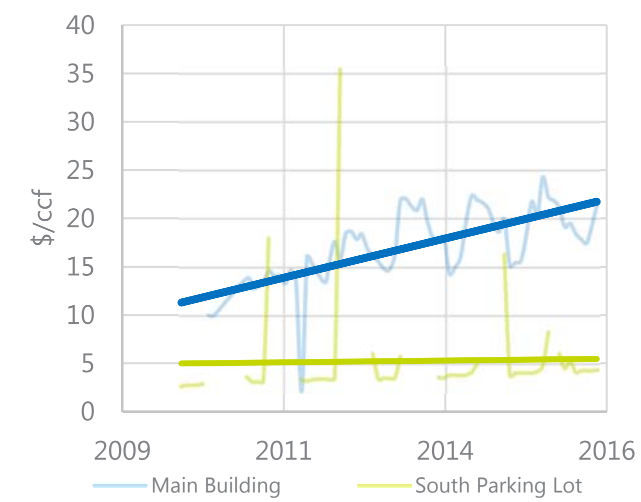
Figure 6.1.C - OMSI PV Car charging station

The efficient lighting system at OMSI includes a centralized computer system or motion sensors (when not on centralized system), and efficient lighting systems (mainly fluorescents with LEDs in theaters exhibition halls and at the exterior). OMSI also participates in a peak sharing program to reduce demand (and stress on the grid) during peak summer and extreme winter events.

OMSI has a photovoltaic car charging station located in the parking lot. The system has a capacity of 8.2kW, an annual generation of 7,800–10,000 kWh, and is fit for Level 1, 2 and 3 fast charging of electric vehicles.

Water and Wastewater: The existing water and wastewater infrastructure has the capacity to manage future development (according to the Portland Water Bureau). Additional potable water and sewage connection will be required. Potable water and sewage discharge costs have increased over the past seven years (Figure 6.1.D top), however OMSI receives Clean River Rewards Program credits through the green infrastructure located in the parking lots (one of the first installations in the United States). OMSI also receives Customer Sub-meter Program Credits for the recycling of water in its cooling towers.

Waste: OMSI has a tradition of separating waste streams, including standard waste (landfilled), recyclables, organics, construction waste, hazardous waste, kitchen grease, and fluorescent lamps. Standard waste is collected by Waste Management approximately five times per month, and recyclables and organics are both collected weekly. In 2008, the Portland Composts Program initiated the organics program at OMSI to collect and transport food and other compost-able items to a thermal compost site in Washington. Since 2015, the organics program only collects food waste due to a denial of a conditional permission. To dispose of the other waste streams, OMSI has construction waste collected annually, hazardous waste, which is small in volume, collected infrequently, kitchen grease collected by a food service contractor to be recycled, and fluorescent lamps collected by a lighting contractor when required. Standard waste collection costs have increased significantly over the past 11 years (Figure 6.1.D bottom). Efforts to promote waste generation reduction, increase waste diversion from landfills, and sustainable treatment strategies have the potential to help reduce waste related costs, while also increasing the site's environmental and operational performance.



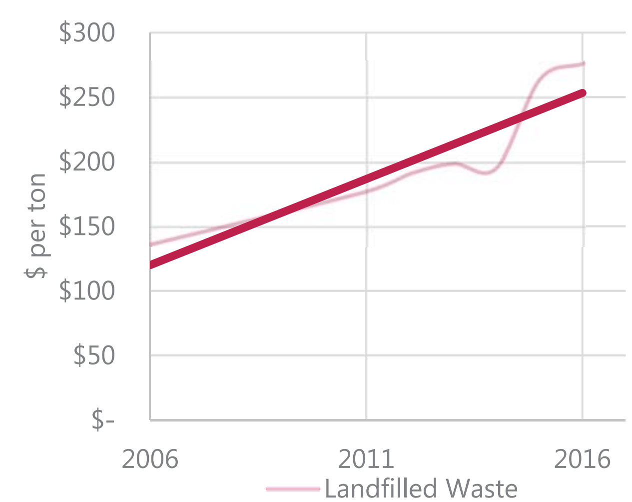


Figure 6.1.D - Main Building Water Consumption and Irrigation in South Lot Prices (top) and Waste Collection Prices (bottom)

Figure 6.1.E - Portland Business Journal 2014 Award

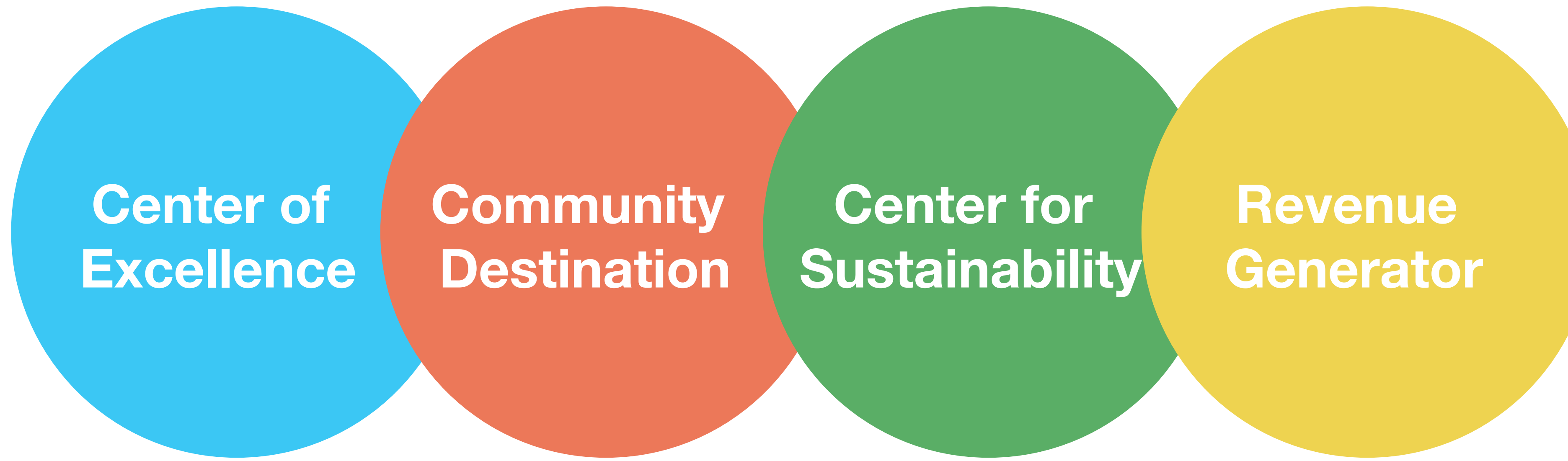
06.2 Sustainability Framework

The OMSI master planning process was underpinned by a guiding Sustainability Framework. The Framework establishes a high-level sustainability vision, objectives, implementation strategies, and metrics (key performance indicators) to evaluate sustainability performance and progress towards the objectives over time. The Framework takes a comprehensive view across all technical disciplines, ensuring that sustainable outcomes are achieved through an integrated design approach.

In summary, the Sustainability Framework:

1. Coordinates and aligns the Master Plan's vision with sustainability objectives, key performance indicators (metrics), and performance targets;
2. Responds to and incorporates relevant policy frameworks (e.g., client sustainability policies, government regulations), recognized best practice guidelines, and leading rating systems (e.g., LEED and EcoDistricts);
3. Enables collaboration across technical teams in the development of shared strategies towards established targets; and
4. Identifies and builds synergies between different technical strategies to ensure mutually supporting outcomes.

In developing a Sustainability Framework, it is possible to take into account the complexity of urban interactions by simultaneously addressing challenges related to efficient land use, infrastructure efficiency, transport, economics, climate, ecology, health, agriculture, hydrology, and energy use, among others. This process capitalizes on the potential synergies that exist between disciplines. Identifying these conditions enables integrated solutions and efficiencies in operation, with measurable outcomes and benefits. Ultimately, this results in a more robust and sustainable design strategy.



For the OMSI Master Plan, the Sustainability Framework uses OMSI's Four Guiding Principles:

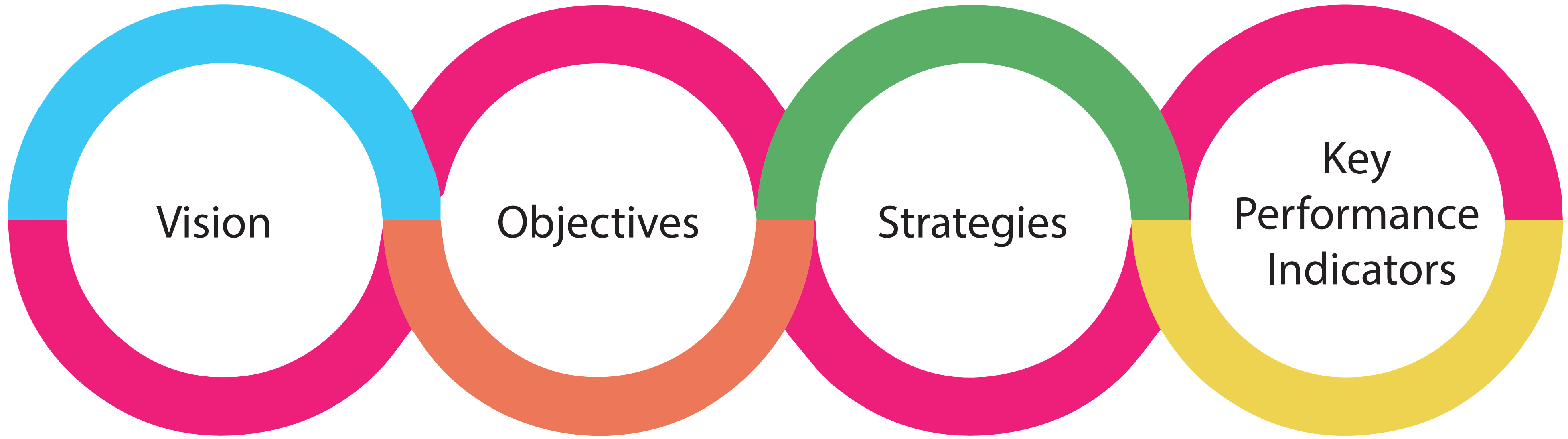
1. The property will be a center of excellence in science learning and teaching as OMSI expands its current programs and acts as a pipeline for highly motivated students from diverse backgrounds to move on to Oregon's higher education institutions or into careers in industry.
2. The museum is a community destination for public engagement around today's critical global issues, such as climate change and degradation of wildlife habitat, and local issues such as storm water runoff and transportation systems, alternative energy systems and techniques; uses of innovation and appropriate technologies and opportunities for public dialog on science policy.
3. The museum is a center for sustainability in its design as a carbon-neutral campus and as a center for public education through demonstrations of alternative energy systems and techniques; use of innovative appropriate technologies to solve problems; and opportunities for public dialog on science policy.
4. The property will become a revenue generator to support OMSI's educational mission and build financial strength.

The Sustainability Framework identifies objectives for each of OMSI's Guiding Principles, potential strategies to help meet those objectives, and key performance indicators to measure progress. In order to identify appropriate objectives and strategies, the following planning and policy frameworks, studies and guidelines were reviewed:

1. Central City Plan 2035 Vol 1
2. River Environmental Overlay Zone
3. Innovation Quadrant (IQ)
4. EcoDistrict Protocol
5. OMSI Accepted Master Planning Goals
6. Southeast Quadrant Plan
7. Central City Plan 2035 Vol 2
8. OMSI Framework Aggregate Document - Background Information and Supportive Data
9. Previous OMSI Planning Efforts
10. Additional strategies

Additional strategies were identified based on the existing conditions analysis and best practices. The Final Sustainability Framework is shown in Table 1 (this is based on existing project team documents for the non-infrastructure related elements and requires inputs from the rest of the project team).

Sustainability Framework



Focus Areas

Frameworks, Studies & Guidelines

Central City Plan 2035 Vol 1
River Environmental Overlay Zone
Innovation Quadrant (IQ)
Ecodistrict Protocol
OMSI Accepted Master Planning Goals

Southeast Quadrant Plan
Central City Plan 2035 Vol 2
OMSI Framework Aggregate Document - Background Information and Supportive Data
Previous OMSI Planning Efforts

06.3 Sustainability Framework Matrix

A Center of Excellence

Guiding principles	Public engagement around today's critical global issues and local issues; uses of innovation and appropriate technologies and opportunities for public dialog on science policy		
Objectives	Develop an innovation quadrant	Integrate interactive exhibitions throughout the district that support research and discovery	Program spaces for ongoing and lifelong learning
Sample strategies	*(e.g., integrate with innovation district across the river)*	*(e.g. make infrastructure visible)*	*(e.g., offer classes and exhibits that supports toddler to senior learning)*
Key performance indicators	- # of jobs generated/supported [or # of start-ups or creative jobs supported] - # of people service or $ of resources opened up through connections between educational institutions and workforce development and private sector partners - Enhances connections between educational institutions, workforce development, and private sector partners [y/n] - # of interactive opportunities with science		
OMSI master planning strategies/ priorities	- Allocate space for classroom and assembly/community space that can be rented out as an additional revenue source - Develop OMSI exhibits related to the waterfront (e.g., develops pilot water project monitored as an exhibit) - Plan for OMSI Exhibits regarding Stephen's Slough and energy history (e.g., develop pilot energy project monitored as an exhibit - Incorporate district recycling and composting initiatives with educational programming - Develop educational programming and events		

A Community Destination

Guiding principles	Public engagement around today's critical global issues and local issues; uses of innovation and appropriate technologies and opportunities for public dialog on science policy		
Objectives	Foster partnerships with neighbors and future tenants through site design and programming	Celebrate and engage the river by increasing access to the river, expanding riverfront public spaces, and fostering river-related programming	Integrate smart systems into buildings and public spaces to educate, promote, and measure environmental performance
Sample strategies	*(e.g., provide pen and shared spaces throughout the site)*	*(e.g., construct a network of green spaces that stitch the campus to the river)*	*(e.g., provide smart energy and water meters, and sustainability dashboard)*
Key performance indicators	- # of sqft of shared spaces - % greenspace to total site area - Enhances waterfront identify [y/n]		
OMSI master planning strategies/ priorities	- Strengthen the City's greenway network/connectivity and expanded boardwalk/riverfront access - Design waterfront to act as "front door" for OMSI district - Allocate space for Water Taxi transportation connections - Integrate open space into waterfront design, adjacent to the river, with public gathering spaces overlooking river - Include flexible open areas for drop-off, tents, and outdoor events - Create a green network that stitches the campus to the river and expands public spaces on the riverfront - Integrate urban plazas and squares strategically across district, and design them for concessions, seating, shade and rain cover - Join Innovation Quadrant - Design shared street for vehicles, pedestrians and parking		

Figure 6.3: Sustainability Framework

A Center for Sustainability

Guiding principles	Design as a center for public education through demonstrations; use of innovative appropriate technologies to solve problems; and opportunities for public dialog on science policy		
Objectives	Strive towards a carbon-neutral campus	Improve water quality and watershed health	Facilitate achievement of Zero Waste
Sample strategies	*(e.g., require buildings to meet Passive House or Net Zero Emissions building standards)*	*(e.g., integreate green infrastructure across public realm for stormwater management)*	*(e.g., create a solid waste management plan)*
Key performance indicators	- Estimated annual CO_2e emissions per square foot and comparison to Portland Average - MW of on-site renewable energy capacity - # of species attracted/supported - Colony forming units per 100 mL (cfu/100 mL) in Willamette River - % reduction in stormwater runoff - Waste diversion rate from landfill		
OMSI master planning strategies/ priorities	- Consider becoming an EcoDistrict™ - Design district energy systems (including district heating and electric microgrid) that integrate smart technologies for demand management and renewable energy sources - Conduct technical and economic feasibility study for shared energy systems with neighboring facilities - Install electric vehicle charging stations - Plant vegetation along high-density travel areas - Integrate ecological monitoring system - Reintroduce habitats to the site - Recycle greywater to meet non-potable water demands; conduct feasible for on-site blackwater system - Site a natural decentralized wastewater treatment system that uses natural processes involving or mimicking wetland vegetation, soils, and their associated microbial assemblages to improve water quality - Sensor Nodes link physical world to the internet for precise monitoring - Create solid waste management plan that considers district-scale anaerobic digestion for organics and automated waste collection to transport waste using underground tubes - Install district-scale anaerobic digester as part of an organics program		
(Optional) Development requirements	- Require passive house approaches and/or net zero energy building design - Require developments to meet half of their energy needs through on-site renewable energy - Provide energy usage information to occupants feedback through a system of meters and sensors - Install ecoroofs that meet BES standard, consider ecoroof / photovoltaic hybrids (a combination of solar PV system and vegetated roofs), where feasible - Integrate stormwater capture and water reuse capabilities at the building scale to support non-potable water demand (e.g., toilet flushing, irrigation, etc.) - Require building design elements that make organics separation and recycling easy (e.g., three bin system)		

A Revenue Generator

Guiding principles	Support OMSI's educational mission and build financial strength			
Objectives	Create a distinct character that builds on the site's industrial history, neighboring context, and OMSI's science and discovery mission includes strong gateways and landmarks	Promote transit-oriented, dense development that activates sidewalks and encourages people to move through, in and out, both day and night	Create opportunities for revenue generation along the waterfront and through parking strategies	Invest in systems that provide long-term operating cost savings and revenue potential opportunities
Sample strategies	(e.g., use of building materials that reflect historic and industrial uses, e.g., brick/iron, and not modern glass towers)	(e.g., require groundfloor retail/commercial on major corridors)	(e.g., contract with vendors for waterfront activities along waterfront)	(e.g., an efficient district energy system, combined with low energy building design)
Key performance indicators	- Responds to current and projected market demands [y/n] - # of pedestrian trips expected within and to/from the site - $ revenue generation potential - Respects history and existing context (y/n] - Contributes to distinct character? [y/n] - $ estimated utility cost savings compared to traditional systems/buildings (energy, water, waste)			
OMSI master planning strategies/ priorities	- Design waterfront public spaces to seamlessly accommodate pop up entertainment, retail, and food and beverages (see Community Destination) - Contract with third-party energy services company to design, construct, and operate district energy system, renewable energy systems, building efficiency upgrades (for existing buildings), demand management, and project financing (See Center for Sustainability) - Conduct feasiblity study to assess technical and economic potential to sell excess energy to surrounding buildings (See Center for Sustainability) - Conduct feasiblity study to assess technical and economic potential to sell excess recycled water to surrounding buildings (See Center for Sustainability) - Conduct feasiblity study to assess technical and economic potential to accept organic waste from surrounding buildings (See Center for Sustainability) - Allocate space for classroom and assembly/community space that can by rented out as an additional revenue source (see Center of Excellence) - Promote development that activates the ground plane, reinforces adjacent uses and respects the presence of OMSI, with an mphasis on active street life including retail, restaurant, and office activities			
(Optional) Development requirements	- Develop parking strategy with dynamic pricing scheme to both promote alternative transportation modes yet maximize revenue from parking - Design outdoor spaces for concessions, seating, shade and rain cover			

06.4 Land Use Program Options & Resources

While resource consumption alone will not determine the ideal land use program option, the consultant team analyzed three land use programs to provide an understanding of what mix would lead to the highest resource consumption, the lowest resource consumption, and the mix of uses that best support district sustainable infrastructure strategies. The three programs include: High Organics Generation, Low Resources and District Energy, and Microgrid. These options were developed to complement OMSI's vision, the planning ambitions for the development and the real estate analysis (Figure 6.4.A, Figure 6.4.B, and Figure 6.4.C).

