WEST HAYDEN ISLAND
Economic, Social, Environmental, Energy Analsyis

PROPOSED DRAFT – April 2013

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Bureau of Planning and Sustainability

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City of Portland, Oregon

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Executive Summary

Intent and Purpose

The purpose of this Economic, Social, Environmental and Energy (ESEE) Analysis is to evaluate the trade-offs associated with different policy choices for managing significant natural resources in the West Hayden Island (WHI) study area. The ESEE Analysis informs the Portland City Council decisions regarding the annexation, future marine terminal development, and natural resource management on WHI.

The Recommended Draft ESEE includes detailed descriptions of the issues and tradeoffs that should be considered for each of the four topics: economic, social, environmental and energy. The tradeoff analysis explores the potential consequences of allowing, limiting or prohibiting development that could have a negative impact on significant natural resources identified in the Hayden Island Natural Resource Inventory, printed separately and available online at www.portlandonline.com/bps/index.cfm?c=55273&

The ESEE is qualitative and relies on existing information. Information is presented in narrative descriptions and comparative matrices. While the ESEE is not a quantitative analysis some numbers, such as acres of habitat or number of jobs, are used to indicate the relative scale of impact.

The final chapter includes a recommended decision that describes where and to what extent natural resources WHI should be protected and managed and the programmatic tools that should be used to implement the decision.

Relationship to State Land Use Goals and Metro Title 13

Local jurisdictions in Oregon are required to produce an ESEE analyses as a step to comply with State Land Use Goal 5, Natural Resources, Scenic and Historic Areas and Open Spaces. Goal 5 specifies that cities and counties must first inventory existing natural resources and determine the significance of those resources. Then jurisdictions must complete an ESEE analysis before adopting or updating a natural resources protection program. Goal 5 does not specify how the ESEE be done nor does it prescribe an outcome.

Metro inventoried regional natural resources and performed a regional ESEE analysis that was adopted as part of Title 13, Nature in Neighborhoods. Title 13 requires metro area cities and counties to protect, conserve and restore identified Habitat Conservation Areas within their jurisdictions. Metro applied a limit decision for development on WHI and designated the island a Moderate Habitat Conservation Area. Title 13 directed the City of Portland to work with the Port of Portland to develop a district plan for WHI. The Oregon Land Conservation Development Commission (LCDC) acknowledged Metro's inventory, ESEE analysis, and Title 13 as in compliance with portions of State Land Use Goal 5 pertaining to riparian corridor and wildlife habitat, and portions of Goal 6 pertaining to protecting water quality.

This ESEE analysis builds on work Metro completed when creating Title 13, Nature in Neighborhoods and informs natural resource management decision that will be adopted as part of the WHI Plan District.

Geographic Scope of the ESEE Analysis

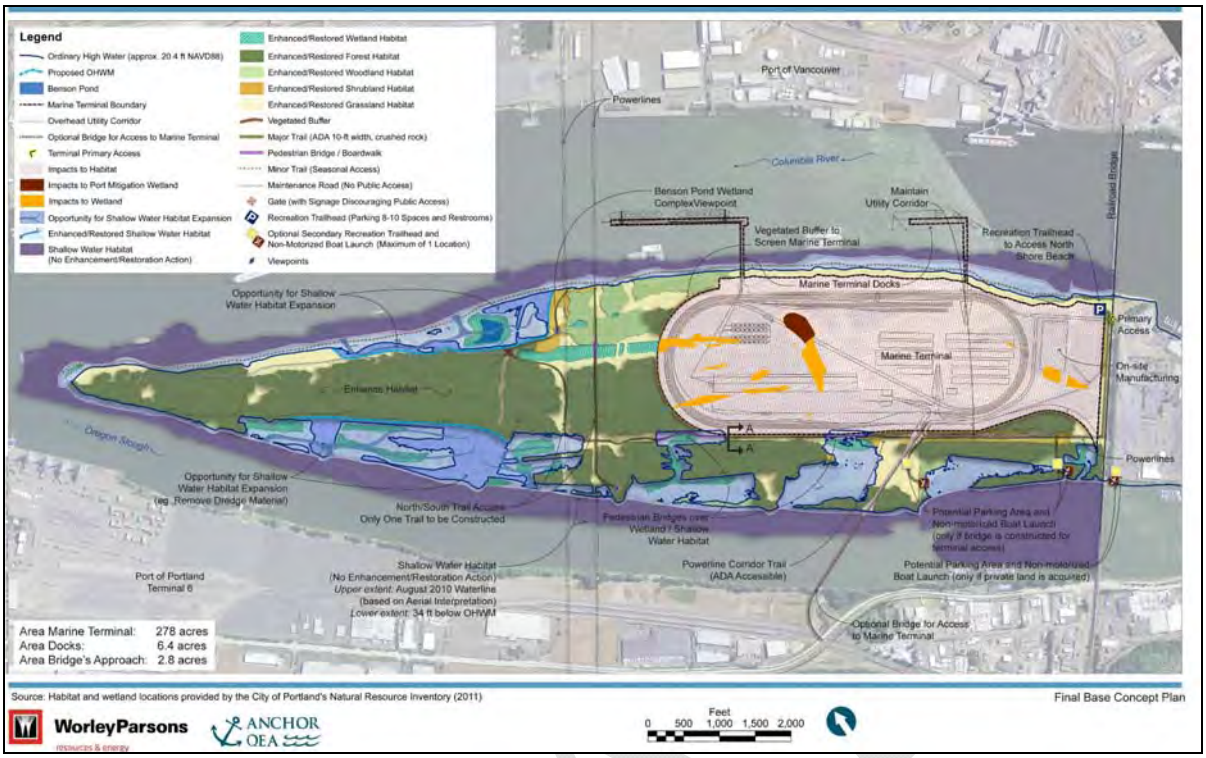
The ESEE Analysis is being performed for a specific portion of the Hayden Island Natural Resource Inventory study area. This "inventory site" includes all of West Hayden Island, the Columbia River surrounding the island including Oregon Slough, and the southern bank of the river from the rail road bridge west to Kelley Point Park. The southern boundary is Marine Drive. Therefore Terminal 6, other industrial uses on the southern bank, and two small floating home communities are within the geographic scope of the ESEE Analysis.

However, the recommendations from this ESEE are being carried forward with the WHI Plan District. While this ESEE analysis is being performed for the entire inventory site, only the portions of this ESEE that apply within the area within to be annexed into the City of Portland are being forward to City Council for adoption. Terminal 6 and other industrial land south of the Oregon Slough are currently located with the City of Portland and ESEE recommendations that would apply within the current city limits will not be carried forward at this time to City Council for adoption.

Assumptions

As noted above, the City's ESEE Analysis for WHI is being done under the auspices of Metro's Title 13 limit decision and designation of Moderate Habitat Conservation Area for WHI and the study area generally. Metro's limit decision is intended to strike a balance between completely developing indentified natural resource and fully protecting them. In carrying forth this limit decision, the City is not considering as part of this ESEE completely allowing development on the whole 800 acres nor completely prohibiting development on the whole WHI.

The ESEE Analysis focuses on a primary use scenario which is based on a Final Base Concept Plan produced by WorleyParsons and the detailed information developed for this scenario. The ESEE also evaluates other "limit" decisions more generally for three alternative use scenarios:



Primary Use Scenario: Based on the City Council resolution that directs the Bureau of Planning and Sustainability to continue planning for a mix of no more than 300 acres of marine terminal industrial development and at least 500 acres of open spaces uses on WHI. The use scenario assumes that WHI would be annexed into Portland.

Alternative Use Scenarios: Based on other splits of use on the island

1. Annexation with 420 acres marine terminal/380 acres open space, or
2. Annexation with 100 acres marine terminal/700 acres open space.
3. Not Annexing WHI. Based on a decision by City Council not to annex WHI into Portland, WHI would remain in Multnomah County and the current county zoning would continue to apply.

In focusing on the primary use scenario, the ESEE Analysis evaluates the consequences of allowing, limiting or prohibiting allowed uses under the relevant City base zones, Heavy Industrial (IH) and Open Space (OS). The other land splits are examined to evaluate how the consequences associated with the primary use scenario may change if there were more or less land available for marine terminal development or for open space. Finally, a general description of the consequences associated with a decision not to annex WHI and it to remain in the Multnomah County is provided.

Approach

Starting with these primary pieces of information, staff produced a general description of how the different types of development and associated activities (such as vegetation clearing and grading) would impact significant natural resources identified in the IH and OS base zones.

The analysis is broken out by the individual economic, social, environmental and energy topic areas. The intent is to capture all the relevant issues and use existing information to craft the trade-off analysis. The trade-off analysis asks the question: What are the positive and negative consequences of fully allowing, limiting to some extent or fully prohibiting development? For example, allowing warehouse development

in a forested wetland would provide jobs and revenue, but would reduce flood storage capacity and wildlife habitat. The consequences are described in narratives and in impact rating tables. Impact ratings include generally positive (+), negative (-), a mix of positive and negative (+/-) or negligible (o).

The last step is to look across the ESEE topics and attempt to optimize and balance the positive and negative consequences. The result is a set of recommended decisions describing where to allow development and where, to what extent, and how natural resources should be protected and managed.

Summary of the Analysis

Below is a summary of key information presented in the Recommended Draft WHI ESEE Analysis.

Economic:

Traded Sector – The Columbia Harbor, which includes the Portland Harbor and traded-sector industries along the Columbia River the Portland, is a hub of economic activity and related infrastructure including two interstate highways, the Portland International Airport and two class one rail roads. The traded-sector is a critical component of the local and regional economy as it represents companies that sell their goods and services to places outside of the Portland region which bring in income to benefit the regional economy. Family-wage jobs are created directly in the Columbia Harbor. These industries also stimulate a significant number of indirect and induced jobs. The draft Harbor Lands Inventory and Economic Opportunities Analysis indicate that Portland has a shortfall of land available to meet growth in traded-sector industries. Some of that demand could be met on to West Hayden Island. Marine terminals at West Hayden Island could create 936 direct, 891 induced and 512 indirect jobs. The revenue of marine terminals is estimated to be $198M.

Ecosystem Services – The services provided by natural resources that have a economic value to people are called "ecosystem services." The existing natural resources on West Hayden Island provide valuable ecosystem services including air purification, carbon sequestration, water purification and wildlife habitat value. The West Hayden Island Cost/Benefit Analysis (ECONorthwest) estimates that the ecosystem services at West Hayden Island provide $0.6M - $3.8M annually. When these services are impaired or eliminated, some must be replaced (e.g. stormwater management). The Cost Benefit Analysis states the mitigation can replace some of the services removed by development, but that the size, location and island mosaic functions will be difficult to mitigate for. In addition, some mitigation would likely need to go off-site, moving the services away from WHI. Finally, the Cost Benefit Analysis cautions that many natural resource functions do not have an easily definable economic value and are not accounted for in the analysis.

Social:

Public Health – The West Hayden Island ESEE Analysis addresses public health, with particular attention to the nearby neighborhoods on East Hayden Island. Multnomah County Health Department completed the WHI Health Analysis, which provides much of the information contained in this section. One of the important determining factors for public health is whether people have well-paying jobs that provide insurance. Traded-sector jobs are generally family-wage, union jobs that provide insurance. Gainful employment is also associated with significant mental health benefits. Development and industrial uses can also negatively affect public health due to additional air toxins, traffic, noise, light, vibration and other impacts. Some of these impacts can be buffered by retaining existing natural resources between industrial and residential development. Other impacts could be mitigated through specific actions such as traffic abatements.

Livability – Natural resources contribute to livability by filtering the air and water, cooling the air, filtering noise and light from adjacent developed areas and providing opportunities for education, recreation and exercise. Development and industrial uses on West Hayden Island would remove some of the benefits provided by existing natural resources, but also offer the opportunity to enhance access to the remaining natural resources.

Cultural Resources – West Hayden Island, due to its location and size, has long been an important feature for Native peoples. While evidence of settlements has been documented or suggested in specific or possible areas on the Columbia River, there is no record of settlement by Native populations on Hayden Island. However, there was likely activity on the island by Native people including hunting, fishing, and gathering plants. Protecting natural resources and providing public access to the resource can aid in preserving the cultural resources of West Hayden Island.

Regulatory Compliance – Natural resources are the subject of numerous federal, state and local regulations including the Endangered Species Act and the Clean Water Act. Protecting and enhancing West Hayden Island habitats can help with regulatory compliance. Requiring mitigation and enhancement as part of development can also help aide in compliance.

Environmental:

Natural Resources Functions and Values - The natural resources in the West Hayden Island study area provide important watershed functions including nutrient cycling, flood storage, microclimate, large wood recruitment, channel dynamics and habitat for fish and wildlife species, including federally-listed fishes and many other species that are at risk for future listings.

Mosaic habitat - The wetland, forest, shrub and grasslands, and shallow water areas on and around West Hayden Island are synergistic, creating one large "mosaic habitat" located at the confluence of two major rivers, the Willamette and Columbia. The West Hayden Island study area provides stopover habitat along the Pacific Flyway and an east-west flyway along the Columbia River.

Mitigation options - Existing natural resources in the study area are currently providing a relatively high level of function. Development would reduce the overall amount and quality of habitat, and the types and extent of functions provided. Requiring mitigation could replace certain of the features and functions within the site (e.g., shallow water habitat). However, some of the features and functions (forest, grassland) would have to be mitigated for off-site. Further, the functions associated with the location of West Hayden Island at the confluence of the Columbia and Willamette Rivers cannot be mitigate for.

Energy:

Mode Split – Moving traded-sector goods by barge and rail uses less energy and produces less carbon emissions than other form of moving goods by truck. By Moving traded-sector goods by barge and rail uses less energy and produces less carbon emissions than other form of moving goods by truck.

Summary of the Recommendations

West Hayden Island is uniquely situated at the confluence of the Columbia and Willamette Rivers in the middle of a metropolitan area. This location provides access to the deep water shipping channel as well as other transportation infrastructure including two rail lines, Interstate 5 and the Portland International Airport. West Hayden Island is also unique as compared to other sites in the Portland Harbor because of its size, which can accommodate a 10,000 unit train loop, and because the site is uncontaminated.

The island's location is also important for fish and wildlife. The Columbia River is the migration route for many fish species, including ESA-listed species. West Hayden Island is also located along the Pacific Flyway for migrating birds and functions as an important habitat link between other regional features like Smith and Bybee Wetlands, Vancouver Lake, Shillapoo Wildlife Area, Ridgefield Wildlife Refuge to the north and south and the Columbia River Gorge, Sandy River Delta and Sauvie Island to the east and west.

This context, that WHI is unique in Portland and the region, both in terms of the economy and environment. The economic and environmental uniqueness is paramount to understanding the recommended decision.

With the intent of optimizing 1) the positive, negative, neutral and negligible consequences associated with conflicting uses described in the Chapter 5, and 2) the pros and cons of the factor-specific recommendations presented above (including the different alternative scenarios for splitting land between heavy industrial and open space uses), the recommended ESEE decision is:

- Limit industrial development to 300 acres;
- Limit primary industrial uses to those that require access to the deep-water shipping channel
- Limit industrial uses below ordinary high water and within the Columbia River;
- Limit industrial uses within wetlands and on land within 50 feet of wetlands;
- Limit open space uses east of the BPA power line corridor; and
- Strictly limit open space uses west of the BPA power line corridor.

Note: The following recommendations are not being forward to the public hearing process at this time. The recommendation for the mainland and portions of the Oregon Slough outside of the proposed WHI Plan District is:

- Strictly limit industrial uses below ordinary high water and within the Oregon Slough;
- Limit industrial uses within high and medium ranked resources located above the ordinary high water mark of the Oregon Slough; and
- Allow industrial uses within low ranked resources.

Table 33: Recommended ESEE Decision for the West Hayden Island Study Area

Base Zone	Significant Natural Resources			
	Columbia River and Land Below Ordinary High Water	**Oregon Slough and Land Below Ordinary High Water**	**Wetlands and Land Within 50 Feet**	**Significant Resources on Land***
Industrial (IH)	**Limit industrial development to 300 acres and limit primary industrial uses to those requiring access to the deep-water shipping channel**			
	Limit	**Strictly Limit**	**Limit**	**Allow**, except **limit** within high and medium ranking resources on the mainland**
Open Space (OS)	**Strictly Limit**	**Strictly Limit**	**Strictly Limit**	**Limit**, except **strictly limit** west of the BPA Power Line Corridor

*Land includes natural resource features located above the ordinary high water of the Columbia River or Oregon Slough; or located more than 50 feet from a wetland.
** The recommendation for resources located on the mainland, which is the southern bank of the Oregon Slough, are not being forwarded to the public hearing process at this time.

Columbia River and Land Below Ordinary High Water within the IH Zone

The Columbia River is the deep water navigation channel and major transportation corridor for the region. The Columbia River is maintained by dredging to a depth of 43 feet, which is three feet deeper

than the Willamette River resulting in larger ocean-going vessels being able to utilize marine terminals on Lower Columbia River.

The Columbia River is also critical habitat for federally-listed fishes and a major migration corridor for hundreds of other fish and wildlife species. The shallow water located all around the island is critical habitat for fish, particularly out-migrating juvenile salmon, and waterfowl.

A limit decision provides the opportunity to continue utilizing the Columbia River channel to transport goods and services that require the deep-water access, while ensuring that negative impacts on natural resource features and functions are avoided, minimized, or mitigated.

Columbia River and Land Below Ordinary High Water within the OS Zone

As stated above the Columbia River is critical habitat for federally-listed fishes and a major migration corridor for other wildlife. Open space uses should be limited to passive recreation including viewing areas and canoeing and kayaking. A strictly limit decision would allow continued maintenance, repair and replacement of existing structures and development of new environmentally-sensitive passive recreation the OS zone below ordinary high water and within the River. A strictly limit decision ensures that negative impacts on natural resource features and functions are avoided, minimized or mitigated.

Oregon Slough and Land Below Ordinary High Water within the IH and OS Zones

The Oregon Slough also provides critical habitat for federally-listed fishes and a migration corridor for other fish and wildlife. Because the Oregon Slough is not maintained as a deep-water navigation channel, there is less impact from shipping and wider areas of shallow water habitat than on the Columbia River. There are existing industries on the banks of the Oregon Slough that are river dependant and use barges, but do not require the deep-water channel. The Oregon Slough also provides opportunity for passive recreation including canoeing and kayaking.

A strictly limit decision allows for continued industrial uses, including maintenance, repair and replacement of existing river-dependent industrial uses, while preserving the natural resources for fish, wildlife and passive recreation. A strictly limit decision would allow for new development under a very narrow set of circumstance, such as that which is necessary for access, while ensuring that negative impacts on natural resource features and function are avoided, minimized, or mitigated.

Wetlands and Land within 50 Feet of Wetlands within the IH and OS Zones

Significant wetlands also exist on land, above and below ordinary high water, proposed for open space OS and IH zoning. Wetlands are important natural resource features that provide hydrologic, water quality and wildlife functions. A combination of limit and strictly limit decisions for wetlands and land within 50 feet will contribute towards compliance with federal and state regulations like ESA and CWA.

IH - WHI area is the only location in Portland for a combined deep-water marine terminal and modern 10,000 unit train loop. There are associated benefits of this type of facility including family-wage employment, income, tax revenue and investing in existing infrastructure. There are no other sites in the Portland Urban Growth Boundary that are large enough to accommodate a modern rail loop. Development on this land would contribute to the industrial land supply which is needed help meet forecasted demand for marine terminals and to comply with State Land Use Goal 9.

A limit decision for wetlands and land within 50 feet of wetlands reflects the relative, economic and social value of proceeding with deep-water marine terminal in combination with a modern rail loop. A limit decision also recognizes the important hydrologic, water quality and wildlife habitat functions provided by these wetlands and would allow the City to require mitigation for unavoidable impacts.

OS - The wetlands in the OS are associated with forests and shallow water habitats, some of which are seasonally inundated from the Columbia River and important for at-risk and federally-listed fish and wildlife species. The use scenario for the open space area consists of natural resource protection and passive recreation. The strictly limit decision would allow for passive recreation provided it avoids the wetlands. A strictly limit decision would allow for new development under a very narrow set of

circumstance, such as that which is necessary for access, while ensuring that negative impacts on natural resource features and function are avoided, minimized, or mitigated.

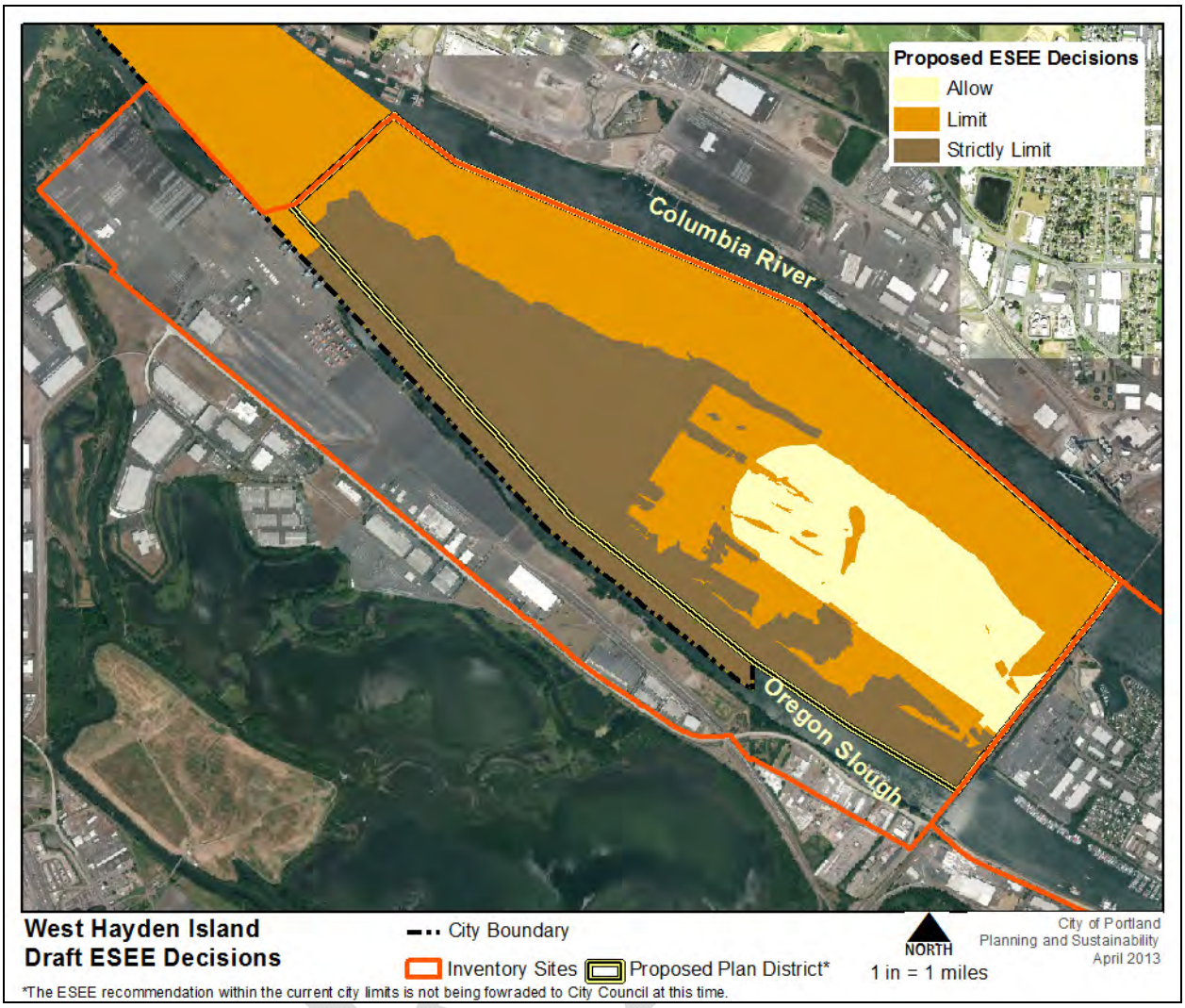
Significant Natural Resources on Land*

IH on WHI - On WHI, the area proposed for industrial zoning, contains significant bottomland hardwood forest used by *at-risk* wildlife species and habitat that is important to grassland-associated species. This area also provides the rare opportunity to develop a deep-water marine terminal and a modern 10,000 unit train loop, and to provide important benefits including family-wage employment, income, and tax revenue. There are no other sites within the Portland Urban Growth Boundary that are large enough to accommodate a modern rail loop. Development on this land would contribute to the industrial land supply which is needed help meet forecasted job demand and to comply with State Land Use Goal 9. An allow decision would facilitate development of this area, recognizing that more than 500 acres of natural resources is recommended to be retained on WHI.

IH on Mainland - Existing industrial land on the mainland south of the Oregon Slough is already developed as a deep-water marine terminal. The remaining natural resources are contained in a narrow band of trees and wildlife habitat corridor along the Oregon Slough, which includes habitat important to grassland-associated species.. A limit decision applied to uses within high and medium ranked natural resources would allow existing uses to continue, along with maintenance, repair or replacement of existing facilities. A limit decision would also allow the City to require that adverse impacts on high and medium ranked resource areas to be avoided, minimized or mitigated, which would help retain habitat connectivity between the mainland and portions of WHI that are proposed to be preserved in open space. *Note: This recommendation is not being forward to the public hearing process at this time.*

OS - Within the proposed open space areas on West Hayden Island, strictly limiting conflicting uses west of the Bonneville Power Administration's power line corridor would preserve the forest, woodland, and wetlands complexes. This large habitat area provides interior habitat for a diverse array of at-risk wildlife species. Strictly limiting conflicting uses within these resource areas, including the land within 50 feet of wetlands would preserve the important riparian and wildlife habitat functions provided by those resource features. Limiting conflicting in the remaining proposed open space area would provide opportunities for passive recreation and education. The mix of limiting and strictly limiting conflicting uses would also help preserve historical and cultural values, and maintain the aesthetic, screening and buffering values associated with the natural resources.

*Land includes natural resource features located above the ordinary high water of the Columbia River or Oregon Slough; or located more than 50 feet from a wetland.



Implementation Tools

The ESEE decision is proposed to be implemented through the application of IH base zoning to 315 acres and OS base zoning to 497 acres of WHI; additional IH and OS base zoning would be applied to the Columbia River and Oregon Slough. It is also recommended that the decision be implemented through the development of zoning regulations and maps applied to a new WHI Plan District. Within the plan district:

1. Where there is a *strictly limit* decision, it is recommended that conflicting uses be restricted to a narrow set of environmentally appropriate uses such as natural resource enhancement, hiking trails, a boat launch without a dock structure and driveways to access and maintain recreation infrastructure and enhancement sites. The code should require negative impacts to natural resource features and functions avoided and minimized and unavoidable impacts to be mitigated (see #3 below).

2. Where there is a *limit* decision, it is recommended that the zoning code require conflicting uses to avoid and minimize negative impacts on natural resource features and functions, except as follows within the IH base zone of the WHI Plan District:
    - Columbia River and land below the ordinary high water: It is recommended that a limit decision not include a requirement to avoid impacts on natural resource features and functions located below the ordinary high water mark or within the Columbia River in IH base zone. This reflects the fact that a marine terminal is river dependant and necessarily

will impact the water and shallow water habitat. However, the limit decision should include analysis of measures to minimize impacts on these features and functions and actions to mitigate unavoidable impacts.

- Wetlands and land within 50 feet: It is recommended that a limit decision not include a requirement to avoid or minimize impacts on wetlands within the IH base zone. It is anticipated under the use scenario that these wetlands will be filled in order to develop the rail loop and marine terminal facilities. However, the important functions provided by the wetlands should be maintained through mitigation.

3. Where there is either a *limit* or *strictly limit* decision, all unavoidable negative impacts to features and functions should be mitigated. Mitigation for unavoidable impacts should result in no net loss of features or functions and account for:
    - location of the mitigation site,
    - timing of the mitigation action in relation to the timing of impacts,
    - time to achieve desired future condition of the mitigation actions,
    - relationship between the mitigation site and adjacent habitats and land uses, and
    - monitoring needed to ensure the mitigation is successful.

4. The code should provide exemptions and/or a non-discretionary review track for conflicting uses with minimal and definable impacts on natural resource feature and functions; and a discretionary review track for other proposed conflicting uses. Under either review track, mitigation for unavoidable impacts to features and function should be mitigated.

Established methodologies should be used to assess impacts on wetlands and shallow water habitat and mitigation necessary to fully compensate for the impacts. However, currently there is no established methodology to assess bottomland hardwood forest impacts and mitigation. As part of the WHI Phase II project, the City of Portland Bureau of Environmental Services developed a mitigation framework for the bottomland hardwood forests on WHI (Appendix C: City of Portland WHI Forest Mitigation Framework). The *Framework* provides a methodology to arrive at appropriate mitigation ratios that fully compensate for unavoidable impacts to bottomland hardwood forest features and functions and the location, timing and desired future condition of mitigation actions. Through the WHI planning process, the *Framework* was vetted and endorsed by the WHI Advisory Committee and was generally endorsed by the Oregon Department of Fish and Wildlife as an appropriate tool to determine WHI forest impacts and compensatory mitigation actions. It is recommended that the *Framework* be considered when designing mitigation programs to implement the ESEE decision.

Chapter 1 – Introduction

This report was prepared as part of the West Hayden Island planning project. The West Hayden Island planning project is a comprehensive, multi-objective, and collaborative effort between the City of Portland, Port of Portland, and the Portland-Vancouver metropolitan community. The project will create a long-range development plan for West Hayden Island. The project focuses on potential marine terminal development, public recreation and natural resource management in the project study area.

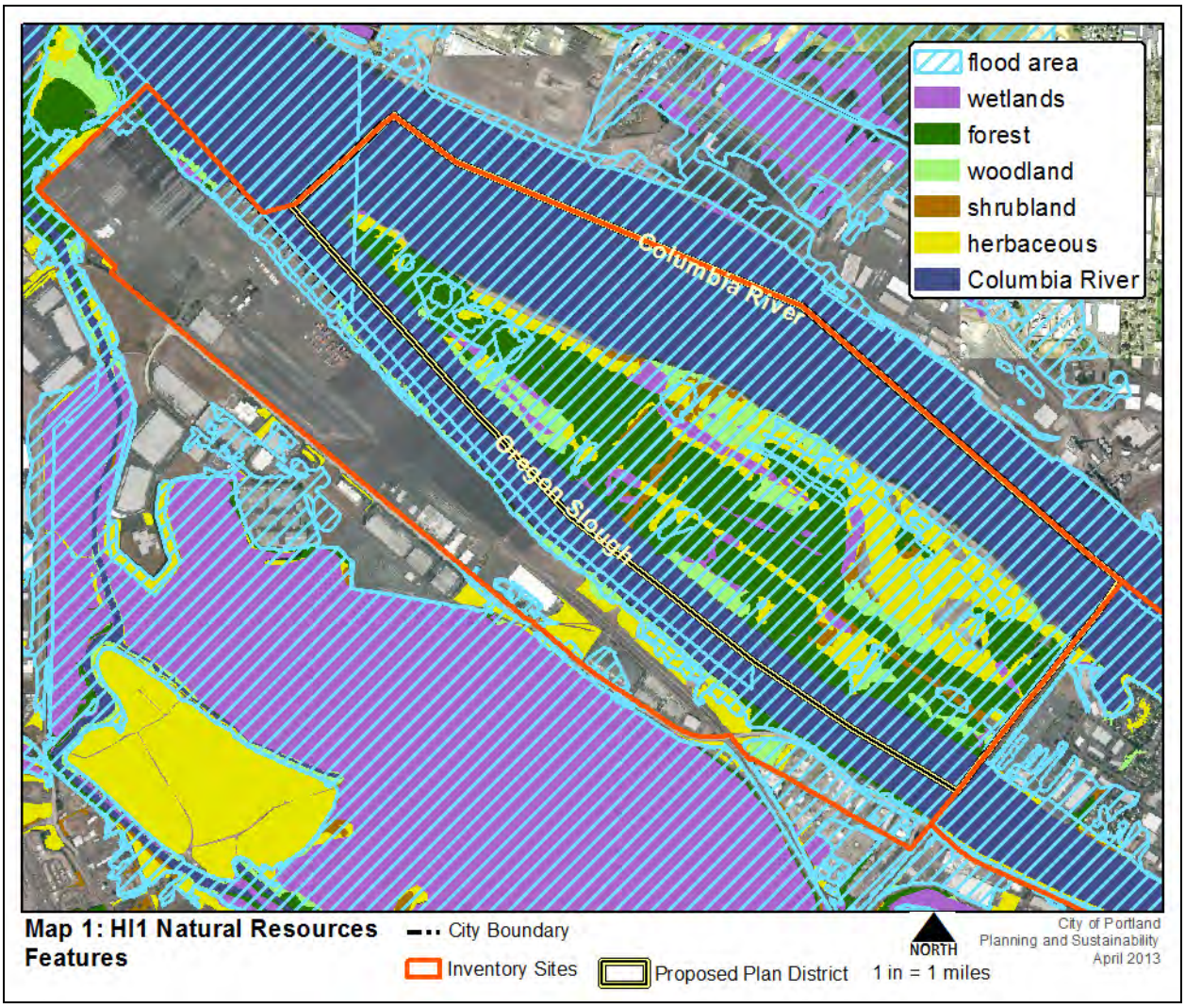
This chapter introduces the geographic scope, role and organization of the Economic, Social, Environmental and Energy (ESEE) Analysis and a brief description of West Hayden Island (WHI).

1.a. Geographic Scope of this ESEE Analysis

This ESEE analysis is being performed for the inventory site HI1: West Hayden Island and Oregon Slough, as specified in the *Hayden Island Natural Resources Inventory* (April 2013).

WHI is located at the confluence of the Columbia and Willamette Rivers between the cities of Portland, OR and Vancouver, WA. Map 1 shows natural resources inventoried within the study area and Map 2 highlights those resources that received a relative rank as providing natural resource functions based on the inventory methodology and are determined to be significant for the purpose of this analysis. Those resources that are determined to be significant (Map 2) are the resources for which this ESEE is being performed. The inventory site is 2,429 acres in size and includes 1,922 acres of significant natural resources.

The recommendations from this ESEE are being carried forward with the West Hayden Island Plan District. While this ESEE analysis is being performed for the entire inventory site, only the portions of this ESEE that apply within the area within to be annexed into the City of Portland are being forward to City Council for adoption. Terminal 6 and other industrial land south of the Oregon Slough are currently located with the City of Portland and ESEE recommendations that would apply within the current city limits will not be carried forward at this time to City Council for adoption.


flood area
wetlands
forest
woodland
shrubland
herbaceous
Columbia River
Columbia River
Oregon Slough
Map 1: HI1 Natural Resources Features
City Boundary
Inventory Sites
Proposed Plan District
NORTH
1 in = 1 miles
City of Portland
Planning and Sustainability
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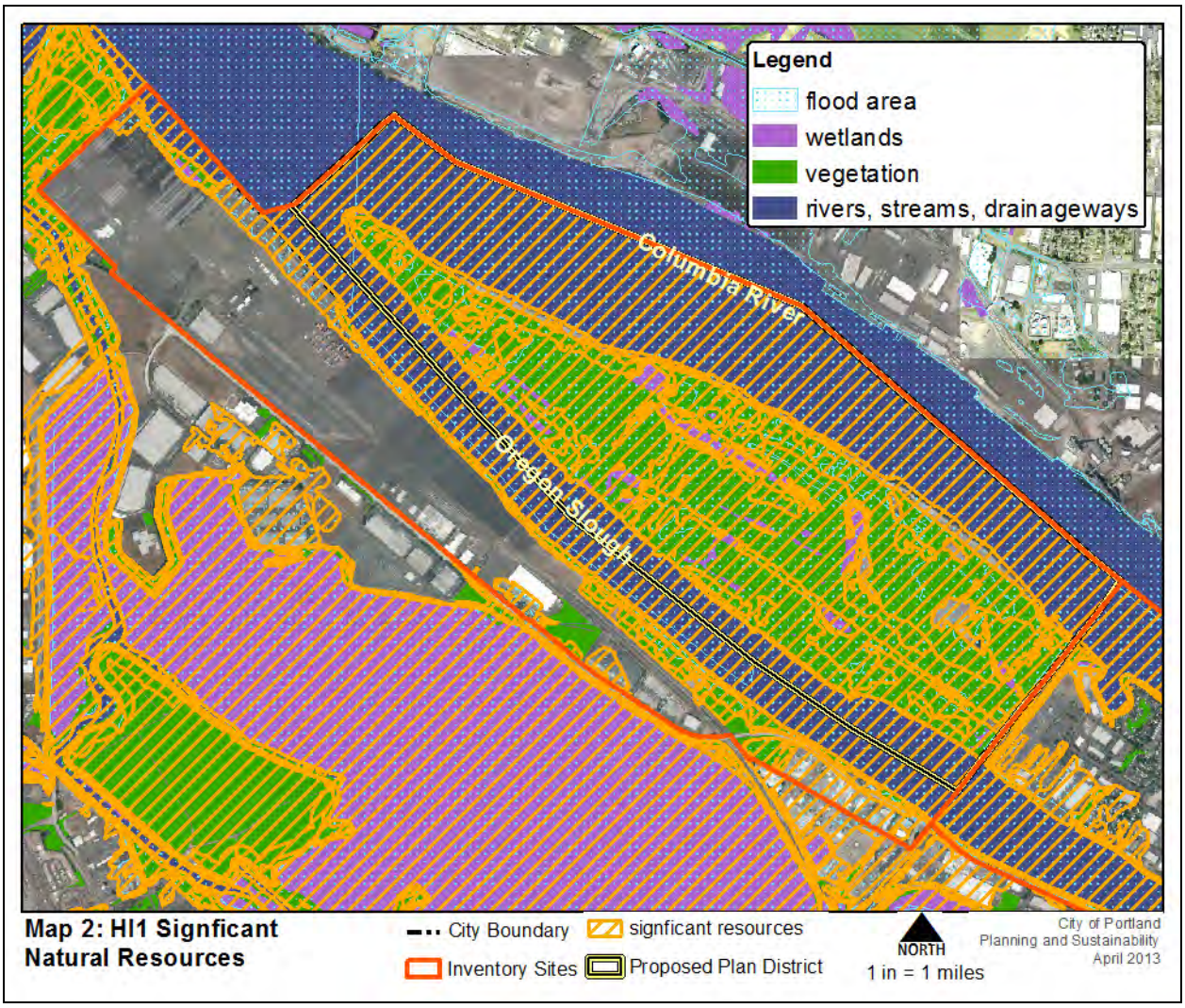


1.b. Role of the ESEE Analysis

1.b.1. Introduction to the ESEE Analysis Process

The purpose of this ESEE Analysis is to update and refine the regional ESEE Analysis performed by Metro for Title 13 Nature in Neighborhoods. The City's ESEE Analysis will evaluate the economic, social, environmental, and energy trade-offs associated with different levels of protection for significant natural resources in the WHI study area. The results of the ESEE Analysis will inform upcoming Portland City Council decisions regarding natural resource management on WHI should it be annexed into Portland.