High Organics Program

	GLA ft2
Office	0
Active Ground Floor	95,000
Hotel	0
Housing	1,400,000
Market	95,000
Senior Living	505,000
Creative Space	350,000

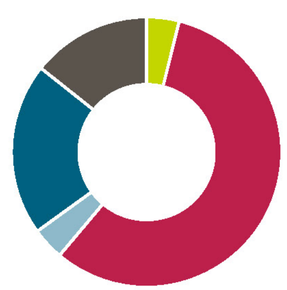


Figure 6.4.A

Low Resource Program

	GLA ft2
Office	900,000
Active Ground Floor	141,000
Hotel	175,000
Housing	900,000
Market	0
Senior Living	0
Creative Space	300,000

Figure 6.4.B

District Energy and Microgrid Program

	GLA ft2
Office	500,000
Active Ground Floor	95,000
Hotel	175,000
Housing	800,000
Market	95,000
Senior Living	505,000
Creative Space	250,000

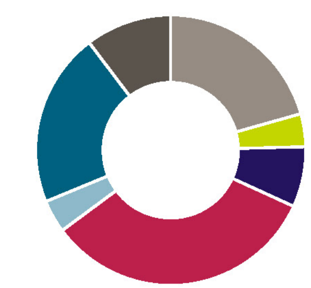


Figure 6.4.C

The High Organics Program is a low resource intensity site with a large amount of organics generation due to the market and housing.

The Low Resources Program is designed to reduce the amount of impact the site will have on resource use such as energy, water, waste, and carbon emissions. Resource consumption was reduced mainly due to removing the market and senior living facilities from the site.

The District Energy and Microgrid Program is designed to balance the heating and cooling loads of the buildings and create a more resilient site for the critical Senior Housing.

Each of the strategies were analyzed to determine the amount of resources consumed and generated (Figure 6.4.D). The District Energy and Microgrid Program required the most energy and generated the most CO2 emissions. The Low Resource Program was designed to be the lowest CO2 emissions program. The District Energy and Microgrid Program is similar to the High Organics Program for potable water and wastewater generated. All three programs could support on-site wastewater treatment system. The High Organics Program generates the most organic waste followed by the District Energy and Microgrid Program. Both of these could support anaerobic digestion (the Low Resource Program may not generate enough organic waste for anaerobic digestion).

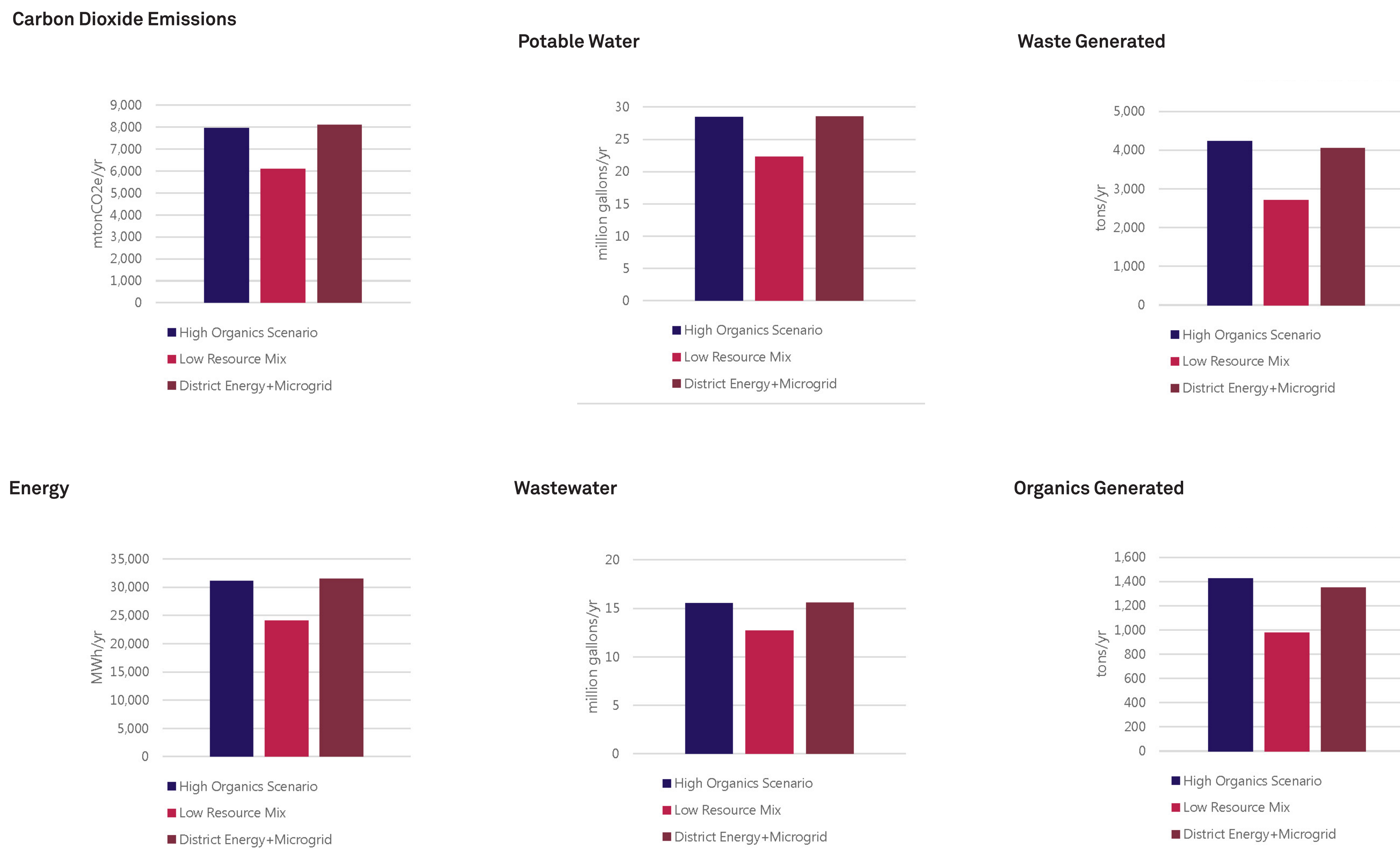


Figure 6.4.D: Resource Analysis

06.5 Primary & Recommended Strategies

The following sustainability systems are primary strategies for the OMSI campus:

- Green Roofs (Central City Plan see section 33.510.243 Ecoroofs and Portland Ecoroof Guide)
- Green Infrastructure (City Requirements)
- Sensor Nodes
- Smart Meters
- Engagement Opportunities

The project team, evaluating the strategies based on OMSI's vision, recommended land use scenarios, discussions with stakeholders, local requirements, and the proposed design and sustainability frameworks. Each of the strategies was analyzed and recommended using the resources used and generated, and the types and amount of square footage of buildings (Figure 14). The following strategies were recommended:

- Anaerobic Digestion
- Natural Wastewater Treatment and Reuse
- District Heating and Cooling
- Photovoltaics
- Microgrid
- Batteries

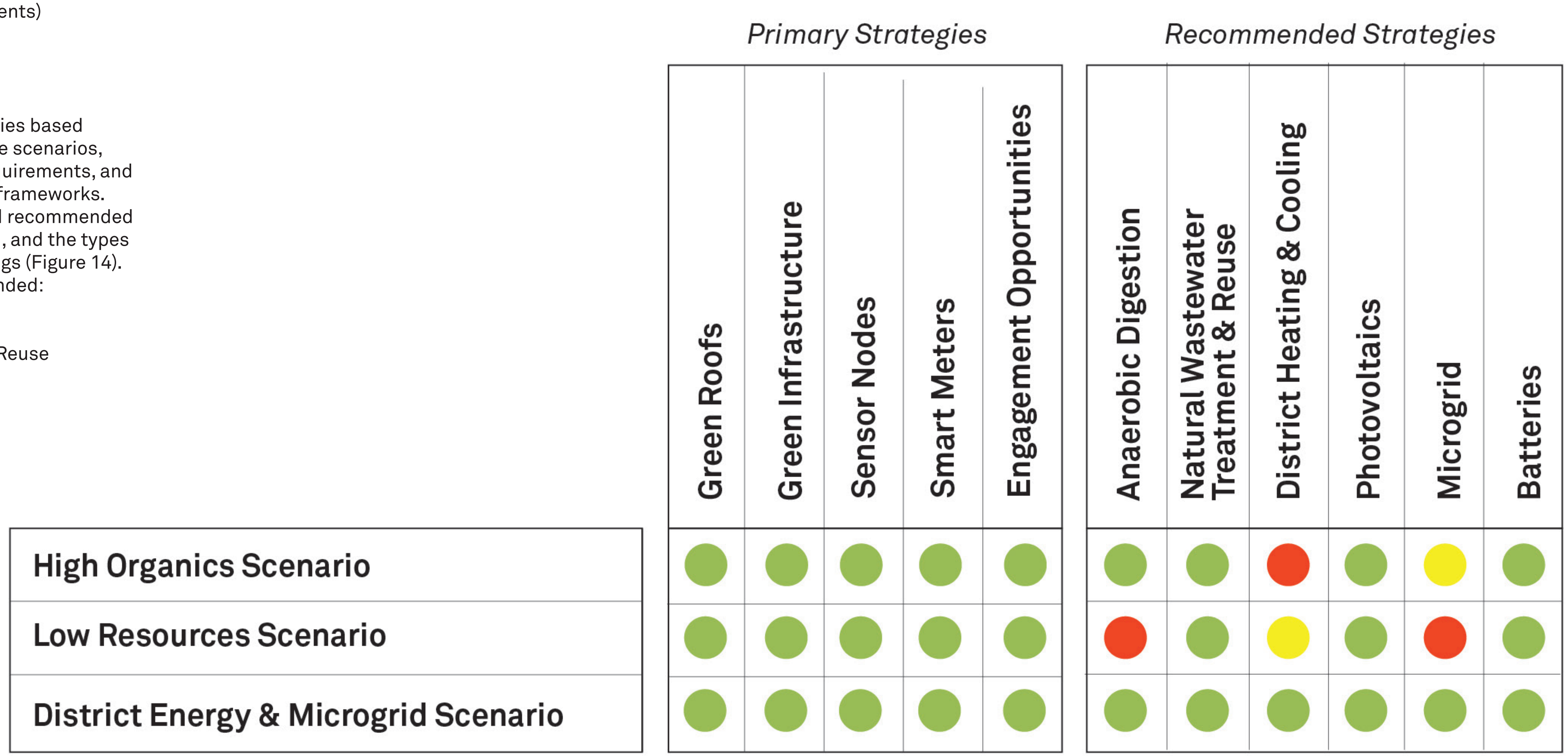


Figure 6.5.A - Primary and Recommended Strategies

06.5.1 Sustainability Plan Diagram

Suggested locations for primary and recommended sustainability strategies are indicated in Figure 6.5.1.B

Figure 6.5.B - Suggested locations for sustainable strategies

06.5.2 Primary Strategies

1. Green Roofs

Green roofs consist of a waterproofing membrane, growing medium (soil), and vegetation (plants) overlying a traditional roof system. These systems are referred to in Portland as “eco-roofs.” Eco-roofs, which cover buildings with a layer of living plants, can help mitigate a number of issues in buildings and districts by bringing together the natural cooling, water-treatment and air filtration properties that vegetated landscapes provide to a district. They are an important tool to increase sustainability, improve biodiversity and decrease energy consumption, urban heat island impacts, and greenhouse gas generation. Green roofs also contribute to wildlife habitat which is particularly valuable for OMSI’s river-adjacent property river.

These systems, including accessible eco-roofs, are required and recommended on all buildings of the site. Eco-roofs range from extensive systems of 3- to 6-inches in thickness (20 to 45 pounds per square foot) to intensive systems 6+ inches in thickness (45+ pounds per square foot).

Benefits

- Reduce stormwater runoff, retains stormwater and could improve stormwater quality
- Improve biodiversity and reintroduce habitats to the urban landscape
- Reduce urban heat island effect
- Reduce energy consumption and buffers noise (specifically on spaces below the roof)
- Create long-term maintenance jobs
- Improve air quality
- Create attractive and leasable space (additional revenue) on otherwise unused zones of buildings
- Last longer than typical roof systems

Constraints

- High capital costs
- Require skilled contractors for installation
- Require irrigation during establishment period and during drought

Figure 6.5.2.A - Eco-roof at Columbia Boulevard Wastewater Treatment Plant

2. Green Infrastructure

Green infrastructure uses natural processes to improve water quality and manage water quantity by restoring the hydrologic function of the urban landscape, managing stormwater at its source, and reducing the need for additional grey infrastructure. These systems provide a wide range of social, economic, and ecosystem or environmental benefit, which includes improvements to human mental and physical health, greater community cohesion (social capital), opportunities to advance aesthetic improvements; direct and indirect sustainable job creation, cost-savings associated with buildings and cost savings for grey infrastructure; and reductions in the urban heat island effect, filtration of pollutants from the air, improved shading, improved stormwater management (both quality and quantity), and opportunities to enhance biodiversity. Types of green infrastructure include: eco-roofs (extensive and intensive), green walls and facades, rain gardens, bioswales, permeable/porous pavement, trees, bioretention, wetlands, and planting beds.

Portland is a pioneer of green infrastructure in the United States, and OMSI is one of the first sites for green infrastructure. Green infrastructure, such as bioswales, rain gardens and bioretention, is required throughout the site.

Benefits

- OMSI already has the tradition of since the parking lot project is one of the first sites in the country to use green infrastructure to manage stormwater
- Incentives available for on-site stormwater management
- Many additional benefits including demonstrating green practices, science at work, and interpretation of the site

Constraints

- Requires irrigation during establishment period and during drought

Figure 6.5.2.B - Bioswales (left), permeable pavers (center), and bioretention (right)

3. Sensor Nodes

Sensor Nodes link the physical world to the internet through wireless networks integrated with software which allow for precise monitoring. OMSI is dedicated to science education and a system of sensors on buildings and infrastructure may provide feedback and learning opportunities while also reducing resource consumption and costs.

Benefits
- Interactive museum display
- Helps decision making with instant feedback
- Detects environmental risks immediately
- Implemented at several scales

Constraints
- Sensors are typically application specific
- Sensors are constrained of memory, computational speed and bandwidth
- Lack of standards for all data collected
- Typically different vendors for system monitored

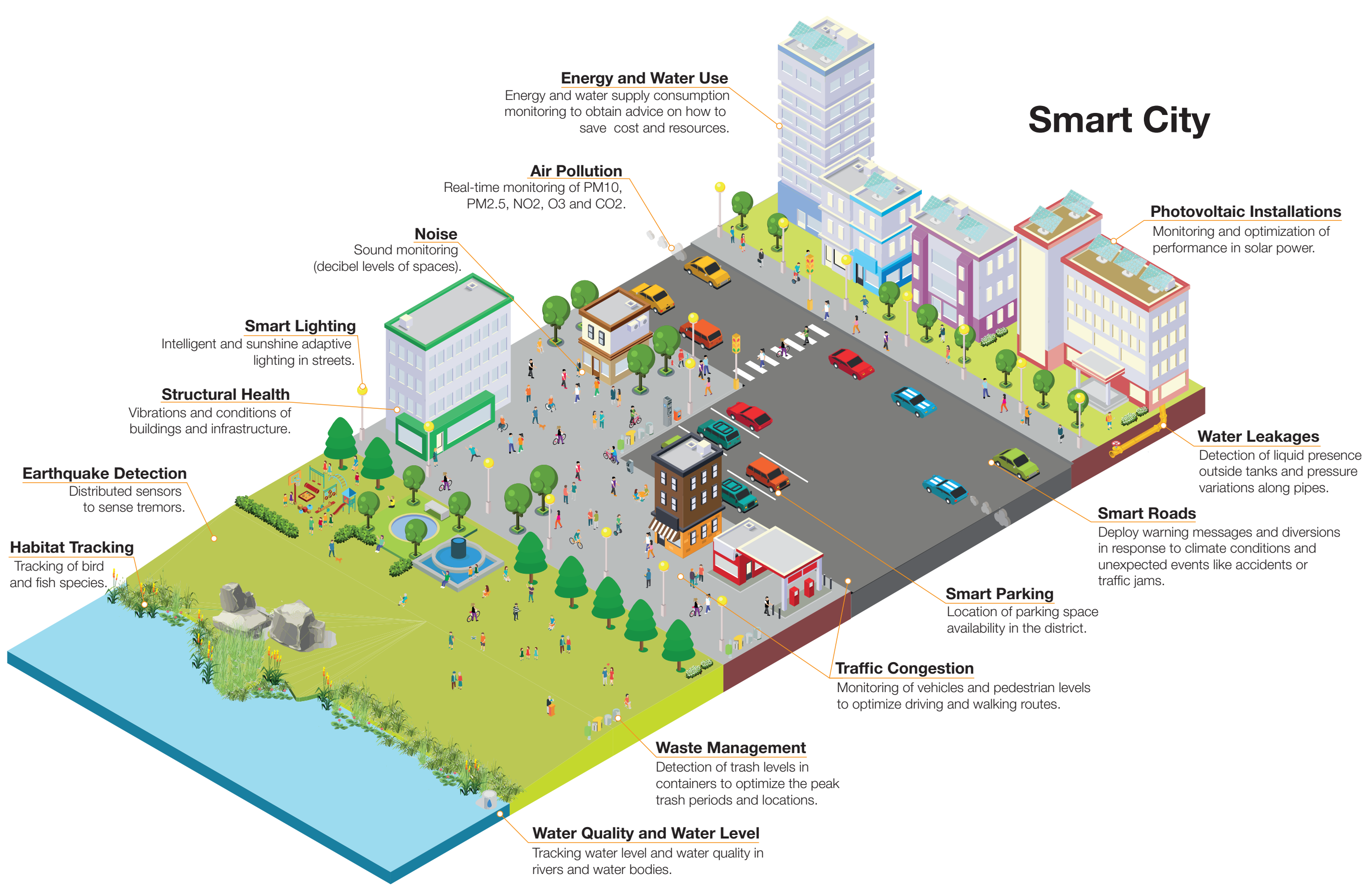


Figure 6.5.2.C - Smart sensors located throughout the district measure and provide feedback

4. Smart Meters

Smart meters provide real-time data to users and utilities and allow for remote building and district-wide energy management by the utility/operator. Smart meters are being installed in communities across the United States and improve efficiency on both the consumer and utility side.

Benefits
- Deliver energy providers accurate data on energy use for billing
- Can inform users' energy management decisions, helping to reduce energy consumption and costs.
- May allow for interoperability, meaning a building manager or utility can remotely control energy use
- Allow maximum comfort and minimal waste of resources
- Creates user awareness (e.g., water prices are increasing)
- Can be used as an exhibit

Constraints
- Consumer concerns with privacy as meters collect vast amounts of user data.
- Resources to install
- Additional maintenance

Figure 6.5.2.D - Household smart meter system

5. Engagement Opportunities

Since OMSI is an educational institution, there are opportunities for engaging individuals to building and district-level consumption, and connecting residents, workers, and visitors to the river with potential technologies. Floating interactive buoys housing a range of sensors could be used to measure water quality and fish presence below water and use an array of LEDs above water to display real-time results. This project was led by the Environmental Health Clinic in the East and Bronx Rivers in New York City. Powerplant stacks and walls could be used to display energy consumption such as the Salmisaari Powerplant and interactive wall in Helsinki, Finland, which relays data about the city's energy consumption.

Additional innovative technologies (displayed to the right) could be used connect people to sustainability.

Figure 6.5.2.E - Floating interactive buoys (left) and a powerplant and interactive wall displaying energy consumption (center and right)

Solar roads, France

Solar bus stations

Smart waste bins

Solar bike paths, Netherlands

06.5.3 Recommended Strategies

1. Anaerobic Digestion

Anaerobic digestion is the natural decomposition (digestion) of organic waste in an oxygen-free (anaerobic) environment. The process generates bio-gas, comprising of approximately 60% methane and 40% carbon dioxide. The bio-gas can be combusted to generate heat and/or power (CHP) or upgraded (scrubbed) to biomethane, for injection into the gas grid or compression into compressed natural gas (CNG), and then used as fuel storage or vehicle fuel. A solid and liquid digestate is also generated from the process that can be used as an organic fertilizer for soil improvement.

Anaerobic Digesters are typically deployed at the city level, in cities like Stockholm. With the advent of technological improvements, they are starting to be deployed at smaller scales in cities like Seattle (at breweries), Minneapolis (in developments), and New York (in buildings). An Anaerobic Digester is recommended in the High Organics and District Energy and Microgrid Programs due to the amount of organic potential being generated. These systems will significantly reduce the amount of heavy and wet organic waste leaving the site, improving waste management logistics, reducing waste management costs (potentially), and creating a local, low carbon energy resource and soil fertilizer. Additionally, the system lends itself to an educational display on waste, anaerobic conditions, soil, and energy.

Benefits
- Divert biodegradable waste from the landfill/incinerator, reducing environmental impacts of leachate and uncontrolled methane production
- Emissions are lower than most forms of waste-to-energy
- Produce organic fertilizer and soil improvers which can generate revenue
- Process is energy self-sufficient

Constraints
- High capital cost
- High maintenance skills required to monitor (can be done remotely in smaller systems)
- Financing requires a long-term contract
- Co-digestion (using other organic materials besides food waste) may impact outputs

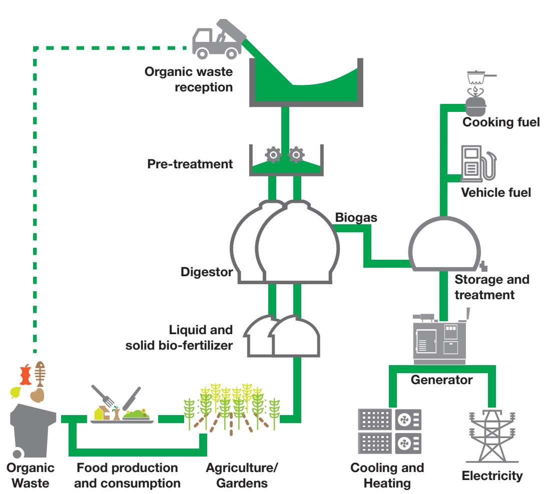


Figure 6.5.3.A - Anaerobic Digestion Process (left) and modular digester (right, Source: SEaB)

2. Natural Wastewater Treatment and Reuse

Natural wastewater treatment system and hybrid systems, such as the Natural Organic Recycling Machine (NORM) at the Hassalo on Eighth development, use natural processes involving or mimicking wetland vegetation, soils, and their associated microbial assemblages to improve water quality. These systems typically use screening systems to remove larger, untreatable particles and use an anaerobic reactor (to reduce solids) and/or an anoxic reactor to mix and aerate the wastewater. Then an aerobic reactor or trickling filters remove pollutants and odors via biofilters. Wetlands could then be used for remaining settlement and polishing (or removing nutrients) from the water for final discharge to a sewage system, a body of water, or for reuse. A separate graywater plumbing system could be implemented in buildings, which will carry these treated flows for toilet-flushing, irrigation, and other non-potable uses.

Not only does the use of reclaimed water reduce the burden on the public potable water system, it also diverts wastewater flows that would otherwise require energy-intensive treatment at a centralized plant. Additionally, the natural wastewater system can reduce fees associated with discharging to the sewage system and fees for potable water, while creating another display of a natural sustainable system.

Benefits
- Industrial process that adds aesthetic interest to the district
- Education opportunity and can be used as an exhibit
- Saves sewer discharge costs when water is reused

Constraints
- Contractor needs to have proven track record and the ability to operate the system
- Additional capital costs compared to direct sewage discharge
- Potential additional on-site maintenance costs (compared to direct sewage discharge

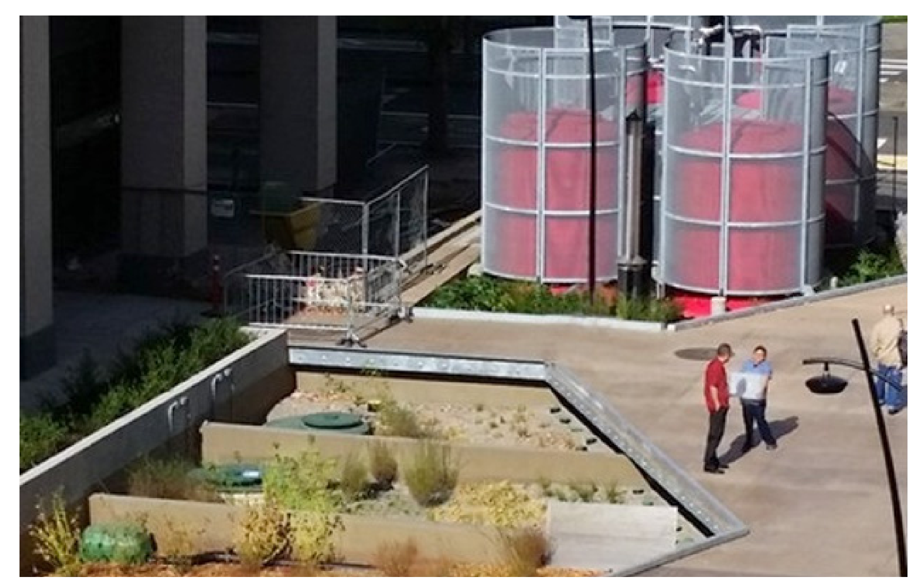


Figure 6.5.3.B - On-site natural wastewater treatment plant located at Hassalo On Eigth in the Lloyd EcoDistrict (Source: BioHabitats)

3. District Heating and Cooling

District Heating and Cooling networks provide clean, reliable, heating, cooling and hot water to developments. These systems eliminate the need for boilers and chillers in buildings saving space for additional real estate in buildings. The proposed system for the OMSI district is a district condenser loop system. These systems use water source heat pumps located in buildings that will generate chilled water and reject heat into a condenser loop during the summer (the rejected heat could be extracted using a water source heat pump and used for hot water in other buildings). At the plant level, surplus heat is rejected via cooling towers and condenser loop water is circulated by the pumps. In the winter, water source heat pumps in some buildings generate hot water and extract heat from the condenser loop (making the water cooler) and in other buildings the water source heat pump generates chilled water (from the lower temperature water) and rejects heat. At the plant level, boilers add heat to the condenser loop and the condenser loop water is circulated by the pumps. These systems are cheaper than traditional four-pipe systems, optimize heat recovery and free cooling and could be modular by saving space for additional boilers at the district plant and adding heat pumps to buildings when they are built.

A district heating and cooling system is recommended for the District Energy and Microgrid Scenario.

Benefits

- Third party financed and operated (optional)
- Energy efficient
- Save usable space

Constraints

- High capital costs(can be mitigated through third party)
- Phasing delays economic return

Figure 6.5.3.C - Part of a condenser loop system

4. Photovoltaics

Photovoltaics (PV) are silicon-based cells and modules that capture energy radiated by the sun and convert it into electricity. These panels provide scalable on-site renewable energy from solar radiation. They can be incorporated into buildings horizontally, vertically, or even within the glass façade itself. The solar cell technology available can be divided into three main categories in increasing order of efficiency: thin-film, poly-crystalline, and mono-crystalline. Overall efficiencies range between 7-20% with the cost of the cell generally correlated to its efficiency. Higher efficiency cells are often more cost-effective, since overall balance-of-system components, such as racking and wiring, are reduced because fewer panels are needed to produce the same amount of power. The cost of solar has declined significantly over the past decade and there are a number of financing models that allow building owners to integrate PVs onto their buildings without taking on debt. PVs are recommended in locations adjacent to green roofs, above green roofs (hybrid systems), or on roofs that cannot support green roofs.

Benefits
- Capital costs of PV has decreased significantly over the past decade
- There are a number of financing options available
- Can provide on-grid and off-grid power (improved with batteries)
- Renewable energy supply

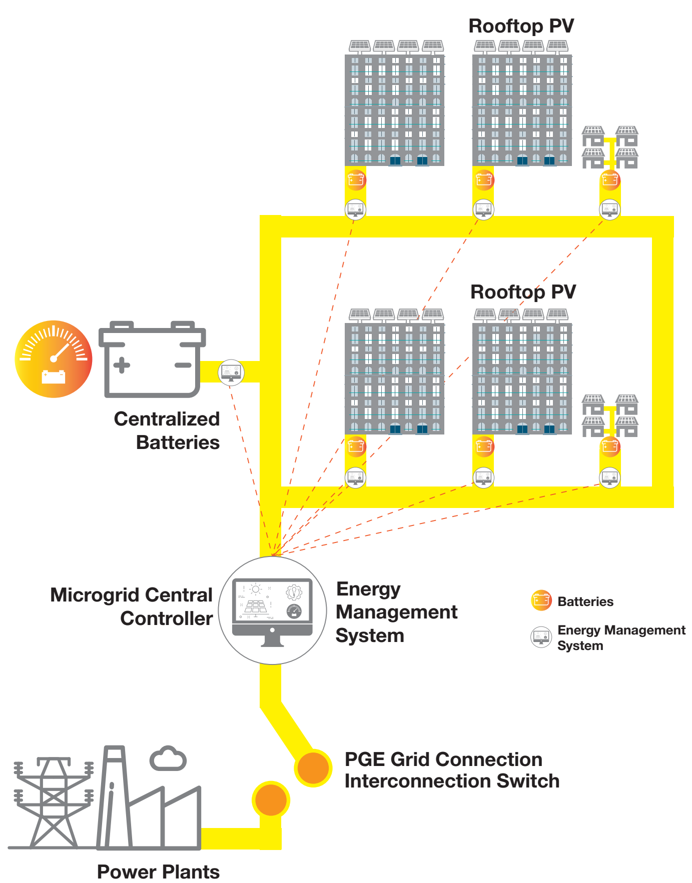
Constraints
- Fair solar resource limits generation potential

Figure 6.5.3.D - Solar photovoltaics located above a green roof, where the green roof improves the efficiency of the photovoltaic panel

5. Microgrid

A microgrid is an electricity distribution system composed of distributed energy resources (generation, communication/controllability, and storage) that is used to support critical loads within a defined area. A key feature of microgrids is 'islanding', the ability to separate from a central electricity grid if that power supply is interrupted. This feature can maintain power to critical facilities during extreme weather conditions or system emergencies, bringing power to individual customers when necessary. Microgrids have become increasingly adopted as a solution to the growing impacts of storm events, wind events, ice storms and transmission outages on electrical utility systems. By providing additional resilience to the electricity grid, microgrids can benefit the local economy by reducing losses due to power outages and attract new businesses interested in clean, cost-effective and reliable energy system.

A microgrid is recommended for the programs but is preferred for the District Energy and Microgrid Program or the High Organics Program because of the Senior Living Facility. These facilities typically require life-critical equipment. With the inclusion of photovoltaics, batteries and additional generation sources in the future, there may be sufficient electricity to supply critical equipment and buildings.



Benefits
- Provide energy service resilience with the ability to isolate ("island") from the central grid to provide electricity when grid goes down
- Potential to increase deployment of low and no carbon energy generation sources

Constraints
- Lack of established standards
- Upfront costs are relatively high, but as components (e.g., renewable technologies, energy storage, advanced controls, smart switches) continue to decline, microgrids become increasingly cost competitive

Figure 6.5.3.E - Example of a microgrid system with rooftop PV, centralized and building battery systems and energy management systems, a microgrid controller and an interconnection switch with the ability to "island" from the PGE grid

6. Batteries

Batteries are a system for storing electricity from on-site generation—including from renewable sources—and from the electric grid. They increase the usability of renewable energy generated at the building-level or site and for electric vehicle charging; they can also provide backup power during utility grid outages. From a resilience perspective, stationary systems such as back-up battery banks provide the best support for off-grid power. In addition, battery systems such as Lithium Ion (typically used in cars) and flow batteries (typically used with renewables and distributed generation) are starting to get cheaper, safer and more efficient. These systems are recommended throughout the site or in buildings to store electricity during peak hours, provide energy during outages to critical equipment and life-safety and be displayed to visitors where appropriate.

Buildings can reduce electricity costs by charging batteries at the building-level and at the substation-level during the day with a solar array or at night when rates are cheaper, and discharge the battery during daily peak hours.

Benefits
- Reduce consumption from the grid and maximizes use of PV-generated power
- Energy storage + distributed generation are becoming an integral part of the distribution grid and will be a game changer for new utility models

Constraints
- High capital costs but prices are decreasing with production and improvements in technology

Figure 6.5.3.F - Lithium Ion battery (left) and Flow battery (right)

Sewer repairs SE Yamhill and Water Avenue 1931
Image Source: City of Portland Archives

07. Campus Infrastructure

07.1 Utility Narrative

07.2 Sanitary Sewer

07.3 Storm Sewer

07.4 Water Service

07.1 Utility Narrative

The current OMSI museum opened to the public in 1992. At that time, what is now SE Water Avenue, was constructed as a private access drive for OMSI. This access was upgraded and dedicated as SE Water Avenue in 1997 or 1998 as part of a Local Improvement District project to improve access to OMSI and the district to the south. As a result, there are private utilities serving OMSI that were constructed prior to the dedication of SW Water Avenue which are now located in the public right of way.

A number of unknown utilities and concrete embedded conduits were uncovered during the construction of Water Avenue, particularly west of the PGE Substation. It was unclear whether the conduit lines were active or obsolete, and they were left in place. Additionally, trenching operations encountered large pockets of unsuitable material, including sawdust that had to be over-excavated and replaced with imported fill. Design and construction of any new public utilities within the existing right of way will have to account for these variable geologic conditions and conflicts with these unmapped duct banks.