The first step to developing a program for WHI was to inventory the existing natural resources and determine which resources are significant. The *Hayden Island Natural Resource Inventory* (April 2013) report (published separately) presents descriptions and maps addressing the types, location, extent, quantity and relative quality of natural resources in the study area. The inventory report also presents determination of resource significance.

Next, the City performed an economic, social, environmental and energy analysis to evaluate the potential tradeoffs associated with different levels of natural resource protection that could be established by the City. This report documents that analysis.

The final step is to develop a program to protect and manage significant natural resources. Portland has an existing environmental program, which was acknowledged as in compliance with State Land Use Goal

5 prior to adoption of Title 13. The existing environmental program relies primarily on established environmental overlay zone maps and regulations, along with supplemental zoning code provisions called "plan districts" that apply to specific areas of the city. The City of Portland also employs other tools to help protect and conserve significant resources identified in natural resource inventories, such as drainage reserves, the Stormwater Management Manual, willing-seller land acquisition and watershed revegetation projects. The results of this ESEE analysis will include decisions that provide the basis for an updated program for the WHI Plan District. The program will be established through annexation of WHI.

The WHI ESEE analysis does not start from scratch. Rather it should be viewed as an update and refinement of the regional ESEE analysis that Metro adopted as part of Title 13, Nature in Neighborhoods. Title 13 established baseline natural resource protection requirements that Metro area cities and counties must meet (more detail provided in the next section). Metro followed the State Land Use Goal 5 process to develop Title 13. Title 13 was acknowledged by the Land Conservation and Development Commission as complying with specified portions of Goals 5 (riparian corridors and wildlife habitat) and 6 (water quality) in January 2007.

Since Title 13 was adopted, a substantial amount of new information has been generated that is relevant to the City's evaluation of options for the future of WHI. To bring some of this information into the decision making process, the City is electing to follow the State Land Use Goal 5 steps to update and refine Metro's natural resource inventory and ESEE Analysis for WHI. These updated products will the City's preparation of a program that will meet City goals, including substantial compliance with Title 13.

The Goal 5 rule (OAR 660-015-0000(5)) requires that the ESEE analysis include the following steps:

1. Determine the impact area. Local governments shall determine an impact area for each resource site. The impact area shall be drawn to include only the area in which allowed uses could adversely affect the identified significant natural resources. The impact area defines the geographic limits within which to perform ESEE analysis.

2. Identify conflicting uses. Local governments shall identify conflicting uses that exist, or could occur, within significant natural resource areas. To identify these uses, local governments shall examine land uses allowed outright or conditionally within the zones applied to the resource site and in its impact area. "Conflicting use" is a land use or other activity reasonably and customarily subject to land use regulations, that could adversely affect a significant resource (except as provided in OAR 660-023-0180(1)(b)).

3. Analyze the ESEE consequences. Local governments shall analyze the ESEE consequences that could result from decisions to allow, limit, or prohibit a conflicting use. The analysis may address each of the identified conflicting uses, or it may address a group of similar conflicting uses. The narratives and tables within this analysis include a thorough explanation of the consequences and describe, to the extent there is existing information, primary, secondary and tertiary impacts for the local and regional community. The final ESEE decision will inform land use actions to address natural resources. However, the city's comprehensive approach provides the community and City decision makers with a better understanding of the broad implications of the options, and may inform decisions that go beyond the ESEE decision.

4. Develop a program. Based on and supported by the analysis of ESEE consequences, local governments shall determine whether to allow, limit, or prohibit identified conflicting uses within significant natural resources areas within designated inventory sites:

(a) A local government may decide that a significant natural resource is of such importance compared to the conflicting uses and the ESEE consequences of allowing the conflicting uses are so detrimental to the resource that the conflicting uses should be prohibited.

(b) A local government may decide that both the significant natural resource and the conflicting uses are important compared to each other and, based on the ESEE analysis, the conflicting uses should be allowed in a limited way that protects the resource to a desired extent or requires mitigation of loss natural resources and associated values and functions.

(c) A local government may decide that the conflicting use should be allowed fully, notwithstanding the possible impacts on the significant natural resources. The ESEE analysis must demonstrate that the conflicting use is of sufficient importance relative to the resource and must indicate why measures to protect the resource to some extent should not be provided, as per subsection (b) of this section.

It should be noted that some of the information contained within the ESEE analysis of consequences will not be directly addressed in the ESEE decision because the consequences, while real and important, are not directly related to protection of the natural resources. This does not preclude the WHI planning project from addressing the consequences outside of the ESEE decision and recommended program.

1.b.2. Context for the WHI ESEE Analysis

In order to understand the role of the WHI ESEE Analysis specifically, it is important to understand the relevant legislative history.

WHI is uniquely situated at the confluence of the Columbia and Willamette Rivers in the middle of a metropolitan area. This location provides access to the Columbia River deep water shipping channel and other transportation infrastructure, including two rail lines, Interstate 5 and the Portland International Airport. This location is also important for fish and wildlife. The Columbia River is the migration route for many fish species, including ESA-listed species. WHI is also located along the Pacific Flyway for migrating birds and functions as an important habitat between other regional features such as Smith/Bybee Wetlands, the Shillapoo Wildlife Area, Vancouver Lake, and the Ridgefield Wildlife Refuge.

In 1977, Multnomah County designated WHI "Natural Resource, Multiple Use Forestry" as the need for future urban uses had not yet been identified.

In 1982, the county changed the designation from "Natural Resources" to "Significant Environmental Concern" and stated that any long term environmental and recreational losses from urban uses would be identified and addressed in the community planning process. The adopting ordinance also stated that future use of WHI is anticipated to be marine industrial.

In 1983 the regional government (Metro) expanded Portland's Urban Growth Boundary to include WHI. In conjunction with the Urban Growth Boundary expansion, Multnomah County re-designated WHI from "Multiple Use Forestry" to "Future Urban" within the Multnomah County Framework Plan. (Note: This is similar to the City's comprehensive plan designations that indicate the future desired use while the zoning remains static.) The impetus for both actions was to provide a future site for waterfront industrial and marine terminal uses. Through the Multnomah County analysis the County found that additional waterfront acreage was needed within the UGB to meet the forecasted demand for marine terminal uses. That analysis also found that natural resources located on WHI are significant enough to warrant some level of protection.

In 1994, the Port of Portland acquired WHI from Portland General Electric and the James River Corporation.

In 1997 (readopted in 2000 and amended in 2002), Metro exempted a portion of WHI from the flood management requirements of Title 3 – Water Quality, Flood Management and Fish and Wildlife Conservation. The exemption coincided with a potential marine terminal development footprint on the eastern portion of WHI, near the existing railroad. Within the exemption, Metro recognized the UGB expansion that brought in WHI for future marine terminal development.

In 2004, Metro designated WHI a Regionally Significant Industrial Area (RSIA) under Title 4 – Industrial and Other Employment Lands. The impetus for the designation was because WHI is located near the Columbia River, Portland International Airport, I-205, I-84 and rail corridors.

As noted above, in 2005 Metro adopted Title 13 Nature in Neighborhoods which requires Metro area cities and counties to establish programs to protect, conserve and restore designated regional Habitat Conservation Areas. As part of developing Title 13, Metro completed a regional natural resource inventory and ESEE Analysis. After evaluating the consequences allowing, limiting and prohibiting

conflicting uses that would impact natural resources for the region, Metro made a *limit decision* for many areas including WHI, the river surrounding WHI and the southern bank of the Columbia River in this project study area. Metro's decision resulted in the designation of Moderate Habitat Conservation Area for WHI and the southern bank of the river and a High Habitat Conservation Area for the river surrounding WHI.

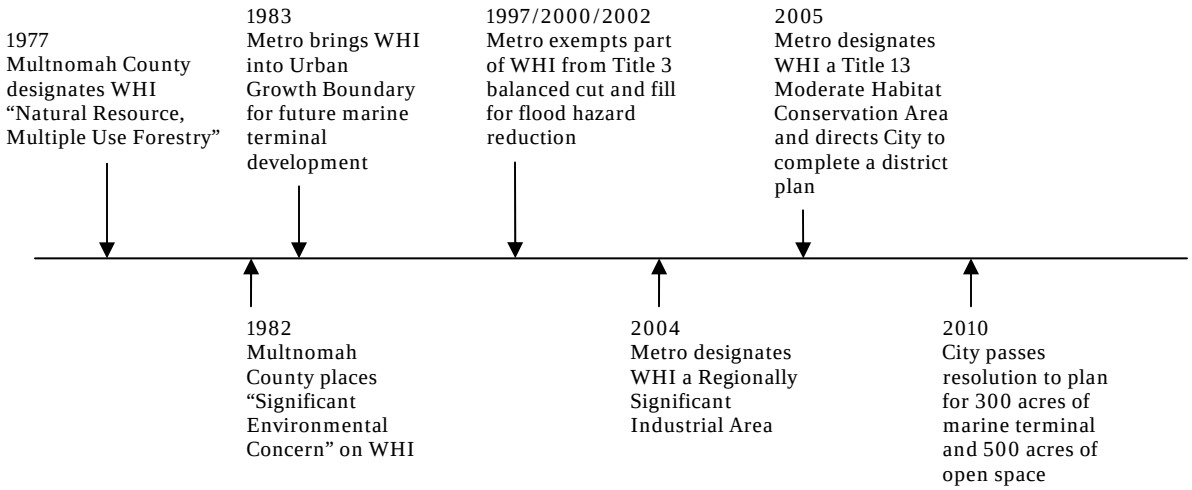
Metro described that a decision to limit conflicting uses "strikes a balance between completely developing the Goal 5 riparian and upland wildlife resources and protecting them. This alternative provides opportunities including developing lands in ways that minimize negative environmental and economic tradeoffs; supporting the goals embodied by the 2040 Design Types and protecting the most important habitats. ...The economic tradeoffs for this alternative depend on the degree of limitation on development actions: lightly limit, moderately limit, or strictly limit.....The limit scenario will generate a more equitable distribution of positive and negative economic tradeoffs...Development interests and the resources will both experience positive and negative economic tradeoffs. *(Appendix C, Economic Report and Literature Review, Ord. No. 05-1077C, Attachment 3 to Exhibit F)*

Recognizing the important natural resource and economic values of WHI, Metro adopted a provision in Title 13 that directs the City of Portland, to create an area-specific "district plan" for WHI in cooperation with the Port of Portland.

In 2007, Oregon Land Conservation and Development Commissioned acknowledged Title 13 as in compliance with the riparian corridor and wildlife habitat related components of State Land Use Goal 5 *Natural Resources, Scenic and Historic Areas and Open Spaces* and the water quality related components of Goal 6 *Air, Water and Land Resource Quality*.

In fall 2008 The City of Portland began the first phase of the current WHI planning process, looking the issues and implications of annexing and developing WHI with a mix of marine terminal and open space uses. July 2010, Portland City Council passed a resolution directing the Bureau of Planning and Sustainability to continue planning for no more than 300 acres of marine terminal and at least 500 acres of open space uses with an emphasis on passive recreation and natural resource enhancement.

Figure 1: West Hayden Island (WHI) Legislative Decisions Timeline



1.b.3 Use Scenarios Considered through the WHI ESEE Analysis

The ESEE Analysis will result in recommendations about where, under what circumstances and to what extent significant natural resources within the study area should be protected and managed. As noted above, the City's ESEE Analysis for WHI is being done under the auspices of Metro's Title 13 limit decision and designation of Moderate Habitat Conservation Area for WHI and the study area generally. As noted above, Metro's limit decision is intended to strike a balance between completely developing indentified natural resource and fully protecting them. In carrying forth this limit decision, the City is not considering as part of this ESEE completely allowing conflicting uses on the whole 800 acres nor completely prohibiting conflicting uses on the whole WHI.

Following the City Council resolution, the City hired WorleyParsons to develop a concept plan that meets the Council resolution. Working with staff and the WHI Advisory Committee, WorleyParsons created the Final Base Concept Plan that includes:

1. 300 acres of marine terminal development
    a. Rail loop for a 10,000 unit train
    b. Three terminal: auto, grain and bulk
    c. Two docks
    d. One value-added manufacturing
2. 500 acres of open space
    a. Opportunity areas for shallow water and wetland restoration
    b. Opportunity areas for forest and woodland enhancement
    c. Beach access trail with trail head
    d. Optional trails to the south side of WHI
    e. Optional non-motorized boat launch locations

The ESEE Analysis will focus on a primary use scenario which is based on this Final Base Concept Plan and the detailed information developed for this scenario. The ESEE also evaluates other "limit" decisions more generally for three alternative use scenarios:

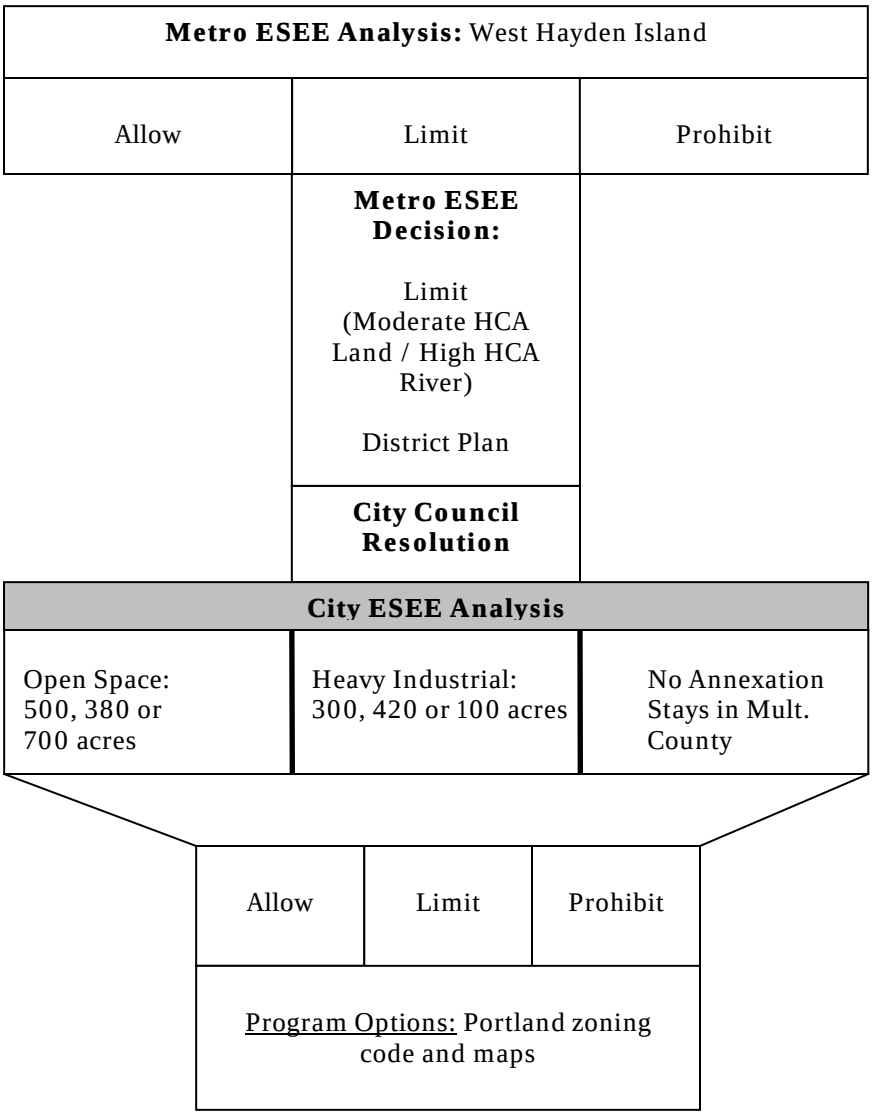
Primary Use Scenario: Based on the City Council resolution that directs the Bureau of Planning and Sustainability to continue planning for a mix of no more than 300 acres of marine terminal industrial development and at least 500 acres of open spaces uses on WHI. The use scenario assumes that WHI would be annexed into Portland.

Alternative Use Scenarios: Based on other splits of use on the island

1. Annexation with 420 acres marine terminal/380 acres open space, or
2. Annexation with 100 acres marine terminal/700 acres open space.
3. Not Annexing WHI. Based on a decision by City Council not to annex WHI into Portland, WHI would remain in Multnomah County and the current county zoning would continue to apply.

In focusing on the primary use scenario, the ESEE Analysis will evaluate the consequences of allowing, limiting or prohibiting allowed uses under the relevant City base zones, Heavy Industrial (IH) and Open Space (OS). The other land splits will be examined to evaluate how the consequences associated with the primary use scenario may change if there were more or less land available for marine terminal development or for open space. Finally, a general description of the consequences associated with a decision not to annex WHI and it to remain in the Multnomah County is provided.

Figure 2: Relationship of Metro and City WHI ESEE Analyses



1.c. Brief Description of West Hayden Island

For thousands of years the confluence area of the Willamette and Columbia rivers was home to native peoples and an important junction in the trade routes of Oregon and Washington. Prior to the 1900's and construction of the Columbia River dams, the confluence of the Columbia and many of its tributary streams, including the Willamette River, were characterized by multiple islands that changed with seasonal flooding. The islands have had many names over the years. The earliest written description of what is believed to be now Hayden Island was by Lt. William Broughton in 1792 (Ellis, 1986). He noted "a small wooded island, about three miles in extent" and called it "Menzie's Island."

The first documented European settlement on the main island, then called "Vancouver Island," was the Hayden family in 1851; the homestead was used for cattle ranching. More recently the islands that now make up Hayden Island were called, from east to west, Tomahawk, Hayden and Cigar islands. Mid- and late-19th century texts and mapping describe a woodland forest land and lowland area on the southern portions of Hayden Island located among shoals, other islands, and channels. Wildlife that used the

island included black-tailed deer, white-tailed deer, bobcats, gray wolves, coyotes, mink, river otter, beaver, muskrat, harbor seals, sea lions, moles, voles, shrews, band-tailed pigeon, Canada goose, mallard, American wigeon, wood duck and many other migratory bird species. The river and shorelines surrounding the island were used by eulachon (smelt), seven salmonid species, sturgeon, lamprey, chiselmouth, peamouth, chub and pike minnow.

Figure 3: 1924 Aerial Photograph of Hayden Island

The most significant human-made changes to the island began in the late 19th century. In the 1880's a railroad was constructed across the island. Dredging of the Oregon Slough was authorized by the River and Harbor Act of 1912 with work occurring between 1913 and 1916. This work resulted in placement of dredge material along the south shore of western Hayden Island, near the rail bridge. Additional dredging in the Oregon Slough occurred between 1915 and 1917 to provide material for the Vancouver approach embankments for the Columbia River Interstate Bridge on both the mainland and eastern Hayden Island. Several pile dikes were installed by the US Army Corps of Engineers in the 1920's along the northern shoreline of western Hayden Island to assist in navigation maintenance. Around this same time the island became a receiving site for dredge materials. Placement of a series of eight permanent spur dikes, or groins, during the early 1920s on the southeast shore of western Hayden Island and north shore of the Oregon Slough served to narrow the navigation channel and assist in maintaining channel depth in the southern channel in service to early industry located near the rail line. Figure 2 shows the southern shoreline of Hayden Island, east and west, post installation of the easterly spur dike just beyond the rail bridge. The observable effect of the groins from aerial image analysis is sediment accumulation and the formation of moderately sloped beaches on the west (downstream) side. Portions of western Hayden Island's north shore have been used by the US Army Corps of Engineers to dispose of materials dredged from the Columbia River navigation channel since the 1920's. To a lesser extent, dredge deposits were also placed near the original south shoreline. Historic and modern log-booming practices also likely contribute to formation of low energy shoreline areas.

In 1927 the United States Board of Geographic Names was petitioned to rename the island as Hayden Island. Tomahawk Island, west of Hayden Island, was still a separate island at that time. Over the years, river silting has filled in the gap between Tomahawk and Hayden Island. Finally, road construction connected the two so that Tomahawk is no longer a separate island.

Figure 4: 1940 Aerial Photograph of West Hayden Island

Portions of western Hayden Island have been used periodically for cattle grazing through 2006. Grazing significantly impacted the vegetation composition by suppressing the recruitment of cottonwood and ash seedlings and supporting grasses and forbs, including invasive species.

For more than 40 years the eastern Hayden Island was home to the "Jantzen Beach Amusement Park", also known as "The Coney Island of the West". The park opened on May 26, 1928, and, at the time, it was the largest amusement park in the United States. Eventually the park covered more than 123 acres and featured a carousel, roller coaster, ballroom, swimming pools and picnic grounds. The amusement park closed in 1970. Today the merry-go-round resides inside the Jantzen Beach Shopping Center and the pumping system from the swimming pools is used to pump drinking water to residents of Hayden Island. Eastern Hayden Island was incorporated into Portland in 1986 and 1990 (Map 10) and developed with commercial, residential and some industrial land uses.

Even with historic alterations and other impacts, West Hayden Island and the Lower Columbia River surrounding it provide habitat for fish and wildlife such as northern red-legged fro), western painted turtles, anadromous salmon, steelhead and Pacific Lamprey. The confluence of the Willamette and Columbia Rivers is a regional nexus on the Pacific and Columbia River flyways. In general, birds move north-south along the Pacific flyway and birds also move east-west along the Columbia River corridor. Over 200 species occur in the Portland area, including resident and migratory species. Migrants pass through the region in large numbers, moving along both flyways, utilizing habitats along the Willamette and Columbia Rivers. Pisciverous diving birds use the near shore water for foraging: horned grebe, eared grebe, western grebe, surf scoter and common loon. Lesser Scaup occur in large flocks in the river feeding on aquatic invertebrates and other prey. Mudflats, shoals and beaches provides habitat for migratory shorebirds: least sandpipers, solitary sandpipers and semi-palmated plovers.

Chapter 2. Regulatory and Policy Context

The purpose of this chapter is to summarize the relevant regulations and policy that should be considered when performing the tradeoffs analysis to determine when, under what circumstances and to what extent significant natural resources should be protected.

2.a Oregon's Statewide Land Use Program

Oregon Land Use Planning Program and the Natural Environment

Comprehensive land use planning was mandated by the 1973 Oregon Legislature, primarily in response to growth pressures on valuable farm and forest land in Oregon. Since 1975, cities and counties in Oregon have been required to comply with Statewide Land Use Planning Goals. Nineteen goals have been established and cities and counties must comply with the goals by adopting, implementing and maintaining local comprehensive plans. Portland adopted its first comprehensive plan in 1981 to satisfy the requirements of the Statewide Land Use Planning Program.

It is the intent of this ESEE evaluation to consider and achieve multiple goals. The state land use planning goals that relate most directly to Portland's natural resources are:

- **Goal 5, Natural Resources, Scenic and Historic Areas, and Open Spaces** – Goal 5 addresses many types of resources. It establishes a requirement for local natural resource protection programs and a process to achieve compliance. Local jurisdictions must first inventory natural resources and determine which resources are significant. If a resource or site is deemed significant, the local government must evaluate and choose among three policy options: to preserve the resource, allow proposed uses that conflict with it, or establish a balance between protecting and allowing uses that conflict with the resource. Local governments must then develop resource protection programs as needed to carry forward the chosen option.
- **Goal 6, Air, Water, and Land Resources Quality** – This goal requires local comprehensive plans and implementing measures to be consistent with state and federal regulations on matters such as air quality, stream quality, and groundwater pollution.
- **Goal 7, Areas Subject to Natural Hazards** – Goal 7 deals with development in places subject to natural hazards such as floods or landslides. It requires that jurisdictions apply "appropriate safeguards" (floodplain regulations, for example) when planning for development.

Goals 5 requires local jurisdictions to develop their own resource inventories, while Goal 7 refers to land hazard inventories developed by federal and state agencies to be used for implementing policy. Goal 6 does not require an inventory, but does require local programs to be consistent with adopted state and federal clean water and clean air laws.

Additional state planning goals are directly applicable to the WHI area.

- **Goal 2, Land Use Planning** – Goal 2 requires that land use processes and policies use a factual base to make decisions and take actions,. Goal 2 also includes language related to government coordination and considering and accommodating as much as possible the needs of governments, semipublic and private agencies and the citizens of Oregon.
- **Goal 8, Recreational Needs** – The purpose of Goal 8 is to satisfy the recreational needs of the citizens of the state and visitors. The goal states that the planning for and provision of recreation facilities should give priority to areas that meet recreational needs for high density population centers and minimize environmental deterioration.

- **Goal 9, Economic Development** – Goal 9 requires comprehensive plans and polices to contribute to a stable and healthy economy; to provide for an adequate supply of sites of suitable sizes, types, locations, and service levels for a variety of industrial and commercial uses consistent with plan policies; and to limit uses on or near sites zoned for specific industrial and commercial uses to those which are compatible with uses allowed within the industrial and commercial zones.
- **Goal 11, Public Facilities and Services –** This goal requires local jurisdictions to plan and develop a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for urban and rural development. Jurisdictions with in the urban growth boundary must develop public facilities plans to coordinate the type, location and delivery of public facilities and services in a manner that best supports existing and proposed land uses.
- **Goal 12, Transportation** – Goal 12 requires the city to develop a transportation plan that considers all modes of transportation (car, public transit, bike, pedestrian) and accessibility to these modes; conserve energy; and facilitate the flow of goods and services so as to strengthen the local and regional economy.
- **Goal 13, Energy Conservation –** The intent of Goal 13 is that land use and development be managed and controlled to maximize the conservation of all forms of energy, based upon sound economic principles.
- **Goal 14, Urbanization –** The intent of Goal 14 is to accommodate urban population and urban employment inside urban growth boundaries, to ensure efficient use of land, and to provide for livable communities.

2.b State Policies and Regulations for Ports

Oregon Revised Statute: Title 58

The State of Oregon regulates Ports through Title 58 of the Oregon Revised Statutes which oversees Shipping and Navigation. ORS Chapter 777 of this Title applies to ports generally and Chapter 778 applies specifically to the Port of Portland. The bulk of these chapters oversee how Ports are organized, their powers and functions, and how they can raise money and acquire land. Under ORS 778, the Port can acquire lands necessary to improve air transport, shipping, commercial and industrial development of the port. It can also acquire land for the purpose of depositing dredge materials and engage in many other activities necessary for the operation of the port. It can issue bonds to help fund projects. The Port has the authority to construct public recreation facilities, "when such facilities may be developed in conjunction with the exercise by the port of any of its other powers."

Oregon Revised Statute 777.065: Development of Port Facilities

The Legislative Assembly recognizes that assistance and encouragement of enhanced world trade opportunities are an important function of the state, and that development of new and expanded overseas markets for commodities exported from the ports of this state has great potential for diversifying and improving the economic base of the state. Therefore, development and improvement of port facilities suitable for use in world maritime trade at the Ports of Umatilla, Morrow, Arlington, The Dalles, Hood River and Cascade Locks and the development of deepwater port facilities at Astoria, Coos Bay, Newport, Portland and St. Helens is declared to be a state economic goal of high priority. All agencies of the State of Oregon are directed to assist in promptly achieving the creation of such facilities by processing applications for necessary permits in an expeditious manner and by assisting the ports involved with available financial assistance or services when necessary. [1981 c.879 §6; 1993 c.106 §1]

In pursuing development of WHI as a marine terminal, the Port of Portland, as a public agency, is acting to implement a state economic goal of high priority.

Oregon Revised Statute 197.722 – 197-728: Economic Development

The provision states that within three years after June 28, 2011, in cooperation with local governments and private industrial, the Economic Recovery Council shall designate regionally significant industrial areas. Regionally significant industrial areas are those lands planned and zoned for industrial use that:

- contain vacant sites that are suitable for the location of new industrial uses,
- have site characteristics that give the area significant competitive advantages that are difficult or impossible to replicated in the region,
- have superior access to transportation and freight infrastructure, and
- are located in close proximity to major labor markets.

WHI is has not been nominated as a regionally significant industrial area because is not currently zoned for industrial uses. If WHI is annexed into Portland and part of the island is zoned for industrial uses, then it could be a candidate for designation. WHI is vacant, it is located within the Columbia Harbor along the Columbia River shipping channel, it has access to multiple rail lines and Interstate 5 and it is located in the Portland/Vancouver metropolitan area. Designation of regionally significant industrial areas requires support and cooperation of the local government.

2.c Metro Urban Growth Management Functional Plan

The 1973 Oregon Legislature granted expanded powers for the Columbia Region Association of Governments (now called Metro), to "coordinate regional planning in metropolitan areas" and to "establish a representative regional planning agency to prepare and administer a regional plan." During the 1990s, Metro worked with local jurisdictions to develop Regional Urban Growth Goals and Objectives (RUGGOs) and the *Urban Growth Management Functional Plan* (UGMFP).

The UGMFP provides a regional approach to growth management by tailoring several key state planning goals to meet regional population growth expectations. This approach recognizes the interrelationships between housing, employment, clean air and water, natural resources, and transportation networks across jurisdictional boundaries. Metro developed the plan with input from the 24 cities and 3 counties within the Urban Growth Boundary.

Metro's UGMFP has been acknowledged by the Oregon Land Conservation and Development Commission**,** making it a part of the state land use planning program. Metro area cities and counties achieve compliance with the UGMFP by updating comprehensive plans and land use ordinances to meet regional requirements. Metro has also authorized, in some instances, local jurisdictions to use other regulatory and non-regulatory tools to achieve compliance. The comprehensive plans and ordinances of the cities and counties within the Metro Urban Growth Boundary must also comply with remaining state goals not covered by the UGMFP.

Nine titles in the UGMFP are derived from or relate to State Planning Goals and the rest are procedural. Titles pertaining most directly to the WHI inventory area and this ESEE Analyses are: Title 1 which addresses housing and employment; Titles 3 which addresses water quality, flood management, and fish and wildlife conservation; Title 4 which addresses management and protection of industrial and other employment areas; and Title 13 which addresses natural resources management and watershed health. These titles and associated compliance obligations are summarized below.

Title 1 – Requirements for Housing and Employment Accommodation

Title 1 specifies the intention of the region to use land within the UGB efficiently by increasing its capacity to accommodate housing and employment. Title 1 directs each city and county in the region to consider

actions to increase its capacity and to take action if necessary to accommodate its share of regional growth. In 1983 the regional government (Metro) expanded Portland's Urban Growth Boundary to include West Hayden Island. In conjunction with the Urban Growth Boundary expansion, Multnomah County re-designated West Hayden Island from "Multiple Use Forestry" to "Future Urban" within the Multnomah County Framework Plan. The impetus for both actions was to provide a future site for waterfront industrial and marine terminal uses. The Multnomah County adopting ordinance also stated that future use of West Hayden Island is anticipated to be marine industrial. An important element in the County analysis was the finding that additional waterfront acreage was needed within the Urban Growth Boundary to meet the forecasted demand for marine terminal uses. That analysis also found that natural resources located on West Hayden Island are significant enough to warrant some level of protection.

Title 3 – Water Quality, Flood Management and Fish and Wildlife Conservation

Title 3, *Water Quality, Flood Management, and Fish and Wildlife Conservation* was established to protect the region's health and public safety by reducing flood and landslide hazards, controlling soil erosion and reducing pollution of the region's waterways. Title 3 also calls for fish and wildlife conservation through a separate title (see Title 13 below). Title 3 has been acknowledged by the Oregon Department of Land Conservation and Development as in compliance with the associated elements of Goal 6 and the portions of Goal 7.

Title 3 established and mapped Water Quality Resource Areas (WQRA) along rivers, streams, and wetlands, and established performance standards to prevent encroachment into vegetated corridors along these water bodies and protect water quality. The WQRA width varies depending on the slope of the land adjacent to the water body. The WQRA width is 50 feet generally, and 200 feet where slopes exceed 25 percent. The performance standards limit encroachment, require erosion and sediment control, require planting of native vegetation on the stream banks when new development occurs, and prohibit the storage of new uses of uncontained hazardous material in water quality areas.

Title 3 also established and mapped Flood Hazard Management Areas and requirements, including a regional requirement to balance cut and fill in areas identified on *Title 3* maps. Metro exempted much of WHI from Title 3, recognizing the Urban Growth Boundary expansion that brought in WHI for future marine industrial uses (Map 2).

In 2002, Metro deemed the City of Portland in compliance with the flood hazard and erosion control requirements of Title 3. Compliance was based primarily on the establishment of new erosion control regulations (Title 10 Erosion Control) and flood hazard requirements in Title 24, Buildings Regulations. In September 2002, the City of Portland submitted to Metro a detailed report titled the *Title 3 Water Quality Compliance Report.* The report explains how the City complies with Title 3 requirements through the existing environmental overlay zoning program and the Willamette Greenway water quality overlay zone, along with other City programs such as the stormwater management program. Metro found the City in substantial compliance with Title 3 in December 2002**.**

Future development on WHI would need to comply with portions of city Title 24 including providing flood protection by bringing the elevation specified areas to one foot above the base flood elevation. Balanced cut and fill would not be required for much of WHI. However, future development actions would require a "No Rise Analysis" for floodway work such as new docks, piling or riverbank stabilization before permits are issued.

Title 4 – Industrial and Other Employment Areas

In support of *Urban Growth Management Functional Plan* goals for a strong economic climate, Title 4 seeks to provide and protect a supply of sites by limiting the types and scale of non-industrial uses in Regionally Significant Industrial Areas (RSIAs), Industrial Areas and Employment Areas. RSIAs are located near the region's most significant transportation facilities for the movement of freight and other areas most suitable for movement and storage of goods. WHI and the industrial and employment lands within the WHI study area are RSIAs as they are located near the Columbia River, Portland International Airport, I-205, I-84 and rail corridors.

Title 4 also seeks to provide the benefits of "clustering" to those industries that operate more productively and efficiently in proximity to one another than in dispersed locations. Title 4 further seeks to protect the capacity and efficiency of the region's transportation system for the movement of goods and services, and to encourage the location of other types of employment in Centers, Employment Areas, Corridors, Main Streets and Station Communities.

Title 13 - Nature in Neighborhoods

Title 13, adopted by the Metro Council in September 2005, establishes the Nature in Neighborhoods program to protect, conserve and restore significant riparian corridors and wildlife habitat. Title 13 was acknowledged by the Land Conservation and Development Commission as complying with specified portions of Goals 5 (riparian corridors and wildlife habitat) and 6 (water quality) in January 2007. Local jurisdictions are required to comply with Title 13 and in doing so comply with Goal 5.

Summarized from Metro Title 13, the general intent of the program is to:

- Protect, conserve and restore a continuously viable stream corridor system, in a manner that is integrated with upland wildlife habitat and the urban landscape; and,
- Control and prevent water pollution for the protection of public health and safety, and to maintain and improve water quality throughout the region.

As stated in Title 13, the program is also intended to:

- Achieve its purpose through conservation, protection and restoration of fish and wildlife habitat using voluntary and incentive-based, educational and regulatory components;

- Balance and integrate goals of protecting and restoring habitat with regional goals for livable communities, a strong economy, preventing pollution, and compliance with federal laws including the Clean Water Act and Endangered Species Act;
- Include provisions to monitor and evaluate program performance over time, including meeting program objectives and targets, and local compliance; and,
- Establish minimum requirements and is not intended to repeal or replace existing local resource protections, nor is it intended to prohibit cities and counties from adopting or enforcing fish and wildlife habitat protection and restoration programs that exceed the requirements of this title.

Metro completed the required process to comply with State Land Use Planning Goal 5 in developing the Nature in Neighborhoods program. First, Metro developed an inventory of regionally significant riparian corridors and wildlife habitat in based on a scientific assessment of functional values (initial Metro Council endorsement in August 2002). In developing the inventory Metro produced technical reports, GIS data and models, and maps of showing natural resource features and relative quality ranks. Metro then completed an ESEE analysis to assess the tradeoffs of protecting or not protecting the resources identified in the inventory.

In the conclusions of the ESEE analysis for Title 13, Metro acknowledged the important role of regulatory and non-regulatory measures to protect important natural resources in the region. Metro allows local jurisdictions to establish or rely on existing comprehensive plans and ordinances, or adopt the Title 13 model code to implement and achieve substantial compliance with Title 13. Metro allows reliance on alternative programs, including non-regulatory measures if these programs provide some level of certainty that they will meet the intent and requirements of Title 13State and federal regulations can complement local programs to implement the ESEE decisions. . Metro also pointed out that non-regulatory programs have not been successful in preventing the overall decline in regional ecosystem health. Non-regulatory tools have been most effective when used in conjunction with a regulatory program to protect important resources.

The Metro Council established the Title 13 through adoption of Ordinance NO. 05-1077C (September 2005) and as amended through Ordinance NO. 05-1097A (December 2005). Through this action the Metro Council adopted the inventory of regionally significant fish and wildlife habitat and its ESEE analysis as the basis for the Nature in Neighborhoods program.

Section 2 of this ordinance states: "...Based on Metro's ESEE analysis, Metro has determined to allow some conflicting uses and to limit some conflicting uses, but not to prohibit any conflicting uses." Metro's determination is reflected in tables 3-07-13a and 3-07-13b, which are contained in Title 13 (see Table 1). These tables illustrate Metro's decision to establish different levels of protection for significant fish and wildlife habitat based on habitat quality and urban development potential. Metro established High, Moderate and Low Habitat Conservation Areas that are to be protected through a tiered approach outlined in Title 13. "High" Habitat Conservation Areas were established where relatively high value riparian corridors and wildlife habitat coincide with areas of low urban development potential. "Low" Habitat Conservation Areas are areas of relatively low value resources coincide with areas of high urban development potential.

For land within Metro's Urban Growth Boundary at the time Title 13 was adopted, Habitat Conservation Areas were established only in conjunction with Class I and Class II riparian corridors/wildlife habitat identified in the regional inventory. Metro determined that development could be allowed in significant resource areas outside of the Class I and II riparian corridors/wildlife habitat, including upland wildlife habitat areas identified in the Title 13 inventory. For lands in Future Metro Urban Growth Boundary Expansion Areas, Habitat Conservation Areas were established for Class I and II riparian/wildlife habitat and Class A and Class B upland wildlife habitat. For lands in Future Metro Urban Growth Boundary Expansion Areas, Habitat Conservation Areas were established for Class I and II riparian/wildlife habitat and Class A and Class B upland wildlife habitat.

WHI was brought into the Metro UGB prior to enactment of Title 13. Metro's regional inventory designated WHI Habitat of Concern and a Class I Riparian/Wildlife Area. WHI is also an important

industrial and designated a Regional Significant Industrial Area (Title 4). Metro's ESEE decision was to *limit* conflicting uses at WHI and Metro designated WHI a Moderate Habitat Conservation Area.