Figure 7.1:Existing stormwater management at OMSI; OMSI was a pioneer in the use of green infrastructure to manage stormwater

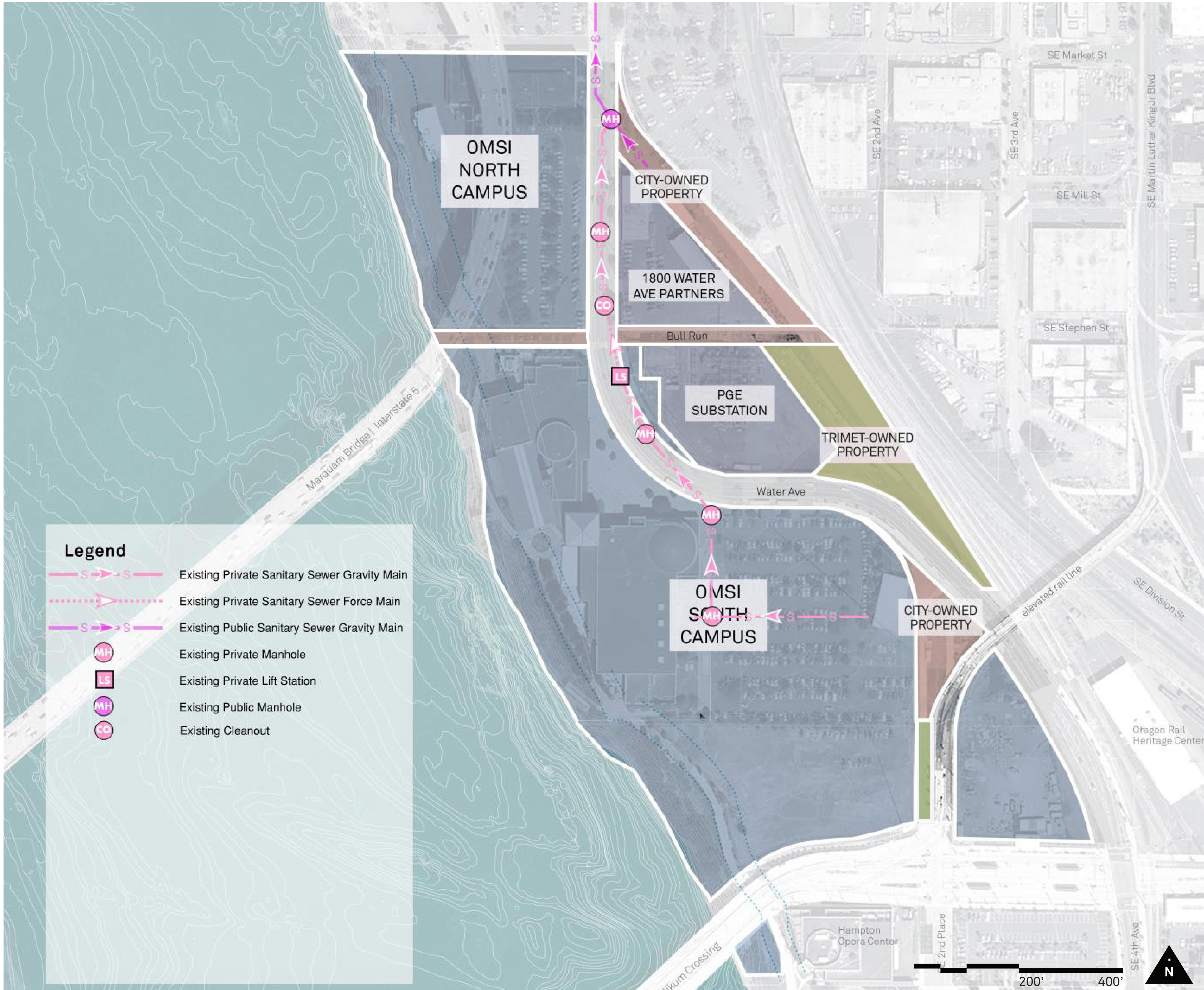


Figure 7.2.A

07.2 Sanitary Sewer - Existing Conditions

According to Portland Maps and record drawings, the OMSI South Campus is serviced by a private 8-inch sanitary sewer gravity main in SE Water Avenue. The main flows north to a private lift station located on privately-owned OMSI property at the NW corner of the PGE substation site, where sewage is pumped in a 4-inch force main approximately 160 feet to the north. Additional segments of private 8-inch main continue to flow north, by gravity in SE Water Avenue, to connect into the public sanitary sewer manhole located in the right-of-way at the NW corner of 1800 Water Ave Partners. Even though portions of the private infrastructure are located within public right-of-way, the system is currently owned and maintained by OMSI.

The existing private pipe and lift station were designed to convey OMSI demands only and are likely undersized to accommodate future development. Construction phasing will have to consider infrastructural upgrades before allowing future development to connect to these facilities.

07.2 Sanitary Sewer - Phase 1

To ensure proper pipe capacity and routing, proposed development will require new public sewer lines routed within the new road network. It is not viable to convey the entire study area by gravity without additional downstream improvements to the public sewer main, to lower the invert at the point of connection. A new public lift station to serve the redevelopment area will facilitate service during Phase 1, with nominal impacts, to construct a new force main and tie into the sewer main at the north end of the project. Ownership for the last reach of the private sewer main may be transferred to BES and made public infrastructure. The new sanitary sewer trunk line and lift station should be sized appropriately to serve all potential development opportunities for the OMSI Master Plan.

The existing lift station and private sanitary infrastructure to the north will remain in place with Phase 1 to maintain service to the existing OMSI North Campus, 1800 Water Ave Partners, and PGE Substation. An additional lift station will likely be necessary to serve Tract D, at the south end of the OMSI property, with trenchless technologies applied to bore a new pipe under the existing TriMet railroad tracks. New development parcels can be served from this new public infrastructure.

The concept plan includes an onsite wastewater treatment facility, centrally located near the new public lift station. The wastewater treatment facility would be sized to meet targeted demands for non-potable water uses throughout the development. Portions of the sewer flows can be extracted from the public lift station and redirected to the treatment facility to meet demands, with the rest of the sewage being pumped to the public main. The controls and portions of the treatment facility can be integrated into the development at Tract B1, while other appropriate elements can be showcased in the adjacent plaza. The non-potable water distribution system referenced above is discussed in the water sections of this document.

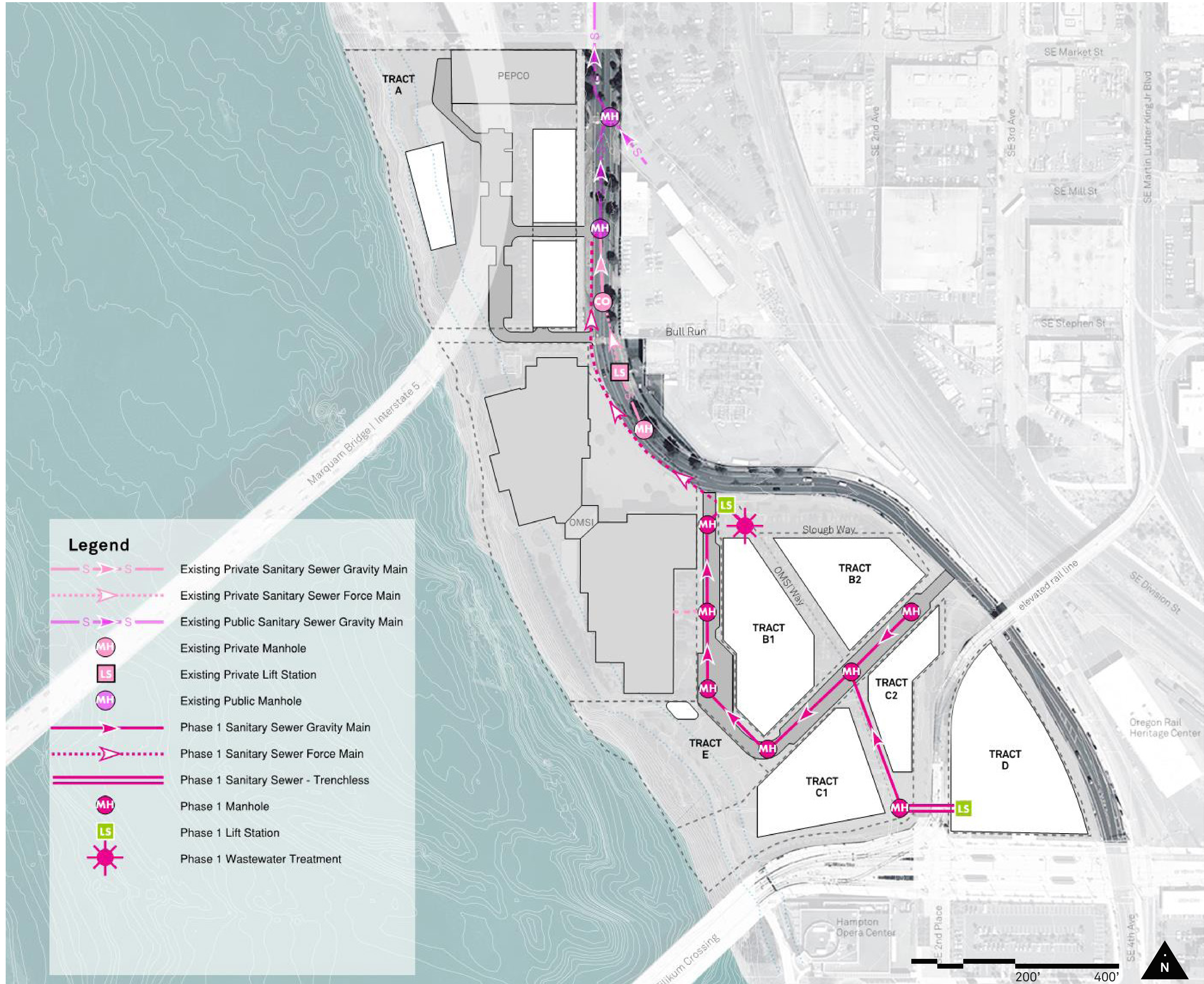


Figure 7.2.B

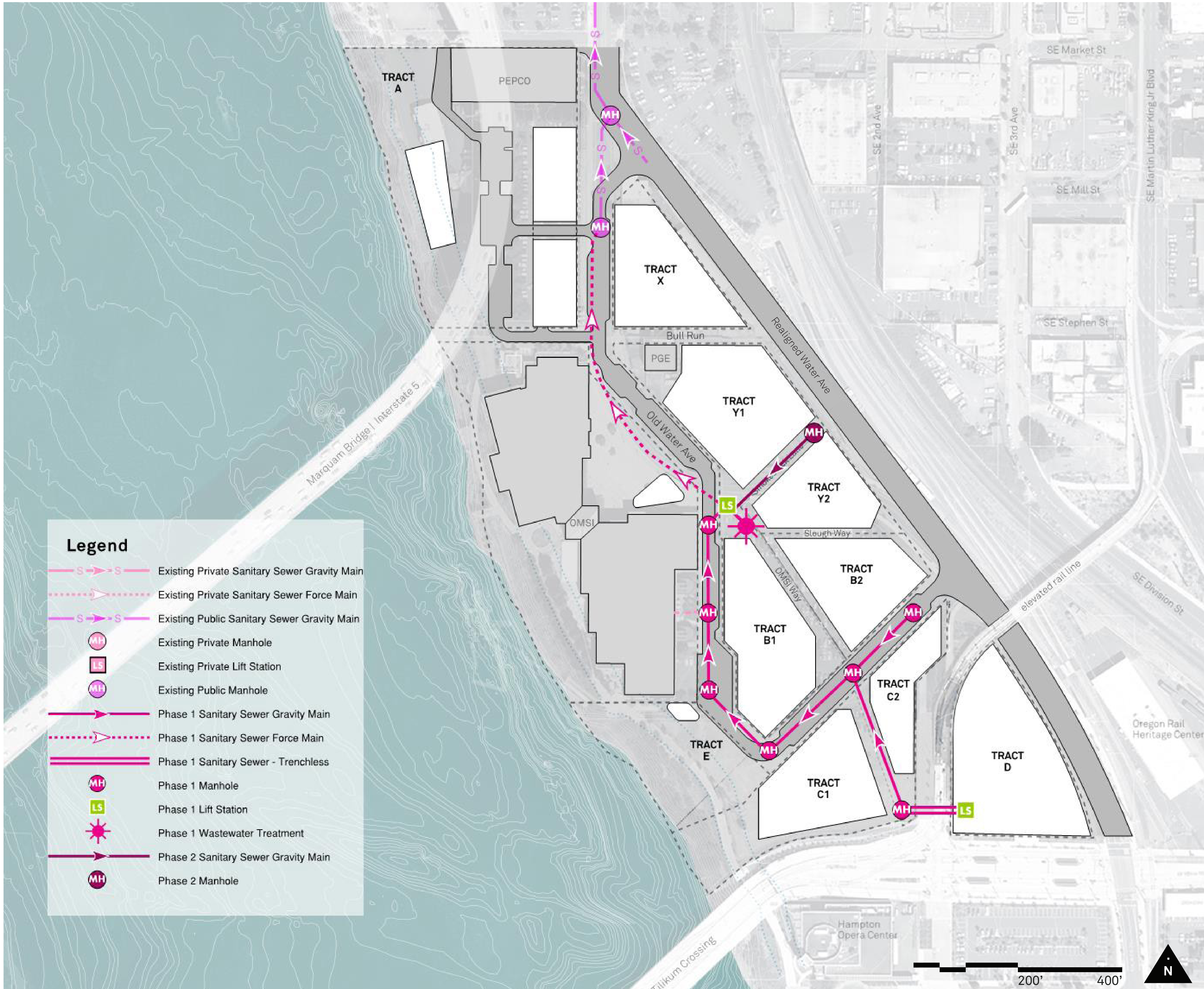


Figure 7.2.C

07.2 Sanitary Sewer - Phase 2

Most sanitary infrastructure would be constructed as part of Phase 1. An additional length of public sewer main that will connect to the public lift station is proposed in a new roadway to serve Tracts Y1 & Y2. The force main installed with Phase 1 will remain in the right of way of the realigned Old Water Avenue. Tract X, at the north end of the development, can be served by the existing sewer main in Old Water Avenue, dedicated as public infrastructure. Pump upgrades may be required within the lift station to manage the additional flows from development.

07.3 Stormwater - Existing Conditions

The site's relatively flat topography and development have created three primary drainage catchment areas that discharge into the Willamette River. The first outlet is a 30-inch storm-only line located toward the south end of the OMSI North Campus. The catchment area for this outfall includes the OMSI North Campus, 1800 Water Ave Partners, PGE Substation, TriMet Property, and SE Water Avenue within the project limits. Additional drainage outside the study area is also collected from the Rail Heritage Foundation site and the industrial parcels on either side of SE MLK Jr Blvd. between SE Stephens Street and SE Division Street. The second is a 24-inch storm only line that outfalls to the river in the middle of OMSI South Campus. The catchment area for this outfall includes the majority of the OMSI South Campus. The third outlet is a 12-inch storm only line located below and south of the Tilikum Crossing. Only a portion of the surface runoff from the OMSI South Campus flows west and south toward the river and to this outfall. There is no formal stormwater infrastructure serving Tract D, but it is presumed that surface runoff from Tract D ultimately flows north and east toward SE Water Avenue.

The existing stormwater management strategy implemented throughout the active OMSI development is Portland's pioneering effort to construct alternative green infrastructure in the early 1990's. The two main parking lots were designed to sheet flow runoff into vegetated bioswales aligned between parking bays. The performance of these facilities exceeded expectations and were the catalyst for requiring more aggressive sustainable drainage standards, with the Portland BES Stormwater Management Manual adopted in 1999.

The existing 30-inch and 24-inch outfall pipes were constructed as part of the original OMSI improvements in 1992. The existing pipe sizing calculations were based on hydraulic modeling for a full build-out condition of the contributing drainage area. Since BES was unsure of how the vegetated bioswales would perform, the hydraulic calculations did not consider reduced flows due to onsite infiltration. As a result, there should be adequate capacity in the existing outfalls to convey future developed flows without the need for upsizing the pipes.

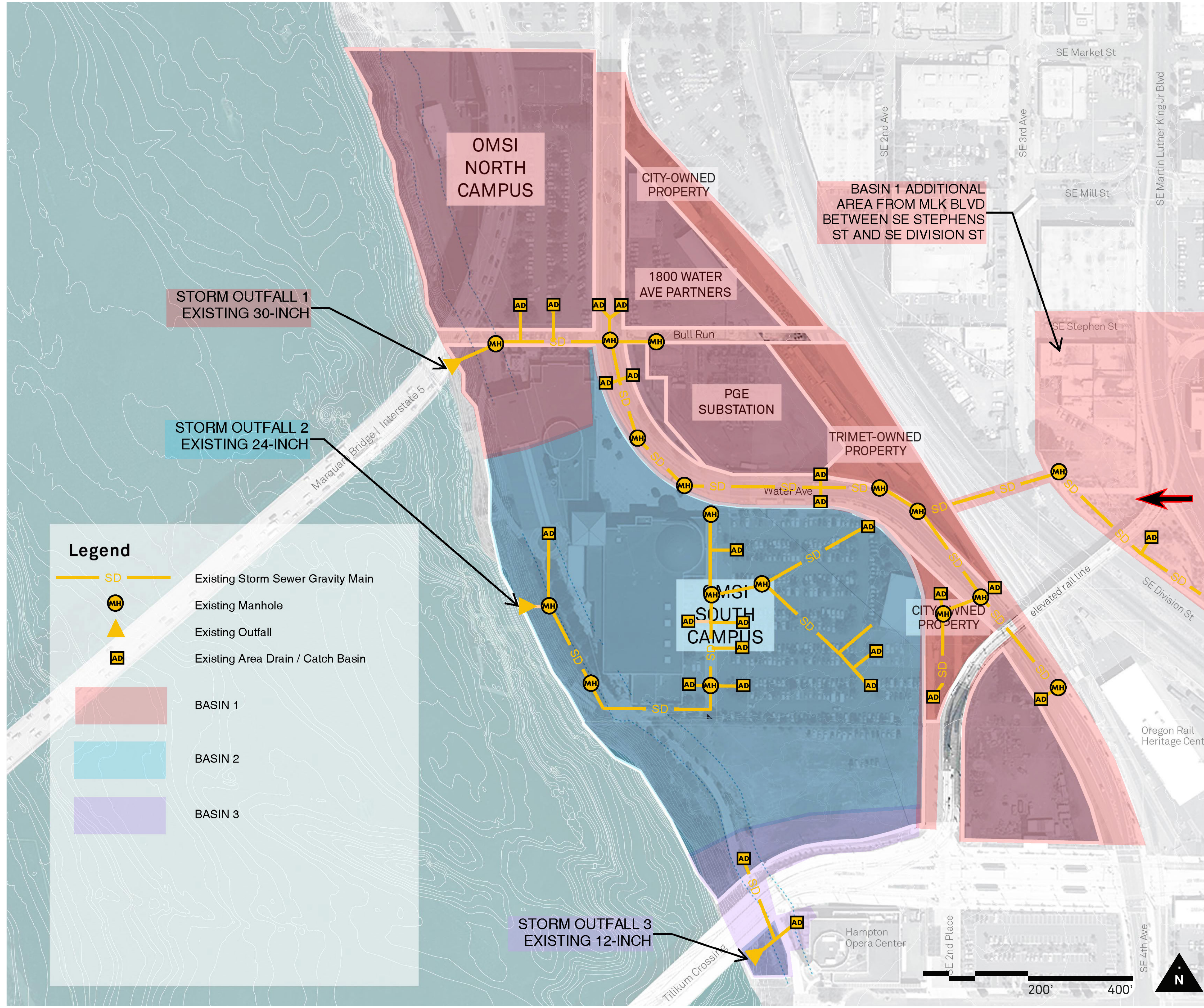


Figure 7.3.A

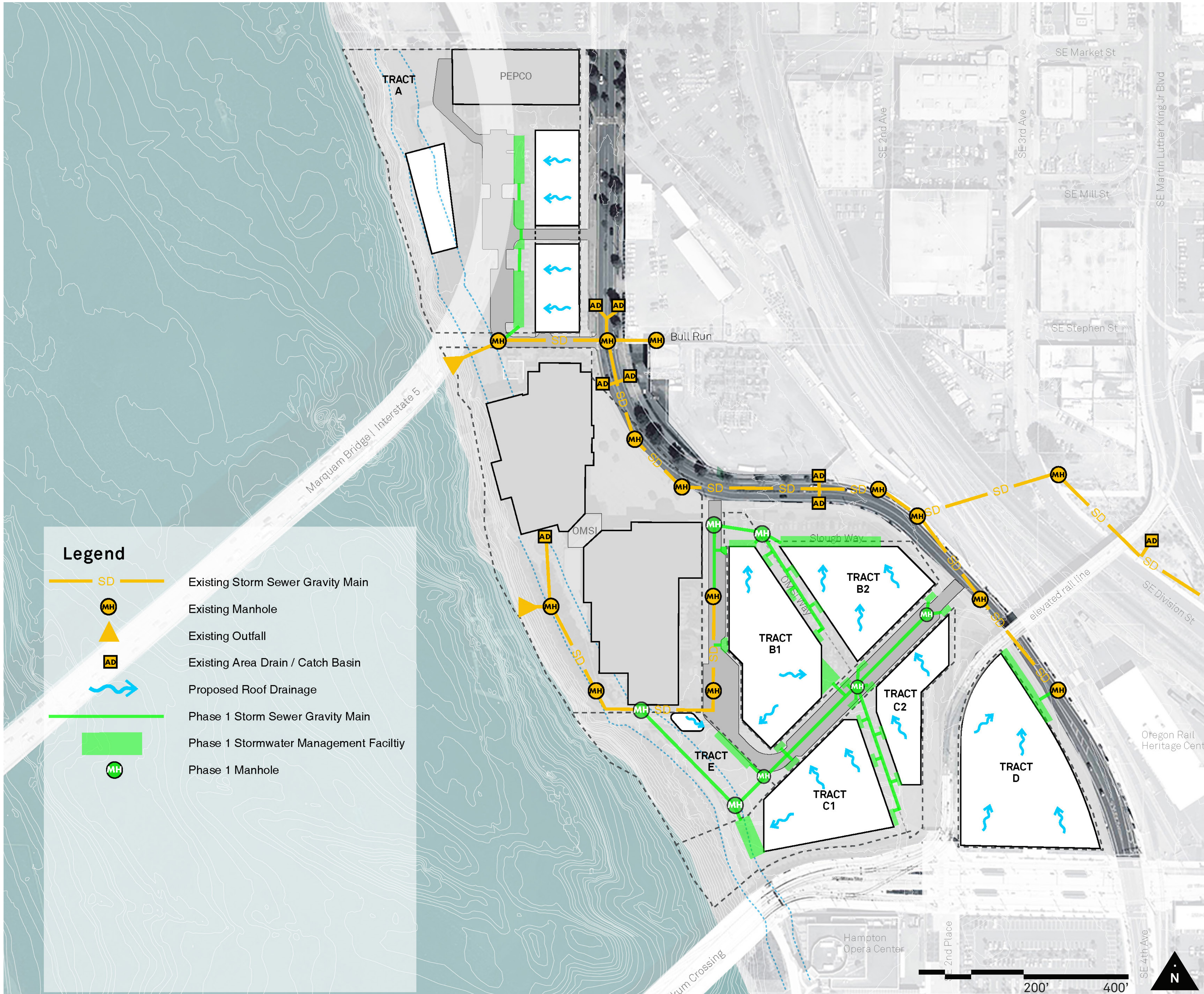


Figure 7.3.A

07.3 Stormwater - Phase 1

New development should embrace and build upon the sustainable measures initiated with the OMSI Master Plan. Strategies will vary depending upon the type of development proposed, but might include green roofs, vegetated infiltration swales, green street infrastructure, or rainwater harvesting from roof areas.

All development and redevelopment will be required to comply with the current BES Stormwater Management Manual (SWMM) at the time of any permit application. The current SWMM does not require flow control to restrict release rates of site runoff due to the proximity to the Willamette River, but does require treatment meeting pollution reduction standards. New development will provide water quality treatment with vegetated storm facilities and reutilize the existing storm pipes and outfalls as is practical. As stated in the existing conditions, the 30-inch and 24-inch storm outfalls likely have adequate capacity for future development, and new outfalls to the river may be avoided.

Each tract would provide localized stormwater treatment before tying into public conveyance infrastructure. Some areas within the master plan have been identified as potential locations for stormwater management facilities to treat runoff from both public roadways and adjacent buildings. However, sizing of the facilities has not been completed with this master planning concept and additional area may be required to allocate to stormwater management. The proposed roadways would treat stormwater through green street infrastructure similar to the existing Water Avenue treatment facilities.

07.3 Stormwater - Phase 2

Phase 2 development will build upon the localized stormwater treatment implemented in Phase 1. Potential stormwater management facility areas have been identified. Old Water Avenue and the new SE Water Avenue would treat stormwater through green street infrastructure.

One stormwater strategy considered along the proposed boulevards is combining runoff from the adjacent buildings with the roadway in a surface conveyance and treatment facility within the median. The conveyance and treatment facilities could be designed to be a major amenity to outdoor spaces, to accentuate drainage during storm events. This approach coincides with progressive stormwater bioswales that OMSI implemented in the 1990's. The facility could provide educational opportunities and exhibits displaying sustainable stormwater strategies.

Although a boulevard concept might be desirable for the Bull Run right-of-way, stormwater infrastructure may not be allowed over the existing water supply line, due to Portland Water Bureau regulations. A more conventional green street planter design is illustrated.

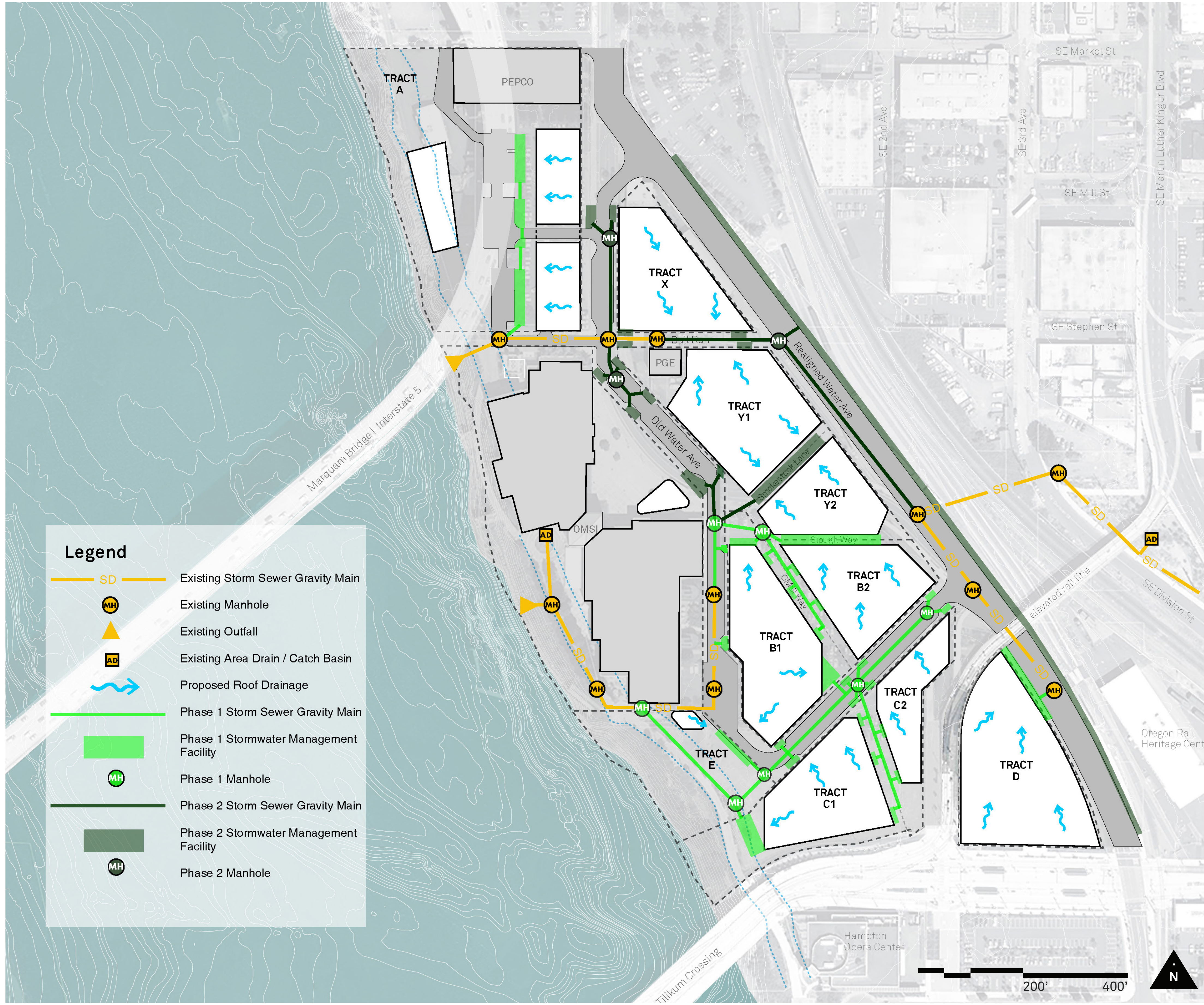


Figure 7.3.C

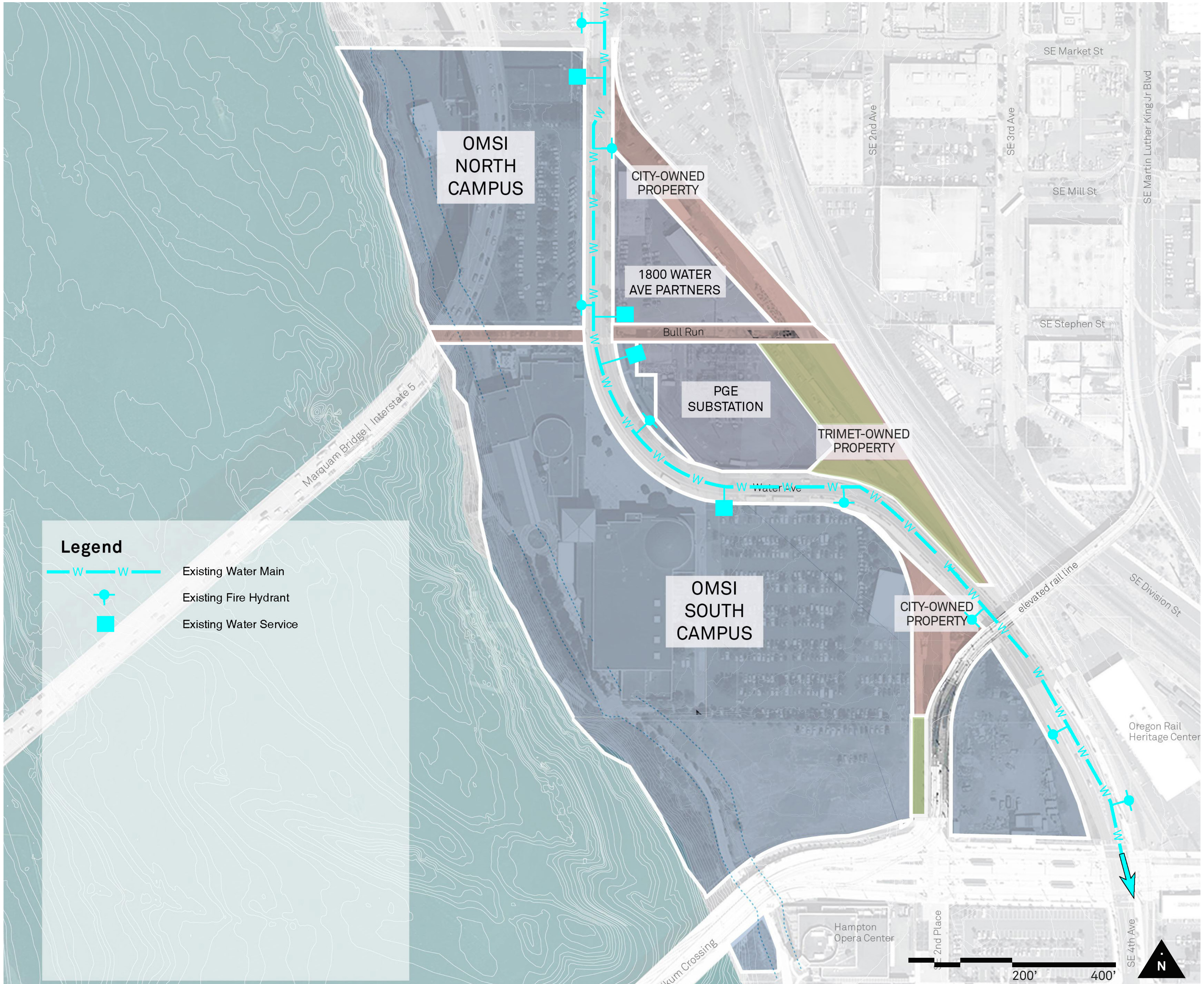


Figure 7.4.A

07.4 Water Service - Existing Conditions

Public water infrastructure is limited to a 12-inch water main located along SE Water Avenue. The main is part of a larger looped public water system network in the Kelly Butte 280 pressure zone, corresponding to a static pressure of about 95 psi throughout the OMSI property. Domestic water and fire service connections for the adjacent parcels are served from this main.

Fire hydrants are within reasonable vicinity of the adjacent properties. The 12-inch water main should provide adequate water supply to support new development.

07.4 Water Service - Phase 1

Phase 1 development would include the construction of a new 12-inch water main along the new roadway that loops with the existing main in SE Water Avenue. Fire hydrants, meters, backflow devices, domestic service, fire service, and irrigation service for the proposed tracts would be served off this main. New connections and meters would be required for the OMSI property.

The existing water main loop infrastructure provides promising capacity to the proposed development. However, the water main capacity requires further investigation based upon the density of the proposed development. The Portland Water Bureau will need to verify that adequate water flow and pressure are available to serve development and meet fire flow requirements.

Depending on the type of onsite wastewater treatment facility provided, new development has the potential to provide water reuse lines to distribute treated water for non-potable needs. The water reuse line could be installed in parallel with the potable water main to serve the proposed tracts.