Metro describes that a decision to limit conflicting uses "strikes a balance between completely developing the Goal 5 riparian and upland wildlife resources and protecting them." Limiting conflicting uses in this way provides opportunities to develop lands in ways that minimize negative environmental and economic tradeoffs.... The economic tradeoffs for this alternative depend on the degree of limitation on development actions: lightly limit, moderately limit, or strictly limit.... The limit scenario will generate a more equitable distribution of positive and negative economic tradeoffs.... Development interests and the resources will both experience positive and negative economic tradeoffs." *(Appendix C, Economic Report and Literature Review, Ord. No. 05-1077C, Attachment 3 to Exhibit F)*

Table 1 was adopted by Metro to guide cities and counties in updating habitat conservation areas within their jurisdictions, and illustrates generally how Metro designated the Title 13 Habitat Conservation Areas.

Table 1: Title 13 Method for Identifying Habitat Conservation Areas ("HCA")

Table 3.07-13a: Method for Identifying HCA

Fish and wildlife habitat classification	***High Urban development value[1]***	***Medium Urban development value[2]***	***Low Urban development value[3]***	***Other areas: Parks and Open Spaces, no design types outside UGB***
Class I Riparian/Wildlife	Moderate HCA	High HCA	High HCA	High HCA/ High HCA+[4]
Class II Riparian/Wildlife	Low HCA	Low HCA	Moderate HCA	Moderate HCA/ High HCA+[4]
Class A Upland Wildlife	No HCA	No HCA	No HCA	No HCA/ High HCA[5]/ High HCA+[4]
Class B Upland Wildlife	No HCA	No HCA	No HCA	No HCA/ High HCA[5]/ High HCA+[4]

Note: The default urban development value of property is as depicted on the Metro Habitat Urban Development Value Map (Title 13 Exhibit C). The Metro 2040 Design Type designations provided in the following footnotes are only for use when a city or county is determining whether to make an adjustment pursuant to Section 4(e)(5) of Title 13.

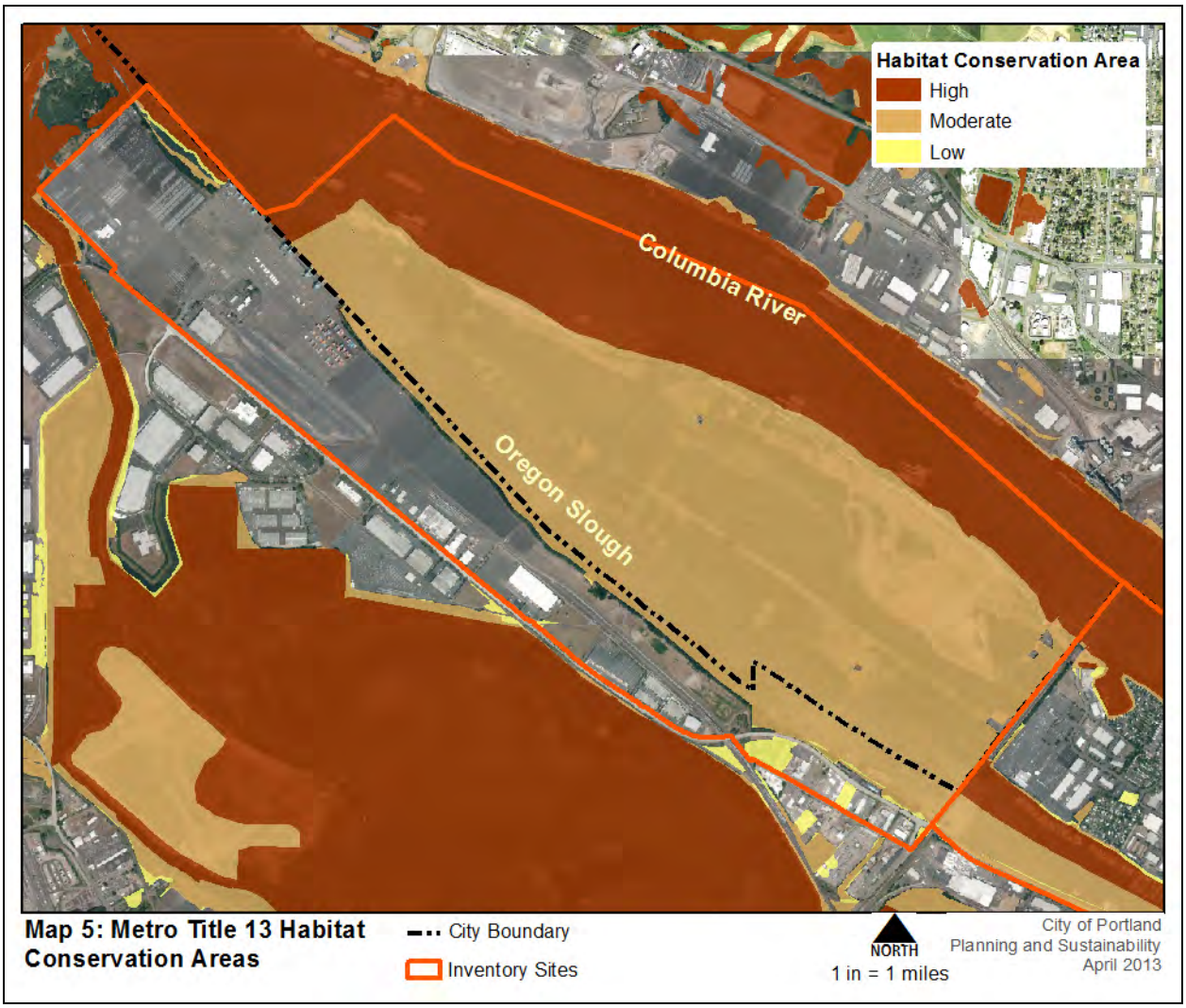
1 – Primary 2040 design types: Regional Centers, Central City, Town Centers, and Regionally Significant Industrial Areas

2 – Secondary 2040 design types: Main Streets, Station Communities, Other Industrial Areas and Employment Centers

3 – Tertiary 2040 design types: Inner and Outer Neighborhoods, Corridors

4 – Cities and counties shall give Class I and II riparian habitat and Class A and B upland wildlife habitat in parks designated as natural areas even greater protection than that afforded to High HCA, as provided in Section 4(A)(5) of Title 13.

5 – All Class A and B upland wildlife habitat in publicly-owned parks and open spaces, except for parks and open spaces where the acquiring agency clearly identified that it was acquiring the property to develop it for active recreational uses, shall be considered High HCA.



Title 13 requires the cities and counties within Metro's jurisdiction to develop comprehensive plans and implementing ordinances that:

- Contain clear and objective, non-discretionary standards to protect Habitat Conservation Areas. Standards are to limit development more strictly in High Habitat Conservation areas than in Moderate or Low Habitat Conservation areas where increasing levels of development would be allowed. Habitat-friendly development practices (presented in Table 13-07- 13c) area are intended to minimize the impacts of development on significant resources shall be allowed.

- Discretionary development approval standards that would be applied through a review process for development that cannot meet the non-discretionary standards. The discretionary standards are to "require a level of protection or enhancement of, the fish and wildlife habitat that meets or exceeds the level of protection provided by the non-discretionary standards." Title 13 directs local jurisdictions to develop a discretionary process to ensure that impacts on Habitat Conservation Areas are first avoided then minimized to the extent practicable, and requires unavoidable adverse impacts to be mitigated. Cities and counties are directed to take into consideration whether a resource area is a High, Medium or Low Habitat Conservation Area in evaluating whether a proposed project alternative has avoided or minimized impacts to the extent practicable.

Local jurisdictions may also establish Title 13 compliance programs for specific areas called "District Plans". Title 13 Section 3.B.4.a allows cities to adopt one or more district plans to portions of the city that demonstrate that the existing or amended comprehensive plan or new implementing ordinance substantially comply with the performance standards and best management practices of Title 13 and that the city's adopted maps substantially comply with the Metro Habitat Conservation Areas.

Title 13 requires that a District Plan be developed for West Hayden Island. Section 3.B.4.b states:

*The City of Portland shall develop a District Plan that complies with section 3.B.4.a, in cooperation with the Portland of Portland, that applies to West Hayden Island.*The City is following the State Land Use Goal 5 steps to supplement and update Metro's natural resource inventory and ESEE analysis. Through this analysis the City's will further hone the limit decision that Metro applied to WHI. The products of this work will inform the local decisions regarding annexation of WHI into the city, and the preparation of a plan district that is intended to meet the intent and requirements for a Title 13 District Plan.

Through the ESEE analysis Metro considered the trade-offs of allowing, limiting or prohibiting conflicting uses from a regional perspective. Metro noted that some of the tradeoffs may be different when considering local concerns and priorities, and that Metro's decision "may not address the needs of a city to provide jobs or housing...or to protect locally significant resources." As such, Title 13 is expressly intended to provide a minimum regional baseline level of protection for significant resources:

> *This program:*
> *D. Establishes minimum requirements and is not intended to repeal or replace existing requirements of city and county comprehensive plans and implementing ordinances to the extent those requirements already meet the minimum requirements of this title, nor is it intended to prohibit cities and counties from adopting and enforcing fish and wildlife habitat protection and restoration programs that exceed the requirements of this title.*

Title 13 recognizes and sanctions upland resource protection through local Goal 5 protection programs that were already in effect at the time Title 13 was adopted, The title states: "A city or county that prior to the effective date of this title, adopted any comprehensive plan amendments or land use regulations that (a) apply to areas identified as upland wildlife habitat on the Inventory Map but not identified as riparian habitat on the Inventory Map, (b) limit development in order to protect fish or wildlife habitat, and (c) were adopted in compliance with division 23 of OAR 660, shall not repeal such amendments or regulations, nor shall it amend such provisions that would allow any more than a de minimus increase in the amount of development that could occur in areas identified as upland wildlife habitat..." This is applicable to the portions of the study area that are already within the city limits, including Port Terminal 6, and presumably to the Multnomah County program as it applies to West Hayden Island.

The WHI project plan is being developed under the auspices of the Title 13 provisions. The City is following the State Land Use Goal 5 steps to update and refine Metro's natural resource inventory and regional ESEE analysis to inform the local decision regarding annexation of WHI into the city and the preparation of a plan district. Through this analysis the City's will further hone the limit decision that Metro applied to all of WHI.

2.d Regional and City Transportation Plans

Regional Transportation Plan

Last updated by Metro in 2010, the *Regional Transportation Plan* (RTP) is a 20-year blueprint to ensure adequate transportation capacity throughout the region as it grows. A key goal of the RTP is to support

revitalization and job creation in downtowns, main streets and employment areas. In industrial and employment areas, the RTP emphasizes providing critical freight access to the interstate highway system. Providing new street connections to support industrial area access and commercial delivery activities will help current and emerging industrial areas remain competitive.

RTP Policy 15, Regional Freight System, includes language addressing ports. Objective D is to "work with the private sector, local jurisdictions, Oregon Department of Transportation and other public agencies to: develop the regional Intermodal Management System and Congestion Management System, including maximizing use of ship, rail, air and truck for a multi-modal freight system." (note, I'm not finding anything relating to a RTP set of policies, or a policy referring to the Regional Freight System in the adopted document. Since I'm no expert, I will defer to the person who wrote this, but I wonder if this is from an older or summary document. (The adopted plan is 492 pages)

WHI is located adjacent to Mobility Corridor #1 in the RTP. This corridor is part of the West Coast Trade Corridor and provides access to the intermodal Albina rail yard, Portland Harbor marine terminals and serving rail and highway access to river-dependent industrial uses.

City Transportation System Plan

Portland adopted a Transportation System Plan (TSP) 2002 (amended 2007 and 2011) and incorporated it into Goal 6 of the City's Comprehensive Plan. The TSP is the long-range plan to guide transportation investments in Portland. Policy 6.35 North Transportation District addresses lands adjacent to the WHI study area. The North District policy is to reinforce neighborhood livability and commercial activity by planning and investing in a multimodal transportation network, relieving traffic congestion through measures that reduce transportation demand, and routing non-local and industrial traffic along the edge of the residential area. Objectives include:

A. Improve truck and freight movement in North Portland through changes to the street system, street classifications, and signing to enhance the economic vitality of the area and minimize impacts on residential, commercial, and recreational areas. .

B. Support efficient functioning of the N Marine Drive / N Lombard (west of N Philadelphia)/ N Columbia Boulevard loop as the truck and commuter access to the Rivergate industrial area and adjacent industrial areas.

F. Support improvements to transit service that will link North Portland to areas outside the downtown, especially to the Rose Quarter transit center and industrial areas within and outside the district.

Regional Freight Plan 2035 and City Freight Master Plan

The *Regional Freight Plan* (RFP) is a 20-year plan to guide stewardship of the regions critical multimodal regional freight infrastructure and industrial land supply. The RFP is an element of the Regional Transportation Plan update.

RFP goals that relate to WHI include:

- Adequately fund and sustain investment in our multimodal freight transportation system to ensure that the region and its businesses stay economically competitive.
- Create first-rate multimodal freight networks that reduce delay, increase reliability, improve safety and provide choices.

- Integrate freight mobility and access needs in land use decisions to ensure the efficient use of prime industrial lands, protection of critical freight corridors and access for commercial delivery activities.
- Ensure that our multimodal freight transportation system supports the health of the economy and the environment.

The Portland Freight Master Plan provides a road map for managing freight movement and commercial delivery of goods and services in Portland. The Freight Master Plan objectives center around three main themes: mobility, livability, and healthy economy. The Freight Master Plan is the base document for the freight element of the City's TSP. It includes the following actions and on-going activities:

Mobility

- Identify a strategy for truck routes that serve the movement of over-dimensional loads throughout the City.
- Coordinate with the Columbia River Crossing Draft Environmental Impact Statement (DEIS) process on the evaluation of freight mobility issues in this segment of the I-5 Trade Corridor.
- Support other freight modes such as rail or short sea shipping as alternatives to moving freight by truck.

Livability

- Partner with railroad operators and ODOT to institute "Quiet Zones" to reduce train whistle noise and improve track safety.
- Support efforts to foster environmentally-friendly goods movement practices such as the use of cleaner fuels and the reduction of truck and train idling.

Healthy Economy

- Collaborate with agency partners on public investment strategies to stimulate economic development associated with freight movement and the industries that rely on the efficient movement of freight.
- Partner with the Portland Development Commission and Port of Portland to identify and implement transportation improvements that enhance marketability of industrial opportunity sites.

The Freight Master Plan also includes a list of Freight System Improvements and prioritizes them based upon their potential funding availability. Included in this list are improving the intersections at I-5 in the North Portland industrial areas, construction of the CRC, and improving the BNSF rail bridge across the river. Farther down the list of funding priority is the construction of the WHI bridge to the terminal.

2.e City of Portland Plans and Programs

The City of Portland has established policies and plans that address natural resources, industrial development and other topics relevant to this ESEE analysis. Key documents are summarized below:

City Council Resolution 36805

In July 2010 the Portland City Council passed Resolution 36805 directing the Bureau of Planning and Sustainability to develop a legislative proposal for the annexation of WHI. The resolution called for designating at least 500 acres as open space with emphasis on permanent protection and management for the benefit of the regional ecosystem. In addition, no more than 300 acres of land should have an industrial designation for future deep water marine terminal development. Council further specified that the deep water marine terminal footprint area, to the extent feasible, should be located over the existing dredge disposal site area. As part of this resolution, the Council directed staff to produce and coordinate several additional studies to help inform any future planning decision. Council asked staff to analyze the costs and benefits of developing part of the island, consider nature-based recreational opportunities, and assess livability impacts, such as traffic, noise, dust and light on neighboring properties.

Comprehensive Plan

The State of Oregon definition of a "comprehensive plan" is: a generalized, coordinated land use map and policy statement of the governing body of a local government that interrelates all functional and natural systems and activities relating to the use of lands, including but not limited to sewer and water systems, transportation systems, educational facilities, recreational facilities, and natural resources and air and water quality management programs."

Portland's *Comprehensive Plan Goals and Policies* (2006) is the current adopted land use plan for the City of Portland includes a set of goals, policies, and objectives that apply to the entire city. The first Comprehensive Plan was adopted in 1980 and contained 12 goals (a City School Policy was adopted in 1979). Since then many of the goals have been amended.

The City is currently completing periodic review and update of the Comprehensive Plan. However, in the meantime, all 12 goals of the current Comprehensive Plan pertain to the *West Hayden Plan Project and* must be considered when evaluating the tradeoffs of different natural resource program choices for the WHI area. The Comprehensive Plan goals are:

Goal 1: Metropolitan Coordination
Goal 2: Urban Development
Goal 3: Neighborhoods
Goal 4: Housing
Goal 5: Economic Development
Goal 6: Transportation
Goal 7: Energy
Goal 8: Environment
Goal 9: Citizen Involvement
Goal 10: Plan Review and Administration
Goal 11: Public Facilities
Goal 12: Urban Design

Below are summaries of the Comprehensive Plan and objectives that pertain most directly to the *West Hayden Island Natural Resources Inventory* and *ESEE Analysis*:

Goal 2 – Urban Development: Maintain Portland's role as the major regional employment, population and cultural center through public policies that encourage expanded opportunity for housing and jobs, while retaining the character of established residential neighborhoods and business centers.

Key policies of Goal 2 include:

- *Open Space* - Provide opportunities for recreation and visual relief by preserving Portland's parks, golf courses, trails, parkways and cemeteries. Establish a loop trail that encircles the city, and promote the recreational use of the city's rivers, creeks, lakes and sloughs.

- *Industrial Sanctuaries* - Provide industrial sanctuaries. Encourage the growth of industrial activities in the city by preserving industrial land primarily for manufacturing purposes.

- *Utilization of Vacant Land* - Provide for full utilization of existing vacant land except in those areas designated as open space.

Goal 5 – Economic Development: Foster a strong and diverse economy which provides a full range of employment and economic choices for individuals and families in all parts of the City.

Key policies of Goal 5 include:

- *Business Development* – Sustain and support business development activities to retain, expand, and recruit businesses. Under this policy, some particularly relevant objectives include:
  - Develop incentives for businesses to locate and stay in Council-designated target areas...
  - Incorporate economic considerations in long-range planning activities undertaken by the Bureau of Planning.

- *Transportation System* – Promote a multi-modal regional transportation system that stimulates and supports long term economic development and business investment.

- *Infrastructure Development* – Promote public and private investments in public infrastructure to foster economic development in Council-designated areas.

- *Diversity and Identity in Industrial Areas* – Promote a variety of efficient, safe and attractive industrial sanctuary and mixed employment areas in Portland. Under this policy, particularly relevant objectives include:
  - Recognize and promote the variety of industrial areas in Portland through development regulations which reflect the varied physical characteristics of the city's industrial areas.
  - For activities which tend to have substantial off-site impacts or demands on public services, limit the zones where they are permitted outright and require additional reviews where they may be appropriate.

- *Protection of Non-Industrial Lands* – Protect non-industrial lands from the potential adverse impacts of industrial activities and development. Under this policy, particularly relevant objectives include:
  - Where possible, use major natural or made- made features as boundaries and buffers for industrial areas.
  - When industrial zoned lands abut residential zoned lands, and there are no natural boundaries, apply special buffer overlay zone provisions to ensure that development is compatible.

Goal 6 – Transportation: Develop a balanced, equitable, and efficient transportation system that provides a range of transportation choices; reinforces the livability of neighborhoods; supports a strong and diverse economy; reduces air, noise, and water pollution; and lessens reliance on the automobile while maintaining accessibility.

A key policy of Goal 6 is:

- *Multimodal Freight System* – Develop and maintain a multimodal freight transportation system for the safe, reliable and efficient movement of freight, within and through the City.
  - Address freight access and mobility needs when conducting multimodal transportation studies or designing transportation facilities.
  - Work with community stakeholders to minimize adverse impacts of freight activity on the environment and residential and mixed-use neighborhoods.

Goal 8 – Environment: Maintain and improve the quality of Portland's air, water and land resources and protect neighborhoods and business centers from detrimental noise pollution.

Key policies of Goal 8 include:

- *Wetlands/Riparian/Water Bodies Protection* - Conserve significant wetlands, riparian areas, and water bodies which have significant functions and values related to flood protection, sediment and erosion control, water quality, groundwater recharge and discharge, education, vegetation, and fish and wildlife habitat. Regulate development within significant water bodies, riparian areas, and wetlands to retain their important functions and values.
  - Create wetland/water body buffers through the designation and protection of transition areas between the resource and other urban development and activities. Restrict non-water dependent or non-water related development within the riparian area.

- *Uplands Protection* - Conserve significant upland areas and values related to wildlife, aesthetics and visual appearance, views and sites, slope protection, and groundwater recharge.
  - Encourage increased vegetation, additional wildlife habitat areas, and expansion and enhancement of undeveloped spaces in a manner beneficial to the city and compatible with the character of surrounding urban development.
  - Protect slopes from erosion and landslides through the retention and use of vegetation, building code regulations, erosion control measures during construction, and other means.
  - Conserve and enhance drainageways and linear parkways which have value as wildlife corridors connecting parks, open spaces, and other large wildlife habitat areas, and to increase the variety and quantity of desirable wildlife throughout urban areas.

- *Wildlife* – Conserve significant areas and encourage the creation of new areas which increase the variety and quantity of fish and wildlife throughout the urban area in a manner compatible with other urban development and activities.

- *Mitigation* – Where adverse impacts cannot be practicably avoided, require mitigation or other means of preservation of important natural resource values. The following order of location and resource preference applies to mitigation:
  - On the site of the resource subject to impact, with the same kind of resource;
  - Off-site, with the same kind of resource;
  - On-site, with a different kind of resource;
  - Off-site, with a different kind of resource.

- *Noise* – Reduce and prevent excessive noise and vibration in attached residential dwelling through construction requirements. Reduce and prevent excessive noise levels from one use which may impact another use through on-going noise monitoring and enforcement procedures.

- *Portland International Airport Noise Impact Area* – Ensure compatible land use designations and development within the noise impacted area of the Portland International Airport while providing

public notice of the level of aircraft noise and mitigating the potential impact of that noise within the area.

- *Intergovernmental Coordination* – Notify and coordinate programs with affected local, state and federal regulatory agencies of development proposal within natural areas

Portland Plan

The Portland Plan is a collaborative blueprint to engage the Bureau of Planning and Sustainability, other city bureaus and public agencies in a citywide plan for the next 25 years. The plan is intended to be strategic, practical and measurable, focusing on a series of long range objectives, 5-year actions and measures of success.

The Portland Plan focuses on a set of three strategies, contained within an overall framework of equity. The three strategies are:

- Thriving Educated Youth
- Economic Prosperity and Affordability
- Healthy Connected City

Equity Framework – All of the strategies should be informed by the objectives provided within the Equity Framework, and are intended to ensure that all Portlanders have equal access to jobs, education and the benefits of growth and that impacts are shared among populations.

The following objectives, policies and actions should be considered through this the ESEE analysis.

Thriving Educated Youth

The primary goal of this strategy is to ensure that all youth (ages 0-25) of all cultures, ethnicities, abilities and economic backgrounds (0-25 years) have the necessary support and opportunities to thrive – both as individuals and as contributors to a healthy community and prosperous, sustainable economy. Several of the 2035 objectives focus on healthy neighborhoods, wellness, and safe, productive learning environments. Policies under this strategy call for public investment in community infrastructure to reduce disparities faced by youth of color, families in poverty, youth with disabilities, and others at risk of not graduating from high school. Policies call for budget decisions to support local school districts' major capital investments and projects that leverage limited capital funding available for schools within the city.

Economic Prosperity and Affordability

The goal of this strategy is to expand economic opportunities to support a socially and economically diverse population by prioritizing business growth, a robust and resilient regional economy and broadly accessible household prosperity. 2035 objectives include.

1. *Grow exports:* The metropolitan area rises into the top ten nationally in export income, and jobs in the city's target clusters grow at rates that exceed the national average.
2. *Public and private urban innovation:* Portland grows as a national leader in sustainable business and new technologies that foster innovation and adaptation to change, spur invention, and attract and develop talent. Portland strives to produce the 'next generation urban places and systems that foster creativity and invention.
3. *Trade and freight hub:* Portland retains its competitive market access as a West Coast trade gateway, as reflected by growth in the value of international trade.
4. *Grow number of jobs:* Portland contains 27 percent of the region's new jobs and continues to serve as the largest job center in Oregon. Portland is home to over 515,000 jobs, providing a robust job base for Portlanders.

Strategic Element 1 Regional Traded Sector Business Growth applicable guiding policies are:

- Focus Portland's limited strategic business development resources on enhancing the competitiveness of businesses in its target cluster industries.

- Integrate traded sector competitiveness into the city's planning and overall policy directions, with focus on export growth.

Strategic Element 2 Public and private urban innovation applicable guiding policy is: Continue to innovate in public projects related to transportation and environmental services including innovative green infrastructure approaches as part of cleaning up the Willamette River; an innovative active transportation system (transit, walking, biking, car and bike sharing, etc.); and urban parks and natural areas, which enhance the livability of the city and give Portland a competitive advantage in retaining and attracting an educated, productive workforce.

Strategic Element 3 Trade and Freight Hub applicable guiding policies are:

- Prioritize freight movement over single-occupancy vehicle travel on truck routes. Increase the share of our limited transportation system capacity to freight movement.
- Leverage more regional, state, port and private resources to make strategic investments in Portland's multi-modal freight hub infrastructure (truck, rail, airport and harbor facilities).
- Build on Portland's 2006 Freight Master Plan to better integrate freight mobility, including the "last mile" aspects of freight delivery, into land use, neighborhood, environmental and sustainability planning.
- Apply best practices that help reduce energy consumption related to freight movement and help carriers and shippers achieve optimal efficiency.

Strategic Element 4 Growing Employment Districts applicable guiding policies are:

- Provide land supply and development capacity to meet job growth targets, and improve the cost competitiveness of redevelopment and brownfields.
- Institute a means to consider economic as well as environmental and social metrics in making land use, program and investment decisions.
- Better link freight transportation and other quality, reliable infrastructure investments with economic health and job growth opportunities in employment districts.

Healthy Connected City of Portland

The goal of this strategy is to improve human and environmental health by creating safe and complete neighborhood centers, linked by a network of city greenways that connect Portlanders with each other, encourage active transportation, integrate nature into neighborhoods, enhance watershed health and provide access to services and destinations, locally and across the city. 2035 objectives include:

- *Carbon emissions and climate change:* Portland's transportation-related carbon emissions are 50 percent below 1990 levels, and effective strategies to adapt to climate change are in place and being implemented.
- *Parks and nature in the city:* All Portlanders can conveniently get to the Willamette and Columbia Rivers and are within a half-mile safe walking distance of a park or greenspace. The regional trail system is substantially complete and is an integrated component of a Healthy Connected City network.
- *Watershed health:* Watershed health is improved. The Willamette River and local streams meet water quality standards. Tree canopy covers at least one-third of the city and is more equitably distributed. Fewer homes and businesses are at risk from flooding. A diversity of critical habitats (including floodplains, riparian areas, wetlands, oak groves, native forests and remnant native meadows) are protected, connected and enhanced to support a rich diversity of native and migratory wildlife.
- *Quality public infrastructure:* By 2035, all Portlanders have safe and reliable transportation choices, water, stormwater and sewer services at levels that benefit human and watershed health and safety, meet or exceed customer and regulatory standards, and are resilient to hazards or other disruptions. Sufficient resources are dedicated to maintain these assets, including green infrastructure.

Strategic Element 1 Public Decisions Benefit Human and Environmental Health and Safety applicable guiding policies are:

- Incorporate the principles of the Healthy Connected City into the City's Comprehensive Plan and use this to coordinate policy, land use, and investment decisions.
- Develop the Healthy Connected City network. For an illustration of the Healthy Connected City network.
- Continue to manage and invest in quality basic public services. These services include public safety, emergency services, transportation and transit, drinking water, sewer, stormwater and green infrastructure, parks and natural areas and civic buildings.
- Improve human and environment health in making decisions regarding growth, urban design and the design of improvements. Include consideration of impacts on community health, safety and equity outcomes as well as ecological and watershed health risks.
- Reduce the risk of social, economic and environmental losses from hazards and ensure effective emergency and disaster response. Do this through investments in environmental protection, asset management and community preparedness and maintenance of critical infrastructure, including emergency routes and water supply.
- Encourage design and development that improves public healthy and safety. This includes design that supports active living and healthy housing, better fire safety and prevention, crime prevention through environmental design and hazard mitigation and adaptation.
- Preserve the distinctive characteristics and history of Portland's neighborhoods and districts in making decisions regarding growth, urban design and the design of improvements.
- Mitigate the impact of change on economic diversity and established communities. Where public actions pose the risk of forced displacement of existing low-income residents, engage all residents in planning for changes that may affect their communities and neighborhoods, and utilize investments, incentives and other policy tools to minimize or mitigate involuntary displacement resulting from new development.
- Support and enhance programs that encourage recreation and physical activity, healthy eating, active transportation, conservation and community safety and resiliency.
- Strengthen collaboration between public agencies and health partners.

Strategic Element 3 Connections for people, places, water and wildlife applicable guiding policies are:

- Develop the network of habitat connections, neighborhood greenways and plan for civic corridors as a spine of Portland's civic, transportation and green infrastructure systems to enhance safety, livability and watershed health, to catalyze private investment and support livability.
- Preserve and restore habitat connections and tree canopy to link stream and river corridors, landslide-prone areas, floodplains, wetlands and critical habitat sites into a system of habitat corridors that provides connections for wildlife, supports biodiversity, improves water quality, reduces risks due to flooding and landslides and supports Portland's adaptation to climate change.

River Renaissance Vision and Strategy

River Renaissance coordinates the city's river-related work, engages the public, and connects community partners to create innovative urban solutions. River Renaissance was launched in the fall of 2000, with a series of interactive workshops that resulted in a community vision for a revitalized Willamette River. The Portland City Council endorsed the *River Renaissance Vision* in March 2001. While *the River Renaissance Vision* is specific to the Willamette River, and also addresses its tributaries, the policies represent the City's intention to focus on watershed health within Portland, as well as a prosperous working harbor. The policies are relevant to the Columbia River because Portland borders both rivers, many fish and wildlife use both rivers, and both Terminal 6 and potentially West Hayden Island are part of the Portland Harbor.

The Vision includes integral themes that are applicable to the Columbia River:

- Clean and Healthy River – Work with communities and government agencies throughout the watershed to advance and coordinate watershed protection, restoration, and cleanup actions that are critical to ensuring a functioning urban ecosystem. Manage watershed health and urban uses in a manner that is mutually supportive.
  - Improve water quality in the river and tributaries through innovative stormwater management and control of sewage flows to the river.
  - Encourage environmentally-friendly building techniques and designs to use resources efficiently and minimize adverse impacts.
  - Do our part to recover wild native salmon populations in the river and its tributaries.
  - Restore and protect streamside habitat and floodplain areas. Plant native vegetation and control invasive species along waterways and throughout the watershed.
  - Advance our scientific knowledge of clean and healthy river systems and their restoration in an urban environment.

- Prosperous Working Harbor – Promote Portland as a hub for ship, barge, railroad, highway, and air transportation and as a Pacific Northwest gateway to the changing global marketplace.
  - Provide efficient and economical freight movement for the region's industries and commerce.
  - Invest in the harbor's industrial districts; a cornerstone of our regional economy.
  - Explore and adopt new technologies, designs, and industrial practices that support habitat restoration and the improvement of water quality.
  - Integrate regional freight-transportation and industrial objectives into river protection and enhancement activities.
  - Promote Portland as a leader in sustainable business.
  - Consider the needs of, and impacts on, the working harbor as we plan for river protection and enhancement.

To advance the *Vision*, a collaborative team of eight city bureaus and community partners produced the *River Renaissance Strategy* which established policy guidance, progress measures, and a set of actions for the city's river-related activities. The Strategy was adopted by the City Council in December 2004.

Portland Watershed Management Plan

In December 2005, City Council adopted the Portland Watershed Management Plan. The Watershed Plan describes the approach that will be used to evaluate conditions in the City's urban watersheds and implement projects to improve watershed health. Four city-wide watershed health goals were adopted through the Watershed Plan:

- Hydrology: Move toward normative* stream flow conditions to protect and improve watershed and stream health, channel functions, and public health and safety.
- Physical Habitat: Protect, enhance, and restore aquatic and terrestrial habitat conditions and support key ecological functions and improved productivity, diversity, capacity, and distribution of native fish and wildlife populations and biological communities.
- Water Quality: Protect and improve surface water and groundwater quality to protect public health and support native fish and wildlife populations and biological communities.
- Biological Communities: Protect, enhance, manage and restore native aquatic and terrestrial species and biological communities to improve and maintain biodiversity in Portland's watersheds.

A list of actions is presented in the Watershed Plan that includes updating the city natural resources inventory and to protect sites and features with high watershed values and functions. The *Hayden Island Natural Resources Inventory*, this report and the Airport Plan District advance the goals and actions of the Watershed Plan.

Climate Action Plan

In 1993, Portland became the first local government in the U.S. to adopt a plan to address global warming. In 2001, Multnomah County joined the City of Portland in adopting a revised plan, the Local Action Plan on Global Warming. In late 2009, the City and County adopted the third-generation local strategy on global warming, the Climate Action Plan.

The Climate Action Plan identifies objectives and actions in several topical areas to put Portland and Multnomah County on a path to reduce carbon emissions by 80 percent from 1990 levels by 2050. The Climate Action Plan also establishes an interim goal of a 40 percent reduction in local carbon emissions by 2030. As of 2010, total local carbon emissions have fallen to six percent below 1990 levels, even with rapid population growth (per capita emissions in 2010 were 26 percent below 1990 levels).

Selected key objectives in the Climate Action Plan that are most relevant to the WHI study area include the following 2030 Objectives:

Buildings and Energy

a) Achieve zero net greenhouse gas emissions in all new buildings and homes.
b) Ensure that new buildings and major remodels can adapt to the changing climate.
c) Produce 10 percent of the total energy used within Multnomah County from on-site renewable sources and clean district energy systems.
d) Reduce the total energy use of all buildings built before 2010 by 25 percent.

Urban Form and Mobility

a) Create vibrant neighborhoods where 90 percent of Portland residents and 80 percent of Multnomah County residents can easily walk or bicycle to meet all basic daily non-work needs and have safe pedestrian or bicycles access to transit.
b) Reduce per capita daily vehicle-miles traveled (VMT) by 30 percent from 2008 levels.
c) Improve the efficiency of freight movement within and through the Portland metropolitan area.
d) Increase the average fuel efficiency of passenger vehicles to 40 miles per gallon and improve the efficiency of the road system.
e) Reduce the lifecycle greenhouse gas emissions from transportation fuels by 20 percent.

Urban Forestry and Natural Systems

a) Expand the urban forest canopy to cover one-third of Portland, and at least 50 percent of total stream and river length in the city meet urban water temperature goals as an indicator of watershed health.

Community Engagement

a) Motivate all Multnomah County residents and businesses to change their behavior in ways that reduce carbon emissions.

Climate Change Preparation

a) Adapt successfully to a changing climate.

Urban Forestry Management Plan (UFMP)

Last updated in 2004, this plan provides direction for the maintenance and improvement of Portland's urban forest and makes recommendations to enhance and improve this valuable resource now and for the future. Specifically, it responds to recent environmental mandates, clarifies resource management and authority, and better coordinates the roles of different agencies and bureaus. The UFMP establishes canopy targets and following three main goals with associated objectives:

- Protect, preserve, restore and expand Portland urban forest
- Develop and maintain support for the urban forest

- Manage the urban forest to maximize benefits for all residents

To implement the UFMP, the *Urban Forest Action Plan* was developed by an inter-bureau committee to ensure attainment of the many goals and recommendations of the 2004 UFMP. The Action Plan recognizes the full array of benefits and services that trees provide across the urban landscape. The prioritized actions are those that can be done by City of Portland bureaus, although achieving all of the plan's goals will require participation from private organizations, individuals, and other public agencies. The Action Plan was accepted by City Council on March 14, 2007.

Title 11: Trees

In 2011 the Portland City Council approved a comprehensive regulatory framework for trees in the city. The new Title 11, Trees and revisions to the zoning code and other City titles will be implemented starting in February 2013. Title 11 establishes a standardized tree removal permit program and tree-related development standards. The updated tree rules will encourage preservation of large healthy trees and ensure that trees are routinely planted as new development takes place. Title 11 contains exemptions from tree preservation and planting standards in specified industrial, employment and commercial zones. The provisions of Title 11 will complement but not duplicate tree related requirements in the zoning code that apply to certain types of new development and trees in environmental resource areas.

Stormwater Management Manual (SWMM)

The *Stormwater Management Manual* (SWMM) is a technical document that outlines the City's stormwater management requirements to comply with the City's National Pollution Discharge Elimination System (NPDES) permit and the federal Safe Drinking Water Act. The SWMM was originally adopted in 1999 and last updated in 2010. The requirements defined in the manual apply to all development and redevelopment projects within the City of Portland on both private and public property. The SWMM applies to the following:

- Properties that proposed new offsite discharges or new connections to the public system; or
- Projects that develop or redevelop over 500 square feet of impervious area.

The City's approach to stormwater management emphasizes the use of vegetated surface facilities to treat and infiltrate stormwater on the property where the stormwater is created. This approach helps protect stormwater infrastructure and improve watershed health, including pollutant reduction, volume and peak flow reduction, and groundwater recharge. If an applicant cannot meet the onsite stormwater management the City may allow the applicant to construct an offsite facility or compensate the City for the future development of offsite facilities through payment of a fee. The applicant must request for City approval of "special circumstances" m before an alternative approach would be allowed.

The SWMM complements and supports the City's *Portland Watershed Management Plan*, *System Plan*, Revegetation Program, Sustainable Stormwater Program, and other City standards and practices.

Environmental Overlays and other Zoning Tools

The City of Portland employs a number of tools to meet its environmental goals and policies, including willing-seller land acquisition, revegetation projects, education and stewardship programs, and regulations, including zoning regulations established to meet Oregon Land Use requirements. Multiple bureaus are responsible for the City's environmental programs, including the Bureau's of Environmental Services, Parks and Recreation, Development Services, and Water Works.