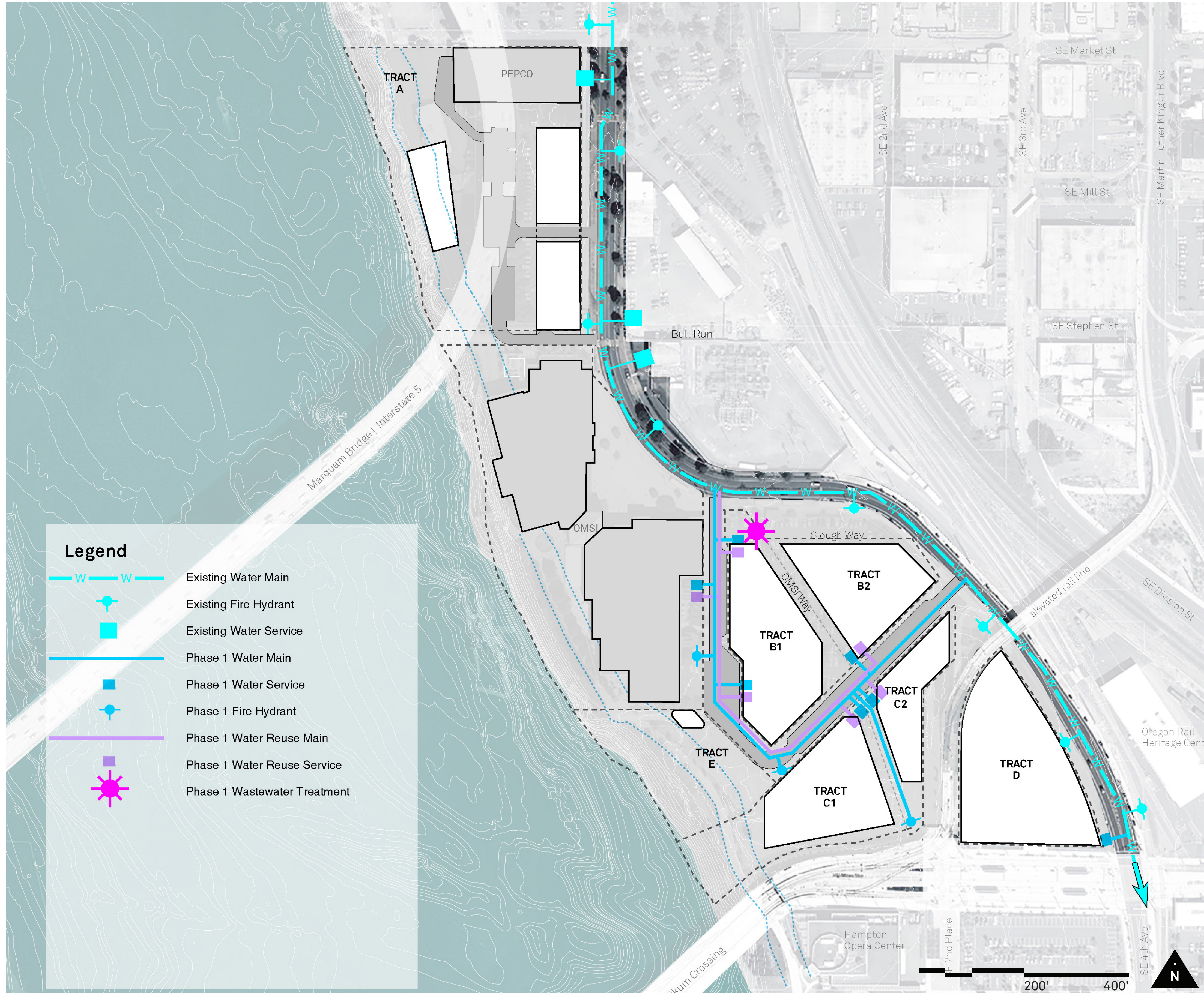


Figure 7.4.B

07.4 Water Service - Phase 2

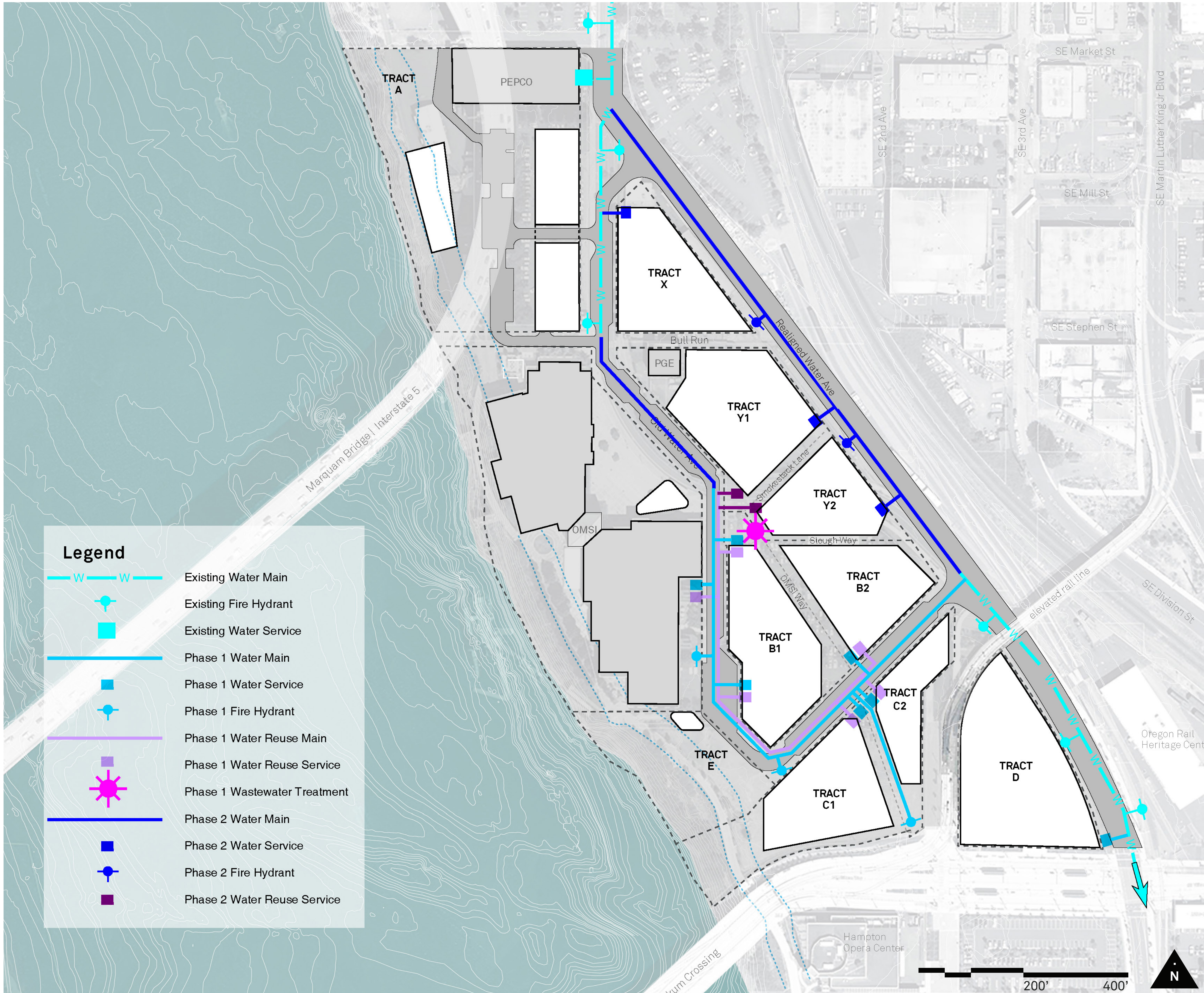


Figure 7.4.C

Phase 2 development would include the construction of a new 12-inch main in the realigned new Water Avenue. The water main from the Phase 1 development would be extended within the Old Water Avenue to the existing main by the PGE Substation. The proposed routing would maintain the loop connection and also provide options for most of the tracts on which side to provide service.

Tracts Y1 & Y2 can be served from the water reuse line constructed as part of Phase 1. Although not shown on the exhibit, the reuse line would have to be extended north to serve tract A and tract X if desired.


F4LYN

08. Campus Identity Framework

08.1 Wayfinding Concept

08.2 Identity Guidelines

08.3 Program Typeface

08.4 OMSI Campus Wayfinding and Signage Storylines

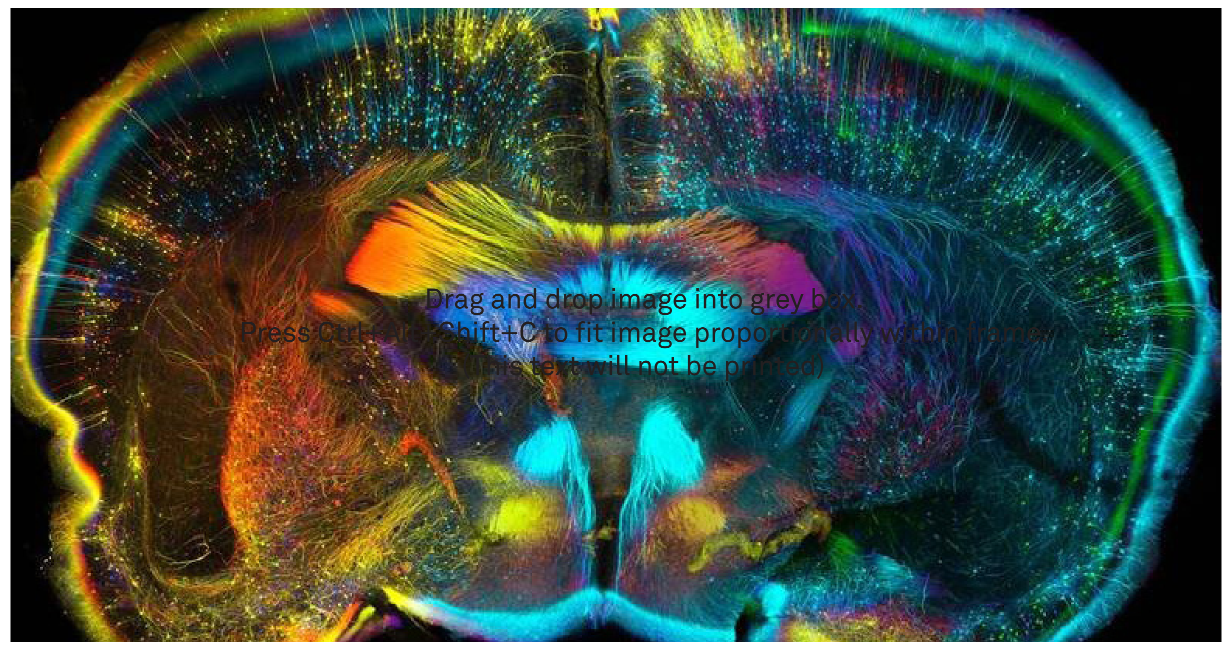
08.5 Sign and Signboard Recommendations

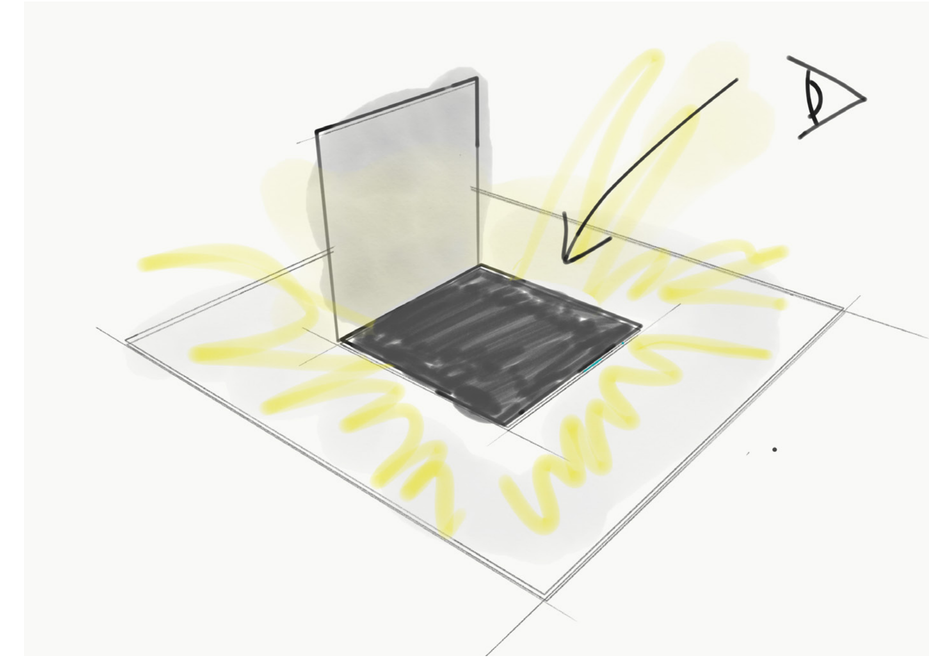
08.1 Wayfinding Concept

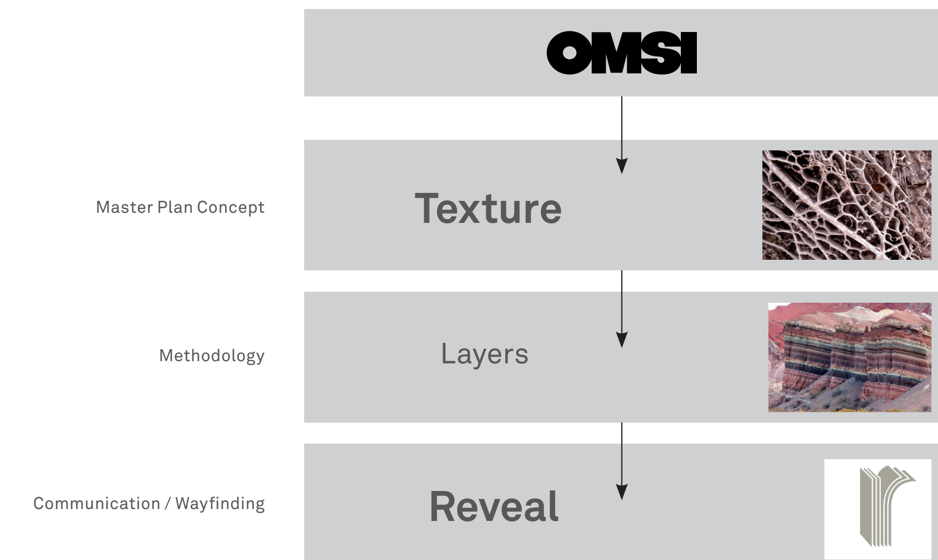
An integrated wayfinding and identity strategy is key to creating a successful OMSI campus. From the far edges of the property to the core, embedding the site with compelling visual cues and signage will create a campus of clear and intuitive circulation. The new wayfinding system will enhance the campus aesthetic and capture the museum's core values to create a compelling visitor and user experience.

The visual elements of this wayfinding and campus identity system were selected to reflect the essence of the OMSI mission—to inspire curiosity through engaging science learning experiences, to foster experimentation and the exchange of ideas, and to stimulate informed action.

Materials and finishes were selected to evoke curiosity and make lasting impressions on museum-goers and those simply passing through the campus.







Texture → Layer → **Reveal**

The Reveal Concept

The overall objective of the Campus Identity Framework is the development of a new wayfinding system and design communication concept for the OMSI Campus Master Plan.

The proposed design concept and central theme of *Reveal* is the basis for visual wayfinding structures and the updated OMSI brand identity. This theme builds on the symbolic and associative forms of OMSI's existing design and wayfinding strategies, while also connecting the OMSI brand to a broad range of other disciplines.

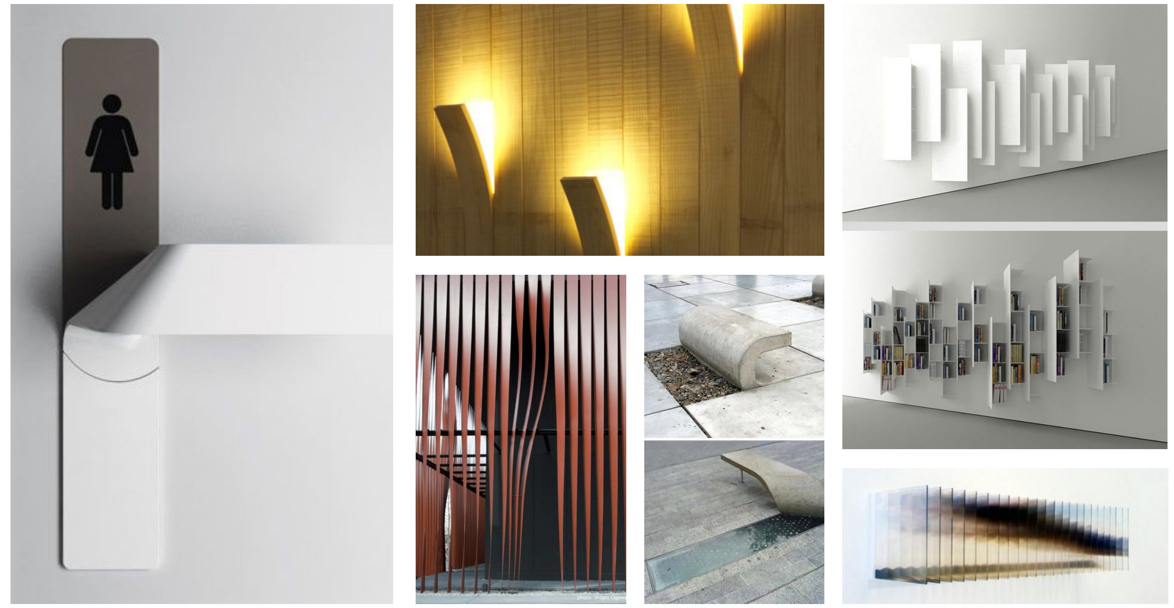
The concept is based on the act of "personal discovery"—the process of uncovering the existence and function of something new, of decoding through science, of revealing how something works and how it is constructed.

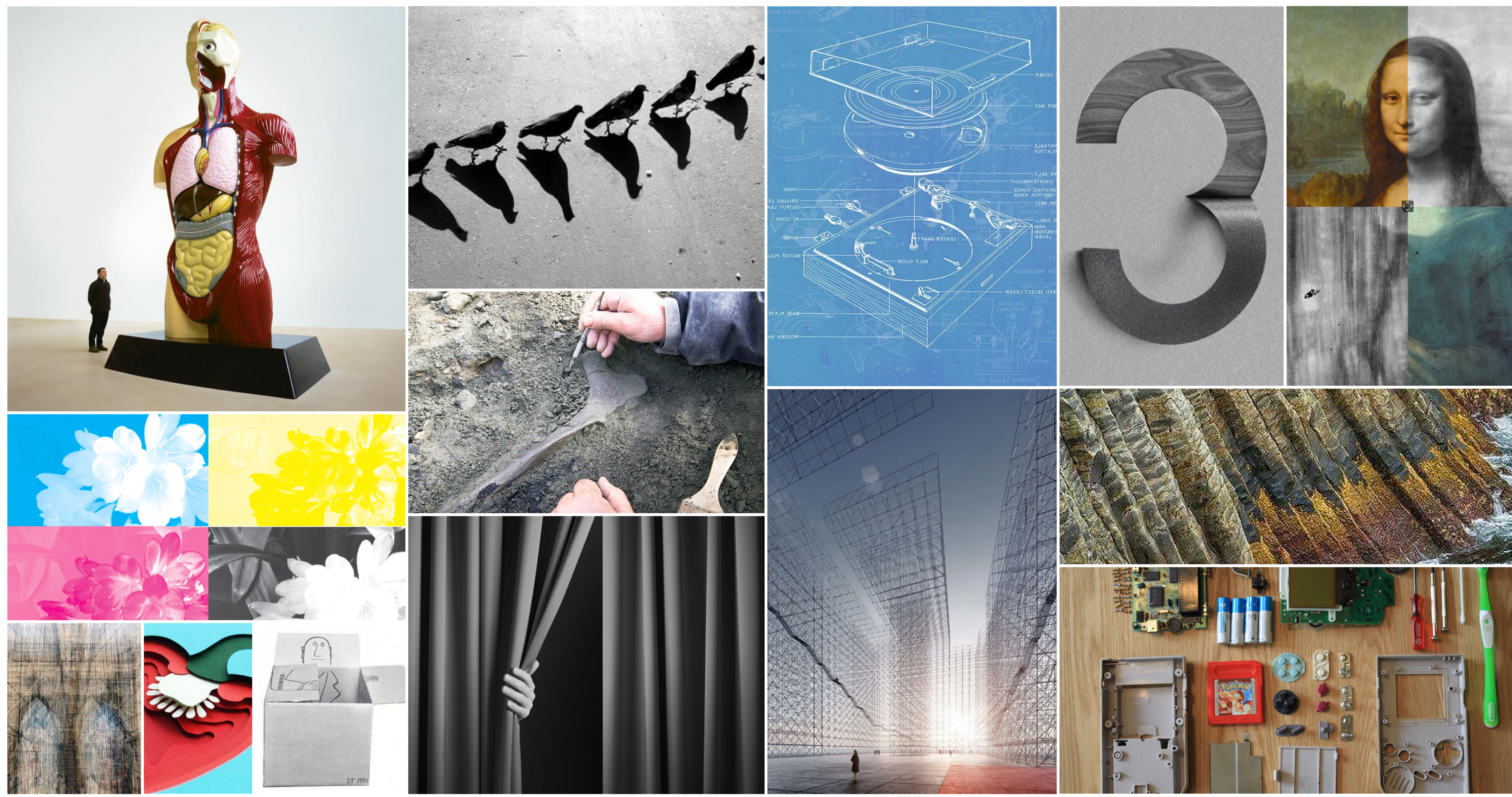
The Reveal concept plays on two definitions of the term:

1. – *to make known; disclose; divulge: to reveal a secret.*

2. – *to lay open to view; display; exhibit.*

The concept informs both the wayfinding design and proposed architectural elements—a flexible system to be expanded or scaled back when necessary.