The Bureau of Planning and Sustainability is responsible for creating and maintaining the City's zoning code provisions related to conservation and protection of natural resources. Environmental overlay zoning was first established in the City in 1989, primarily to comply with Goal 5, but also to comply with

Goals 6 and 7. The environmental overlay zones help protect and conserve natural resource features and the functions and values they provide. The application of environmental overlay zones to protect significant natural resources has occurred as the final step in the Goal 5 process. During the past 20 years, eleven Goal 5 processes have been completed for specific areas within the City and urbanizing portions of Multnomah and Clackamas counties:

- Columbia Corridor Industrial/Environmental Mapping Project (1989)
- Northwest Hills Protection Plan (1991)
- Southwest Hills Resource Protection Plan (1992)
- East Buttes, Terraces and Wetlands Conservation Plan (1993)
- Fanno Creek and Tributaries Conservation Plan (1994)
- Skyline West Conservation Plan (1994)
- Balch Creek Watershed Protection Plan (1995)
- Johnson Creek Basin Protection Plan (1991); Boring Lava Domes Supplement (1997)
- Columbia South Shore Natural Resources Protection Plan (2000)
- Natural, Scenic and Open Space Resources within Multnomah County Unincorporated Urban Areas (2002)
- Pleasant Valley Natural Resources Protection Plan (2004)
- Portland International Airport Plan District (2011)

Two types of environmental overlay zones are applied within the city: the environmental conservation overlay zone (c-zone) and the environmental protection overlay zone (p-zone).

> Within the c-zone, development is allowed if it meets standards or criteria to avoid adversely affecting natural resources where practicable. Mitigation is required for unavoidable impacts.
>
> Within the p-zone, only a narrow set of uses or development types are allowed under specific circumstances. Development that is necessary to provide access is allowed. If the public benefits provided by the proposed development are found to outweigh the impacts on natural resources, the development may be allowed with or without conditions. In either situation, mitigation for unavoidable impacts on natural resources is required.

In addition to environmental overlay zones, other zoning tools are used to conserve and protect natural resources. Plan Districts are area-specific zoning codes that may include provisions related to natural resource management. Comprehensive Natural Resources Plans (CNRPs) allow the establishment of a 10 year master plan type mechanisms to for larger sites within established resource overlay zones. These plans establish goals and provisions to specify allowed uses and development activities and guide natural resource protection, mitigation, and enhancement activities.

The Environmental Overlay Zone and other zoning tools are key components of the City's program to comply with Metro Titles 3 and 13, and are also a component of City strategies to comply with the stormwater, Total Maximum Daily Loads (TMDL) requirements of the Clean Water Act and the Endangered Species Act.

City of Portland Streamlining Agreement

The City of Portland has a signed agreement with federal agencies to participate in a shared and cooperative streamlining process for federal consultations. This streamlining agreement process was extended to state and local agencies in 2006 to ensure better coordination and communication between all permitting and consulting agencies.

A Streamlining Team consisting of all participating federal, state and local agencies was created along with standard operating protocols. These protocols are intended to promote the sharing of information needed for agencies to review the proposed activity. In addition to assisting City project teams, the

procedures are designed to improve coordination, communication, and consistent, timely decisions among the agencies.

The streamlining agreement is primarily designed to facilitate the permitting of city sponsored projects. In special circumstances, the process has been extended to private and other public entities when the City is a partner to a project, financially or otherwise.

Project managers that participate in the streamlining process must present a purpose and need statement and a range of alternatives to meet project goals, including looking for practicable alternatives with the least impacts to natural resources. The U.S. Army Corps of Engineers, Oregon Department of State Lands (DSL) and the Portland Bureau of Development Services (BDS) generally require analysis of options that first avoid and minimize and then mitigate for impacts through compensatory or in-kind functional replacement. If the preferred alternative would have unavoidable impacts on natural resources, mitigation requirements can also be identified early in the process.

Consultation with Indian Tribes

In addition to the Tribal consultation requirements discussed below in section 2.f, many governments and natural resource regulatory agencies have internal policies regarding consultation with interested Native American Tribes in the area. Examples include, but are not limited to State of Oregon, USACE, NMFS, USFWS, and EPA. The City of Portland recently adopted Resolution 39641 in July 2012 that formalized government relationships with Tribal Government Partners. The resolution directed the City to enter into intergovernmental agreements (IGA) or memorandums of understanding (MOU) with Tribal governments to support development and implementation of city programs and activities that respect and honor tribal treaty rights, federal-tribal trust responsibilities and the cultural heritages of native peoples. No IGAs or MOUs have been developed to date; however, city staff has coordinated with interested Tribes during the WHI planning effort.

2.f Federal Environmental Regulations

The City is required to address a number of federal environmental regulations, and does so through the broad array of program tools mentioned above. These federal regulations are taken into consideration though the course of the ESEE analysis.

Clean Water Act

The Water Pollution Control Act Amendments of 1972 and subsequent amendments, now known as the Clean Water Act (CWA), regulate discharges of pollutants to waters of the United States. The CWA calls for restoration and maintenance of the quality of the nation's water, where attainable, to promote a range of beneficial uses.

CWA Section 404 establishes a program to regulate the discharge of dredge and fill material into waters of the United States, including wetlands. Responsibility for administering and enforcing Section 404 is shared by the US Army Corps of Engineers (USACE) and Environmental Protection Agency (EPA).
Permit review and issuance follow a sequential process that encourages avoidance of impacts first, followed by minimizing impacts and, finally, requiring mitigation for unavoidable impacts to the aquatic environment. Common activities that take place in waters of the US and require a federal permit include:

- Excavation or dredging in waters of the US
- Channel changes, realignments or relocations;
- Construction of a dock, pier, wharf, seawall, boat ramp, intake or outfall structure;

- Placement of fill, riprap or similar material;
- Placing fill to construct levees, roadways and bridges; and
- Bank or shore stabilization projects including jetties and revetments.

The issuance of a 404 permit is a federal action that triggers consultation with National Marine Fisheries Services (NMFS) under the Endangered Species Act, tribal governments, US Fish and Wildlife Services USFWS) and historic preservation delegated to State Historic Preservation Office (SHPO).

Section 401 of the federal Clean Water Act (CWA) requires that any federal license or permit to conduct an activity that may result in a discharge to waters of the United States must first receive a water quality certification from the state in which the activity will occur. In Oregon, the Department of Environmental Quality (DEQ) is the agency responsible for reviewing proposed projects under this requirement.

A federal permit is required to conduct any activity, including but not limited to, the construction or operation of facilities which may result in any discharge into navigable waters. Federal permits that are most frequently subject to Section 401 water quality certification include CWA Section 402 (NPDES) permits issued by EPA, Section 404 (dredge and fill) permits issued by the USACE, and Rivers and Harbors Act (RHA) Section 9 and 10 permits issued by the USACE.

As authorized by the Clean Water Act, the NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters, including the Willamette River and its tributaries. There are different types of NPDES permits depending on the activity that results in a discharge.

The City of Portland manages stormwater discharge per the NPDES program in accordance with an NPDES permit and MS-4 permit issued by the Oregon DEQ.

Development on WHI would likely require a 404 and 401 permit. It would also require an updated to the Port's MS-4 permit. The Port of Portland maintains its own MS-4 Permit.

National Environmental Policy Act (NEPA)

In enacting NEPA, Congress recognized that nearly all federal activities affect the environment in some way and mandated that before federal agencies make decisions, they must consider the effects of their actions on the quality of the human environment. Under NEPA, the Council on Environmental Quality was established to work with agencies to balance environmental, economic, and social objectives in pursuit of NEPA's goal of "productive harmony" between humans and the human environment (42 U.S.C. §4331(a)). NEPA assigns CEQ the task of ensuring that federal agencies meet their obligations under the Act. CEQ NEPA regulations require an analysis of environmental impacts and, if necessary, identification of measures to avoid, minimize, rectify, reduce, or compensate for environmental impacts.

The NEPA analysis bears similarities with other federal agencies review requirements and can be used to inform review under the Endangered Species Act and National Historic Preservation Act, Executive Orders on Environmental Justice, and other Federal, State, tribal, and local laws and regulations.

The NEPA process begins when a federal agency proposes to take an action, which may include rule making, regulations, plans, funding or specific projects (40 C.F.R. § 1508.18). For example, Department of Transportation funding for a bridge or rail improvement is an action that would trigger the NEPA process. Another example is the USACE issuing a CWA 404 permit; this is an action that would trigger NEPA requirements.

Under NEPA, the agency determines whether the action is a Categorical Exclusion (CE) or if additional analysis is necessary. To perform an analysis, the applicant must identify the purpose and need of the action and alternatives that meet the purpose and needs. Through an Environmental Assessment (EA) or Environmental Impact Statement (EIS), the applicant identifies measures that will be taken to mitigate (avoid, minimize or compensate for) environmental impacts.

Development on WHI would likely require permits, such as the CWA Section 404 permit, which would trigger a NEPA analysis.

Endangered Species Act

NOAA National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) administer the Federal Endangered Species Act (ESA) to protect species that have are threatened or endangered and at risk of extinction. A number of listed species reside in the Columbia River or on WHI (WHI) on a year-round or seasonal basis.

NMFS administers the ESA for marine animals including salmonids and other ocean-migrating fish. The USFWS administers the ESA for wildlife, bird species and inland fish such as bull trout and coastal cutthroat trout. Several listed species, including salmon, trout, and eulachon are currently present in the Columbia River at and near WHI; additional species are proposed for federal listing.

Under Section 7 of the ESA, federal agencies must use their authorities to protect listed species and habitats that are critical to their survival. Section 7 also requires federal agencies to ensure that their actions, including any actions they authorize, fund or carry out, do not jeopardize listed species or destroy or adversely modify their critical habitat.

NMFS and USFWS designate "critical habitat" for species that are listed under the ESA. "Critical habitat" is the "specific areas within the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection." NMFS has designated critical habitat for most of the listed species that have been observed found or are likely to be present on WHI. For several species, critical habitat extends landward 300' from the top of bank, for others critical habitat stops at the top of bank. Although private entities are not required to protect critical habitat, federal agencies cannot destroy or adversely modify critical habitat. The critical habitat provisions would be triggered on WHI through the USACE issuance of a CWA 404 permit or federal transportation dollars being used for a bridge or marine terminal.

Section 9 of the ESA states that no one may "take" an animal that is listed as endangered. "Take" includes the harassment, harm, pursuit, hunting, shooting, wounding, killing, trapping, capture, or collection of any threatened or endangered species. "Harm" may include habitat modification that results in the death or injury of a listed species. This is referred to as a "take prohibition." For species listed as threatened, Section 4(d) of the ESA (referred to as the "4(d) rules") requires NMFS to issue rules that citizens, organizations and governments must follow in order to protect the species.

After the 1998 listing of steelhead trout as a Lower Columbia River Evolutionary Significant Unit (ESU) the City of Portland developed a comprehensive, coordinated citywide response that was adopted by City Council adoption (Resolution No. 35715). The City Council established an intent to avoid "take" of a listed species (i.e., harming individuals or populations or their habitat), and to assist with recovery of listed salmonids. The City has since taken actions to identify and prioritize City programs that could affect listed species, provide technical support to bureaus, provide oversight for activities involving federal permitting or funding, and develop a watershed management plan to help guide city actions. The City's existing environmental zoning program is one mechanism the City uses to reduce risk to ESA-listed species.

Magnuson-Stevens Act – Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act is the federal law that governs U.S. marine fisheries management. In 1996 Congress added new habitat conservation provisions to that act in recognition of the importance of fish habitat to productivity and sustainability of U.S. marine fisheries. The re-named Magnuson-Stevens Act mandated identification of Essential Fish Habitat for managed species. The act also requires measures to conserve and enhance the habitat needed by fish to carry out their life cycles.

Essential Fish Habitat (EFH) for the Pacific salmon means those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem. The definition for EFH includes currently viable aquatic habitat and most of the habitat historically accessible to Pacific Salmon.

A federal agency taking an action can use existing processes to support EFH consultations. For example, as part of ESA Section 7, NMFS and USFWS consult on the conservation of species and assist the agency taking an action to meet their responsibilities under Section 7. This serves as consultation for the Magnuson-Stevens Act on EFH. NMFS/USFWS would evaluate the effects of the action, determine jeopardy and adverse habitat modification and estimate incidental take and issues a take permit if necessary.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) implements various treaties and conventions between the U.S. and Canada, Japan, Mexico and the former Soviet Union for the protection of migratory birds. The MBTA protects more than 800 species of birds. Unless permitted, the Act provides that it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product. The Department of Interior enforces the act. Violations may be addressed through fines or imprisonment.

Portland joined four other U.S. cities in 2003 in establishing a local commitment to help protect migratory birds and enhance their habitats within urban environments by participating in the Urban Conservation Treaty for Migratory Birds. The U.S. Fish and Wildlife selected Portland as a pilot project city due to its location along the Pacific Flyway. As such, habitats in Portland provide critical resting, feeding and nesting habitat for numerous types of migratory and resident birds. Over 200 migratory bird species migrate through Portland every year.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or Superfund)

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, was enacted by Congress on December 11, 1980. Superfund:

- establishes prohibitions and requirements concerning closed and abandoned hazardous waste sites;
- assigns liability to persons responsible for releases of hazardous waste at identified sites; and
- establishes a trust fund to provide for cleanup when no responsible party can be identified.

In Oregon, the Department of Environmental Quality (DEQ) implements Superfund. The Superfund cleanup process is complex. It involves the steps taken to assess potentially contaminated sites, place them on the National Priorities List, and establish and implement appropriate cleanup plans.

Within the WHI inventory study area are 17 confirmed contaminated sites, 29 suspected contaminated sites, and 27 cleanup or no further action sites (data updated in January2008). More information is available through the DEQ website www.deq.state.or.us/lq/ECSI/ecsi.htm.

National Flood Insurance Program (NFIP)

The Federal Emergency Management Agency (FEMA) manages the National Flood Insurance Program (NFIP). This program includes voluntary and regulatory components relating to floodplain management, floodplain mapping and flood insurance. The NFIP floodplain management regulations (44 CFR 60) are implemented through local jurisdictions. The City of Portland's local floodplain ordinance is found in Portland City Code 24.50.

FEMA identifies the Nation's floodplains and publishes Flood Insurance Rate Maps (FIRMs), which depict the floodplain data. FEMA maps the area that has a 1% chance of being flooded in any given year. This establishes the 100-year floodplain, which is the standard used by the NFIP and most federal and state agencies for floodplain management and to determine the need for flood insurance. FEMA most recently updated the FIRMs for portions of Portland in 2009.

The principal requirements for development in the 100-year floodplain include, but are not limited to, the following:

- Development within the Floodway is prohibited unless hydraulic engineering analysis demonstrates the development will result in no increase in 100-year flood elevations. The Floodway is the channel of the watercourse and that portion of the adjacent floodplain that must remain open for passage of the 100-year flood without significantly increasing flood elevations. Floodway boundaries are depicted on the FIRMs.
- Occupied or inhabited structures must be built at least one foot above the 100-year flood elevation. This is often achieved by placing fill within the 100-year floodplain to raise the ground elevation and allow development in that area. Other site improvements such as parking or exterior storage may be located below the base flood elevation.
- Fill material placed below the 100-year flood elevation must be balanced with an equal or greater volume of excavation below the 100-year flood elevation such that the flood storage capacity of the floodplain in maintained; this is often referred to as flood storage compensation or "balanced cut and fill". Much of WHI is exempt from this requirement (See also Metro Title 3.)

FEMA is under a court order to initiate consultation with NMFS to evaluate the impacts of the NFIP on ESA-listed salmon species in Oregon. This consultation may result in additional regulations and changes in how the NFIP is implemented in Oregon. A similar consultation in Washington has resulted in changes in how the NFIP is implemented there.

The Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The Act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not

present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death or nest abandonment.

The USFWS removed Bald Eagles from the endangered species list in June 2007 because their populations recovered sufficiently and the State of Oregon removed Bald Eagles from the Oregon Endangered Species List in 2012. However, the protections under the Bald and Golden Eagle Act continue to apply. When the Bald Eagle was delisted, the USFWS proposed regulations to create a permit program to authorize limited take of Bald Eagles and Golden Eagles where take is associated with otherwise lawful activities. The permits will authorize limited, non-purposeful take of Bald Eagles and Golden Eagles; authorizing individuals, companies, government agencies (including tribal governments), and other organizations to disturb or otherwise take eagles in the course of conducting lawful activities such as operating utilities and airports. Most permits issued under the new regulations would authorize *disturbance* in limited cases, a permit may authorize the physical take of eagles, but only if every precaution is taken to avoid physical take. Removal of eagle nests would only be allowed when it is necessary to protect human safety or the eagles.

There are nesting bald eagles on WHI. The Port has established a 600 foot buffer as outlined in the USFWS Bald and Golden Eagle Act guidelines to prevent activities that would disrupt nesting activities and rearing of young.

Marine Mammal Protection Act, 1972

The Marine Mammal Protection Act (MMPA) is intended to conserve marine mammals. All marine mammals are protected under the MMPA. The MMPA prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. California sea lions, Pacific harbor seals and stellar sea lions are found in the Columbia River around WHI. Actions, such as the Columbia River Crossing, require a letter of authorization related to protected marine mammals.

The implementation of the MMPA is divided between two federal departments. The Department of Commerce, which NMFS is part of, is charged with protection of cetaceans and pinnipeds other than walrus. The Department of the Interior, USFWS, is responsible for all other marine mammals, including sea otter, walrus, polar bear, dugong and manatee.

2.g State Environmental Regulations

Oregon Department of State Lands Removal-Fill Permit

In Oregon, a state permit issued by the Department of State Lands (DSL) is required if activities involve filling or removing more than 50 cubic yards of material in waters of the state. In designated Essential Salmonid Habitat or State Scenic Waterways a permit is required for any amount of fill or removal. DSL regulates all wetlands, including isolated or ephemeral wetlands.

Under this permit, the ecological functions (biotic and abiotic) that are impacted by the project must be replaced. In addition to determining which ecological functions should be replaced, DSL uses ratios for spatial considerations; ratios are specific to the restoration, creation, or enhancement types of compensatory mitigation. DSL prefers mitigation within the same watershed; payment in lieu of mitigation may be possible or by acquiring mitigation credits from a DSL approved mitigation bank.

National Pollutant Discharge Elimination System (NPDES)

As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters.

In Oregon, the NPDES permit program is administered by Oregon Department of Environmental Quality (DEQ). The DEQ issues stormwater discharge permits to industries that discharge stormwater into rivers, lakes and streams from pipes, outfalls or other point sources at a site. Based on federal regulations, NPDES permit coverage is required for industrial facilities that discharge stormwater from their industrial areas to surface waters of the state, or to storm drains that discharge to surface waters. Examples of industrial activities that require a permit include manufacturing, transportation, mining, and steam electric power industries, as well as scrap yards, landfills, certain sewage treatment plants, and hazardous waste management facilities.

A municipal separate storm sewer system (MS4) is a conveyance or system of conveyances (e.g., roads with drainage systems, municipal streets, catch basins, curbs, gutters, manmade channels or storm drains) owned or operated by a governmental entity that discharges to waters of the state. Sources that need to obtain an MS4 permit are classified as either "Phase I" or "Phase II". Phase I MS4s are those with populations greater than 100,000, while regulated Phase II (or "small") MS4s serve populations less than 100,000 located within Census Bureau-defined Urbanized Areas. (Also see section on Clean Water Act above for more information including Portland's NPDES permit.)

Oregon Waterway Authorization Program

The Oregon Department of State Lands (DSL) is responsible for establishing rules controlling public use of submerged and submersible land underlying state-owned waterways. State-owned waterways are navigable waterways below ordinary high water. Many uses of and structures occupying state-owned waterways require DSL's written approval. Types of uses that require authorization include but are not limited to:

1. Waterway Lease for commercial and non-commercial marina/moorages, industrial, non-marine uses, floating homes, and large (more than 2,500 square feet) non-commercial docks, and boathouses
2. Waterway Structure Registration for non-commercial docks, and boathouses under 2,500 square feet.
3. Waterway Registration of a structure that is actively and exclusively used to accommodate ships, boats, or vessels engaged exclusively in the receipt and discharge of goods or merchandise, or in the performance of active government functions on the waterway
4. Public Facility License for public agency owned, operated, and maintained docks/floats, boat ramps, boat landings, floating restrooms, navigational aids, and viewing structures with no, or a nominal, fee.

Note: DSL plans to convene a rules advisory committee in Fall 2011 to assess the valuation of state owned submerged and submersible lands.

Archeological Review Oregon Parks and Recreation Department: Heritage Programs: State Historic Preservation Office (SHPO)

A number of federal and state laws protect Oregon's cultural and historic resources including historic properties such as archaeological sites, historic structures, and other cultural resources. Any state water-related permit must take into account the effects of the applicant's activities on historic properties. When a state agency permits an activity that may affect cultural resources, the agency must consult with the SHPO.

SHPO Archaeological Services´ staff assists state agencies and their applicants in protecting historic properties in Oregon. This consideration process involves a series of steps:

1. Identify if any historic properties exist within the project area;
2. If there are historic properties, evaluate the eligibility of the historic properties and determine the effects the proposed project will have on those properties; and
3. If the project will have a negative impact on a significant historic property, explore alternatives to avoid, minimize, or mitigate the effects.

Historic properties include all Native American cairns and graves and associated cultural items in Oregon protected under The Native American Graves and Protected Objects State Law (Indian Graves and Protected Objects (ORS 97.740-97.760)). Historic properties also include archaeological sites 75 years of age or older, and items of significance and cultural patrimony (ORS 358.905 - 358.955). The Scenic Waterways Law (ORS 390.805 - 390.925) establishes a state policy that protects historic and archaeological sites that are located adjacent to designated scenic waterways (i.e., rivers or lakes) from destruction due to the building of dams, construction, mining, etc., and provides tax incentives to private land owners who agree to restrict their use of such lands.

WHI's cultural resources were inventoried in 1986. The report documented the importance of the island and the Columbia River/Willamette River confluence for native peoples. There was no evidence of native settlements located on Hayden Island.

Chapter 3 – Summary of Hayden Island Natural Resources Inventory

The first step of the Goal 5 process is inventorying the location, extent, quantity and quality of natural resources within a project area. The *Hayden Island Natural Resources Inventory* (February 2012), published separately, contains the inventory for the evaluation area. A brief summary of the approach, methodology and inventory sites is included as background for the ESEE analysis.

3.a Summary of Approach and Methodology

The Bureau of Planning and Sustainability has recently produced substantial new inventory information for riparian corridors and wildlife habitat in Portland. Products include natural resources descriptions, GIS data, GIS models, maps, and a report documenting the project approach.

The Bureau used Metro's inventory of regionally significant riparian corridors and wildlife habitat as a starting point for citywide natural resource inventory development. Metro's inventory was reviewed by the Independent Multidisciplinary Science Team (a group of leading scientists in the Pacific Northwest), and other local experts. Public workshops were held and a public hearing was conducted before the Metro Council. The Metro Council endorsed the regional natural resources inventory in December 2001 and adopted the inventory in 2005 as part of the Title 13: Nature in Neighborhood program

By basing the City's newly refined inventory methodology on Metro's approach, the Bureau was able to incorporate and build on the extensive research, analysis, technical review, and public scrutiny that went into the development of Metro's regional inventory.

Both the City and Metro inventories focus on riparian corridors and wildlife habitat, and can be summarized as follows:

Riparian corridors are comprised of rivers and streams, riparian vegetation, and off-channel areas, including wetlands, side channels, and floodplains. Riparian corridors usually contain a complex mix of vegetation consisting of trees or woody vegetation, shrubs and herbaceous plants. Riparian corridors also include areas that provide the transition between stream banks and upland areas.

Wildlife habitats provide food, cover, and roosting and nesting sites for a broad array of birds, mammals, reptiles and amphibians. The terrestrial habitat features that provide these functions include forests, woodland, shrubland, grassland and meadows, wetlands, rocky slopes and uplands, buttes, and other topographic features.

Below is a summary of the steps the Bureau took to produce the citywide inventory of riparian corridors and wildlife habitat. Included are brief explanations about how the Bureau built and improved on Metro's inventory work generally, and specifically in producing the Hayden Island Natural Resource inventory.

1. Compiled GIS Data and mapped key natural resource features, including rivers, streams, wetlands, flood areas, vegetation and topography.

The natural resource feature data are the primary inputs to the GIS inventory models for riparian corridor and wildlife habitat. The Bureau has updated and improved Metro's regional natural resource feature GIS data by:

- Remapping more than 160 miles of stream/drainageway centerlines; adding 100 stream/drainageway miles to the maps.

- Mapping smaller vegetation units (1/2 acre minimum), and classifying forest, woodland, shrubland and herbaceous vegetation over a wider area (using the National Vegetation Classification System). Vegetation mapping does not include land that is sparsely vegetated.[1]
    - Forest: Trees with their crowns overlapping, generally forming 60-100% of cover.
    - Woodland: Open stands of trees with crowns not usually touching, generally forming 25-60% of cover. Tree cover may be less than 25% in cases where it exceeds shrubland and herbaceous vegetation.
    - Shrubland: Shrubs generally greater than 0.5 m tall with individuals or clumps overlapping to not touching, generally forming more than 25% of cover with trees generally less than 25% of cover. Shrub cover may be less than 25% where it exceeds forest, woodland, and herbaceous vegetation. Vegetation dominated by woody vines (i.e., blackberry) is generally included in this class.
    - Herbaceous: Herbs (graminoids, forbs, ferns and shrubs less than 0.5m tall) dominant, generally forming at least 25% of cover. Herbaceous cover may be less than 25% where it exceeds forest, woodland and shrubland vegetation. This includes shrubs less than 0.5 m tall.
- Verifying the existing wetland data using state and city permits and site visits; modifying some wetland boundaries were there was sufficient data.
- Updating the City's flood area data for use in the inventory, including incorporation of the 2004 and 2010 FEMA 100-year floodplain.
- Utilizing Light Detection and Ranging (LiDAR), a method for precisely measuring the elevation of the Earth's surface, and objects on the surface (trees, buildings, etc.) to update the topographic and stream data layers.
- Targeted site visits to confirm stream and vegetation data.

The City has updated and honed the data and information for certain areas in conjunction with area-specific planning projects, i.e., River Plan/North Reach, Airport Futures, and Hayden Island. For the Hayden Island Natural Resource Inventory the City relied on previous studies and conducted vegetation and wildlife surveys (e.g., bird, amphibian and bat surveys).

2. Developed criteria and GIS models to rank and map the relative functional value of existing natural resources

Like Metro, the City produced GIS models to assess the relative functional value of riparian corridors and wildlife habitat. The riparian corridor and wildlife habitat GIS models assign relative ranks of "high," "medium," or "low" to natural resource features that meet certain science-based model criteria. The ranks are produced using a consistent and replicable method, and represent a simple ordinal scale depicting the relative number and distribution of functions provided by natural resource features in the city. The ranks are not tied to a reference or baseline condition, but allow comparison of the relative condition of natural resources within the region or city. For example, a "high" ranked resource provides more functions or has stronger attributes or unique characteristics, as described in the inventory, than does a "low" ranked resource.

The City's inventory models apply the same general sets of evaluation criteria that Metro developed to score the natural resource features for individual riparian corridor functions and wildlife habitat attributes. These criteria reflect Metro's extensive review and compilation of scientific literature on these subjects. The City has refined some of the regional criteria to reflect additional detail, more recent data and studies, and local conditions. For example, the City's wildlife habitat model assigns a higher value to smaller habitat patches than Metro's model assigned to habitat patches at the regional scale. Shifts in the patch size scoring thresholds were based on additional scientific studies, including recent wildlife studies conducted in Portland natural areas. The Bureau worked closely with Metro, the Bureau of Environmental Services and other technical experts to ensure that refinements to the

[1] Sparse vegetation is defined as areas with a predominance of boulders, gravel, cobble, talus, consolidated rock and/or soil with unconsolidated, low-structure vegetation.

regional inventory would reflect the best available science, be consistent with Metro's work, and support the City's watershed health goals.

The City's riparian corridor GIS model assigns scores to natural resources features for each of the following functions:

- *Microclimate and shade* – Open water bodies, wetlands, and surrounding trees and woody vegetation are associated with localized air cooling, soil moisture, and increased humidity.
- *Bank function and control of sediments, nutrients and pollutants* – Rivers, streams, trees, vegetation, roots and leaf litter intercept precipitation; hold soils, banks and steep slopes in place; slow surface water runoff; take up nutrients; and filter sediments and pollutants found in surface water. Structures, such as pilings, can also help stabilize banks and contain contaminants but can impair channel dynamics and other functions.
- *Streamflow moderation and flood storage* – Waterways and floodplains provide for conveyance and storage of streamflows and floodwaters; trees and vegetation intercept precipitation and promote infiltration which tempers stream flow fluctuations or "flashiness" that often occurs in urban waterways.
- *Organic inputs, nutrient cycling and food web* – Water bodies, wetlands and nearby vegetation provide food for aquatic and terrestrial species (e.g., plants, leaves, twigs, insects) and are part of an ongoing chemical, physical and biological nutrient cycling system.
- *Large wood and channel dynamics* – Rivers, streams, riparian wetlands, floodplains and large trees and woody vegetation contribute to changes in location and configuration of waterway channels over time.
- *Wildlife movement corridors* – Rivers and streams and vegetated corridors along waterways allow wildlife to migrate and disperse among different habitat areas and provide access to water.

The predominance of riparian functions occurs within 30 to 100 meters (approximately 100 to 300 feet) of a water body, but some functions, such as the microclimate effect associated with adjacent, contiguous forest vegetation, can occur up to several hundred feet from a river, stream or wetland. Typically, the riparian corridor model assigns aggregated relative ranks to natural resource features as follows:

- **High –** Rivers, streams and wetlands; forest or woodland vegetation within a flood area, in close proximity to a water body, and woody vegetation on steep slopes.
- **Medium –** Shrubland and herbaceous vegetation within a flood area or in close proximity to a water body.
- **Low —** Vegetation outside the flood area and further from a water body; developed flood areas; and hardened, non-vegetated banks of the North and Central reaches of the Willamette River.

The wildlife habitat GIS model assigns scores to mapped habitat patches based on their size, shape, and connectivity to other patches or water bodies. For purposes of the inventory, habitat patches are defined as areas of forest vegetation and wetland that are at least two acres in size, plus adjacent woodland vegetation. The following wildlife habitat attributes are indicators of habitat function:

- *Habitat patch size* – Larger habitat patches generally provide more food, cover, breeding and nesting opportunities for multiple wildlife species.
- *Interior habitat area (edge effect)* – Rounder-shaped habitat patches experience less "edge effect" (disturbance from urban land uses, predation and invasive species) than narrow patches. Larger, rounder patches provide interior habitat that is needed by certain species.
- *Connectivity between habitat patches (including distance and edge effect)* – Patches located closer together generally facilitate species dispersal and migration, and provide access to food, cover, nesting sties, and reproduction opportunities.
- *Connectivity/proximity to water* – Access to water is vital to wildlife survival. Habitat that is connected or close to rivers, streams and wetlands is valuable for all types of wildlife.

Typically, the wildlife habitat model assigns aggregated relative ranks to natural resource features as follows:

- **High –** Large forest and wetland areas such as Forest Park, Smith and Bybee Wetlands, Tryon State Park, and Riverview Cemetery.
- **Medium –** Moderate sized forest and wetland areas such as those at Oaks Bottom, portions of Powell Butte, and the South Rivergate Corridor.
- **Low –** Numerous smaller forest and wetland areas throughout the city.

Again, the riparian corridor and wildlife habitat ranks are not tied to a reference or baseline condition, but allow comparison of the relative condition of natural resources within the region or city. All resources that receive a relative rank (high, medium or low) provide important functions. For example, the developed floodplain receives a low relative rank in the inventory because it provides only one function, flood storage. Flood storage is an important function related to protecting public safety and private property.

The City, in consultation with a group of technical experts, reviewed and confirmed the natural resource inventory model criteria while developing the Hayden Island Natural Resource Inventory.

3. Designated Special Habitat Areas and Updated Regional Species Lists.

As part of the regional Title 13 inventory Metro designated Habitats of Concern for areas with documented sensitive/threatened fish or wildlife species, sensitive/unique plant populations, wetlands, native oak, bottomland hardwood forests, riverine islands, river delta, migratory stopover habitat, connectivity corridors, upland meadow, and other unique natural or built structures or resources (such as bridges that provide habitat for Peregrine Falcons).

Portland has updated Metro's Title 13 Habitats of Concern and refers to these areas as Special Habitat Areas (SHAs). The City has expanded the documentation, refined the mapping, and honed the eligibility criteria explanations. The City has also added and removed SHA designations for certain areas based on additional analysis.

Like the Title 13 Habitats of Concern, SHAs are mapped more generally than the landscape feature data used in the riparian and wildlife GIS models. The SHA boundaries may extend beyond the specific landscape features to capture seasonal variations in conditions (e.g., water levels) or a feature containing one or more habitat points, such as nesting areas on a bridge. Boundaries are determined on a case-by-case basis rather than through the use of model criteria. The rationale for the boundary is described in the natural resource descriptions for each inventory site.

The City has updated the SHA criteria to include National Oceanic and Atmospheric Administration (NOAA) designated as Critical Habitat for anadromous salmonids. Within this inventory for Hayden Island, the Columbia River is designated as Critical Habitat for multiple fish species. The City has also designated certain urban structures as SHAs, including several bridges on the Willamette and Columbia Rivers that provide nesting sites for Peregrine Falcons. A full list of SHA criteria is available in Appendix B.

Consistent with the Title 13 Habitats of Concern, SHAs receive a high relative rank for wildlife habitat, which supersedes medium or low ranks assigned by the Wildlife Habitat Model.

The citywide inventory also includes up-to-date plant and wildlife species lists. Metro's regional vertebrate species list has been refined to include species whose natural range includes Portland. Some species may be present in small numbers, experiencing declines, or have occurred historically but are now extirpated from the City. "Special Status Species" is a City term that includes fish and wildlife species that are officially listed under the Endangered Species Act by the NOAA Fisheries or the U.S. Fish and Wildlife Service (Candidate, Threatened, Endangered, Species of Concern), and/or classified by the Oregon Department of Fish and Wildlife as Threatened, Endangered, State Sensitive, or State Strategy species. The City's Special Status Species list for wildlife also includes species that have been identified by entities or programs other than state or federal government agencies.

The City also consulted with technical experts regarding the designation of Special Habitat Areas for the Hayden Island Natural Resource Inventory. This information is summarized in the next section of this chapter.

4. Produced combined ranks and maps based on GIS model results and information on Special Habitat Areas.

Once the GIS models produce the aggregated riparian corridor and wildlife habitat ranks and Special Habitat Areas are designated, a single combined relative rank for riparian corridor/wildlife habitat areas is produced. Where ranked riparian corridors and wildlife habitat areas overlap, and if the two aggregated relative ranks differ, the higher of the two ranks becomes the overall combined rank for that resource area. For example, a feature that ranks medium for riparian corridor functions and low for wildlife attributes, would receive a medium combined relative rank.

As noted in previous sections, it is important to keep in mind that natural resource features can rank high based on the specific inventory criteria and also be impacted by land management activities, invasive plants or animals, or contamination as discussed in the natural resource description for each inventory site.

The City's has produce different inventory maps displaying the GIS model results for individual riparian and wildlife habitat functions and attributes, the Special Habitat Areas, the aggregated riparian corridor and wildlife habitat relative ranks, and the combined riparian corridor/wildlife habitat relative ranks. Maps of the aggregated riparian corridor and wildlife habitat ranks and combined riparian/wildlife habitat relative ranks are presented in this report for each inventory site.

5. Addressed Resource Significance

To comply with the Oregon Statewide Land Use Goal 5 rule, local jurisdictions must assess inventoried natural resources to determine if the resources are "significant" based on location, and relative quantity and quality. Resource sites that have been deemed significant must then be evaluated to determine if and how those resources should be protected by the local jurisdiction. Goal 5 contains language specific to Metro stating that Metro will protect "regionally significant resources."

Metro determined the significance of inventoried riparian resources and wildlife habitats located in large regional-scale resource sites, first by determining ecological or biological significance, followed by a determination of regional significance. Metro based the determination of ecological or biological significance the scientific literature. For riparian corridors, Metro determined that all natural resources receiving scores for riparian functions are ecologically and regionally significant. For wildlife habitat, Metro determined that all ranked habitats are ecologically significant, and all but the lowest ranked wildlife habitats (e.g., street trees in developed neighborhoods) are regionally significant. Metro determined regional significance by applying specific criteria to different options for assigning significance to the inventoried resources. Metro notes that Goal 5 allows local jurisdictions to adopt additional criteria by which significance is determined. The regional significance criteria included a mix of ecological factors, regulatory compliance factors, and policy factors.

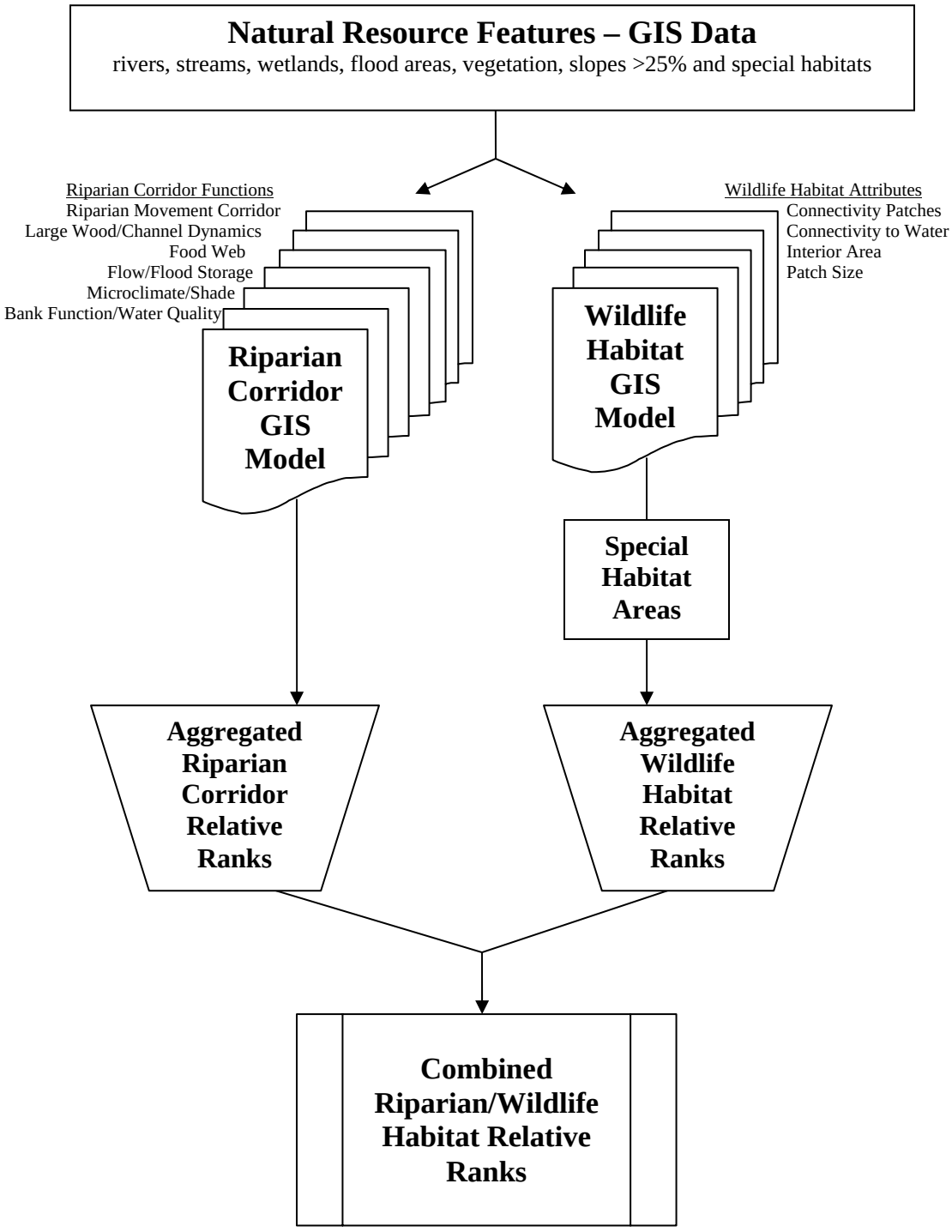
The Oregon Department of Land Conservation and Development acknowledged Metro's regional inventory and associated Title 13: Nature in Neighborhoods program as in compliance specified portions of Goal 5 (riparian corridors and wildlife habitat) and Goal 6 (water quality, flood management) in January 2007.

Given that the City's inventory methodology is consistent with Metro's approach, natural resources identified in the City's inventory and Metro's inventory overlap to a large extent. Differences between the two are primarily a reflection of City improvements to the Metro inventory, such as inclusion of more current, higher resolution data. These data can be broken down by resource sites presented in

adopted inventories where such resources have already been deemed significant through prior City Council ordinances. The data has also informed the delineation of resource sites to update natural resource inventories for the River Plan/North Reach, Airport Futures planning area, and Hayden Island inventory.

As such, the City concluded that natural resources receiving riparian corridor and wildlife habitat scores and ranks (high, medium and low) in the City's inventory, and in area-specific inventories including the *Hayden Island Natural Resources Inventory* (February 2012), are significant.

Figure 5: City's Natural Resources GIS Models Flow Diagram



6. Resource descriptions

In addition to the inventory modeling, the inventory includes detailed descriptions of natural resources on WHI. The descriptive information reflects existing studies and recent research and data gathering conducted specifically for the Hayden Island NRI. The site description is intended to provide more detailed natural resources information than can be generated using the GIS models.

These descriptions address the natural resources in the context of the planning area, the city as a whole, and the region. The inventory also provides relevant information beyond the immediate region such as fish and wildlife species that migrate over long distances and pass through Portland.

The report describes natural resources on the island as well as in shallow and deeper water portions of the Columbia River around Hayden Island. The descriptions address plant species and assemblages, and wildlife species observed during field visits and surveys or as documented in other reports. The descriptions also address water quality, and impacts such as invasive plants and contamination.

3.b Summary of the West Hayden Island and Oregon Slough Inventory Site

This ESEE analysis applies to inventory site HI1: WHI and Oregon Slough. The Bureau of Planning and Sustainability delineated the WHI and Oregon Slough inventory site consistent with recent City inventories. The inventory sites are contiguous to each other and include not only the significant natural resources, but also the surrounding land uses as well.

The inventory site boundaries are intended to:

- Capture similar and contiguous landscape features (natural and human-made) in the same inventory site.
- Abut one another – no gaps between inventory sites.
- Address areas included in Metro's inventory of regionally significant riparian corridors and wildlife habitat.

In other City natural resources inventories and ESEE analyses, the term "resource site" or "habitat site" has typically been used, including in the Columbia Corridor Industrial/Environmental Mapping Project (1989). For this process, the Bureau of Planning and Sustainability uses the more general term "inventory site," as the WHI inventory sites contain both natural resources and fully developed areas.

West Hayden Island is located at the confluence of the Columbia and Willamette Rivers between the cities of Portland, OR and Vancouver, WA. Prior to the 1900's, the confluence of the Columbia and many of its tributary streams, including the Willamette River, were characterized by multiple islands that changed with seasonal flooding. The most significant human-made changes to the island began in the late 19th century. In the 1880's a railroad was constructed across the island. Dredging of the Oregon Slough was authorized by the River and Harbor Act of 1912, with work occurring between 1913 and 1916. This work resulted in placement of dredge material along the south shore of western Hayden Island, near the rail bridge. Additional dredging in the Oregon Slough occurred between 1915 and 1917 to provide material for the Vancouver approach embankments for the Columbia River Interstate Bridge on both the mainland and eastern Hayden Island. Several pile dikes were installed by the US Army Corps of Engineers in the 1920's along the northern shoreline of western Hayden Island to assist in navigation maintenance. Around this same time the island became a receiving site for dredge materials. Placement of a series of eight permanent spur dikes, or groins, during the early 1920s on the southeast shore of western Hayden Island and north shore of the Oregon Slough served to narrow the navigation channel and assist in maintaining channel depth in the southern channel in service to early industry located near the rail line.

Today the existing uses on WHI include a federally designated dredge material placement area, three power line utility corridors, two City of Portland wastewater treatment outfalls, and open space/natural resources (Map 7).

Below is a description of the existing natural resources on WHI.

Inventoried Natural Resources

The WHI ESEE study area contains 1,559 acres of significant natural resources (Map 7). For a full inventory of natural resources in the study area, please refer to the *Hayden Island Natural Resources Inventory* (April 2013). Below is a summary of key natural resources:

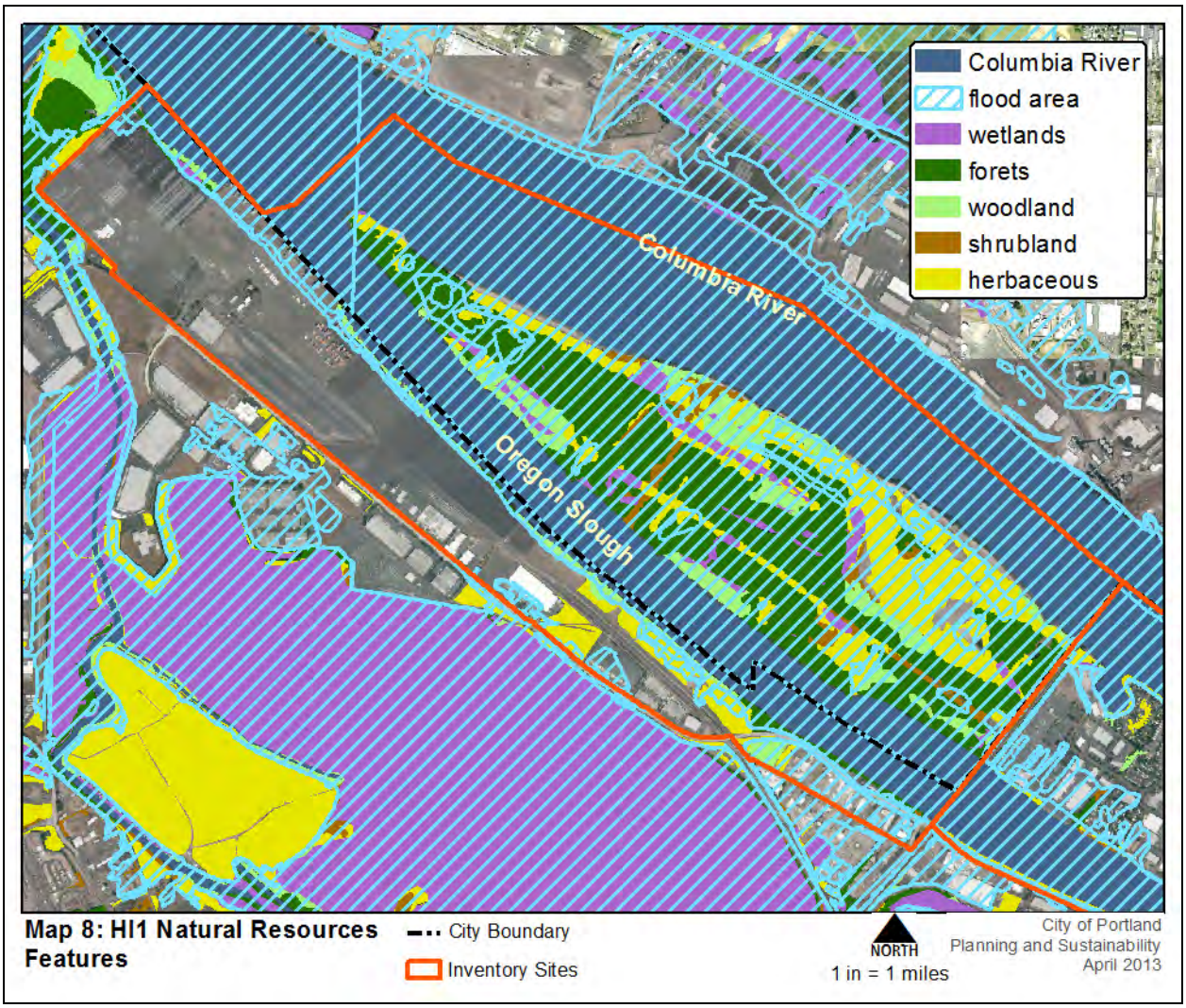


Table 2: Summary of Natural Resource Features in HI1: West Hayden Island and Oregon Slough	
Study Area	**2,429**
River (miles/acres)	3 / 938
Stream/Drainageway (miles)	0
Wetlands (acres)	48
Flood Area (acres)*	1,891
Vegetated (acres)	786
Non-vegetated (acres)	167
Open Water** (acres)	938
Vegetated Areas >= ½ acre (acres)⁺	775
Forest (acres)	419
Woodland (acres)	127
Shrubland (acres)	27
Herbaceous (acres)	203
Impervious Surfaces (acres)	271
* The flood area includes the FEMA 100-year floodplain plus the adjusted 1996 flood inundation area.	
** Open Water includes portions of the Columbia River	
⁺ The vegetation classifications are applied in accordance with the National Vegetation Classification System specifications developed by The Nature Conservancy. The data within the primary study area and within 300 feet of all open water bodies in Portland is draft and is currently being updated based 2011 aerial photography.	

Island Mosaic

WHI functions as one of the largest intact island habitats (830 acres) in the Lower Columbia and Willamette Rivers, third to Sauvie and Government Islands. This natural area provides a substantial north-south habitat connection between Vancouver Lake and the Smith and Bybee Wetlands Natural Area and a critical link in the east-west Columbia River system and habitat corridor. The relatively large, unfragmented, and complex mosaic of habitats on WHI provides a range of functions and values. WHI includes emergent and herbaceous wetlands, backwater channels and shallow water habitat, grasslands, interior forests, and bottomland hardwood forests and riparian habitats contiguous to beaches and open water river habitat. The location of WHI in the metro area, at the confluence of two large rivers and adjacent to industrial and urban land uses, further elevates the importance of this habitat feature within the landscape.

Columbia River Open Water and Shallow Water

The Lower Columbia River includes the 146 miles of river from the Bonneville Dam to the Pacific Ocean. The mainstem is free flowing and the area near Portland, river mile 100, is tidally influenced. The confluence of the Willamette and Columbia Rivers is a regional nexus on the Pacific and Columbia River flyways. In general, birds move north-south along the Pacific flyway and birds also move east-west along the Columbia River corridor. Over 200 bird species occur in the Portland area, including resident and migratory species. The Columbia River provides habitat for anadromous salmonids, steelhead, trout and Pacific Lamprey. Juvenile salmonids migrate and overwinter in shallow water habitat before entering the ocean. As adults returning to spawn, these fish are dependent on good water quality, complex habitat and cover for predator avoidance. Habitat connectivity along the shoreline is also crucial to the salmon's survival. As both juveniles and adults move along the shoreline, they seek refugia habitats that provide opportunities to feed, rest, recharge, and hide from predators. WHI is surrounded by shallow water habitat that is critical to these fishes.

Forest and Woodland Habitat

WHI and the south banks of the Oregon Slough contain one of the largest remnant stands of historically abundant cottonwood-ash floodplain forests in the Lower Columbia River Basin, 548 acres in total. Other nearby islands with large stands of cottonwood-ash include Sauvie Island, Government Island and Lady Island. The forests provide important habitat for birds, amphibians, mammals and bats, and supply near shore aquatic communities with food and cover. Breeding and migratory bird densities in area riparian cottonwood forests are high. Large trees provide quality nesting habitat for larger birds that need big trees for their nests such as bald eagles, great-horned owls, and a number of colonial nesters including great blue herons. Bat surveys conducted for this Inventory revealed the presence of four at-risk bat species in the cottonwood/ash forests of WHI: California myotis, long-legged myotis, silver-haired bat and Yuma myotis. Little brown bats were also detected.

Shrubland

On WHI there are 29 acres of shrubland habitat, most of which is found at the edge of forest and woodland areas or within the power line corridors, or are associated with wetlands. Roughly half of the shrubland on WHI is dominated by dense thickets of Armenian blackberry (dominant under power line corridors) and the other half is willow dominated, often on the edges of wetlands and the river channel. Shrub thickets dominated by willows, snowberry, red osier dogwood, and Indian plum are common at the edge of wetlands and the nearshore. Some areas on the island contain the rare Columbia River willow. This habitat type is important to birds such as the willow flycatcher, as well as numerous terrestrial insects.

Grasslands and Sparsely Vegetated Areas

Grasslands and sparsely vegetated areas have a predominance of grasses (in general graminoids), forbs and wildflowers, with woody vegetation comprising less than 25 percent of the area. Vegetation species and percent cover vegetation vary greatly in these areas due to the frequency of disturbance by deposition and maintenance of dredge spoils. There are depressions within the grassland areas that pond with water. One of the larger grassland areas addressed in the inventory supports grassland-associated species. The placement of dredge materials and maintenance of the area mimics disturbance that once occurred

naturally. This disturbed grassland matrix offers a diversity of vegetation height and density, and provides habitat for various grassland birds including the *at-risk* songbird Western meadowlark.

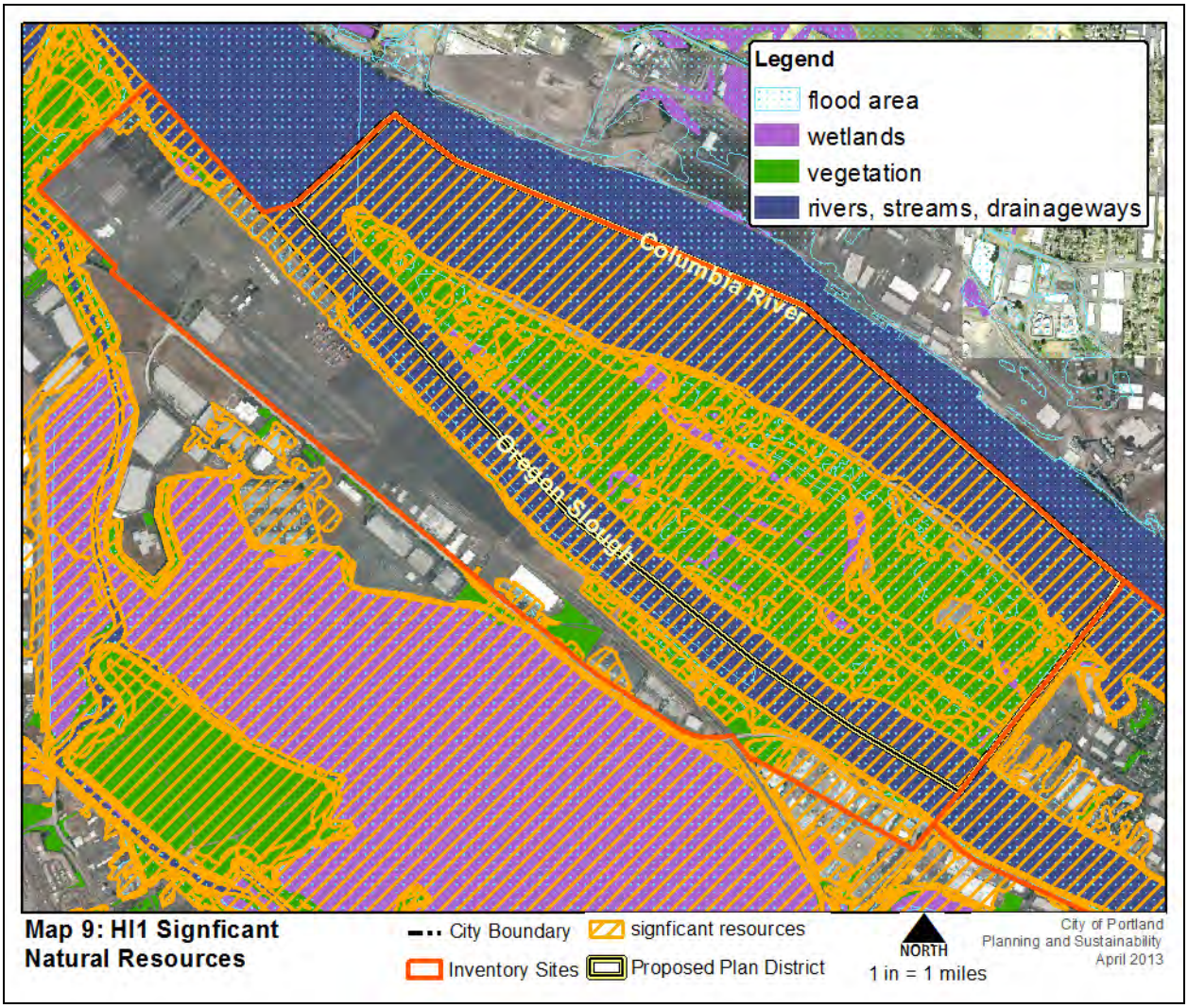
Wetlands

There are 48 acres of wetlands on WHI. The wetlands vary in size from approximately 300 square feet to 15+ acres. Wetlands are productive areas for wildlife and host a diversity of plants. Benson Pond is an artificially-created wetlands that now functions as a permanently flooded palustrine aquatic bed that supports both persistent and non-persistent emergent wetland vegetation. With its flood storage capacity, the Benson Pond wetlands complex provides critical habitat for fish, including many species of ESA-listed salmon and trout; foraging habitat and refuge for waterfowl, wading birds, and diving birds; potential habitat for turtles (one painted turtle was observed in 1997); habitat for breeding amphibians; foraging habitat for insectivorous birds; and watering opportunities for wildlife. Other wetlands types including interior wetlands that provide breeding habitat for red legged frog; forested palustrine wetland areas on the south-central side of the island; and several scrub/shrub and herbaceous wetlands are found in the interior of the island.

Chapter 4 – Conflicting Uses Analysis

After inventorying of significant natural resources, an initial step of the ESEE Analysis is for local governments to identify conflicting land uses that are allowed within inventoried natural resource areas. According to the Goal 5 administrative rule: *a conflicting use* is one that, if allowed, could negatively impact a significant inventory site. The conflicting uses must be identified within the resource areas and the impact area.

This Chapter introduces the Impact Area and describes the Conflicting Uses associated with the Final Base Concept Plan, as well as the uses allowed under current Multnomah County zoning. Map 9 shows the significant natural resources and the impact area.



4.a. Impact Area

A required step in the ESEE analysis is to identify "impact areas." An impact area is the area surrounding natural resources that may impact the quality, quantity, functional or extent of those resources. Per the Goal 5 rule:

> *Local governments shall determine an impact area for each significant resource site. The impact area shall be drawn to include only the area in which allowed uses could adversely affect the identified resource. The impact area defines the geographic limits within which to conduct an ESEE analysis for the identified significant resource [OAR 660-23-040 (3)].*

Determining the impact area is complicated in an urban area. As documented in Metro's Title 13 natural resource inventory and the City's natural resources inventory reports, the effects of urbanization on the functions and values of fish and wildlife habitat are pervasive. Metro notes in their ESEE analysis adopted as part of Title 13 Nature in Neighborhoods:

> *…a compelling case can be made for identifying the entire watershed as an impact area based on the cumulative impacts of urbanization, such as road density, impervious surfaces and altered hydrology, vegetation loss and alteration, and species depletion. However, doing so may necessitate an ESEE analysis for the entire watershed, which significantly encumbers the Goal 5 process. Stormwater management through watershed planning may be more realistic for addressing these larger more pervasive effects of urbanization on the function of fish and wildlife habitats….(citation)*

Metro identified the impact area as the land extending 150 feet from a water body, and the land extending 25 feet from edge of inventoried wildlife habitat (includes Habitats of Concern). Metro's intent was to:

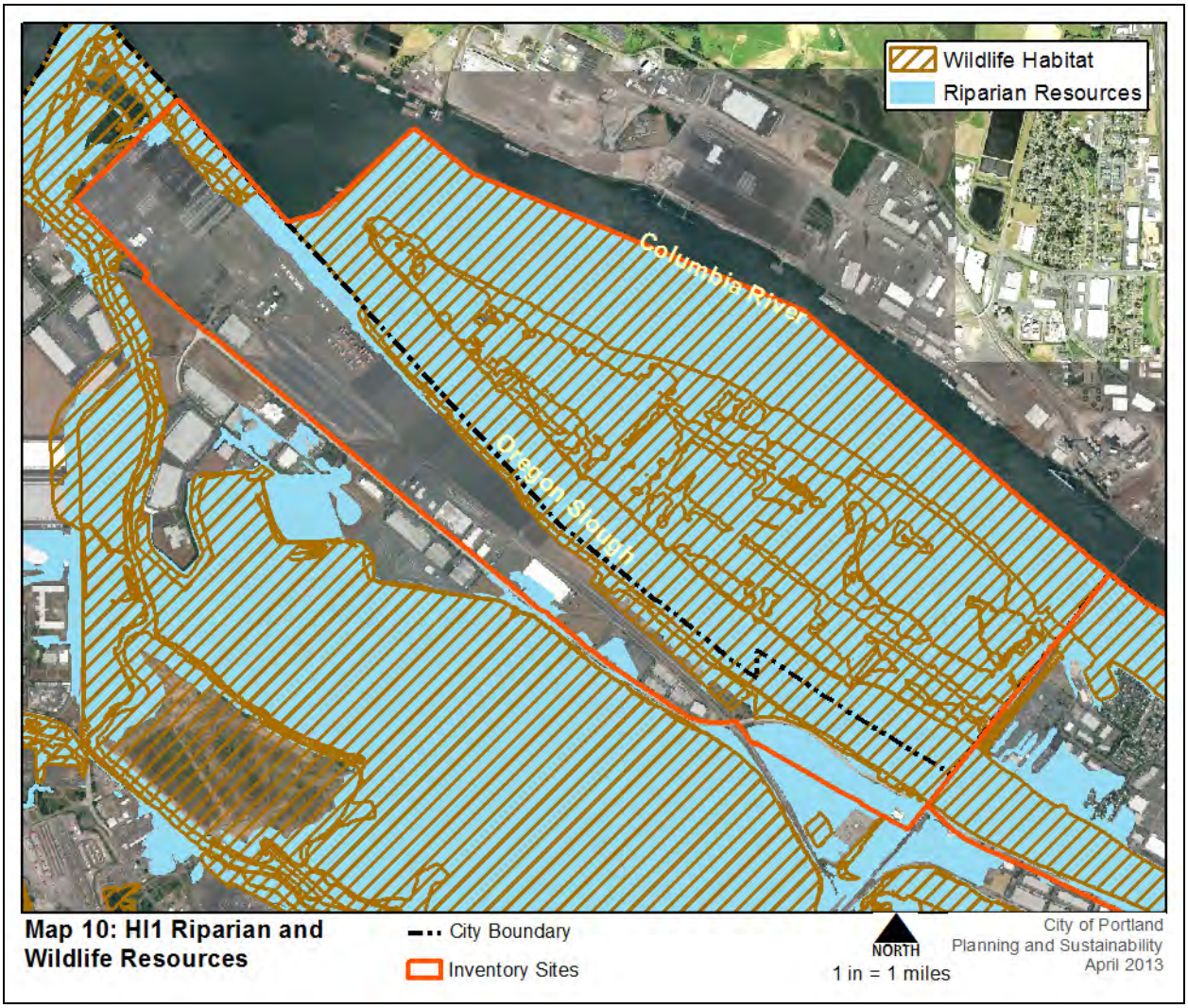
- Provide all fish and wildlife habitat with an impact area and provide the most sensitive habitat with wider impact areas (note: developed floodplains do not have an impact area)
- Provide an impact area to address tree root zones
- Address areas that are already degraded, but where development or disturbance could influence onsite and downstream water quality and key wildlife habitat (such as wetlands)
- Meet the requirements of the Goal 5 rule

For purposes of the West Hayden Island ESEE Analysis, the City elects to use the same general methodology to define the impact area, specifically to include land within 25 feet of all ranked resources, including Special Habitat Areas, and land within 150 feet from rivers, streams, drainageways and wetlands. Where ranked riparian resources extend 150 feet or more from a water body, an additional 25 feet is added as a buffer to those resources. The intention is to provide an impact area around all existing ranked natural resources and to provide a minimum impact area for water bodies. The entire WHI inventory site is ranked natural resource; therefore, the impact area extends beyond the inventory site.

The Goal 5 rule requires that these areas be considered along with the inventoried natural resource areas in conducting the ESEE analysis. These areas are considered as extensions of the resource areas and are therefore not addressed separately in the analysis of potential consequences.

4.b. Identifying Conflicting Uses

To identify potential conflicts, the Goal 5 rule directs local governments to examine the uses allowed within broad zoning categories (e.g., industrial, open space). The Goal 5 rule states that water-dependent and water-related uses are excluded from being considered a conflicting use within *riparian corridor resources*. The Goal 5 rule does not exclude water-dependent and water-related uses from being considered a conflicting use with wildlife habitat. WHI is both a significant riparian corridor and significant wildlife habitat (Map 10). Given the Goal 5 exclusion, the marine terminal and boat launch uses associated with the use scenarios are being evaluated as conflicting with wildlife habitat, not with riparian corridors. All other uses (e.g., trails, rail) are being evaluated as conflicting with wildlife habitat and riparian corridors.



While developing Title 13, Metro performed an analysis of conflicting uses by applying generalized regional zones to most of the regionally significant riparian corridors and wildlife habitat (see Map 5). Metro's conflicting uses analysis provides a general framework for identifying conflicting uses. The generalized regional zones by themselves are not conflicting uses. It is the disturbance activities associated with development permitted by local zoning that potentially conflict with natural resources. Table 3 includes Metro's regional zones and generalized regional zones.

Metro used policy directives represented in the UGB expansion to include WHI as a future marine terminal. The Title 4 designation of WHI as a Regionally Significant Industrial Area and the regional 2040 Design Types were the bases for assessing of potential urban development value in the Title 13 ESEE Analysis. Here, Metro identified WHI has having a mix of high and low development, employment and policy priority values. The rationale is explained below in the Economic Section of the Metro Title 13 ESEE Analysis:

> … …*show that primarily design types are distributed across more of Metro's jurisdiction than are areas of high land value or employment density, which are concentrated mostly in the downtown Portland area. This is especially true along the Columbia River and the Willamette River outside of downtown Portland. These industrial areas have low land values and employment densities for the most part, but have a primary design type designation. One interpretation of this difference is that the design types reflect public policies to support or enhance the industrial areas along the river for future development. Even though these areas have low land values and employment densities relative to the Portland city center, public policy considerations dictate that these industrial lands should be emphasized or enhanced for resources other than land value or employment.* (Title 13 ESEE Phase 1 Analysis, April 2005)

Based on this assessment Metro assumed that WHI was comparable to the generalized Industrial (IND) zone for purposes of the Title 13 ESEE analysis (correspondence with Tim O'Brien, Metro, May 16, 2012).

Table 3: Metro Generalized Regional Zones	
Regional Zone	**Generalized Regional Zone**
IL Light Industrial – districts permitting warehousing and light processing and fabrication activities. May allow some commercial	**IND Industrial**
IH Heavy Industrial – districts permitting light industrial and more intensive industrial activities (e.g. heavy manufacturing, limited chemical processing).	
IMU Mixed Use Industrial – districts accommodating a mix of light manufacture, office and retail uses.	
IA Industrial Area – districts designated exclusively for manufacture, industrial, warehouse and distribution related operations.	
CN Neighborhood Commercial – small scale commercial districts with retail and service activities (e.g. grocery stores) supporting the local residential community. Floor space and/or lot size from 5,000 to 10,000 sq ft	**COM Commercial**
CG General Commercial – larger scale commercial districts with regional orientation for providing services. High and strip commercial zones are included.	
CC Central Commercial – allows a full range of commercial activities associated with central business districts. More restrictive than CG regarding large lots and highway orientation; allows multi-story development.	
CO Office Commercial – districts accommodating a range of businesses, professional and medical offices, typically a buffer between residential and more intensive uses.	
PF Public Facilities – generally provides for community services such as schools, churches, hospitals, etc.	
MUC1 Mixed Use Center 1 – combines residential and employment uses in town centers, main streets and corridors.	**MUC Mixed Use Centers**
MUC2 Mixed Use Center 2 – combines residential and employment uses in light rail station areas and regional centers.	
MUC3 Mixed Use Center 3 – combines residential and employment uses in central city locations. Mixed use is weighted toward residential development.	
MRF1 Multi-family 1 – housing and/or duplex, townhouse and attached single-family structures allowed outright. Maximum net allowable densities range from 2 to 25 units per acre, with height limits usually set at 2 ½ to 3 stories.	**MFR Multi-family Residential**
MRF2 Multi-family 2 – housing accommodating densities ranging from 25 to 50 units per acre. Buildings may exceed 3 stories in height.	
MFR3 Multi-family 3 – housing accommodating densities ranging from 50 to 100 units per acre.	
MFR4 Multi-family 4 – housing accommodating densities greater than 100 units per acre. This is the densest of the multi-family zones and would require greater use of vertical space and buildings with multiple stories.	
SFR1 Single Family 1 – detached housing with minimum lot sizes from 20,000 sq ft and over	**SFR Single-family Residential**
SFR2 Single Family 2 – detached housing with minimum lot sizes from 12,000 to 20,000 sq ft	
SFR3 Single Family 3 – detached housing with minimum lot sizes from 8,500 to 12,000 sq ft	
SFR4 Single Family 4 – detached housing with minimum lot sizes from 6,500 to 8,500 sq ft	
SFR5 Single Family 5 – detached housing with minimum lot sizes from 5,500 to 6,500 sq ft	
SFR6 Single Family 6 – detached housing with minimum lot sizes from 4,000 to 5,500 sq ft	
SFR7 Single Family 7 – detached housing with minimum lot sizes up to 4,000 sq ft	
FF Agriculture or Forestry – activities suited to commercial scale agricultural production, typically with lots sizes of 30 acres or more.	**RUR Rural**
RRFU Rural or Future Urban – residential uses permitted on rural lands or areas designated for future urban development with minimum lots sizes of one acre or more.	
POS Parks and Open Space – preservation of public and private open and natural areas.	**POS Parks & Open Space**

Through the WHI Phase II Planning Project, the Bureau of Planning and Sustainability has proposed specific uses and base zones for WHI that correspond with the primary use scenario (see Map 6). Based on the City Council Resolution 36805 and the Final Base Concept Plan for West Hayden Island, the two base zones that are proposed are IH, Heavy Industrial, and OS, Open Space. For this analysis these same base zones and conflicting uses are evaluated for different splits of land. The *Hayden Island Natural Resources Inventory* identifies significant resources within both of these proposed zones.

The IH and OS base zones generally correspond with two of Metro's generalized regional zones IND and POS (see Table 4). This conflicting use analysis examines the allowed and conditional uses in the context of Metro's generalized regional zones, and the allowed, limited, conditional, temporary and prohibited uses in the context of the base zones proposed for WHI.

Table 4: City of Portland Base Zones Nested within Metro's Generalized Regional Zones

Metro Generalized Regional Zone	Metro Regional Zone	City Base Zone in the West Hayden Island Area	City Zone Description
IND	IH	IH	Heavy industrial uses on larger lots; prevents other conflicting uses
POS	POS	OS	Public and private open space

Industrial Uses

Metro's Generalized Regional Zone – IND

Industrial zones allow a variety of industrial uses from light manufacture (e.g. fabrication) to heavy manufacturing (e.g. chemical processing) to mixed use industrial (e.g. mix of light manufacturing, offices and retail uses) to marine terminals. Supporting commercial services such as restaurants and banks may be allowed outright, depending on the zone, or permitted with limitations. Conditional uses may include junkyards, wrecking yards, basic utilities, commercial recreation al facilities, and waste related services.

Portland's Industrial Zones in West Hayden Island area

IH – The Heavy Industrial zone of the three zones that implement the Industrial Sanctuary map designation of the Comprehensive Plan. The zone provides areas where industries may locate including those not desirable in other zones due to their objectionable impacts or appearance. The development standards associated with the IH zone are the minimum necessary to assure safe, functional, efficient, and environmentally sound development. Sites in the IH zone generally have large lots with high building and site improvement coverage. All industrial use categories are permitted by right, except for waste-related uses, which are either conditional or allowed with limitations. Other uses permitted by right are quick vehicle servicing, vehicle repair, self-service

storage, parks and open areas, agriculture and rail lines and utility corridors. Household living is a conditional use, while group living is prohibited. Other limited or conditional uses are retail sales and service, office uses, commercial parking, commercial outdoor recreation, major event entertainment, basic utilities, community services, daycare, aviation and surface passenger terminals, detention facilities, mining and radio frequency transmission facilities. Temporary uses allowed are: parking lot sales; seasonal outdoor sales; fairs and carnivals; warehouse sales; temporary actions to respond to natural disasters and emergencies; and staging areas for public utility installation.

Within the West Hayden Island site, 315 acres of land and 227 acres of the Columbia River are proposed to be zoned for industrial uses. All of this area is designated as significant natural resource in the *Hayden Island Natural Resource Inventory* (April 2013).

Parks and Open Spaces

Metro's General Regional Zone – POS

Parks and open spaces are allowed outright or conditionally in all of the generalized regional zones, although to varying degrees. The disturbance activities associated with parks and open spaces vary depending on the intensity of use. Maintenance practices can be similar to residential landscaping practices and have impacts on natural resources.

Portland's Open Space Zone in West Hayden Island area

OS – The Open Space zone is intended to preserve public and private open and natural areas. Agriculture, certain park and open area uses and certain broadcast facilities are allowed by right in the OS zone. Park and open area facilities are generally allowed as conditional uses. Retail sales and service uses are allowed only if they are associated with a park and open area use and then only as conditional uses. Several institutional uses are allowed as conditional uses: basic utilities; community service; school; and daycare. Rail lines and utility corridors, mining and certain broadcast facilities are permitted as conditional uses. Temporary activities are permitted: fairs, carnivals and other special events; temporary actions to respond to natural disasters or emergencies; staging areas for public utility installation; and radio frequency transmission facilities.

Within the West Hayden Island site, at 487 acres of land and 509 acres of the Columbia River are proposed to be zoned for open space uses. All of this area is designated as significant natural resource in the *Hayden Island Natural Resource Inventory* (April 2013).

Table 5: Industrial and Open Space Zone Primary Uses		
Use Categories	**IH**	**OS**
Residential Categories		
Household Living	CU [1]	N
Group Living	N	N
Commercial Categories		
Retail Sales And Service	L/CU [6]	CU [1]
Office	L/CU [6]	N
Quick Vehicle Servicing	Y	N
Vehicle Repair	Y	N
Commercial Parking	CU [15]	N
Self-Service Storage	Y	N
Commercial Outdoor Recreation	CU	CU
Major Event Entertainment	CU	N
Industrial Categories		
Manufacturing And Production	Y	N
Warehouse And Freight Movement	Y	N
Wholesale Sales	Y	N
Industrial Service	Y	N
Railroad Yards	Y	N
Waste-Related	L/CU [8]	N
Institutional Categories		
Basic Utilities	Y/CU [13]	L/CU [6]
Community Service	L/CU [11]	CU [5]
Parks And Open Areas	Y	L/CU [2]
Schools	N	CU [3]
Colleges	N	N
Medical Centers	N	N
Religious Institutions	N	N
Daycare	L/CU [11]	CU
Other Categories		
Agriculture	Y	Y
Aviation And Surface Passenger Terminals	CU	N
Detention Facilities	CU	N
Mining	CU	CU
Radio Frequency Transmission Facilities	L/CU [14]	L/CU [4]
Rail Lines And Utility Corridors	Y	CU

Y = Yes, Allowed L = Allowed, But Special Limitations
CU = Conditional Use Review Required N = No, Prohibited
Notes:

- The use categories are described in Chapter 33.920.
- Regulations that correspond to the bracketed numbers [ ] are stated in 33.130.100.B.
- Specific uses and developments may also be subject to regulations in the 200s series of chapters.

4.c. Multnomah County Existing Zoning Conflicting Uses

Although the main purpose of this ESEE Analysis is to evaluate the consequences of the primary use scenario that the City Council specified in its resolution, the analysis also generally addresses uses allowed under current zoning should the City decide not to annex WHI and leave WHI within Multnomah County.

WHI is currently in Multnomah County and is zoned Multiple Use Forest (MUF) with a Special Environmental Concern (SEC) overlay. WHI is also designated "Future Urban" in the *Multnomah County Framework Plan* because Metro expanded the UGB to include WHI for the expressed purpose of future marine terminal development. Conflicting uses allowed within the MUF zone are summarized below.

The uses allowed in the MUF zone that can conflict with natural resource features and functions are:

A. Forest practices associated with the production, management and harvesting of timber;
B. Wood processing operations, such as:
    i. Pole and piling preparation;
    ii. Portable sawmill for lumber cutting only;
    iii. Wood chipping;
    iv. Manufacture of fence posts; and
    v. Cutting firewood and similar miscellaneous products.
C. Farm Use for the following purposes only:
    i. Raising and harvesting crops;
    ii. Raising of livestock or honeybees; or
    iii. Any other agricultural or horticultural purpose or animal husbandry purpose or combination thereof, except as provided in MCC .2172(B).
D. Public and private conservation areas and structures other than dwellings for the protection of water, soil, open space, forest and wildlife resources; and
E. Residential use consisting of a single-family dwelling including a mobile or modular home, on a lot of 38 acres or more, subject to the residential use development standards.
    i. A resource management program must be created that relates to timer or agricultural uses.
F. Actions taken in response to an emergency/disaster event.