08.2 Identity Guidelines

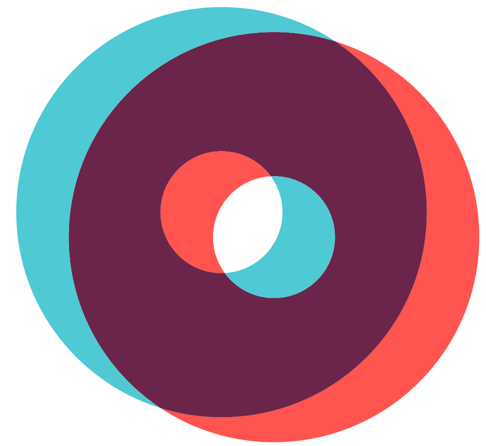
Colors

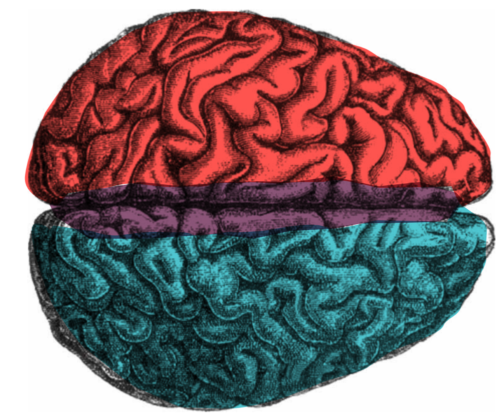
Brands and color are inextricably linked. Color is an instantaneous mode of conveying meaning and message without words. Color is the visual component people remember most about a brand, followed by shapes, symbols, numbers, and words.

The OMSI color system represents the essence of the museum's commitment to hands-on science education and fostering a space for curiosity and exchange OMSI Red is the most prominent color within the system, drawing a clear link to the museum's iconic brand heritage. Science Blue symbolizes science and knowledge, the cornerstone of all OMSI exhibits. The mix of red and blue, Curiosity Purple stands for the deep curiosity OMSI imparts onto visitors.

The OMSI color system has been specified through various means. Pantone® values that describe color within a three-dimensional color space corresponding to the range of the human eye have been provided. This is a consistent and measurable way to describe how we perceive a color in reality. As an alternative to Pantone, the standard CMYK (process color) system can also be used.

When recreating Lab colors for a display, Hexadecimal codes are needed for the specific device being used in order to compensate for much smaller possible color ranges. Adobe RGB has the largest RGB display color space and should be used as the reference whenever possible. The Hex values are used for all screens and HTML coding, and are based on sRGB. Finally, we have also specified NCS and RAL values for signs, buildings, walls and other industrial use.





OMSI Red

Pantone –185 C/U
RAL – 3028 Reinrot
NCS –S 1080-Y90R
CMYK – 0.90.80.0
RGB 230.0.40
HEX – e60028

Curiosity Purple

Pantone – 512 C/U
RAL – 330 40 45
NCS – S 3055-R40B
CMYK –50.100.0.20
RGB 130.30.100
HEX – 821E64

Science Blue

Pantone – 3125 C/U
RAL – 210 60 40
NCS – S 1050-B15G
CMYK – 85.0.20.0
RGB 0.175.200
HEX – 00afc8

Industry Black

Pantone – Black 7 C/U
RAL – 7021 Schwarzgrau
NCS –S 8500-N
CMYK – 0.0.0.90
RGB 50.50.50
HEX – 323232

08.2.1 Identity Guidelines

Images

Photography is a potent tool for demonstrating the vibrant, dynamic nature of OMSI. The palette selected for OMSI's identity framework is rooted in scientific imagery, storytelling, and texture. Photographic selections can be broken down into three subject categories:

1. Scientific Storytelling

Scientific Storytelling photography is the best way to capture OMSI's commitment to learning. Whether an enlarged cell or a dinosaur fossil, these photographs spark one's imagination by offering narratives directly related the content pictured.

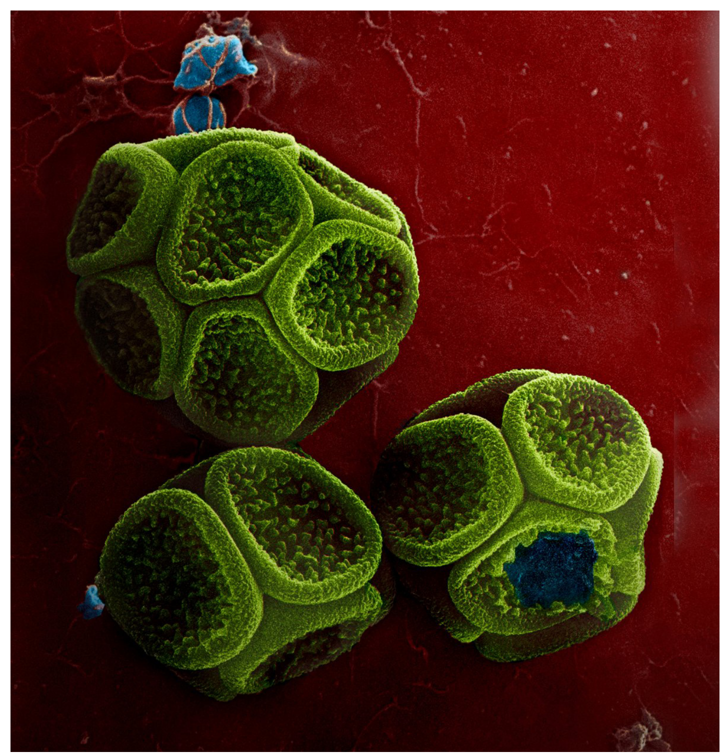
2. Revealed Texture

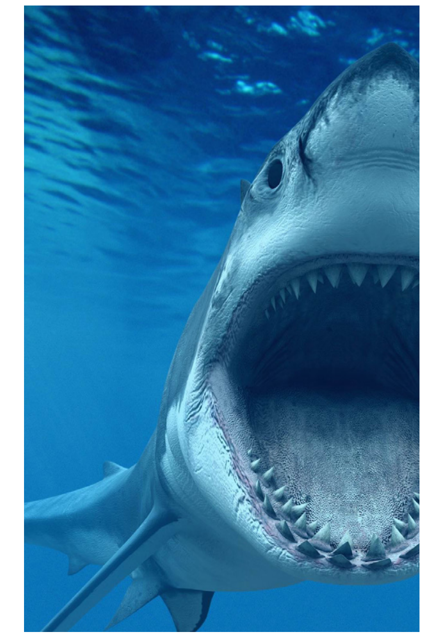
Revealed Texture photography captures the essence of "OMSIness" by illustrating the mysterious innerworkings of everyday things. Ranging from the cells of a leaf to the gears of a watch, these images illustrate the very structure of things and illustrate that beneath the surface of all things, there is more that meets the eye.

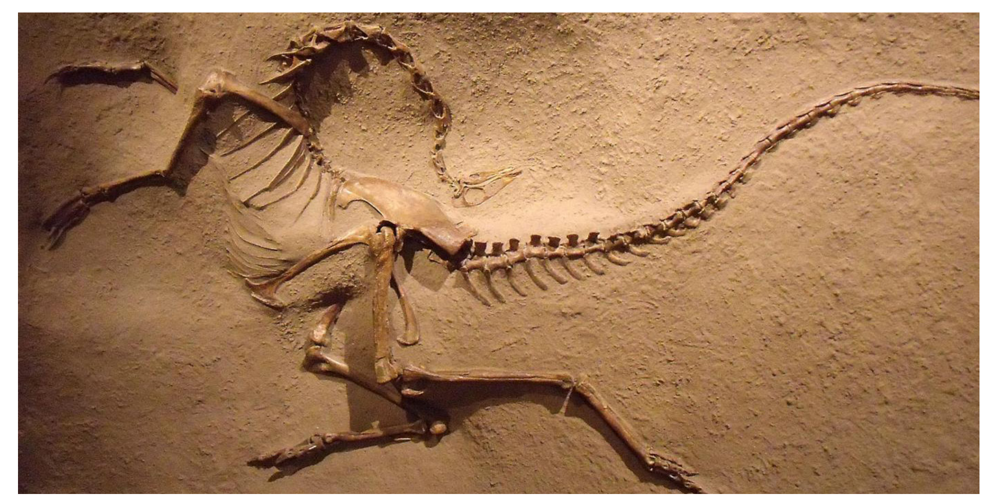
3. Reveal Graphic Texture

Reveal Graphic texture is a more graphically provocative aesthetic. It reinforces the two previous categories and invites the use of broad range of themes and disciplines.

1. Scientific Storytelling





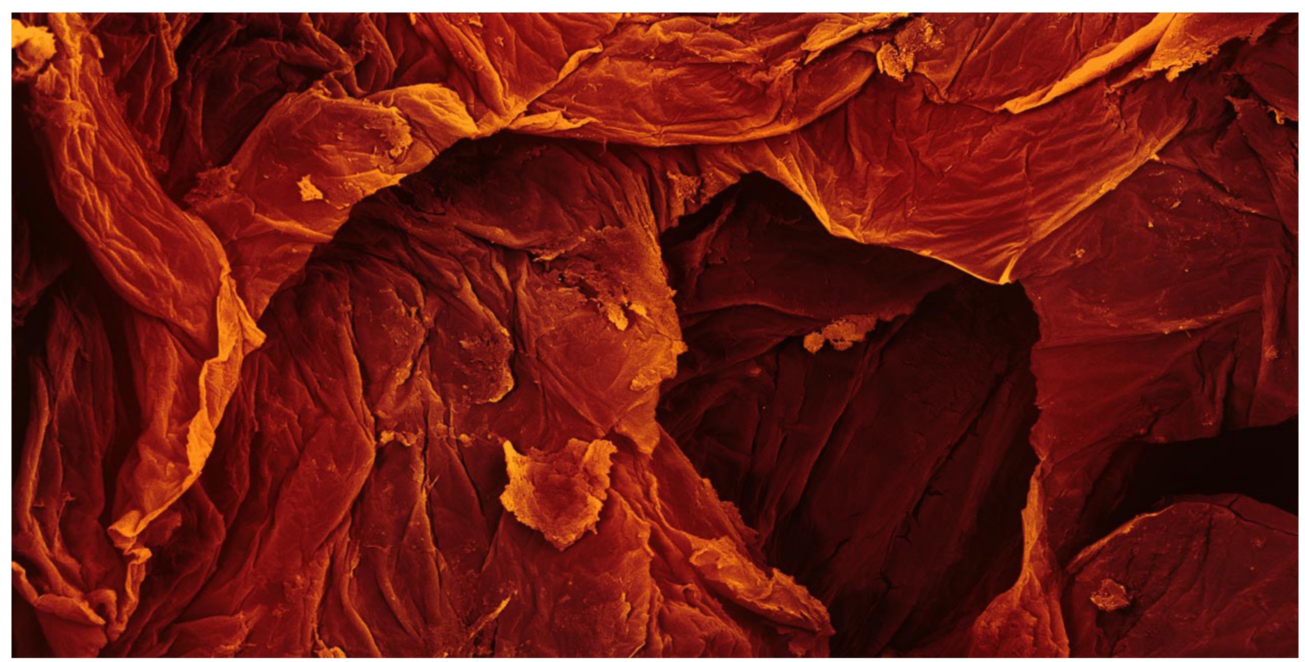
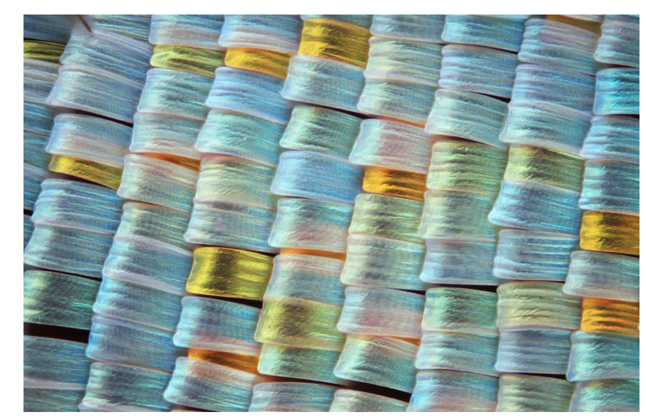