Conflicting uses permitted conditionally in the MUF are:

A. Wholesale or retail sales of farm or forest products
B. Utilities, roadways, driveways and other structures needed for continued protection of essential public services;
C. Mining and processing of subsurface resources;
D. Houseboats and houseboat moorages

The SEC is intended to protect, conserve, enhance, restore, and maintain significant natural resources. All uses permitted by the underlying district are permitted on lands designated SEC; provided that the location and design of any use, or change or alteration of a use shall be subject to an SEC permit. The following uses do not require a SEC permit:

A. Farming practices
B. Timer propagation or harvesting (in accordance with State Forest Practices Act)
C. Dredging and channel maintenance
D. Maintenance of dikes, levees, groins, etc.
E. Activities to protect, conserve, enhance or maintain public recreation or natural resources
F. Replacement or expansion of transmission systems
G. Other maintenance activities

4.d. Conflicting Uses Impacts

This section describes the common impacts associated with conflicting uses generally and within the areas addressed by the *Hayden Island Natural Resources Inventory* (April 2013). The analysis begins with impacts that are common to the conflicting uses allowed by the proposed city zoning. Following the discussion of common impacts is a description of impacts associated with industrial/employment[1] and open space uses. Lastly, is a description of impacts associated with the existing county zoning.

As described above, the Goal 5 rule states that water-dependent and water-related uses are excluded from being considered a conflicting use within riparian corridor resources. Water-dependent and water-related uses are not excluded as a conflicting use within wildlife habitat. Uses that would be allowed and could be sited on WHI in absence of a water-dependent use are not excluded. For example, a rail yard would be allowed in the IH zone and would not be dependent on water access.

Therefore, the marine terminal, including the docks and terminal facilities, and boat launch and river trail uses identified in the primary use scenario are being evaluated as conflicting within wildlife habitat, not riparian corridors. All other uses, including rail, trails not associated with the river, etc., are being evaluated as conflicting within wildlife habitats and riparian corridors.

4.d.1 Common Impacts of Conflicting Uses

Development and disturbance activities that can adversely affect natural resources occurring within each of the City's base zones; however, the degree or intensity of the impacts may vary depending on the intensity of the land use, the form, layout or design of the development, construction protocols or ongoing operation and maintenance activities. Below is a description of activities associated with the conflicting uses generally, and related impacts on natural resources.

The following impacts are generally site specific and cumulative with respect to other impacts and conditions in the watershed.

Clearing vegetation

Rainwater is intercepted and taken up by vegetation. This function is impaired when vegetation is cleared, resulting in increased overland runoff. In turn this increases runoff volume and flows into receiving water bodies following storm events. Increased streamflow volume and rate can cause bank erosion, undercutting, and slumping, and flooding. Vegetation also filters surface stormwater flows removing pollutants and sediment. Vegetation removal can affect these functions in streams that are far from the development site as stormwater is often piped great distances within the city.

Tree canopy and associated understory vegetation create shade and local microclimate effects that cool the air and water, and maintain humidity and soil moisture. Trees and vegetation also help capture carbon dioxide; carbon dioxide is a contributing factor to global warming. All of these functions are affected when the vegetation is removed.

Clearing vegetation also removes important structural features of the forest such as large trees and multiple canopy layers, snags and downed logs, large trees, and root systems that holds soils in place. This can result in soil erosion and impaired habitat for native wildlife. Vegetation removal reduces food, nesting opportunities, cover, and perching and roosting opportunities for wildlife. Removing streamside or shoreline vegetation also eliminates sources of leaf litter which provides food and nutrients for aquatic organisms, and woody debris that provides river habitat structure and food resources for fish. Wildlife affected by vegetation removal includes mammals, birds, reptiles, amphibians, fish and insects. Removal of vegetation can fragment riparian and upland wildlife movement corridors, isolate remaining vegetation patches, and limit wildlife access to water. These

[1] Industrial uses are allowed by-right in both industrial and employment base zones. Uses within the employment base zone are intended to be industrial-related and located in a large building or warehouse type structure. Therefore, the general impacts associated conflicting uses in the industrial and employment base zones are addressed together.

impacts impede wildlife migration and can limit recruitment from other areas, making wildlife populations more vulnerable to disease, predation and extirpation.

Some vegetation types have been declining in the Portland area due to clearing and grading for development and the use of ornamental vegetation in landscaping (not replacing cleared vegetation with like native species). Certain assemblages, such as native bottomland hardwood forests and native oak stands require specific soil, water and sun exposure to survive and are slow growing, taking many years to become established. These vegetation assemblages still exist including bottomland forest along the Columbia River and Oregon Slough, and on West Hayden Island. Removal not only reduces habitat functions as discussed previously, but also would contributes to the decline in these unique vegetation types and potentially extirpation within the city.

Grading, excavation, filling and soil compaction
Grading activities and soil compaction can reduce the capacity of soil to support vegetation by disturbing the soil structure, accelerating erosion, and decreasing soil fertility, microorganisms, seeds and rootstocks. Soil porosity and stormwater infiltration can be reduced by grading, excavating, filling and soil compaction. This in turn can reduce groundwater recharge and in-stream summer and fall low flows, which adversely affects aquatic species. Grading, excavation, filling and compaction also affect wildlife habitat for some species. For example, long-toed salamanders require forest leaf litter and downed logs for thermal protection and foraging areas

It should be noted that historic floodplain resources benefit from periodic disturbance. Within the 100-year floodplain of the Columbia River, historic semi-regular flood events maintained areas of low structure, sparse vegetation and open areas of sand that supported many grassland-associated wildlife species. The Columbia River dams, dikes and fill within the floodplain have reduced flood events and the extent of flooding. In some instances, human activities can mimic historic natural disturbances caused flooding. This is the case in the Dredge Deposit Management Area on WHI. The periodic placement of dredge materials and management of vegetation maintains a 100+ acre area of low structure, sparse vegetation and open sand that supports grassland associated species. In this specific instance, filling and grading is not a conflicting use; it is supportive of the habitat. Management of this area could become a conflicting use if the frequency, timing or duration of human disturbance were to change, for example, if dredge material were placed during the nesting season of certain grassland-associated species that are ground nesters.

Adding impervious surface (e.g. buildings, parking areas, roads, sidewalks, driveways)
Impervious surfaces alter the hydrologic cycle by preventing stormwater infiltration and concentrating overland flow. This results in increased stormwater runoff and decreased groundwater recharge. Increased stormwater runoff can result in increased volume and flows into receiving water bodies (see vegetation clearing). Decreased groundwater recharge can reduce in-stream summer low flows (see grading, excavation, filling and soil compaction). Impervious surfaces also contribute to urban heat island effect, which affects local air quality. Increased impervious surfaces can also cause wildlife habitat fragmentation and create hazards or barriers to wildlife movement (see vegetation clearing).

Modifying rivers and floodplains (e.g. filling, bank armoring)
Altering the natural configuration, geomorphology, and structure of river banks and the floodplain results in:

- increased in-stream flow velocity, which can cause bank erosion, undercutting and slumping on-site or at upstream or downstream locations
- a decrease in aquatic habitat area and simplified remaining habitat when side channels, wetlands and oxbows are disconnected from the main river channel
- a decrease in areas of wood deposit where side channels and wetlands are filled in
- reduced flood storage capacity and other benefits associated with active flood areas (e.g., nutrient transport, off-channel habitat)
- reduction in vegetation that attenuates flows and provides important fish habitat during flood events

Generating pollution
Oil, gas, tar, antifreeze, dissolved metals, pesticides, herbicides, fertilizers and other contaminants degrade habitat and water quality. These pollutants are transported to water bodies in stormwater via runoff from streets, driveways, parking lots, farms, parks, golf courses and buildings. Dirt and sediments from eroded areas or deposited from vehicles can also be transported via stormwater to water bodies and degrade aquatic habitat. Pesticides, herbicides and fertilizers used in landscaping can pollute ground and surface waters and degrade habitat and harm fish and wildlife.

Landscaping with non-native and/or invasive vegetation (e.g. lawns, ornamental trees)
The removal of native vegetation and establishment of cultivated landscapes can change or reduce food, cover and nesting opportunities for native wildlife. Manicured landscaped areas generally lack complex vertical structure – little if any multi-layered canopy, large trees, snags, thick understory vegetation, and downed logs are retained in landscaped areas. The reduction in vertical structure impairs wildlife habitat and alters microclimate effects and hydrology. Some non-native plants used in landscaping are invasive (e.g. ivy, morning glory, holly and laurel) and can out-compete native plants reducing biodiversity. Non-native landscapes may also require irrigation and may be treated with chemical fertilizers and pesticides, which can run-off into local waterways and wetlands, or may be ingested by wildlife.

Building fences and other wildlife barriers
Barriers to wildlife movement can include buildings, roads, rail lines, fences and other manmade features. These barriers fragment connectivity between wildlife habitats and reduce the ability of native wildlife species to thrive (see clearing vegetation). Some such barriers, such as roads and rail lines, may create hazards that increase the risk of wildlife mortality.

Other impacts: pets, light, noise, litter, etc.
Human activities that create outdoor noise and light can disrupt the competition, communication, reproduction, and predation habits of wildlife (Brown, 1987). For example, night-time lighting can interrupt the navigation of migrating birds and bats. Domestic pets can kill or injure native wildlife or compete for limited space. For example, allowing dogs to run freely in a grassland area can disrupt grassland-associated wildlife that build nests on the ground. Domestic pet waste, litter and garbage can degrade natural resources including soil and water quality.

4.d.2 Impacts of Specific Conflicting Uses

This ESEE Analysis is intended to focus the primary use scenario provided by the City Council resolution, which includes marine terminal development, natural resource protection and passive recreation. To fully understand the consequences of limiting uses within each base zone, the analysis will look at the conflicting uses allowed, conditionally or with limitation, within the IH and OS base zones and the conflicting uses proposed in the use scenario.

Industrial
Under the Final Base Concept Plan it is assumed that Heavy Industrial zoning (IH) would be proposed for 542 acres of West Hayden Island including 315 acres of land and 227 acres of the river. The entire area is designated as significant natural resource in the *Hayden Island Natural Resources Inventory* (April 20130). Industrial uses proposed for these areas include: rail, roads, marine terminals, docks, and a manufacturing facility.

Development and disturbance activities in industrial areas are typically more intensive than in other zones like residential and commercial areas. Site preparation generally includes clearing most or all vegetation and completely re-grading the site. Industrial development is usually land intensive and requires a large percentage of the total area to accommodate facilities, resulting in large impervious surfaces, compacted soils and ongoing light noise, lighting and vibration.

Development geometry is often driven by the maneuvering requirements of large freight vehicles and loading equipment. Because the development components are often relatively large, in comparison to residential development, there are relatively fewer opportunities to cluster development away from the resource areas. Industrial uses can diminish vegetation and other natural resources such as wetlands and reduce or eliminate open space, scenic and recreational values.

Some industrial activities require the use of water in manufacturing processes (e.g. cooling equipment) and draw substantial amounts of water from wells and public water sources. The resulting effluent, which is typically warm, may be discharged to receiving waters, such as a river, and influence in-water temperature. Cool water temperature is a fundamental requirement for many native aquatic species in this region, particularly federal ESA-listed fishes. Industries that discharge effluent into water bodies are generally required to obtain a discharge permit through the Oregon Department of Environmental Quality.

Industrial areas can contribute high quantities of heavy metals and other toxic material to the soil, water and air, but are typically regulated to manage the impacts. In addition, the use, storage and transport of hazardous materials, waste storage and recycling and similar activities requiring special permitting often occurs in industrial sites.

In the study area, the proposed industrial use is a marine terminal facility with associated infrastructure. This will involve filling of the Columbia River floodplain, removal of approximately 300 acres of significant natural resources, development of industrial structures (marine terminals, roads, docks, rail) and on-going impacts including noise, lighting and vibration. All of this will impact the quantity, quality and function of remaining natural resource areas by fragmenting habitat, disrupting wildlife use and impairing fish and wildlife production.

Open Space

Parks and open spaces are allowed by right in all areas zoned Open Space (OS) and in all industrial zones.

Under the Final Base Concept Plan it is assumed that OS zoning would be proposed for 993 acres of West Hayden Island including 487 acres of land and 509 acres of river. This entire area is designated as significant natural resource in the *Hayden Island Natural Resource Inventory* (April 2013). Open space uses proposed for these areas include: nature based recreation (e.g. hiking, bird watching, canoeing) and natural resource restoration and enhancement.

Undeveloped open space has the least amount of disturbance of all urban uses. These areas often provide important wildlife habitat and riparian functions (e.g. water storage, microclimate, food web). Construction of trails can create different levels of impact on natural resources depending on trail design and location; an example is fragmenting habitats and creating opportunities for invasive plant intrusion into a habitat area. Landscaping with non-native plants and use of irrigation, herbicides, pesticides and fertilizers can have a detrimental affect on natural resources.

Impacts associated with more active open space uses can be similar to residential or commercial development. For example, sports fields generally require significant grading and vegetation management. Some open space uses require development of parking lots, which can generate stormwater runoff.

In the study area, the specific open space uses anticipated under the Final Base Concept Plan include natural resource protection and enhancement, and passive recreation including a trail head with limited parking, walking trails, viewpoints and a non-motorized boat launch. Human activity (e.g. biking, dog walking, boating) can have a negative impact on natural resources including noise, litter, pet waste and wildlife harassment. Trails can fragment habitat types, particularly forests, and provide corridors for introduction of invasive plant species.

Basic Utilities
Basic utilities are infrastructure services such as water and sewer pump stations, electrical substations, and power line corridors that need to be located in or near areas where the utility service is provided. Basic utilities are allowed by right, with limitations or as conditional uses in all zones.

Construction and maintenance of utilities can have negative impacts on natural resources. Corridors cleared of vegetation can increase wind and light penetration into adjacent habitat areas and can provide opportunities for intrusion of invasive, non-native plant species. Construction of basic utility facilities often fragments wildlife habitat. Operation of existing facilities has few adverse impacts on natural resources, except in the case of overhead electrical lines which must be cleared of high structure vegetation and can entangle birds.

Mining
Mining is allowed as a conditional use in the Open Space (OS) and is prohibited in all other zones. Currently there are no mining operations in the WHI area.

Mining has the most severe environmental impacts of all uses allowed in the OS zone as it generally eliminates all natural resources from the area being mined and often results in long-term water quality degradation. Once the mining operation is closed, enhancement of soil and vegetation is possible, but natural resources often cannot be fully restored.

While mining is allowed conditionally within the OS base zone, mining is not an anticipated use under the Final Base Concept Plan for WHI.

Radio and Television Broadcast Facilities
Most low powered transmitters, such as cordless telephones and citizen band radios are allowed in all zones. More powerful and larger radio, television and cell phone broadcast facilities are allowed in all zones subject to limitations or as conditional uses. The impacts of these facilities are minimal as compared to other uses, except open space. Certain of these facilities can pose hazards to migratory birds. During bad weather birds fly lower and may be disoriented by the lights of the towers and may run into towers or guy wires. There may be a greater visual impact from these broadcast facilities.

Rail Lines and Utility Corridors
Rail lines and utility corridors are allowed by right in industrial zones and are a conditional use in open space zones. Construction of rail lines often requires substantial quantities of excavation and fills to meet the 0-3 percent slope standards. Generally, additional grading results in natural resource disturbance and degradation of soil, vegetation and wildlife habitat. Most rail corridors are maintained by extensive chemical vegetation treatment with a potential for ground and surface water impacts. Rail corridors can also create wildlife hazards or barriers to wildlife movement.

Rail and utility corridors can, pose additional risk of wildfire. Rail lines can cause sparks that can ignite dry vegetation. Utility corridors typically must be kept clear of tall vegetation that could harm overhead facilities. Topping or removal of trees is a common practice in utility corridors. Topped trees are more susceptible to disease and are less inhabitable by wildlife.

The West Hayden Island area is a major transportation hub which contributes to the economic value of the area. Rail lines distribute goods regionally. The Burlington Northern Santa Fe Railroad corridor is located on the eastern edge of West Hayden Island and the Union Pacific Railroad corridor is located immediately south on the mainland in Portland.

Commercial and Institutional Uses
Retail office, commercial parking lots, event facilities and daycare facilities could be allowed as conditional uses in the IH zone. These uses would involve vegetation clearing, grading, filling and solid

compaction, as well as addition of impervious surfaces and landscaping, with associated impacts on natural resources. These types of uses would likely generate more automobile traffic than industrial uses, but less truck traffic and rail use. Impacts would occur primarily during the day, while many industrial uses may occur at all hours.

Residential Uses

Household use is allowed as a conditional use in the IH Zone. This use would also result in vegetation clearing, grading, filling, and soil compaction, as well as addition of impervious surfaces and landscaping, but at lesser scales and intensities than industrial or commercial uses may require. In the West Hayden Island area there are existing floating homes located within an industrial zone. The maintenance, repair and replacement of those structures is allowed as a conditional use.

Other Land Use and Enabling Procedures

There are certain allowed uses and enabling procedures that are not assigned to a single category by the City zoning code. These include infrastructure, nonconforming situations, land divisions, partitions and property line adjustments.

Infrastructure

Infrastructure uses are accessory to urban development and include roads, water, sewer, electric, television lines and other public and private utilities not described by the zoning code category "basic utilities". Infrastructure is allowed in all city zones. Some of these uses are regulated by city public works and building codes, though requirements do not relate to the protection of Goal 5 resources. The uses generally have similar impacts as other development activities like vegetation clearing, soil grading, piping streams, etc.

Land Divisions, Partitions and Property Line Adjustments

These are procedures that establish lots or relocate property lines within a zone. While the act of adjusting or creating lot lines does not directly impact resources, the new or modified lots may allow more conflicting uses or a greater intensity of development than the original lots. Often the outcome of adjusting lot lines or creating lots is to increase development opportunities thus increasing impacts on natural resources.

4.d.3 Impacts of Multnomah County Conflicting Uses

The conflicting uses allowed under Multnomah County zoning for WHI are addressed generally. The uses allowed or conditionally allowed in the county's MUF zone include agriculture, residential housing, including floating homes, wood processing, retail sales, utilities, mining and natural resource conservation. Should the City decide not to annex WHI, these uses would remain on WHI.

The impacts of the conflicting uses associated with county zoning are similar as those described in *4.d.1 Common Impacts of Conflicting Uses*: clearing vegetation; grading, excavation, filling and soil compaction; adding impervious surface (e.g. buildings, parking areas, roads, driveways); modifying rivers and floodplains (e.g. filling, bank armoring to protect structures); generating pollution; landscaping with non-native and/or invasive vegetation (e.g. lawns, ornamental trees); building fences and other wildlife barriers; and other impacts such as pets, light, noise, litter, etc.

Some of the conflicting uses are similar to those described in *4.d.2. Impacts of Specific Conflicting Uses*: residential uses; commercial uses (e.g., retail); open space; basic utilities; mining; and infrastructure. However, the extent and intensity of the conflicting uses would be less in a rural area than in an urban area.

Forestry practices
Depending on the actions, forestry practices can have significant environmental impacts. Harvesting of trees impacts water quality, hydrology, microclimate, flood storage capacity and wildlife habitat. Replanting of the forest can restore the functions, but it takes many decades before a newly planted forest provides the same functions as an established, closed canopy forest.

Farm Uses
Depending on the actions, farm uses can have significant environmental impacts. Animal grazing removes understory vegetation, allowing invasive plants to outcompete reestablishment of native plants. Soil compaction and erosion are also common impact associated with grazing. Raising and harvesting crops can have significant or negligible environmental impacts. For example, plowing fields and planting with hay remove native vegetation, impacts soil and hydrology, and establishes non-native plants. Other uses, like harvesting berries from existing vegetation has little impact on the natural resources.

Mining
Mining has the most severe environmental impacts of all uses allowed in the OS zone as it generally eliminates all natural resources from the area being mined and often results in long-term water quality degradation. Once the mining operation is closed, enhancement of soil and vegetation is possible, but natural resources often cannot be fully restored.

Residential Uses
Residential uses within the current county zoning include one house per 30 acres of land. The impacts would include some clearing and grading to develop roads, driveways and structures. Landscaped areas remove native vegetation and can introduce invasive plants. Pets can also harass wildlife.

Commercial Uses
Wholesale or retail sales of farm and forest products is allowed per county zoning. Commercial uses typically include clearing and grading and large parking lots and other impervious areas are common features of commercial, which reduces infiltration and generates stormwater runoff. Vehicle-related pollution is generally greater in commercial areas than in residential areas due to increased traffic and concentrated parking areas. Increased traffic can also be hazardous to wildlife. Commercial uses can diminish or eliminate open space, scenic and recreational values.

Chapter 5 – ESEE Analysis

5.a. Introduction

The ESEE analysis is intended to evaluate the potential consequences of ***allowing, limiting, or prohibiting*** conflicting uses, based on the primary use scenario and other potential scenarios, in areas containing significant natural resources for the WHI resource site, plus the impact area.

Significant natural resources are identified and mapped in the draft inventory (*Hayden Island Natural Resources Inventory, February 2012*). The inventory includes maps and narratives describing the type, location, extent and condition of the resources. The inventory also assigns these resources scores and ranks to reflect the relative quality and quantity of the resources in terms of specific riparian corridor functions and wildlife habitat attributes (see Chapter 3 for more detail on the inventory methodology).

Conflicting uses are described in Chapter 4 and are based on uses allowed under the proposed primary use scenario for WHI and alternative scenarios:

Primary Use Scenario: Based on the City Council resolution that directs the Bureau of Planning and Sustainability to continue planning for a mix of no more than 300 acres of marine terminal industrial development and at least 500 acres of open spaces uses on WHI. The use scenario assumes that WHI would be annexed into Portland.

Alternative Use Scenarios: Based on other splits of use on the island

a. Annexation with 420 acres marine terminal/380 acres open space, or
b. Annexation with 100 acres marine terminal/700 acres open space.
c. Not Annexing WHI. Based on a decision by City Council not to annex WHI into Portland, WHI would remain in Multnomah County and the current county zoning would continue to apply.

The ESEE analysis includes a section for each of the four factors evaluated: economic, social, environmental and energy. Each section includes a narrative that describes the issues and conflicting use impacts being assessed for each factor based on the primary use scenario. For example, the social analysis addresses consequence of development for cultural and historic values, education, public health, etc.

Following the narrative are two tables that summarize the consequences of allowing, limiting or prohibiting conflicting uses based on the primary use scenario. The first table addresses consequences from the perspective of the conflicting uses and the second table addresses consequences from the perspective of the natural resources in the study area. For example, prohibiting conflicting uses (e.g. industrial development) within significant natural resource area may have negative economic consequences as relates to the conflicting uses (e.g., no additional employment), as described in the first table. The same decision might have positive economic consequences relating to the natural resources (e.g., ecosystem services), as described in the second table.

The consequences are presented using qualitative descriptions and simple ratings to show whether the net potential impacts are expected to be generally and relatively positive, negative, or neutral/negligible. In some instances a consequence may be assigned a positive and negative rating, reflecting that the policy choices may have a mix of advantages and disadvantages.

Following the detailed evaluation of the primary use scenario, a narrative is provided that examines how the consequences would change if more or less land were available for marine terminal development or for open space. Also included here is a general description of the consequences associated with a decision not to annex WHI and it to remain in Multnomah County with current zoning.

A third table in each of the four ESEE sections presents a recommended decision for that specific factor. This recommended decision is intended to balance the consequences of only that factor to produce a recommended level of protection taking only that factor into account. For example, given the environmental consequences, if environmental factors were the only thing considered, what would be the recommendation? The recommendations in this chapter do not look across the factors; economic vs. social consequences are not included in this chapter. Chapter 6 will evaluate the consequences across the factors and produce a recommendation.

The narratives and tables within this chapter include both detailed and summary explanations of the consequences and describe, to the extent there is existing information, primary, secondary and tertiary impacts for the local and regional community. While the main intent of the final ESEE recommendation is to inform land use actions to address natural resources, this analysis is intended to be inclusive and will give the community and City decision makers a better understanding of the full affects of the different development scenarios. As such, the analysis will likely inform decisions and strategies that extend beyond the official ESEE decision.

5.b. "Allow," "Limit," and "Prohibit" Explained

Allow a conflicting use

According to the Goal 5 rule, "a local government may decide that a conflicting use should be allowed fully, notwithstanding the possible impacts on the [inventory] site." The Goal 5 rule also requires that the ESEE analysis "demonstrate that the conflicting uses is of sufficient importance relative to the [inventory] site, and must indicate why measures to protect the resource to some extent should not be provided." [660-23-040(5)(a)]

Where an allow decision is applied, cities and counties may still apply tools to protect or enhance natural resource functions. For example, the City of Portland requires any new development or redevelopment involving at least 500 square feet of impervious surfaces (e.g. structures, driveways) to meet Stormwater Management Manual requirements. This requirement came about as a result of other regulatory obligations, independent of a Goal 5 program decision. Other tools include low impact development, best management practices, education and restoration.

Limit a conflicting use

The Goal 5 rule states, "a local government may decide that both the [inventory] site and the conflicting uses are important compared to each other and, based on the ESEE analysis, the conflicting use should be allowed in a limited way that protects the [inventory] site to a desired extent." [660-23-040(5)(b)]

A program to limit conflicting uses can be designed to allow some level of development with certain restrictions to protect the natural resources to the maximum extent possible and/or compensate for impacts. Mitigation may be required to replace lost natural resource features and/or resource functions (e.g. planting native vegetation, restoring floodplain connectivity, creating new resource areas, etc.). Design standards may be established to lessen the impact on natural resources (e.g. tree preservation, cluster development, impervious surface reduction, etc.).

The levels of limitation on conflicting uses can vary and could include one or more of the following options that may apply to specific natural resources features and functions in the site:

- *Strictly Limit* – Development would need to avoid significant natural resources except in narrowly defined instances (e.g., the resource area is the only place where access across a property can be provided; the project is needed and the public benefit outweighs the environmental impacts).
- *Limit (avoid, minimize, mitigate)* – This type of limit decision would require conflicting uses to avoid and minimum impacts to significant natural resources to the maximum extent practicable and to mitigate for unavoidable impacts. Currently, where a land use review is required, the City must find that the selected project alternative will have the least adverse impact on significant natural resources as is practicable. Impacts that cannot be avoided must be mitigated.

- *Limit (mitigate only)* – In this instance, specific activities, called out in the ESEE analysis, would need be mitigated for, but would not be required to avoid or minimize impacts on natural resources. This approach can be appropriate when the future impacts of a conflicting use are well understood and the benefits of the conflicting use outweigh the impacts to the significant natural resources. It can also be appropriate to address an existing or potential future problem, such as when a slope fails and property is at risk. Actions to repair the slope could be taken without avoiding or minimizing impacts to the resource, however, mitigation for impacts (e.g. tree removal) would still be required.

Prohibit conflicting uses

A decision to prohibit conflicting uses would provide, significant natural resources the highest level of protection. According to the Goal 5 rule, "a local government may decide that a significant [inventory] site is of such important compared to the conflicting uses, and the ESEE consequences of allowing the conflicting uses are so detrimental to the resource, that the conflicting use should be prohibited." [660-23-040(5)(c)] Some development may be allowed if all economic use of a property would be prevented through full protection.

5.c. Building on Metro ESEE Analysis

As described in earlier chapters of this report, Metro conducted a regional-scale ESEE analyses, following the State Land Use Goal 5 steps, and upon which it based the Title 13 Nature in Neighborhoods program. Cities and counties in Metro's jurisdiction must demonstrate that their programs are in substantial compliance with Metro's ESEE decision in developing or refining programs to comply with the requirements of Title 13 to protect and conserve significant riparian corridors and wildlife habitat. Based on an evaluation of fish and wildlife habitat value and urban development value Metro's decision was to designate West Hayden Island a *Moderate* Habitat Conservation Area.

Metro general approach for evaluating these respective values is presented in the table below (EXHIBIT C, Ordinance No. 05-1077C, Urban Growth Management Functional Plan, Title 13 Nature in Neighbhorhoods, p.13 of 21).

Table 6: Method for Identifying Habitat Conservation Areas (HCA)

Fish and wildlife habitat classification	***High Urban development value[1]***	***Medium Urban development value[2]***	***Low Urban development value[3]***	***Other areas: Parks and Open Spaces, no design types outside UGB***
Class I Riparian/Wildlife	Moderate HCA	High HCA	High HCA	High HCA/ High HCA+[4]
Class II Riparian/Wildlife	Low HCA	Low HCA	Moderate HCA	Moderate HCA/ High HCA+[4]
Class A Upland Wildlife	No HCA	No HCA	No HCA	No HCA/ High HCA[5]/ High HCA+[4]
Class B Upland Wildlife	No HCA	No HCA	No HCA	No HCA/ High HCA[5]/ High HCA+[4]

Note: The default urban development value of property is as depicted on the Metro Habitat Urban Development Value Map (Title 13 Exhibit C). The Metro 2040 Design Type designations provided in the following footnotes are only for use when a city or county is determining whether to make an adjustment pursuant to Section 4(e)(5) of Title 13.

1 – Primary 2040 design types: Regional Centers, Central City, Town Centers, and Regionally Significant Industrial Areas

2 – Secondary 2040 design types: Main Streets, Station Communities, Other Industrial Areas and Employment Centers

3 – Tertiary 2040 design types: Inner and Outer Neighborhoods, Corridors

4 – Cities and counties shall give Class I and II riparian habitat and Class A and B upland wildlife habitat in parks designated as natural areas even greater protection than that afforded to High HCA, as provided in Section 4(A)(5) of Title 13.

5 – All Class A and B upland wildlife habitat in publicly-owned parks and open spaces, except for parks and open spaces where the acquiring agency clearly identified that it was acquiring the property to develop it for active recreational uses, shall be considered High HCA.

In addition, Title 13 directs the City of Portland develop a "district plan" for West Hayden Island in cooperation with the Port of Portland. A district plan is intended to serve as an area-specific program for compliance with Title 13. District plans may be developed for land within the same watershed. Cities and counties must demonstrate that district plans are in substantial compliance with Title 13 provisions to protect, conserve and restore Habitat Conservation Areas. District plans are envisioned to incorporate a mix of programs, including alternative programs as described in Title 13, as well as conventional approaches (e.g., comprehensive plans and associated ordinances) (See Chapter 2 for additional explanation of Title 13).

The City's ESEE analysis is intended to incorporate the wealth of new information that has been produced for West Hayden Island since Title 13 was adopted and to evaluate a specific scenario as directed by the Portland City Council. As noted above, the City will be carrying forward Metro's overall "limit" decision for WHI, and honing that decision through a more detailed, site specific evaluation of tradeoffs as related to specific potential use scenario. The use scenario is described below.

5.d. Baseline Assumptions

This ESEE analysis reflects several key assumptions, specifically:

- Scenarios for limiting conflicting uses on WHI
- Assumed uses of West Hayden Island Absent a Future Marine Terminal
- Columbia River Crossing
- Terminal 6

5.d.1. Scenarios for Limiting Conflicting Uses on WHI

This ESEE Analysis evaluates in detail a primary use scenario for WHI, as described in the Final Base Concept Plan. The primary use scenario was the subject of multiple studies, some of the findings of which are summarized here. There are alternative scenarios that would create different mix of marine terminal development and open space uses on WHI and would likely meet the general regional limit decision for all of WHI. In all scenarios, annexation of WHI into the City of Portland and application of IH and OS base zones is assumed. Additional assumption for the use scenarios are described below.

5.d.1.a. Primary Use Scenario: Final Base Concept Plan for West Hayden Island

In July 2010 the Portland City Council passed Resolution 36805 directing the Bureau of Planning and Sustainability to develop a legislative proposal for the annexation of WHI. The resolution called for designating at least 500 acres as open space with emphasis on permanent protection and management for the benefit of the regional ecosystem. In addition, no more than 300 acres of land should have an industrial designation for future deep-water marine terminal development. Council further specified that the deep water marine terminal footprint area, to the extent feasible, should be located over the existing dredge disposal site area.

The City hired a consultant, WorleyParsons (WP), to develop a concept for a 300 acre marine terminal design, including a rail loop, three terminals and two docks, and at least 500 acres of open space with natural resource enhancement and passive recreation. WP worked with staff and an advisory committee to produce the Final Base Concept Plan that meets the City Council resolution. The Final Base Concept Plan includes the following elements (see Map 12):

Marine Terminal

- A rail loop that accommodates a 10,000 foot long unit train
- Three terminals (grain, automobile and dry bulk) and on-site manufacturing
- Two different types of docking systems
- A 100-foot set back from ordinary high water, expect for the docks

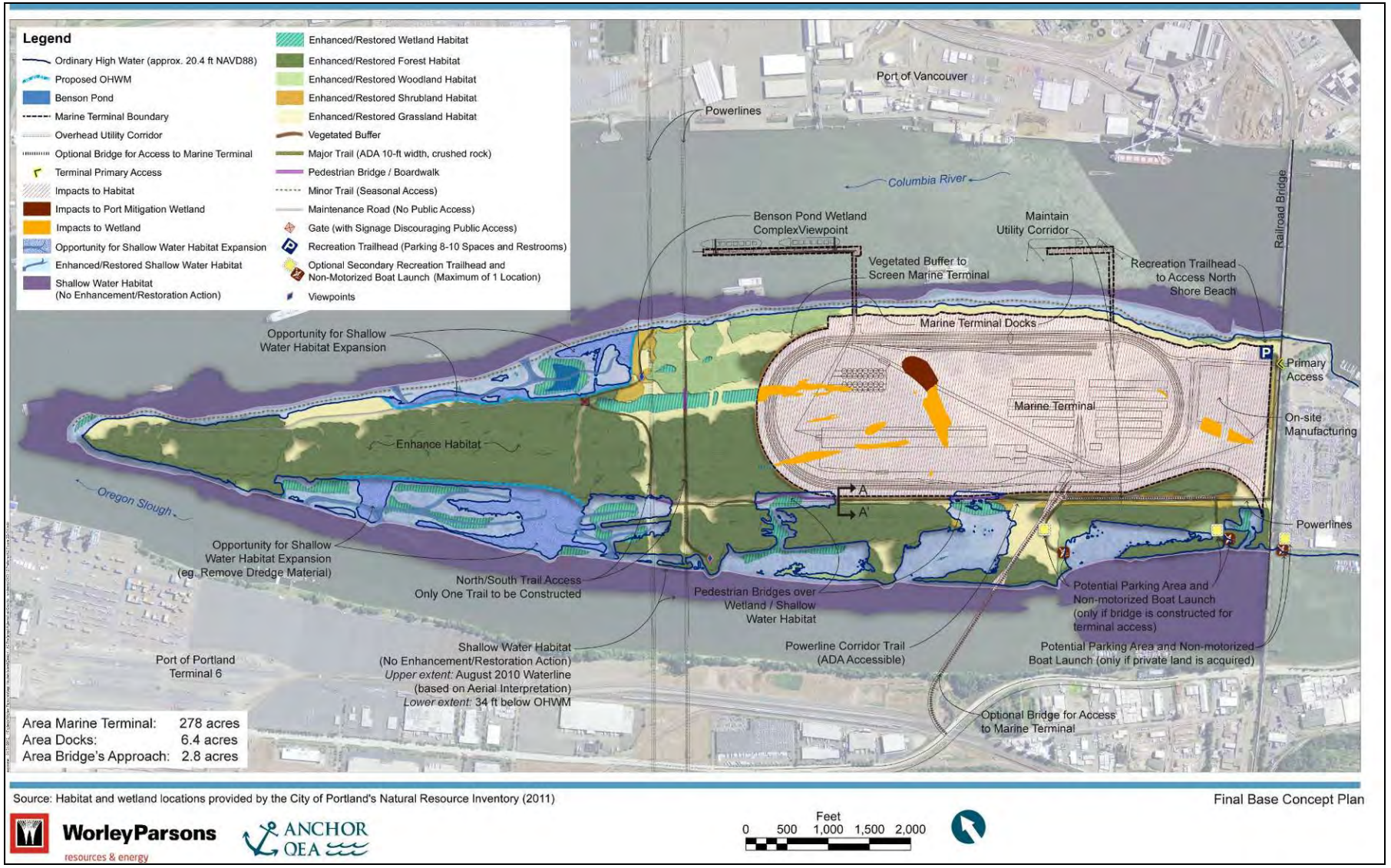
Natural Resources (some habitats overlap)

- 500 acres of on-island natural resource preservation
- 340 acres of forest and woodland enhancement opportunity area
- 170 acres of shallow water habitat enhancement opportunity area and 15-25 acres of opportunity for shallow water habitat expansion
- 45 acres of wetland enhancement opportunity area

Recreation

- A pedestrian trail and two points that are confined to the eastern half of WHI
- An informal pedestrian trail along the north shoreline below ordinary high water
- A small parking area and trail head at the end of Hayden Island Drive
- An option for a non-motorized boat launch along the southern bank

The Final Base Concept Plan serves to document a realistic scenario for development on WHI. The Final Base Concept Plan is the primary use scenario being evaluated in this ESEE. For purpose of the ESEE it is assumed that under this scenario the City would annex WHI and apply base zoning in the current configuration shown in the Final Base Concept Plan. However, the Final Base Concept Plan is not treated as a foregone conclusion, but rather a model to evaluate the trade-offs of marine terminal development and open space uses within proposed base zones. It is important to keep in mind that while the City Council resolution and the Final Base Concept Plan envision a limited suite of uses on WHI, the ESEE analysis is required to assess the potential consequences of the full range of conflicting uses allowed under the anticipated zoning.



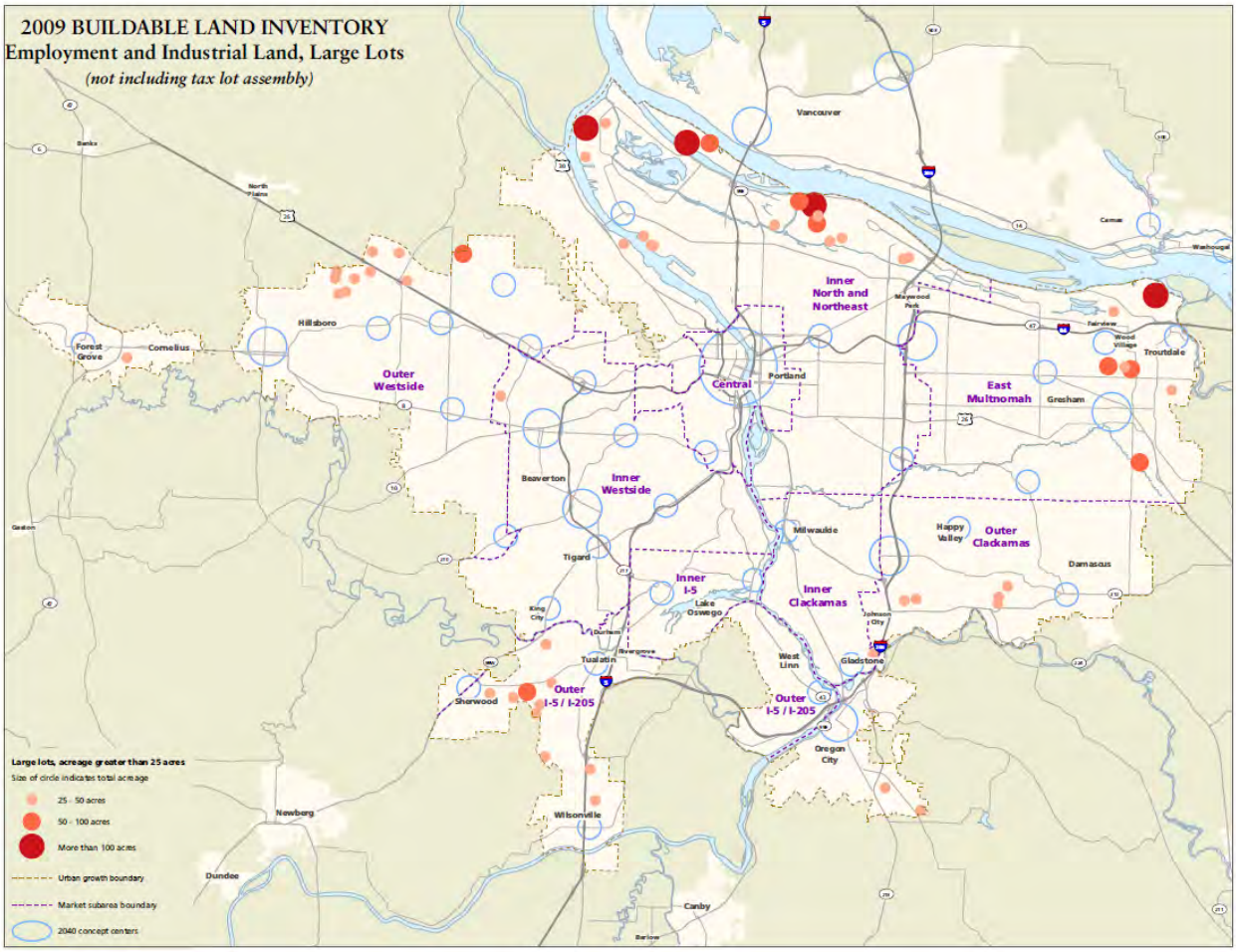
Map 12: Final Base Concept Plan

5.d.1.b. Alternative Marine Terminal/Open Space Ratios for West Hayden Island

The main purpose of this ESEE Analysis is to evaluate a specific use scenario for WHI based on the City Council's direction. Other studies, such as the Final Base Concept Plan, evaluated how much land would necessary to accommodate a modern marine terminal. However, there are other plausible scenarios that could also provide for a mix of marine terminal development and open space uses on WHI. One option would be to reserve 420 acres for marine terminal development and 380 acres for open space uses. This split comes from the Urban Growth Report produced by Metro in 2010.

The Urban Growth Report (UGR) is used to estimate regional land supply and demand for employment and residential uses over 30 years and support decisions regarding the location of the Urban Growth Boundary to accommodate estimated growth. Metro completed the most recent regional analysis in 2009. To determine land supply for industrial uses, Metro identified vacant land in the region and categorized the sites into three size thresholds: less than 50 acres, 50-100 acres and 100 plus acres. On WHI, four tax lots were identified as vacant and buildable using the UGR methodology. The tax lot acreages were 343, 62, 9 and 9 acres each, totaling 423 acres. Metro identified two "large" lots on WHI, one in the 50-100 acre category and one in the 100 plus category.

The second use scenario is based on the UGR that considered 420 acres of marine terminal development and 380 acres of open space.



Map 13: 2009 Buildable Lands Inventory, Employment and Industrial Land Large Lots
Source: Metro Urban Growth Report 2009

A third use scenario could be to provide more open space and less industrial land. The UGR used 100 acres as the cut off between "large" and "small" industrial lots. The Harbor Lands Analysis (ECONW, 2012) and the Buildable Lands Inventory (DRAFT, October 2012) also used 100 acres as a cut-

off. Although opinions vary on the minimum size required for a modern marine terminal with rail access, the Harbor Lands Inventory considered 100 acres as a potential minimum when considering lands within the Portland Harbor. These reports form the basis for the third use scenario of 100 acres of marine terminal development and 700 acres for open space uses.

Most of the information incorporated in this ESEE Analysis was developed to evaluate the 300/500 acres primary use scenario called for in the City Council resolution. Neither the 420/380 acre nor 100/700 acres split have been studied in great detail. Therefore, evaluation of the alternative use scenarios is based on a general extrapolation of the 300/500 acre use scenario findings and information from other sources. Each section in this chapter includes a short description of the issues that would be substantially different if a different land spilt between marine terminal and open spaces were addressed.

5.d.2. Assumed uses of West Hayden Island Absent a Future Marine Terminal

In 1977, Multnomah County designated West Hayden Island "Natural Resource, Multiple Use Forestry" because the need for future urban uses was not identified. In 1983, the county changed the designation from "Natural Resources" to "Significant Environmental Concern" and stated that any long term environmental and recreational losses from urban uses would be identified and addressed in the community planning process. The adopting ordinance also stated that future use of West Hayden Island is anticipated to be marine industrial.

Also in 1983 the regional government (Metro) expanded Portland's Urban Growth Boundary to include West Hayden Island. In conjunction with the Urban Growth Boundary expansion, Multnomah County re-designated West Hayden Island from "Multiple Use Forestry" to "Future Urban" within the Multnomah County Framework Plan. (Note: This is similar to the City's comprehensive plan designations that indicate the future desired use while the zoning remains static.) The impetus for both actions was to provide a future site for waterfront industrial and marine terminal uses. Through the Multnomah County analysis the County found that additional waterfront acreage was needed within the UGB to meet the forecasted demand for marine terminal uses. That analysis also found that natural resources located on West Hayden Island are significant enough to warrant some level of protection.

When Metro performed their ESEE Analysis for Title 13, Metro did not use the MUF/SEC zoning to perform the evaluation. Instead, Metro looked at development value, employment value and policy priorities. WHI was identified as having high and low development, employment and policy value. The policy directives that support this are the UGB expansion for future marine terminal use and the Metro Title 4 designation of WHI as a Regionally Significant Industrial Area.

The City's ESEE Analysis builds on Metro's analysis and tests a use scenario involving a specific mix of marine terminal development and open space. This ESEE Analysis assumes that the City would annex WHI and apply IH and OS base zoning. The analysis also looks at the consequences of a modified mix of marine terminal and open space uses to explore how the consequences could incrementally change.

If City were to decide to not annex WHI, it is assumed that WHI would remain in Multnomah County and the MUF/SEC zoning would govern future development. Each section in this chapter includes a short description of the MUF uses and the potential consequences of those uses. County MUF uses include: forest practices associated with the production, management and harvesting of timber; wood processing operations (e.g., piling preparation, wood chipping); farm use for raising and harvesting crops or raising livestock; public and private conservation areas and structures other than dwellings for the protection of water, soil, open space, forest and wildlife resources; and residential use consisting of a single-family dwelling including a mobile or modular home, on a lot of 38 acres or more.

5.d.3. Columbia River Crossing (CRC)

The Columbia River Crossing (CRC) is a large transportation project jointly owned by the Oregon Department of Transportation (ODOT) and the Washington State Department of Transportation

(WSDOT). Oversight of CRC rests with the governors and legislatures of both states. The project proposes to replace the Interstate Bridge, improve five miles of I-5, extend light rail to downtown Vancouver and improve bicycle and pedestrian facilities. The CRC has completed its analysis of community and environmental effects of the project in the Final Environmental Impact Statement (EIS) released in September 2011 and the record of decision in December 2011. The project is currently finalizing financial plans and construction phasing for the various phases of the project.

The WHI Transportation Analysis prepared by the Portland Bureau of Transportation (PBOT) assumes that the CRC project will be built. PBOTs future model network incorporates the I-5/Marine Drive interchange and Hayden Island interchange designs from the CRC project.

Completion of the CRC, including the improvements to Interstate 5, is an important aspect of the transportation modeling for the WHI project, but more importantly, it is a key link to the regional transportation network. Removal of or significant alterations to the current CRC project parameters would have a residual effect on all planning models undertaken by PBOT including modeling assumptions for WHI. Any significant changes to the CRC would require PBOT to reassess their models for WHI, and could result in different conclusions.

5.d.4. Terminal 6

Note – While this ESEE analysis is being performed for the entire inventory site, only the portions of this ESEE that apply within the area to be annexed into the City of Portland are being forward to City Council for adoption. Terminal 6 and other industrial land south of the Oregon Slough are currently located with the City of Portland and ESEE recommendations that would apply within the current city limits will not be carried forward at this time to City Council for adoption.

The Port of Portland Terminal 6 is located on the southern bank of the Oregon Slough and Columbia River, at the confluence with the Willamette River. Two auto terminals and a container terminal are the main uses along with dredge material handling. It is anticipated that these uses will be on-going:

- Ongoing berth maintenance activities occur on an annual basis along all berths at Terminal 6. This includes, but is not limited to berths, wharves, piers, fendering systems, mooring points, and dolphins.
- Maintenance of the pipe access ramp into the Suttle Road site occurs as needed along the shoreline and bank of the Oregon Slough.
- Vegetation management activities occur along the shoreline and bank or all Port properties along the Oregon Slough
- Ongoing Suttle Road Dredge Material Rehandling Area and WHI DMMA management, including vegetation management, security, safety, structure maintenance and other maintenance activities on an as needed basis.

The 2012 Port Transportation Improvement Plan (Port of Portland) identified new projects at Terminal 6 including:

- Wharf optimization
- Container crane modernization
- Auto import storage
- Rail extension and overcrossing
- Stormwater improvements

5.e Economic Analysis

This section examines the economic consequences of allowing, limiting or prohibiting conflicting uses for the West Hayden Island study area. The economic consequences are expressed as the qualitative and relative costs, benefits, and impacts of the three program choices – allow, limit or prohibit the conflicting use. This portion of the ESEE analysis relies on current information and specified assumptions relating to:

1) The economic goods and services provided by the conflicting uses (i.e. development and use-related activities); and
2) The ecosystem services provided by existing significant natural resources in the West Hayden Island study area.

5.e.1. Goods and Services provided by Conflicting Uses in the West Hayden Island Study Area

In 1983, Metro brought WHI into the Urban Growth Boundary (UGB) "to satisfy a long term regional need for water-dependent deep water marine terminal and industrial facilities" (Metro Ordinance No. 83-151). The land was designated as a Regionally Significant Industrial Area in 2004, "with site characteristics that are relatively rare in the region that render them especially suitable for industrial use" (Metro Ordinance 04-104B; MC 3.07.130).

West Hayden Island is located within the Columbia River flood plain. The existence of natural resources on the island and the shoreline include extensive bottomland hardwood forests, wetlands, shallow water habitat and natural banks. These resources have been depleted in the lower Columbia River basin, especially in urban areas. In 2005, Metro designated West Hayden Island as a moderate Habitat Conservation Area (HCA) under Metro Title 13 because of the multiple riparian corridor and wildlife habitat functions it provides. Title 13 requires that the City develop a District Plan for West Hayden Island in cooperation with the owner, the Port of Portland, to establish site-specific habitat conservation measures that protect natural resources and mitigate the environmental impacts of industrial development (Metro Code 307.1330.B.4.b).

In accordance with the Final Base Concept Plan, West Hayden Island would be zoned for 300 acres of Heavy Industrial uses (IH) similar to other lands within the Portland Harbor. The Comprehensive Plan would also be amended to indicate that the 300 acres are designated as Industrial Sanctuary. The IH zone allows a wide variety of industries and is one of three zones that implement the industrial sanctuary policy.

The remaining acreage would have an Open Space (OS) zoning designation. The types of uses specified in the Final Base Concept Plan include limited passive recreation (e.g. pedestrian trail, non-motorized boat launch) and natural resource enhancement opportunities.

It is important to remember that the inventory site also include existing industrial uses along the southern bank of the Oregon Slough, such as Terminal 6. There are also natural resources along the bank. While much of the narrative below is specific to West Hayden Island, the information is applicable to the rest of the inventory site as well.

Generally, the conflicting uses in the study area provide local and regional economic benefits associated with industrial development, commerce, employment, local commercial enterprises, transportation infrastructure, and parks and recreation. Below is a summary of the economic goods and services that would be provided by marine terminal development on West Hayden Island and that are generally associated with the existing industrial development in the rest of the inventory site.

5.e.2 The Traded Sector

Traded sector businesses are companies that sell many of their products and services to people and businesses outside the Portland region, nationally and globally. Examples include most manufacturing and many professional and business service companies as well as smaller craft businesses with local and global customers. Traded sector businesses may be locally owned and can be small, medium or large in size. Portland is considered a small to medium-sized hub in the national and international business and trade community.

Traded sector businesses are important to the local economy. By selling to people and businesses outside Portland, locally-based traded sector businesses bring new money into the local economy. The additional income brought in from exporting goods is further circulated within the local economy as these local firms purchase additional services. Traded sector productivity and market size tends to lead these businesses to offer higher wage levels. Jobs at traded sector companies help anchor the city's middle class employment base by providing stable, living wage jobs for residents. For these reasons, Portland's traded sector businesses have the power to drive and expand Portland's economy. The Draft Portland Plan calls for retaining the competitive market as a West Coast trade gateway as reflected by growth in the value of international trade.

Portland has a strong traded sector job base. The EcoNorthwest *Evaluation of Economic Specialization* (2009) found that the City of Portland's 2nd and 5th largest economic specializations are wholesale trade and transportation, which are the city's freight distribution industries. In 2008, the Portland region's traded sector businesses brought $22 billion of export income into the regional economy, which was 21 percent of total regional economic output. Portland ranked second among U.S. metropolitan areas in export growth over five years. The 118,700 jobs in Portland's industrial districts accounted for 30 percent of the city's employment, including 30,400 manufacturing jobs and 44,000 wholesale and transportation jobs, (Bureau of Planning and Sustainability, 2012).

Portland's transportation and freight related industries are concentrated in the Columbia Harbor; this includes the Port of Portland, trucking and warehousing companies and manufacturing companies that take advantage of the areas proximity to marine shipping, rail, and highway infrastructure. Portland has a strategy to support and expand a targeted set of business clusters: advanced manufacturing, athletic and outdoor, clean tech, software, and research and commercialization. The advanced manufacturing cluster is an important component of the Portland Harbor industrial base, and relies on the transportation infrastructure of that district. In particular, access to the river and railroads is important for shipping raw materials and products that are either too heavy to go by truck or travel longer distances than is economically feasible by truck.

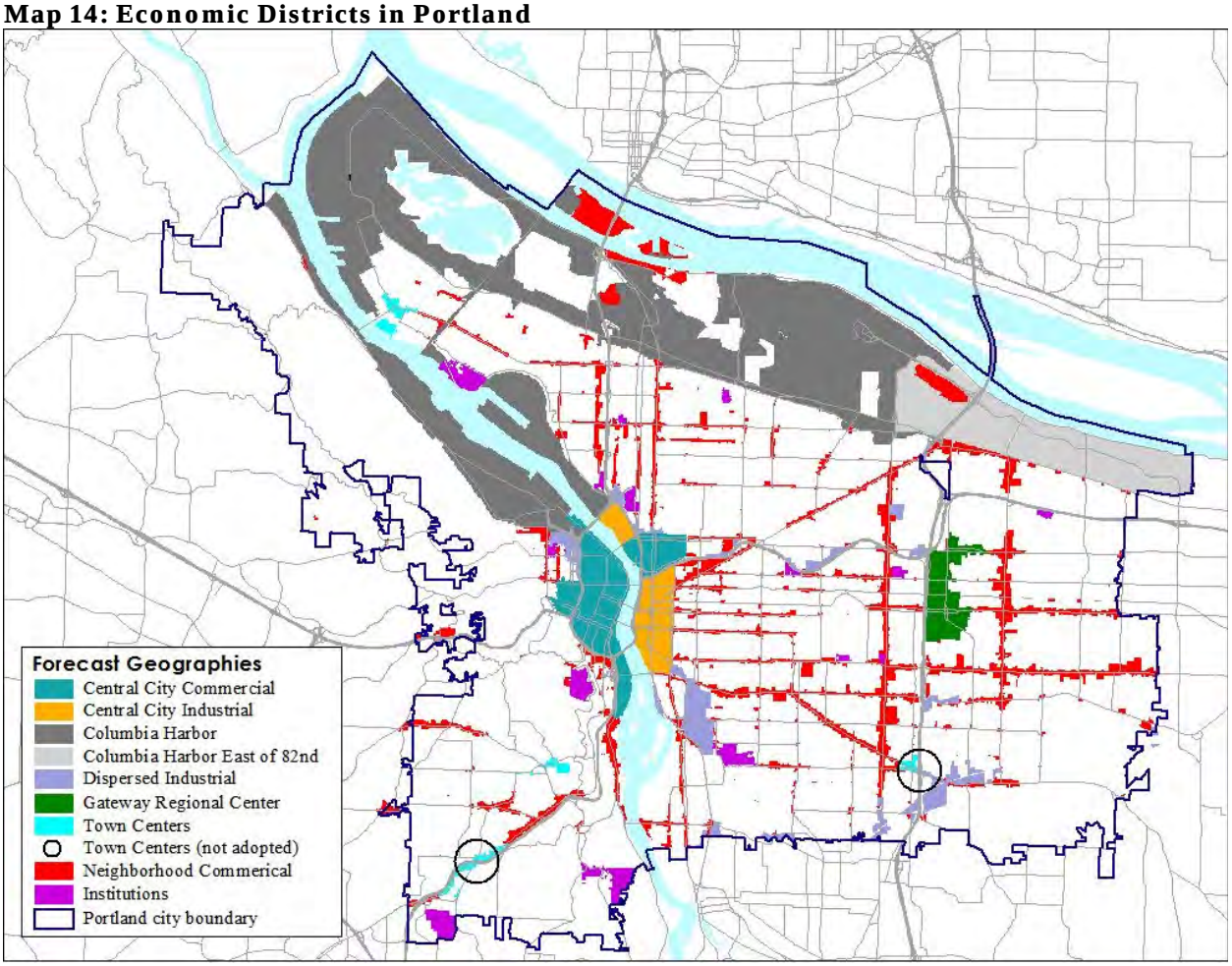
The Columbia River is also the main shipping channel for goods transported by water. The industry sector "transport by water" contributes to the local, regional, and national economies in numerous ways. It provides employment and income to individuals, tax revenue to local and state governments, and revenue to businesses which handle freight. In 2007, an estimated $540 million in direct economic output by this industry sector generated an additional $248 million in indirect output and nearly $117 million in induced output for a total estimated economic output of nearly $905 million from transport by water (ENTRIX Inc., History and Economic Role of Portland Harbor and Marine Related Development, DRAFT Oct 2009).

Portland's Climate Action Plan calls for protection of existing intermodal freight facilities, and support for centrally located and regionally significant industrial areas that may provide for future intermodal facilities. Given geographic and competitive challenges, Portland's role as a leading exporter is fragile because of the limits of the current transportation system. The system is burdened with many obsolete, end-of-life assets (e.g. the functional condition of many roadways and bridges.) Maintaining a cutting-edge built environment is an important aspect of sustaining the region's freight and trade dependent economy.

5.e.2.1. Employment, Income, Business Revenue and Local Tax Benefits

The Columbia Harbor, which includes the Portland Harbor and the Columbia Corridor, has by far the largest share of employment with nearly 54,000 jobs, or 14.6 percent of the City's job base in 2010 (Hovee, 2012).

Map 14: Economic Districts in Portland



Source: E.D. Hovee & Company, LLC, City of Portland Bureau of Planning & Sustainability

The vast majority of jobs in the Columbia Harbor fall into the following categories: transport and warehousing, manufacturing, construction, and industrial services. There are also management and administrative jobs within the district, generally part of the above noted industrial uses, or in related headquarters offices.

Periodically, the Port of Portland commissions Martin and Associates to produce a report called *The Local and Regional Economic Impacts of the Port of Portland*. The most recent report (March 2012) provides information for the 2011 calendar year. This report summarizes the economic impacts generated by maritime activity in the Portland Harbor, including public and private terminals, which comprise a significant percentage of the area of the Columbia Harbor geography addressed in the Economic Opportunities Analysis.

The Martin study estimated that 18,081 resident jobs in Oregon and Washington were generated by cargo and vessel activity at the public and private marine terminals in the Portland Harbor, with a total personal income of over $1.4 billion. Of these, 7,275 were generated specifically by the movement of cargo over the

docks (direct jobs); 6,878 jobs were created to serve the purchasing demand of those employed in direct jobs (induced jobs – like restaurants, retail and professional service, etc); and 3,928 jobs were created by the firms directly related to the shipping of cargo (indirect jobs – like suppliers, trade-related financial and brokerage services, maintenance, etc.). To place these values in context, these values amount to about one percent of total employment and personal income in the Portland-Vancouver metropolitan area.

These direct, induced and indirect jobs also generated $1.5 billion in annual business revenue, and $140 million in tax revenue to state and local governments in Oregon and Washington.

The Martin study also provided data on employment in the public terminals. Within the public terminals, they counted 3,549 direct jobs, 3,476 induced jobs, and 2,074 indirect jobs in 2011. Based on the 885 acres that the public terminals occupied at the time, the following job densities are estimated:

Direct jobs: 4.01/acre
Induced jobs: 3.93.8/acre
Indirect jobs: 2.34/acre

In 2011 both Martin Associates and EcoNorthwest attempted to apply similar information based on 2010 data to arrive at an estimate of the economic effects of development on WHI. EcoNorthwest compiled the following summary:

Table 7: Summary of Results from Recent Economic Impact Analysis

	Total Portland Harbor	WHI Estimate #1	WHI Estimate #2
Jobs			
Direct	7,011	1,175	936
Induced	6,668	1,591	891
Indirect	3,833	847	512
Total	17,512	3,613	2,340
Personal Income			
Direct	$355,905,000	$64,003,000	$47,566,000
Induced	$871,367,000	$192,764,000	$116,456,000
Indirect	$193,015,000	$39,441,000	$25,796,000
Total	$1,420,288,000	$296,208,000	$189,818,000
Business Revenue	$1,481,570,000	$240,324,000	$198,008,000
State and Local Taxes			
Oregon	$80,998,000	$19,977,000	$10,825,000
Washington	$55,221,000	$10,292,000	$7,075,000
Total	$136,219,000	$30,269,000	$17,900,000

Source: EcoNorthwest, 2012, with data from Martin Associates.

At the time the EcoNorthwest estimates were done, the updated information from the 2012 report was not available, but the 2011 numbers were similar. Estimate #1 is based on a 2011 Martin Associates study, adjusted by EcoNorthwest to reflect the smaller 300 acre footprint. Estimate #2 is a further adjusted estimate to reflect the relationship between jobs and tons of cargo anticipated in the forecast, reflecting the most likely mid-range cargo forecast estimate. This second adjustment reflects the cargo types actually envisioned with the WHI concept plan, and the likely demand. In other words, the second estimate is more conservative because it assumes the WHI facilities will not be fully utilized to maximum capacity immediately, and because the cargo types being anticipated for WHI may not be as job-dense as the average figures for the Portland Harbor cited by Martin Associates.

Based on these results, EcoNorthwest estimated direct employment of approximately 900–1,200 people and associated personal income of $45–$65 million. Including multiplier effects, the WHI port may be associated with 2,000–4,000 jobs, $200–$300 million in personal income, and approximately $18–$30 million in state and local tax revenue. It is important to note that EcoNorthwest suggests caution when interpreting these estimates. One reason for this caution is that some of the people employed in these jobs may have been able to find alternate employment elsewhere in the region if WHI were not developed. As a result, the actual impact of development would be less than this. That said, EcoNorthwest notes that

realizing even a small fraction of this annual benefit would be substantial, considering the cost of developing the terminal.

Not all economic development investments have the same impact on the regional economy. Some jobs pay more than others, which means that they can have a greater ripple effect through the regional economy. Creation of a new job with a high wage can lead to the creation of other secondary jobs, as some of those wages will be spent consuming other local products and services. The table below shows the different job multipliers that economists use for economic sectors. A multiplier of 2.0 includes that every job in that sector generates 1 more job off-site through indirect or induced spending effects elsewhere in the region. All other things being equal, industrial and warehouse investments have a greater potential to create a beneficial ripple effect throughout the region.

Table 8: Job Multipliers

Type of Building	Job Multiplier
Office	1.95
Institution	1.62
Flex/BP	2.19
Warehouse	2.36
General Industrial	3.15
Retail	1.64

(Source: ED Hovee, 2012)

The Port of Vancouver hired Martin and Associates to do a similar study, the last of which was completed in August of 2011, summarizing the economic impacts of the Port of Vancouver in 2010. This report separated out the Port's maritime activities and their other industrial real estate holdings. In 2010, the Port of Vancouver's marine terminals generated a total of 1,474 direct jobs, 1,556 induced jobs and 952 indirect jobs for a total of 3,982 jobs related to marine terminal development. In addition there were 10,889 related jobs at firms that used the port to ship and receive cargo via the terminals. This study indicated that maritime jobs had nearly twice the economic value to the local community of jobs generated by other lines of business operated by the port, with an average impact of $230,249 per direct job.

5.e.2.2. Household Self- Sufficiency and Economic Equity

Today, approximately 77 percent of Portland households earn enough income to be considered economically self-sufficient (Bureau of Planning and Sustainability, 2012). This means more than 20 percent of Portlanders do not make enough money to cover their basic household needs. The Self-Sufficiency Index measures whether an income is sufficient to meet the basic needs of most adults, including the cost of housing, childcare, food, health care and transportation. Unlike the federal poverty measure, this standard looks at "real world" household costs, not just the cost of food. The index reflects the variation in the cost of these items by geography and the effects of taxes and tax credits on household income.

The annual income threshold of the federal poverty level for a household with an adult and infant was $14,840 (2008). In comparison, the Self-Sufficiency Index posits that an annual income of $35,711 is needed to meet the basic needs of the same family. Unfortunately, this income substantially exceeds the average 2008 earnings in Multnomah County. In 2008, annual income (2008) for workers in various employment sectors was:

- Retail worker - $27,300
- Food and drink service - $16,600
- Personal service workers - $25,360

Low-income residents have generally lost ground during the economic growth of recent decades. From 1979 to 2005, Oregon households in the bottom 20 percent of the income distribution have seen a 14 percent decline in their inflation-adjusted average income (Bureau of Planning and Sustainability, 2012). In particular, disproportionate income disparities persist for communities of color, residents with disabilities, young female householders and other groups. In 2010 the average household income for African Americans in Portland was only $26,449, which is well below what is necessary to maintain self-

sufficiency (Bureau of Planning and Sustainability, 2012).

An important factor in Portland's future economic prosperity, and addressing economic equity concerns, will be maintaining and growing "family-wage" jobs. Manufacturing and distribution jobs are typically an important part of any long-term economic development strategy because often wages in these sectors are significantly higher, and they are available to those with lower levels of education. Average wages of the direct jobs provided at public and private marine terminals in the Portland harbor is $50,392 (Local and Regional Economic Impacts of the Port of Portland, 2011, Martin Associates, March 2012). Although both in Portland and nationwide, manufacturing jobs have declined as more industrial processes have become automated, the Portland region has held onto a higher number of manufacturing jobs than most other US cities have. Portland has some comparative advantage in this sector (ED Hovee & Company, 2012 - see Section I of the EOA, Local Sector Specializations).

5.e.2.3. Land Supply for Marine Terminal Development

Oregon cities are periodically required to update their Comprehensive Plans, this is called *Periodic Review*. Portland is undergoing that review now, through late 2013. One key part of that state-mandated process is evaluation of economic opportunities and review of the land supply available to accommodate expected job growth. This analysis is known as an Economic Opportunities Analysis (EOA). Portland completed an initial draft of this analysis in 2009. A second draft was published in 2011, and a final report was adopted by City Council in October 2012. The EOA includes four elements: 1) a summary of trends, opportunities and market factors; 2) an analysis of the demand (employment and cargo growth in this case); 3) an inventory of land supply; and 4) a summary of policy options.

The Harbor Lands Analysis (ECONW, 2012) evaluates vacant land supply that has been identified in several different studies, including the draft and current EOA, an Economic Foundation Study done by ENTRIX and an aerial survey that was done by BPS staff. Table 9, below, summarizes the land supply conclusions for the Portland Harbor.

Table 9: Summary of Portland Harbor Vacant Land Inventories

		City of Portland Harbor Land Supply		Parcel Size (3)	
Study	**Year**	**Gross Acres (1)**	**Effective Acres (2)**	**50-250 Acres**	**250+ Acres**
EOA, ED Hovee & Co. Draft 1	2009	266	61	0	0
ENTRIX, Inc.	2010	299	<50	2	0
BPS GIS Inventory	2011	586	174	3	0
EOA, ED Hovee & Co., BPS	2012	337	94	0	0

1) Total acres of vacant land, without regard to environmental or contamination constraints.
2) Total acres adjusted for environmentally-sensitive land, contaminated land, or land with insufficient infrastructure.
3) Number of individual parcels or polygons of the stated acreage.

Based on this work, there are between 50 and 174 acres of land available for further marine terminal development in the Portland Harbor. There are three significant assumptions that influence this finding.

First, there is an assumed difference between the gross acres of vacant land and the effective supply. Much of the acreage available for development is constrained by contamination or is environmentally-sensitive (riparian habitat, wetlands, etc.). There are several hundred acres of vacant land in the Portland harbor (excluding WHI), but by discounting those acres that are constrained, 178 acres or less are believed to be effectively available to the market. West Hayden Island is also located in the floodplain and would require significant investments to bring portions of the land to the meet the required elevation prior to development.

Second, the amount of land available depends on how "vacant" is defined and whether existing parcel boundaries are treated as a given. A challenge in the harbor is that many areas may appear vacant because there are no buildings; however, large open areas may function as storage or maneuvering area that is integral to industrial operations. For this reason, the City of Portland Bureau of Planning and Sustainability completed a detailed GIS inventory in 2011 to identify truly vacant plots of land, to make these assumptions transparent. Based on that analysis, there is some limited opportunity to "create" more supply (resulting in the higher potential figure of 174 acres) through parcel reconfiguration and aggressive land assembly. A caveat is that much of that land is still constrained by the factors noted above, and not effectively available to the market.

Third, is that the size of available parcels matters. Although there may be up to 174 acres of unconstrained vacant land in the Portland Harbor, most of that land is in small parcels that could not accommodate a modern marine terminal with necessary infrastructure. Based on the Harbor Land Inventory it appears that there are only two sites larger than 50 acres, and no sites over 100 acres, which is the minimum size believed necessary to accommodate a modern rail loop configuration (ECONorthwest, 2012). These existing large sites are located along the Willamette River.

Employment Forecasts

The City of Portland employment forecast is based on Metro's regional forecast of job growth (Metro Gamma Forecast, November 2011). Metro's baseline forecast for the Portland region projects that employment will increase from just under 1 million jobs in 2010 to nearly 1.5 million by 2035. This gain of 520,000 jobs represents a 54% job growth, with an average annual growth of 1.7% from 2010-2035.

The Metro forecast allocates 147,000 additional jobs to the City of Portland by 2035 – an annual average growth rate of 1.3%. This represents a 27% capture rate of the regional employment growth, which is consistent with the historic long-term capture rate for the City of Portland.

Of those 147,000 additional jobs, 18,900 are expected to occur within the Columbia Harbor geography. 2,000 are projected on the riverfront properties with direct access to the river including primarily public and private marine terminals, or private manufacturers and distributers that rely on river access. The EOA concludes that approximately 100 acres of "harbor access land" will be needed to accommodate those additional jobs (ED Hovee & Company, BPS, 2012). This need is distinct from, but potentially overlaps with, the cargo derived demand described below.

Cargo Forecasts

While employment forecasts traditionally form the basis of employment land supply analysis, employment is not a very good indicator of the long-term land needs of the freight and traded sectors of the economy. Despite a general decline in harbor industrial employment between 2002 and 2008 (-1.3% AAGR), cargo tonnage handled in the Portland Harbor went up 4.1% per year during that same period. An average of 18 acres of land was developed each year during that period (EcoNorthwest Harbor Lands Inventory, 2012).

There have been several attempts to understand how cargo tonnage trends may impact future land needs in the Portland Harbor and by extension on West Hayden Island. ENTRIX studied this in 2010, based on forecasts completed in 2009. The most recent cargo forecasts are based on a 2010 study by BST, refined to specifically call out cargo demand for Portland and Vancouver, updated with the most recent economic data (Portland and Vancouver Harbor Forecast Update, BST Associates, 2012). Cargo forecasts generally assume an adequate land supply will be made available; that is, the forecasts do not attempt to predict how any land supply constraint might impact growth. The most recent BST forecast demand for the region in 2040, including both Portland and Vancouver, ranges from 39 million to 66 million metric tons. For context, in 2010 approximately 27 million tons moved through the region as a whole including private terminals and both public Ports. The Port of Portland moved 13 million metric tons of this cargo total.

Table 10: 2040 Forecast Cargo Volume, Portland

Cargo Type	Low	Mid-Range*	High
Automobiles (units)	811,000	912,500	1,014,000
Containers (TEUs)	379,000	452,500	526,000
Metric Tones			
Automobiles	1,076,000	1,206,000	1,336,000
Containers	2,162,000	2,583,500	3,005,000
Breakbulk	1,132,000	1,242,000	1,352,000
Grain	6,686,000	9,078,000	11,470,000
Dry Bulk	10,278,000	14,093,500	17,909,000
Liquid Bulk	6,912,000	7,461,500	8,011,000
TOTAL	**28,246,000**	**35,664,500**	**43,083,000**

Source: BST Associates, 2012; EcoNorthwest, 2012
*Mid-Range scenario is calculated by ECONorthwest as the average of the BST low and high scenarios

Table 11: 2040 Forecast Cargo Volume, Vancouver

Cargo Type	Low	Mid-Range	High
Automobiles (units)	159,000	197,000	235,000
Containers (TEUs)	-	-	-
Metric Tones			
Automobiles	226,000	278,500	331,000
Containers	-	-	-
Breakbulk	534,000	568,500	603,000
Grain	3,808,000	4,109,000	4,410,000
Dry Bulk	5,931,000	11,663,500	17,396,000
Liquid Bulk	510,000	802,500	1,095,000
TOTAL	**11,009,000**	**17,422,000**	**23,835,000**

Source: BST Associates, 2012; EcoNorthwest, 2012

Factoring in the capacity of existing marine terminals, ECONorthwest estimated the regional (i.e. Portland and Vancouver) need for additional marine terminal facilities by 2040, by cargo type (2012). With the low scenario forecast, they concluded that existing terminals could handle all commodity types, except automobiles. With the high scenario forecast, additional new terminals would be needed for all cargo types (automobiles, containers, break bulk, grains, liquid, and dry bulk commodity types. With the mid-range scenario forecast, additional terminals would be needed for automobiles, grain, and dry bulk commodities. These are the three terminal types that are included in the Final Base Concept Plan.

The actual acres of land needed to accommodate the projected marine terminal need varies, depending on the commodity type, and depending on how important it is to have an optimal terminal design. For example, it is possible to operate a grain terminal on less than 10 acres, but a modern rail-served terminal would likely require 100+ acres. A modern automobile terminal may require 150 acres or more. Using this information, and the forecast information described above, ECONorthwest estimated that the Portland/Vancouver region will have a combined need up to 570 acres of land for marine terminal development under a medium capacity shortfall scenario. If modern rail-served facilities are desired, the low, medium, and high range forecast conclusions are as follows:

Table 12: Combined Portland and Vancouver Land Need by Forecast Scenarios

Cargo Type	Acres Needed Low Scenario Forecast	Acres Needed Medium Scenario Forecast	Acres Needed High Scenario Forecast
Automobiles	51	370	757
Containers	0	0	100
Breakbulk	0	0	50
Grain	0	100	200
Drybulk		100	300
Liquid Bulk	0	0	50
TOTAL	**51**	**570**	**1,457**

Source: EcoNorthwest, 2012

Marine Terminal Land Supply and Demand Reconciliation

As part of their analysis on the Harbor Lands Inventory, ECONW completed a demand forecast to compare with potential supply in the Portland and Vancouver harbors. Due to the varied nature of marine terminals their forecast ranged from the extreme low of 51 acres to an extreme high of 1,457 acres of need for marine terminals in the region. Neither extreme of these ranges was considered reasonable. ECONW focused their analysis on considering a medium scenario of cargo forecasts and capacity for the two port facilities and considered minimum, practical, and rail dedicated scenarios for these.

Factoring in the potential range of terminal sizes, and based upon the medium scenario forecast, the Portland and Vancouver harbors would need to add acreage to accommodate grain, auto imports/exports, and dry bulk materials. This corresponds with a minimum land need of 210 acres, a practical (based on case studies) land need of 490 acres and a high land need of 570 acres, which includes each terminal having its own dedicated rail loop.

There is not enough land in the current Portland Harbor to accommodate the cargo forecasts for 2040. Development of 300 acres of WHI would provide an opportunity to meet some of the forecasted land supply demand and is large enough for a modern rail loop. Without development of WHI, the regional land demand could be partially met by developing vacant land in Vancouver or by land assembly and redevelopment of the available constrained land in the Portland Harbor. However, the two sites in the Portland Harbor are too small, even with potential land assembly, to accommodate a modern rail loop.

The vacant land currently available at the Port of Vancouver could also accommodate much of the region's cargo-derived demand. This scenario would involve development of new automobile, grain, and dry bulk terminals. Although the associated jobs may still be in the region, this would represent a redistribution of jobs and a redistribution of local government and school district revenue from Oregon to Washington.

The Portland/Vancouver region has a maximum supply of 1,340 acres for marine terminal development by 2040, with complete utilization of the vacant but constrained land in the Portland Harbor, development of 300 acres on WHI, and full development of the vacant land at the Port of Vancouver. However, a large portion of the acreage in the Portland Harbor is not combinable to achieve a large contiguous site.

5.e.2.4 Regulatory Compliance

Many different regulations and policies address employment, industrial lands and marine terminals (see Chapter 2: Regulatory and Policy Context). Regulatory compliance is important for City of Portland to avoid cost and liability. Providing opportunities for marine terminal development on WHI would aide in compliance with certain of these regulations and policies, including Metro Title 4. Marine terminal development would also trigger a number of environmental regulations and their associated costs, such as

the Clean Water Act and Endangered Species Act. Maintaining compliance with these regulations would reduce the risk of unintended costs and liabilities associated with non-compliance.