Images

2. Reveal Texture

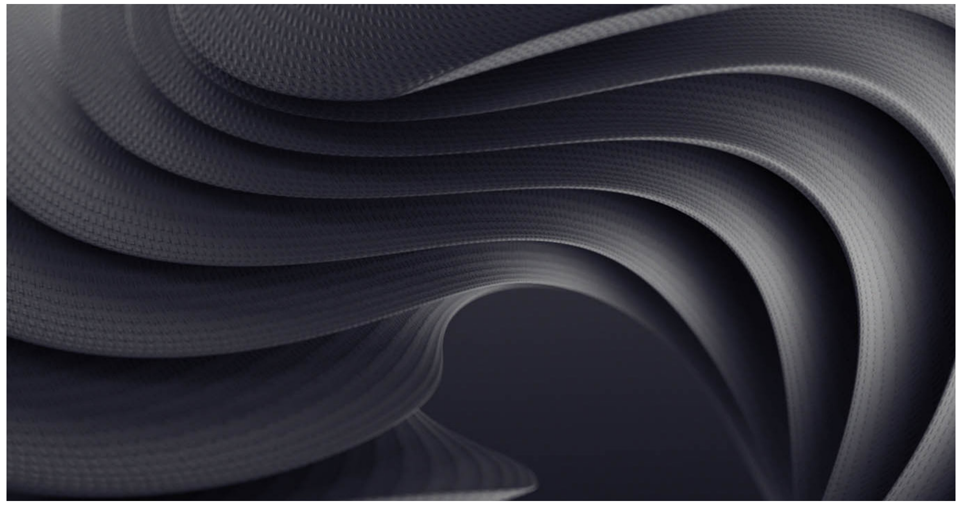


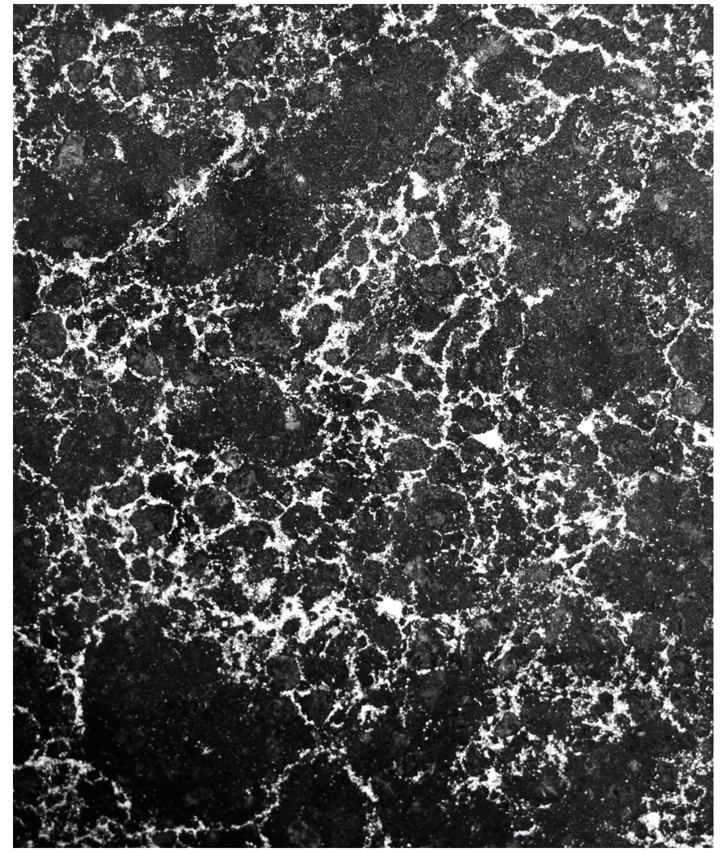


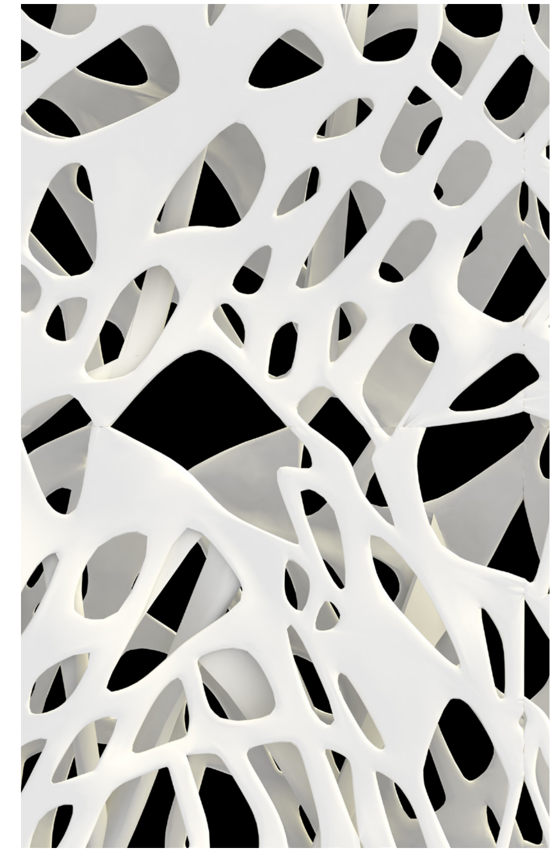




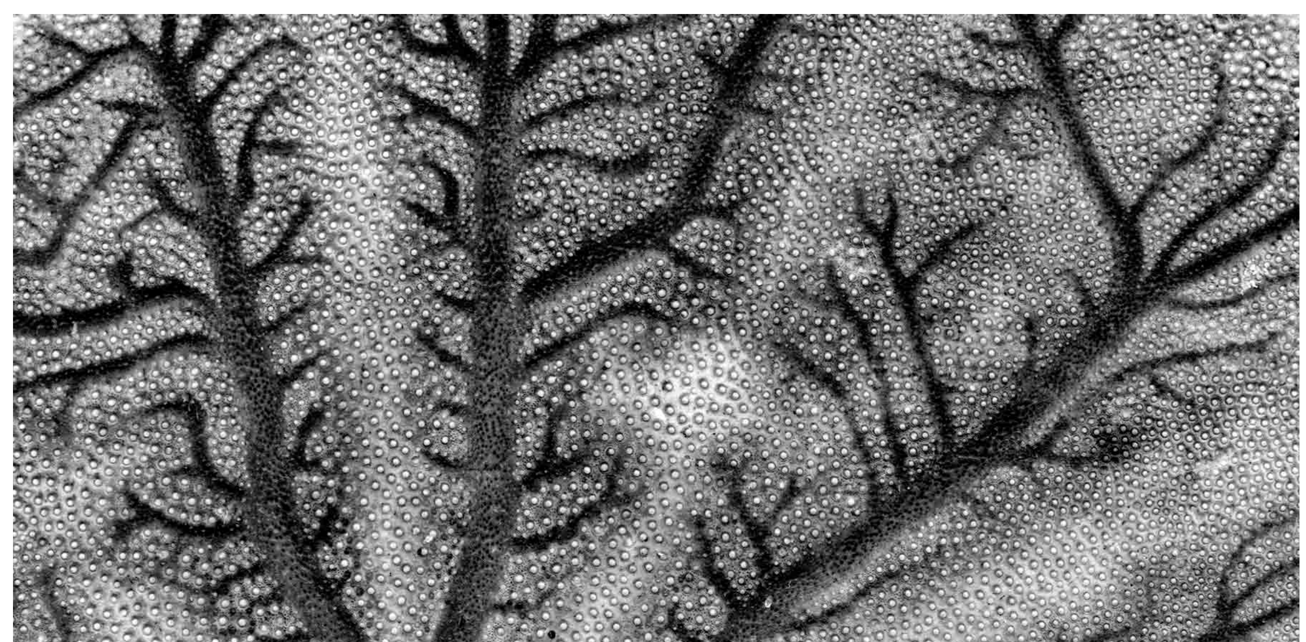
Images

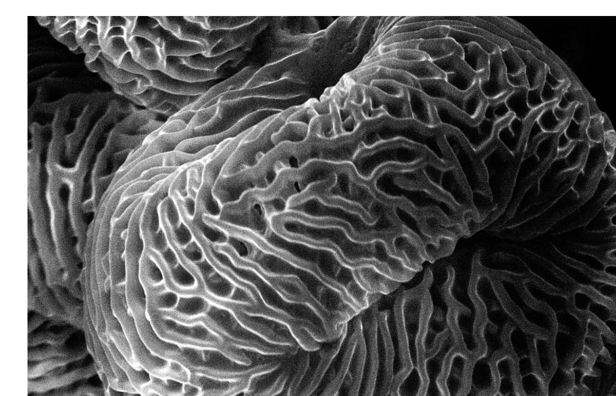
3. Reveal Graphic Texture











08.3 Program Typefaces

To ensure brand consistency across programs and scales, the following fonts should be used in all OMSI signage and wayfinding materials.

The primary program typeface, Suisse Inter-national, features Regular and Semi-bold fonts. The Suisse family was selected because it is warm, open, and legible at all sizes. Flexibility comes from using one type family that contains all necessary styles. Suisse should be used for all signage, both exterior and interior.

ITC Caslon is our secondary typeface. Designed by William Caslon in 1725 and redesigned by Edward Benguiat in 1982. Resembling the style of handwritten text, it enhances the feeling of familiarity and playfulness. Within the OMSI wayfinding identity, it should be used for storytellling components.

Consistent use of our primary and secondary typeface—Suisse and ITC Caslon—reinforces OMSI's brand identity throughout the entire campus.

Primary font

Suisse International

Aa**BbCc**

Regular

ABCDEFGHIJKLMOPQRSTUVWXYZ
abcdefghijklmopqrstuvwxyz

Semi Bold

ABCDEFGHIJKLMOPQRSTUVWXYZ
abcdefghijklmopqrstuvwxyz

→ → → ›

Museum
Planetarium
Restaurant

Secondary font

ITC Caslon 224

AaBbCc

Book Italic

ABCDEFGHIJKLMOPQRSTUVWXYZ
abcdefghijklmopqrstuvwxyz

Bold Italic

ABCDEFGHIJKLMOPQRSTUVWXYZ
abcdefghijklmopqrstuvwxyz

Everyday
encounters
with
Science

A wise ***person***
knows ***that***
there is ***something***
to be ***learned***
from ***everyone***

08.4 OMSI Campus Wayfinding and Signage Storylines

To allow for fluid, intuitive circulation throughout the OMSI campus, a detailed wayfinding and signage program will need to be developed for all exterior spaces. Signage clearly indicating building entries, vehicular and bycicle parking lots, transit locations, and recreation areas will enhance user experience and further cultivate a distinctive brand for the OMSI campus. Figure 8.4.A Is suggestive of locations where signage occurs and should not be used for estimating or procurement purposes.

Identification

- Site
- Site entry
- Building mounted
- Entrance
- Parking areas for cars and bikes

Directional

- Connections to transportation networks
- On -site vehicular
- Pedestrian

Orientation

- Area

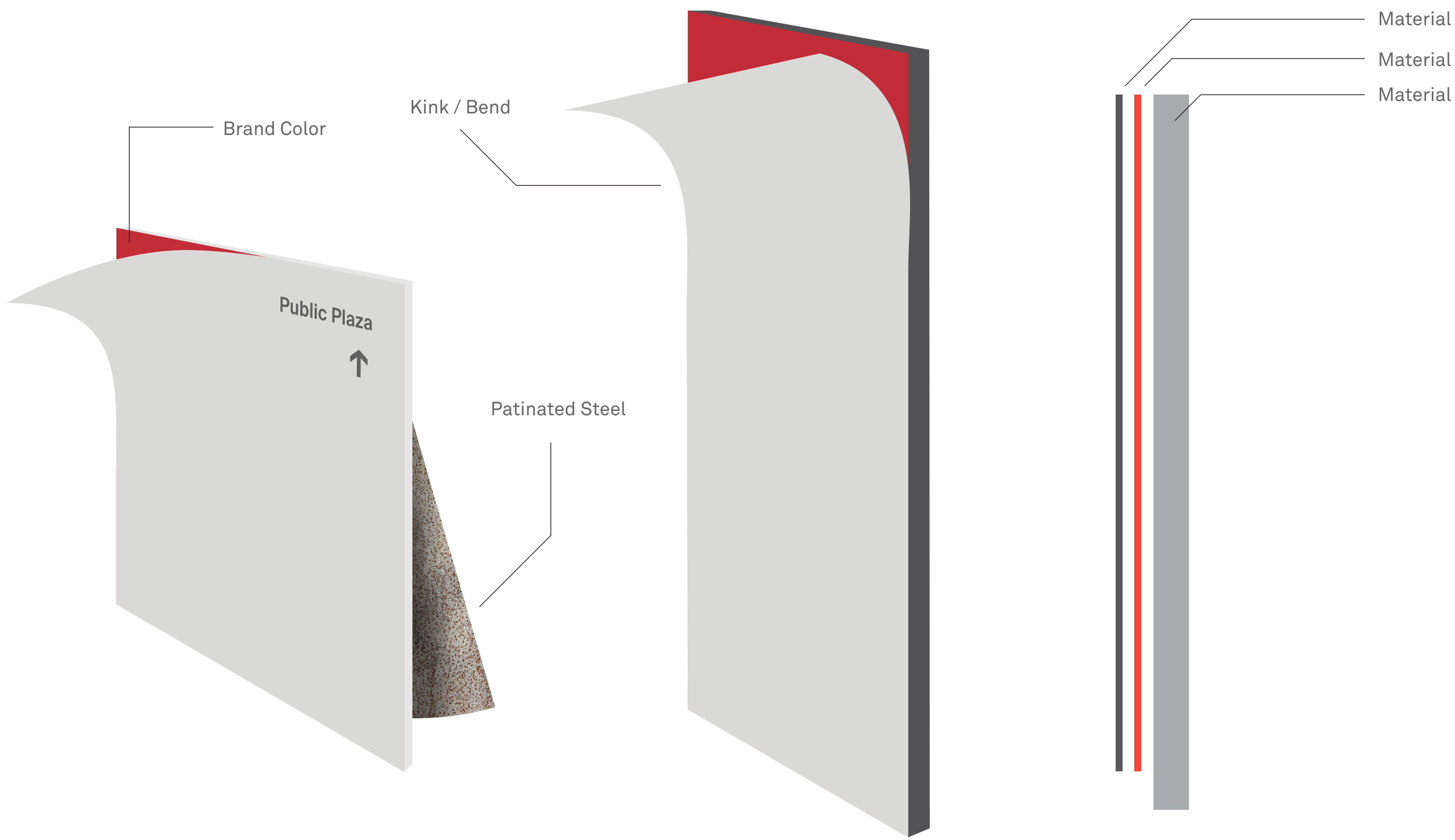
Regulatory

- Parking
- Entrance

Figure 8.4.A - Possible locations for OMSI Campus Wayfinding and Signage

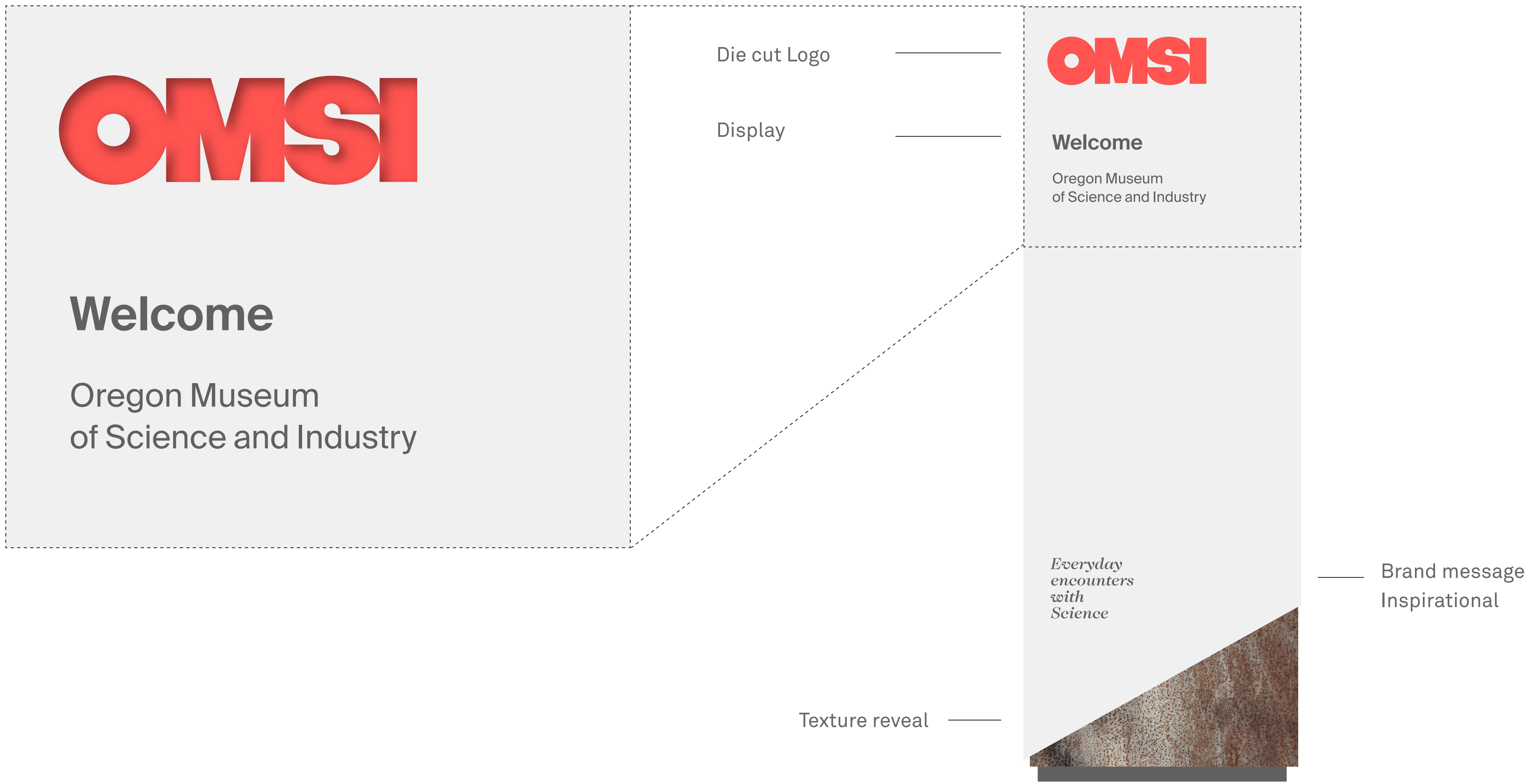
08.5 Sign and Signboard Recommendations

Concept



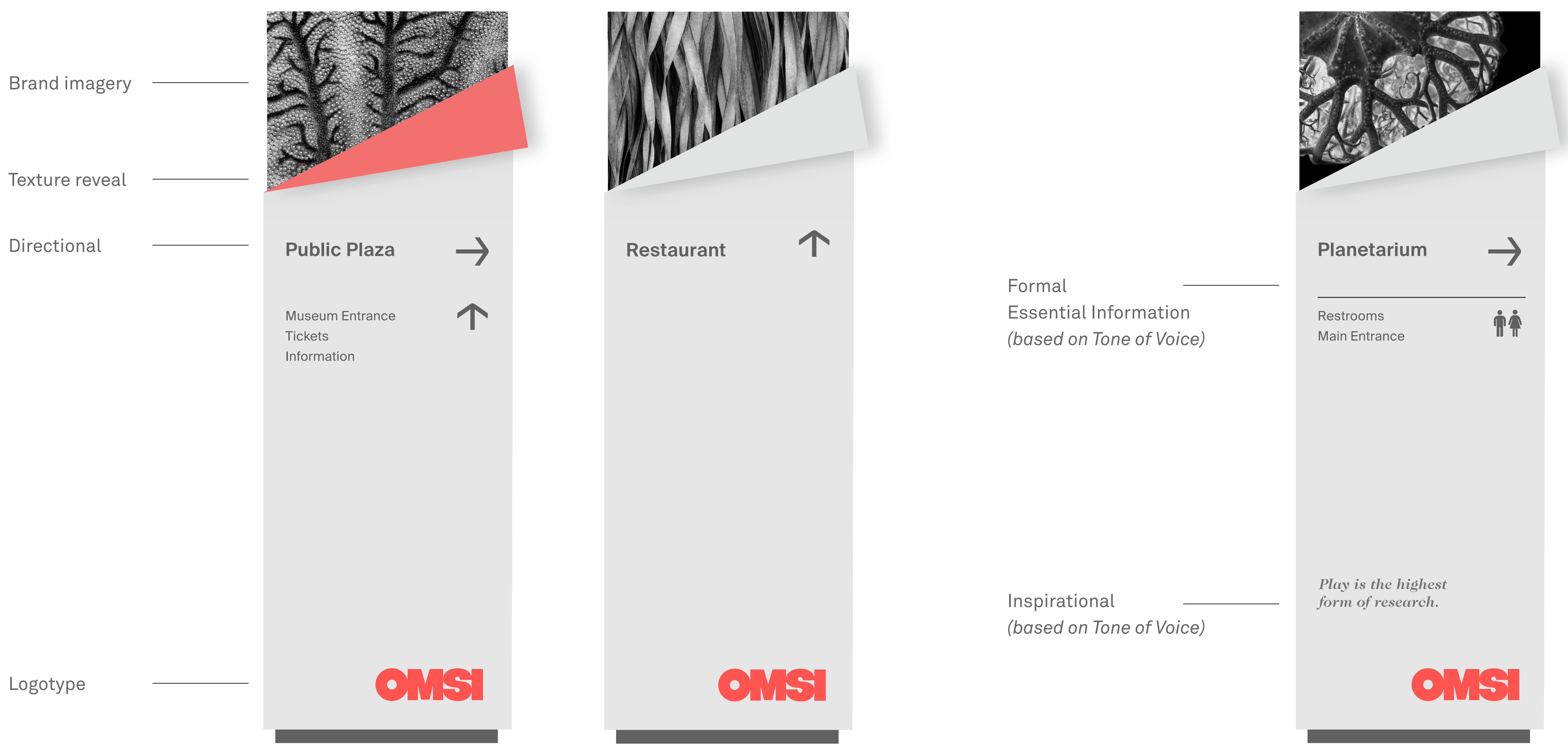
08.5.1 Sign and Signboard Recommendations

Identification



08.5.2 Sign and Signboard Recommendations

Directional




EXIT
Digging In and Looking Around
WHAT DOES IT MEAN TO CELEBRATE AND ENGAGE THE RIVER?
HOW DO YOU CREATE A PLACE THAT IS GROUNDED IN OPPORTUNITIES FOR EDUCATION?
Digging In and Looking Around
WHAT DOES IT MEAN TO BE AN INNOVATION DISTRICT?
WHAT WOULD MAKE THIS A UNIQUE AND WELCOMING CAMPUS?

09. Appendix

09.1 Central City Plan 2035 Memo

09.2 OMSI Implementation Tools and Strategy Memo

09.3 OMSI Market Study and Current Valuation Memo

09.4 Meeting Minutes

09.5 OMSI Master Plan Workshop Summary

09.6 Open House Summary

**All appendix items are available upon request from OMSI*