5.e.2.5. Jobs from Mitigation Efforts

Compensatory mitigation is often required for development impacts to natural resources. Compensatory mitigation means actions taken to replace the natural resource features or functions removed by development. The types of jobs associated with mitigation are engineering, landscape architecture, construction, monitoring, etc. EcoNorthwest estimated the number of job-years that could be generated by mitigation associated with the Final Base Concept Plan. Job-years means one year of a job; for example, 10 job years could mean that one person holds a job for 10 years or 2 people hold a job for 5 years. Approximately 140 job years could be directly generated by mitigation efforts on West Hayden Island and another 133 job years could be generated through indirect and induced effects of mitigation activity.

5.e.3 Open Space Uses

The Columbia River is an important recreational amenity in the metropolitan area. The river is used by paddlers, boaters and fishermen. The banks of the river and trails located along the banks, provide walking, biking and viewing areas. These amenities contribute to tourism in Portland.

The Final Base Concept Plan anticipates that at least 500 acres would be zoned open space. The proposed uses within the 500+ acres are passives recreation (e.g. trail and non-motorized boat launch) and natural resources enhancement. In 2010, ENTRIX estimated recreational and cultural values in the *West Hayden Island Environmental Foundation Study*. ENTRIX estimated the value of going to the beach on West Hayden Island at $11,000 - $45,000 annually (2010 dollars). The existence value of WHI habitat was estimated at $1,250 to $24,000 annually (2010 dollars). Existence value is based on the benefit people derive solely from the knowledge that the habitat exists, both for the habitat itself and for its provisions of species' needs. ENTRIX was not able to estimate the value of recreational fishing but suggested that the recreational fishing values are higher than commercial fishing values associated with West Hayden Island.

The draft *WHI Benefit/Cost Analysis* (ECONW 2012) provided an initial review of the effect of providing recreational amenities as part of the Final Base Concept Plan. Potential activities included walking on the beach, wildlife viewing, fishing, picnicking, non-motorized boating, swimming and hiking. The value of the recreation was measured based upon the number of recreation days and the consumer surplus (i.e. a person's well being) generated annually from these activities. Due the wide range of values associated with individual activities, the value was estimated to be between $78,000 and $293,500 annually.

The Final Base Concept Plan does not propose more active recreational uses, such as a dog park, community center or motorized boat launch, for West Hayden Island. However, those uses are allowed within the open space zone. None of the studies for West Hayden Island estimated the potential value from these types of uses. Presumably there would be additional economic value placed on active recreational uses, although those values may be tempered by a reduction in passive recreational values. For example, a dog park could reduce the value of hiking and bird watching on West Hayden Island.

5.e.4. Ecosystem Goods and Services provided by Natural Resources in the West Hayden Island Study Area

Natural resources provide ecosystem goods and services, which in turn provide economic and social value. Ecosystem services include water conveyance, purification, and flood control, air cooling and purification, carbon sequestration, soil fertilization and pollination. Ecosystem goods include commodities like food, fuel, fisheries, timber, minerals, etc. Ecosystem goods also include supporting recreation and tourism. Ecosystem service have been evaluated for the West Hayden Island project:

- *WHI Environmental Foundation Study*, ENTRIX, July 2010.
- *WHI Benefits/Costs Analysis*, ECONorthwest, 2012.

Additional information related to ecosystem services comes from the following reports:

- ECONorthwest, *Economic Arguments for Protecting the Natural Resources of the East Buttes Area in Southeast Portland*, 2009.
- Bergstom, Loomis and Brown, *Defining, Valuing and Providing Ecosystem Goods and Services*, Natural Resources Journal, 2007.
- Banzhaf and Boyd, *What Are Ecosystem Services? The Need for Standardized Environmental Accounting Units*, 2006.
- Anielski and Wilson, *Counting Canada's Natural Capital: Assessing the Real Value of Canada's Boreal Ecosystems*, Pembina Institute, 2005.
- Olewiler, N., *The Value of Natural Capital in Settled Areas of Canada*, Published by Ducks Unlimited Canada and the Nature Conservancy of Canada, 2004.

5.e.4.1. West Hayden Island Ecosystem Services

The results of the WHI Benefits/Costs Analysis (ECONorthwest) are summarized in this section. Table 11 summaries the ecosystem service values associate with West Hayden Island. Following are a general description of the ecosystem services provided by natural resources identified in the *West Hayden Island Natural Resources Inventory* (2012).

ECONorthwest estimated the ecosystem services value of the natural resources associated with West Hayden Island, absent marine terminal development, and the Columbia River range from $0.6 - $3.8 million annually.

Table 13: West Hayden Island Ecosystem Services Valuation (2011$/Acre/Year)

Habitat Type	Air Purification	Carbon Sequestration	Water Purification	Wildlife Habitat Value	Total Value
Forest/Woodland	$73–$267	$26–$92	Not Quantified	$309–$516	$408–$875
Wetland	$74–$266	Not Quantified	$153–$664	$3,095–$11,347	$3,322–$12,277
Shrubland	$30–$110	$24–$88	Not Quantified	$309–$516	$363–$714
Grassland	$24–$89	$24–$88	Not Quantified	$309–$516	$357–$693
Shallow Water	Not Quantified	Not Quantified	Not Quantified	$1,037–$15,473	$1,032–$15,473
Source: ECONorthwest (2012)					

Based on the Final Base Concept Plan for WHI, removing 300 acres of natural resources would reduce ecosystem services values by $0.2 – $0.5 million annually. The ecosystem services could be potentially replaced through mitigation, on-site or off-site. Some of that mitigation would be required to meet state and federal environmental regulations (e.g., Endangered Species Act, Clean Water Act). However, state and federal environmental regulations do not address the broad range of ecosystem services provided on WHI. The City can address the broad range of services through local requirements. The WHI Cost/Benefit Analysis evaluated all mitigation, local, state and federal, that would be needed to replace ecosystem services impacted by development. This level of mitigation is estimated to cost $24.5M which includes long-term maintenance and management.

Riparian Forests and Woodlands

Riparian forests provide several different types of ecosystem services. One way to estimate the values of these ecosystem services is to evaluate the avoided cost of preserving the functions provided by natural resources. The City of Portland for example, avoided purchasing a $200 million filtration treatment system for its water supply by protecting 102 square miles of its watershed. Similarly, Clean Water Services, a water-resource management utility in northwestern Oregon avoided investing in a chiller for a water treatment plant on the Tualatin River by planting riparian vegetation to shade and cool the river, for a savings of $50 million.

Forests and woodlands on WHI also provide air quality benefits from purification and pollutant removal. Table 12 below shows the kilograms of pollutant removal by forestland on WHI per acre, per year and the economic value of those pollutants in avoided health care costs.

Table 14: Annual Quantity and Value of Pollutant Removal by Forests and Woodlands (2011$)

Pollutant	Annual Kilograms Removed per Acre	Annual Value per Ton	Annual Value per Acre
CO	2.03	$1,403	$3
NO^2	3.65	$4,039—$9,875	$15—$36
O^3	14.57	$2,019—$9,875	$29—$144
PM^{10}	10.53	$6,593	$69
SO^2	2.83	$2,418—$9,546	$7—$27
Source: ECONorthwest, 2012			

Wetland Habitat

Table 13 provides estimated values for key ecosystem services that wetlands provide. The table presents values associated with wetlands that were assumed to provide only a single type of service. The range of values associated with single-service wetlands is about $2–$9,669 per acre per year. In many cases wetlands provide multiple services; however, the values cannot simply be added up and an estimate for multiple services was not made.

The next set of rows estimates the values associated with ecosystem services provided by both native and restored wetlands. The way the ecosystem services are combined in this section combine more of the single-services into larger categories. For example, recreation can include fishing, bird hunting, bird watching, amenity, etc. The values in the second set of rows are additive. It was estimated that the total value associated with native wetlands is about $29,400 per acre per year and that the total value associated with restored wetlands is about $27,400 per acre per year.

Wetlands also provide ecosystem services include water quality improvement, water temperature regulation and flood regulation. However, these values in the context of WHI and the Columbia River Basin are likely small. The exception is local water-quality benefits derived from existing wetlands. The analysis of ecosystem services did not include the potential introduction of pollutants from port activities.

Table 15: Value of Ecosystem Services Associated with Wetlands (2011$/Acre/Year)

Single-Service Wetlands		
Single-Service Wetland Type	**Mean Value**	**Range of Values**
Flood	$676	$153-$3,007
Quality	$718	$2,177-$2,372
Quantity	$219	$10-$4,425
Recreational Fishing	$614	$163-$2,310
Commercial Fishing	$1,339	$186-$9,669
Bird Hunting	$120	$43-$339
Bird Watching	$2,086	$909-$4,788
Amenity	$5	$2-$24
Habitat	$527	$163-$1,688
Storm	$408	$19-$8,850
Ecosystem Service	**Native Wetlands**	**Restored Wetlands**
Gas regulation	$128	$93
Disturbance regulation	$15,300	$15,300
Water supply	$1,424	$1,424
Nutrient cycling	$7,706	$5,780
Commodities	$2,907	$2,907
Biodiversity	$185	$163
Recreation	$1,744	$1,744
Total	**$29,394**	**$27,410**

Source: Woodward, R., and Y. Wui. 2001. "The Economic Value of Wetland Services: A Meta-Analysis." *Ecological Economics* 37: 257-270; Dodds, W. K. Wilson, R. Rehmeier, et al. 2008. "Comparing Ecosystem Goods and Services Provided by Restored and Native Lands." *BioScience* 58(9):837-845.

Shrubland and Grassland

One estimate of shrubland value, based on the net primary productivity of various landscapes in the U.S. National Wildlife Refuge System, suggests that the ecosystem service value may be about $600–$800 per acre per year. The same study estimated the value of grasslands, and suggests that the ecosystem service values of grassland, generally, may be about $30–$140 per acre per year. Based on these figures, the value of shrublands and grasslands on West Hayden Island is between $160,000 and $240,000 annually.

Shrublands on WHI provide air quality benefits from purification and pollutant removal. Table 16 shows the annual per acre pollutant removal by shrubland and grassland on WHI, and a range of economic values of those pollutants in avoided health care costs.

Table 16: Annual Quantity and Value of Pollutant Removal by Shrubland and Grassland (2011$)

Pollutant	Annual Kilograms Removed per Acre	Annual Value per Ton	Annual Value per Acre
CO	0.79	$0—$1,403	$1
NO^2	1.45	$4,039—$9,875	$6—$14
O^3	6.05	$2,019—$9,875	$12—$60
PM^{10}	4.34	$0—$6,593	$29
SO^2	1.18	$2,418—$9,546	$3—$11

Source: ECONorthwest

Value of Wildlife

Economic research has shown that people place a considerable value on the continued survival of sensitive species, such as those listed as threatened or endangered. Such studies also suggest that the value associated with protecting threatened, endangered, and rare species similar to those found on WHI ranges from an annual payment of $11 per household to a one-time payment of nearly $400 per household (see Table 17).

Table 17: Willingness to Pay to Protect Threatened, Endangered, and Rare Species

Studies Reporting Annual Values		
	Average Value	**Range of Values**
Bald eagle	$43.51	$23.43-$50.21
Owl	$72.52	$43.51-$145.05
Salmon/Steelhead	$90.38	$11.16-$155.09
Whooping Crane	$62.48	$49.09-$76.99
Woodpecker	$17.85	$14.50-$22.32
Studies Reporting Lump Sum Values		
	Average Value	**Range of Values**
Arctic grayling	$25.66	$22.32-$29.01
Bald eagle	$331.38	$273.36-$390.52
Falcon	$35.70	-
Source: ECONorthwest, 2012 (taken from Richardson and Loomis,. 2009)		

It is important to note that willingness to pay a different measure than estimating the economic value associated with maintaining individual species and biodiversity. For example, the courts have interpreted Congress to say that the value of threatened and endangered species is incalculable (TVA v. Hill).

Development related threats to sensitive species on WHI also may lead to higher future costs for governments, firms, and households engaging in activities that affect the species. Such costs might be associated with required or voluntary species monitoring, as well as measures to ensure their protection. Avoiding such costs could be supported by pre-emptive efforts to protect sensitive species and prevent future threatened and endangered species listings.

Flood Area

ECONorthwest performed a peer review of the previous ecosystem services analysis done by ENTRIX (Report, DATE). ENTRIX found that the relative flood storage capacity on WHI is small. Dams along the Columbia River are managed, in part, to control flooding the Lower Columbia River. Furthermore, flood storage capacity on WHI is small relative to the size of the river, which means the potential value derived from flood regulation is likely small. Similarly, due to the size of the basin and the volume of water that runs through it, the marginal impacts on water quality and water temperature are likely small. ECONorthwest agreed with this analysis of ecosystem services.

Summary of Ecosystem Services

The existing natural resources on WHI and Columbia River surrounding the island provide ecosystem services that have economic benefits as described in Table 18. The total ecosystem services provided by the existing natural resources are estimated at $0.6-$3.8 million annually. After development, without mitigation, ecosystem services provided by the remaining natural resources are estimated at $0.4-$3.3 million annually, as summarized in Table 19.

Table 18: Ecosystem Services Provided by Existing WHI Natural Resources

Habitat Type	Acres	Annual Value ($/Year)
Forest/Woodland	480	$196,000-$420,000
Shrubland	25	$9,000-$18,000
Grassland	230	$82,000-$159,000
Wetland	45	$149,000-$552,000
Shallow Water Habitat	170	$175,000-$2,630,000
Flood Area	788*	Negligible
Total		**$0.6-$3.8 million**

Table 19: Ecosystem Services Provided by Remaining WHI Natural Resources, Post Development

Habitat Type	Acres	Annual Value ($/Year)
Forest/Woodland	204	$83,000-$179,000
Shrubland	20	$7,000-$14,000
Grassland	105	$38,000-$73,000
Wetland	30	$116,000-$430,000
Shallow Water Habitat	167	$172,000-$2,584,000
Flood Area	505*	Negligible
Total		**$0.4-$3.3 million**

5.e.4.2. Other Ecosystem Services and Considerations

In addition to the ecosystem services described above, the natural resources in the West Hayden Island study area provide other general services that are important considerations in this analysis.

Property Values

The existence of trees, greenspaces and other natural resources have been positively correlated with residential property values in Portland (EcoNorthwest, 2009). Natural resources contribute to the quality of neighborhoods, to local and regional recreation and trail systems, and also to the quality of views. Screening and buffering between residential and industrial land uses can be provided by established trees and vegetation, and can improve the economic value of both uses (e.g. noise reduction). Other indirect "quality of life" values associated with natural resources include labor force retention, attraction of new employees and reputation. Portland is generally known nationally and internationally as a *green* city and a desirable place to live, visit, work and play, which has a positive impact on aspects of the local and regional economy.

Off-Site Benefits of Ecosystem Services

Natural resource benefits can occur beyond the immediate area. For example, large forest patches located in close proximity to other large patches provide a habitat network for wildlife residency, migration and dispersal. The benefits of flood storage on a site may reduce the cost of flood repair at upstream or downstream from the site itself. When benefits occur off-site, the property cannot capture the value of these benefits directly. As a result, the market price for natural resources, whether the floodplain or a stand of trees, does not fully reflect a true exchange value relative to other goods. In fact, most natural resources are not priced because they are not bought and sold like other products. This makes establishment of value difficult.

Temporal Considerations

Some of the benefits provided by natural resources take many years to be realized. For example, the value of an immature stand of trees may not be realized for 25-50 years when the trees have grown and matured and are providing maximum shade, carbon sequestration, rainwater interception and evapotranspiration

functions. Another complicating factor when determining the economic value of natural resources is that many natural resources have "irreversibility" properties. If the resource is eliminated there may be little or no chance of regeneration in any meaningful timeframe. Therefore the cost of losing natural resources must also include the opportunity costs, or the cost of future choices foregone.

Scarcity

Another topic of consideration is *scarcity*. As an area develops and natural resources are reduced, the functions those resources provide become scarce. This can increase the value of the remaining natural resources. One example is bottomland hardwood forests. West Hayden Island represents approximately four percent of the remaining bottomland hardwood forest between the Bonneville Dam and Astoria. Bottomland hardwood forest is identified by the Oregon Conservation Strategy (ODFW, date) as a conservation strategy habitat with a regional priority for preservation. Bottomland hardwood forest is an important habitat type for migrating birds, particularly neotropical birds. Another example is grassland habitat. In the Willamette Valley grassland has been reduced to less than 2% of its historic extent. This means that the wildlife species that depend on grassland habitat to complete their life cycle (e.g. ground nesters that need land sparsely vegetated with herbaceous vegetation) have significantly less habitat areas to choose from. The scarcity of bottomland hardwood forests and grasslands increases the value of the remaining habitat from a biodiversity standpoint and with regard to preventing future species listings under the federal Endangered Species Act.

Mitigation

The objective of most mitigation efforts is to make up for disturbances or damages to the ecosystem functions and services in a natural area by improving the functional capacity in another area or portion of a development site. In many instances state or federal agencies have established guidelines outlining the proper mitigation ratios to consider for a particular type of mitigation.

Several studies tracking the success of mitigation projects have found that many mitigation efforts do not result in full economic replacement of impacted ecosystem services (ECONW, 2012). In addition, the size, location and island mosaic of functions provided by West Hayden Island is an important determining factor for the ecosystem services being provided. Finally, there is a temporal aspect to mitigation because some habitats (e.g. bottomland hardwood forests) can take many years to grow and provide the same services provided by an existing forest. The result is that the existing ecosystem services are valued at a higher rate than services resulting from mitigation.

Regulatory Compliance

Many different regulations address the types of natural resources that currently exist in the inventory study area (see Chapter 2: Regulatory and Policy Context). Regulatory compliance is important for City of Portland to avoid cost and liability. Please see the Social section for additional explanation of regulatory compliance.

Value of West Hayden Island as a Mitigation Receiving Site

West Hayden Island is one of the largest, mostly unfragmented habitat areas remaining in the Portland area. As Portland continues to develop and areas to perform mitigation for natural resource becomes increasingly scarce, large open spaces like West Hayden Island become attractive receiving sites for mitigation, particularly opportunities to expand or enhance shallow water habitat.

Additional mitigation for damages will also be required as part of the Portland Harbor Superfund project resolution. Some of this required mitigation can occur outside the Portland Harbor Superfund Boundary. West Hayden Island is still a candidate site for Superfund related mitigation given its proximity to the Willamette River and current and potential habitat value.

5.e.5. Economic Consequences

To evaluate the potential economic consequences of different natural resource protection program options, three scenarios or policy choices are assessed: allowing, limiting and prohibiting conflicting uses that would adversely affect significant natural resources in the West Hayden Island study area. The positive and negative consequences of these program choices are evaluated from the perspectives of both the conflicting uses and the significant natural resources identified in the inventory for this site. As such, the program choices would result in different mixes of positive and negative economic consequences as indicated below.

In evaluating the consequences of *allowing* conflicting uses it is assumed that all significant natural resources would be subject to development allowed by regulations that apply in the base zone. It is also assumed that mitigation for impacts on natural resources would not be required.

In evaluating the consequences of *limiting* conflicting uses it is assumed that rules would be established to limit the impacts of allowable development in areas containing significant natural resources. Areas containing significant natural resources could still be subject to development, but development restrictions would exist in addition to base zone regulations. For example, the type, location or extent of development could be restricted. Another example, development could be required to avoid adversely affecting natural resources where practicable, and to mitigate for unavoidable impacts. Another example would be to restrict the type of development allowed.

The recommendation to *limit* conflicting uses can also be implemented by relying on the City's existing environmental program which uses conservation and protection overlay zones or the recommendation could be implemented through specific code provisions in a plan district. Plan Districts are area-specific zoning codes that may include provisions related to natural resource management and development. Another tool are master plans, such as the Comprehensive Natural Resources Plans (CNRPs) and Natural Resource Management Plans (NRMPs) which can be established for sites in environmental overlay zones, provide another mechanism to coordinate development, natural resource enhancement, mitigation, recreation and other activities.

In evaluating the consequences of *prohibiting* conflicting uses it is assumed that the regulations would preclude all allowable development in significant natural resource areas.

Tables 20 address the potential economic consequences of associated with the three programmatic approaches. Consequences are described, and further represented by these symbols:

- (+) more substantial positive than negative consequences
- (-) more substantial negative than positive consequences
- (+/-) positive and negative consequences of development are generally balanced
- (o) consequences would be neutral or negligible

Table 20.a outlines the economic consequences of allowing, limiting or prohibiting identified conflicting uses from the perspective of the conflicting uses. Table 20.b provides an explanation of the consequences from the natural resource perspective.

Table 20.a: Economic Consequences for Conflicting Uses

	Allow		Limit		Prohibit	
Industrial	A. Final Base Concept Plan 1. Would expand the local and regional economic benefits of marine industrial development in the Columbia Harbor (e.g. trade commerce, employment). In the Portland Harbor, the total jobs directly associated with terminals are 7,011; annual business revenue is currently valued at $1.5 billion; and personal income from all jobs at $1.4 billion (2011). Would add an estimated 900-1,200 jobs directly associated with WHI and an additional 1,400-2,400 indirect and induced jobs. The associated personal income is estimated at $200-$300 million. The estimated tax revenue is $11-$20 million (state and local). 2. Would reduce the projected deficit of land available in the City of Portland to meet moderate to high industrial land demand estimates for the next 25 years. 3. Would enhance economic benefits of the existing Columbia River shipping channel and existing railroad infrastructure. 4. Development would incur costs to replace certain ecosystem services provided by natural resources (e.g., stormwater treatment, erosion control), but would not incur additional costs to avoid, minimize or mitigate for a broader range of ecosystem services. 5. Would forgo the opportunity to leverage development to require enhancement of local and regional public recreational opportunities and associated economic benefits. B. Full Suite of Uses Allowed in Heavy Industrial Zone 1. Other uses allowed (e.g., other heavy industrial, commercial parking lot, event facility) would provide economic benefit and incur similar costs as marine terminal development, but might not address the industrial land supply shortfall, particularly demand for deep water marine terminals in the Portland Harbor.	+ +	A. Final Base Concept Plan 1. Would expand the local and regional economic benefits of marine industrial development in the Columbia Harbor (e.g. trade commerce, employment). In the Portland Harbor, the total jobs directly associated with terminals are 7,011; annual business revenue is currently valued at $1.5 billion; and personal income from all jobs at $1.4 billion (2011). Would add an estimated 900-1,200 jobs directly associated with WHI and an additional 1,400-2,400 indirect and induced jobs. The associated personal income is estimated at $200-$300 million. The estimated tax revenue is $11-$20 million (state and local). 2. Would reduce the projected deficit of land available in the City of Portland to meet moderate and high industrial land demand for the next 25 years. 3. Would enhance economic benefits of the existing Columbia River shipping channel and existing railroad infrastructure. 4. Marine terminal development on West Hayden Island could incur additional costs and time related to project design, ecosystem restoration, and other measures to avoid, minimize and mitigate for impacts to natural resource functions and values, including ecosystem services. This could increase the time needed to realize marine terminal growth opportunities. 5. Would maintain the opportunity to leverage development to require enhancement of local and regional public recreational opportunities and associated economic benefits. B. Full Suite of Uses Allowed in Heavy Industrial Zone 1. Other uses allowed conditionally (e.g., other heavy industrial, commercial parking lot, event facility) would provide economic benefit and incur similar costs as marine terminal development, but might not address the industrial land supply shortfall, particularly demand for deep water marine terminals in the Portland Harbor. 2. Could affect the location, scale or design of future industrial development and the cost or time required to avoid, minimize and/or mitigate for impacts on natural resource functions and values, including ecosystem services. This could affect the future economic benefits provided by development for this area.	+/- +/-	A. Final Base Concept Plan 1. Would eliminate the economic benefit derived from expansion of marine terminal development on WHI and T6, affecting the economic role of the Columbia Harbor (e.g. trade commerce, employment) and potentially affecting other communities that ship goods through Portland (e.g. Easter Oregon farmers). If WHI is not developed additional vacant land located along the Columbia River/Willamette River shipping channel will need to be considered for development, in order to meet the forecasted regional demand for land to support industrial/marine terminal uses. This would shift some of the local economic benefits (e.g. tax revenue) from Portland to other cities or states. 2. Would reduce the City's ability to comply with Title 4 Industrial and Other Employment Areas, because WHI is identify as a Regionally Significant Industrial Area under Title 4. 3. Would forgo the opportunity to leverage development to require enhancement of local and regional public recreational opportunities and associated economic benefits. B. Full Suite of Uses Allowed in Heavy Industrial Zone 1. Would reduce development potential of industrial lands in close proximity to the Columbia River shipping channel, I-5 and rail.	- -

Table 20.a: Economic Consequences for Conflicting Uses

	Allow		Limit		Prohibit	
Open Space	A. Final Base Concept Plan 1. Would maintain economic benefits derived from passive open space uses (e.g. revenue from local recreation and tourism). Annual consumer surplus from activities on the island could range from $78.5k to $293.5k. 2. Would help enhance the quantity and quality of accessible open spaces used for passive recreation, which could in turn enhance the desirability and market value of property in nearby residential areas. 3. Development would incur costs to replace certain ecosystem services as required by state and federal environmental regulations (e.g. ESA, CWA) or City requirement (e.g., Title 10 erosion control). However, development would not incur additional costs to avoid, minimize or mitigate for impacts on a broad range of ecosystem services. B. Full Suite of Uses Allowed in Open Space Zone 1. Could enhance the economic benefit associated with more active open space uses, but could negatively affect the benefit associated with passive open space uses. 2. A mix of passive and active open space uses could enhance the desirability and economic value of property in nearby neighborhoods.	+ +/-	A. Final Base Concept Plan 1. Would maintain economic benefits derived from passive open space uses (e.g. revenue from local recreation and tourism). Annual consumer surplus from activities on the island could range from $78.5k to $293.5k. 2. Would help enhance the quantity and quality of accessible open spaces used for passive recreation, which could in turn enhance the desirability and market values of property in nearby residential areas. 3. Development could incur additional costs and time related to project design, ecosystem restoration and other measures to avoid, minimize and mitigate for impacts on natural resources functions and values, including ecosystem services. B. Full Suite of Uses Allowed in Open Space Zone 1. Could enhance the economic benefit associated with more active open space uses, but could negatively affect the benefit associated with passive open space uses. Limiting the scale or types of uses, development, or activities to avoid, minimize or mitigate impacts on natural resources would reduce such negative impacts. 2. A mix of passive and active open space uses could enhance the desirability and economic value of property in nearby neighborhoods.	+/- +	1. A prohibit scenario would reduce the economic benefit derived from passive and active open space uses (e.g. local recreation and tourism) that could potentially take place on West Hayden Island. Annual consumer surplus from existing informal recreational activities may remain, valued at $2.9 to $34.2k. 2. Would not provide additional access to West Hayden Island open space areas which could have enhanced local property and amenity value. 3. Preserving the opportunity for environmental enhancement would foster City compliance with certain regional, state and federal requirements, preventing liability and associated costs; but would complicate compliance with Title 13 and Title 4 requirements (since Title recognizes the importance of the study area for its natural resources and industrial development potential. *(Note – Both the Final Base Concept Plan and the full suite of open space uses would have similar consequence under a prohibit decision.)*	-

Table 20.b: Economic Consequences for Natural Resources

Base Zone	Resource Ranks	Allow		Limit		Prohibit	
Industrial	**High, Medium & SHA**	A. Final Base Concept Plan 1. Would reduce the economic benefit derived from multiple ecosystem services. All ecosystem services would be affected by development of conflicting uses within areas of high ranked natural resources and Special Habitat Areas. 2. Could complicate efforts to comply with certain regional, state and federal regulatory requirements (e.g., ESA), resulting in potential liability and associated costs. 3. Could increase chance for future ESA listings of at-risk fish and wildlife species in the study area, resulting in additional regulatory costs and liabilities. 4. Would eliminate the opportunity to use portions of West Hayden Island for future off-site mitigation associated development in Portland/Columbia Harbor or elsewhere. 5. Would reduce ability to leverage development to help protect and improve ecological condition and ecosystem services provided on-island and off-island (lost opportunities may have future economic costs). B. Full Suite of Uses Allowed in Heavy Industrial Zone 1. The consequences are similar to those under the Final Base Concept Plan, except that non-port industrial uses and commercial uses may be less land intensive and not river-dependant, which could reduce the impact on ecosystem services.	**-** **-**	A. Final Base Concept Plan 1. Design and mitigation requirements will reduce the net impact and help maintain most of the economic benefit derived from multiple ecosystem services. . 2. Would support efforts to comply with regional, state and federal requirements (e.g., Titles 13, ESA). 3. Would, by requiring mitigation, help reduce risk of future ESA listings of at-risk fish and wildlife species in the study area, and associated costs and liabilities. 4. Would eliminate the opportunity to use portions of West Hayden Island for future off-site mitigation associated development in Portland/Columbia Harbor or elsewhere. 6. Would provide the opportunity to leverage development to help protect and improve ecological condition and ecosystem services provided on-island and off-island (lost opportunities may have future economic costs). Full Suite of Uses Allowed in Heavy Industrial Zones 1. The consequences are similar to those under the Final Base Concept Plan except that non-port industrial uses and commercial uses may be less land intensive and not river-dependant. Design and mitigation requirements would help maintain ecosystem services.	**+/-** **+/-**	1. Would maintain economic benefits derived from multiple ecosystem services provided by existing natural resources. 2. Would support efforts to comply with certain regional, state and federal requirements, preventing liability and associated costs, but would complicate compliance with Title 13 requirements (since Title recognizes the importance of the study area for its natural resources and industrial development potential.) 3. Would, by preventing development encroachment, help reduce risk of future ESA listings of at-risk fish and wildlife in the study area, and associated regulatory costs and liabilities. However, prohibiting existing grand disturbing activities that maintain early succession, low structure vegetation would negatively affect grassland-associated species using the site. 4. If marine terminal development is shifted to another vacant area along the Columbia River shipping channel, the impacts on natural resources would shift to that location as well. This could reduce the net overall ecological benefit provided by preventing development on West Hayden Island. 5. Would maximize potential to use West Hayden Island as a future mitigation receiving site for development impacts elsewhere in the Portland/Columbia Harbor. 6. Would reduce ability to leverage development to help protect and improve ecological condition and ecosystem services provided on-island and off-island (lost opportunities may have future economic costs). *(Note – Both the Final Base Concept Plan and the full suite of industrial uses would have similar consequence under a prohibit decision.)*	**+**

Table 20.b: Economic Consequences for Natural Resources

Base Zone	Resource Ranks	Allow		Limit		Prohibit	
	Low	1. The effect on natural resource based economic value associated with allowing industrial uses in low-ranked resource areas would be negligible. The low ranked resource areas are developed floodplain and hardened, non-vegetated riverbank at Terminal 6 which are subject to balanced cut and fill requirements.	**o**	1. The effect on natural resource based economic values associated with limiting industrial uses in low-ranked areas would be negligible. The low ranked resource areas are developed floodplain and hardened, non-vegetated riverbank at Terminal 6 which are subject to balanced cut and fill requirements.	**0**	2. The effect on natural resource based economic values associated with prohibiting industrial uses in low-ranked areas would be negligible. The low ranked resource areas are developed floodplain and hardened, non-vegetated riverbank at Terminal 6, which are subject to balanced cut and fill requirements.	**0**
Open Space	**High, Medium & SHA**	A. Final Base Concept Plan 1. Would maintain most of the economic benefit derived from multiple ecosystem services. Ecosystem services related to biodiversity, flood storage and public health could be reduced. 2. Would support efforts to comply with regional, state and federal regulatory requirements (e.g. Title 13, ESA). 3. Would likely not increase the risk of future ESA listings of at-risk fish and wildlife species and the associated costs and liabilities. B. Full Suite of Uses Allowed in Open Space Zone 1. Would reduce the economic benefit derived from multiple ecosystem services. All ecosystem services would be impacted by development of conflicting uses within areas of high ranked natural resources and Special Habitat Areas. 2. Could make it challenging for the City to comply with certain regional, state and federal regulatory requirements (e.g., Title 13, ESA), resulting in potential liability and associated costs. 3. Would increase chance for future ESA listings of fishes and grassland-associated species in the study area, resulting in additional regulatory costs and liabilities.	**+** **-**	A. Final Base Concept Plan 1. Would maintain most of the economic benefit derived from multiple ecosystem services. Ecosystem services related to biodiversity, air quality and flood storage could be reduced. 2. Would support efforts to comply with regional, state and federal requirements (e.g., Titles 13, ESA). 3. Would, by requiring mitigation, help reduce the risk of future ESA listings of at-risk fish and wildlife species and the associated costs and liabilities. B. Full Suite of Uses Allowed in Open Space Zone Depending on design and mitigation requirements, 1. Would maintain some of the economic benefits derived from ecosystem services. Ecosystem services related to biodiversity, air quality and flood storage could be reduced. 2. Would maintain some of the City's ability to comply with regional, state and federal requirements (e.g. Title 13, ESA).	**+** **-**	1. Would maintain all economic benefits derived from multiple ecosystem services provided by existing natural resources. 2. Would support efforts to comply with certain regional, state and federal requirements, preventing liability and associated costs, but would complicate compliance with Title 13 requirements (since Title recognizes the importance of the study area for its natural resources and industrial development potential. 4. Would, by preventing encroachment, help reduce the risk of future ESA listings of at-risk fish and wildlife species and the associated costs and liabilities. *(Note – Both the Final Base Concept Plan and the full suite of open space uses would have similar consequence under a prohibit decision.)*	**+**
	Low	1. The effect on natural resource based economic value associated with allowing open space uses in low-ranked areas would be negligible. The low ranked resource areas are developed floodplain and hardened, non-vegetated riverbank at Terminal 6 which are subject to balanced cut and fill requirements.	**o**	1. The effect on natural resource based economic value associated with limiting open space uses in low-ranked areas would be negligible. The low ranked resource areas are developed floodplain and hardened, non-vegetated riverbank at Terminal 6 which are subject to balanced cut and fill requirements.	**0**	1. The effect on natural resource based economic value associated with prohibiting open space uses in low-ranked areas would be negligible. The low ranked resource areas are developed floodplain and hardened, non-vegetated riverbank at Terminal 6 which are subject to balanced cut and fill requirements.	**0**

5.e.6. Economic Consequences of Alternative Limit Scenarios

In addition to evaluating the primary use scenario for WHI based on the City Council resolution, there are other plausible scenarios that would provide for a mix of marine terminal development and open space uses on WHI and generally fit within the regional limit decision under Title 13:

1. Annexation of West Hayden Island with a use mix of 420 acre Marine Terminal/380 acres Open Space: This split reflects a use scenario presented the Urban Growth Report (Metro, 2010).
2. Annexation of West Hayden Island with a use mix of 100 acres Marine Terminal/700 acres Open Space: This split comes reflects information in the Urban Growth Report (Metro, 2010) and the Harbor Land Inventory (ECONorthwest, 2012)

Most of the research summarized in this ESEE Analysis was developed specifically for the primary use scenario. However, some of the economic consequences of allowing, limiting or prohibiting the primary use scenario can be extrapolated to these two scenarios. The general economic consequences are described below:

420 acre Marine Terminal/380 acres Open Space

A larger marine terminal footprint would generally result in greater operational and economic efficiencies because the turn radii could be less tight and the gradient less steep. This would allow trains to access and egress from the main rail line more quickly.

The larger footprint would provide land for larger terminals and more cargo handling space. It could be extrapolated that greater efficiencies and larger terminals would result in additional movement of cargo and have positive economic benefits associated with jobs, business revenue, tax revenue, and making best use of the Columbia River commerce corridor as compared to the primary use scenario. Rail operational efficiencies would also take advantage of the existing infrastructure.

The larger developable area could also make the site more competitive on the local and regional market, making it more likely to develop with benefits to remain in Portland vs. going to other large sites along the Lower Columbia River.

If it is assumed that the larger development footprint would include the footprint associated with the primary use scenario, plus additional area to the west, then additional forest and wetland habitats would be impacted and the ecosystem services provided by those resources would be reduced. Any Additional docks would also impact shallow water habitat and the services provided by that resource. Mitigation could replace some of the impacted services, but most mitigation would likely need to go off-site.

This option would preserve less land for passive recreation and move that recreation to the west of the power line corridor. This area is a large, intact forest with interior area. The ecosystem services of the remaining resources could be impacted by fragmentation.

100 acres Marine Terminal/700 acres Open Space

One of the primary questions asked by the City Council when directing staff to continue planning for marine terminal development and open space on WHI was if a rail loop that fit a 10,000 unit train could be accommodated within 300 acres. WorleyParsons designed concept that includes a modern marine terminal that could handle multiple commodities with a rail loop that could fit a 10,000 unit train. This development scenario was designed to fit within 300 acres. Because of the geometry associated with turn radii and stopping a train of that size, the rail loop couldn't be smaller. Therefore, one consequence of designating 100 acres of industrial land is that a full unit train could not be accommodated on the site. This would restrict the types of marine terminal uses to those that do not require a unit train and would reduce the jobs and tax revenue as compared to the primary use scenario. It would also likely limit the types of materials and number of docking facilities that could be accommodated at the terminal. From the Harbor Lands Inventory, there are no sites in Portland, even with lot reassembly, that could

accommodate a 10,000 unit train. This is one of the industrial land supply deficiencies identified for Portland in the Harbor Land Inventory (2004).

Fully allowing 100 acres of marine terminal development would provide economic benefits including jobs and tax revenue, but it would likely be considerably less than a larger facility that took advantage of the rail infrastructure and could house multiple terminals specializing in different commodities.

Protecting 700 acres as open space, if the uses were limited to passive recreation, would maintain most of the economic benefits derived from multiple ecosystem services provided by existing natural resources. If the marine terminal development were located where the current Dredge Deposit Management Area is, then the bottomland hardwood forest could be largely preserved and existing interior area maintained. Limiting marine terminal development to 100 acres could also minimize impacts to shallow water habitat. The ecosystem services associated with both features would be maintained. And it could simplify compliance with local, state and federal natural resource regulations relative to the primary use scenario. Passive recreation would also result in some economic benefits.

5.e.7. Economic Consequences of Not Annexing WHI

If the City decided to not annex WHI, then it would remain within Multnomah County and retain current zoning as Multiple Use Forest (MUF) and Special Environmental Concern (SEC). The types of uses allowed in the MUF zones are:

A. Forest practices and wood processing operations, sales of forest products and farm uses;
B. Residential use consisting of a single-family dwelling including a mobile or modular home, on a lot of 38 acres or more and floating homes;
C. Mining and processing of subsurface resources; and
D. Conservation areas for the protection of water, soil, open space, forest and wildlife resources.

These uses have economic benefits including jobs, income and business revenue; however, the jobs and revenue associated with these uses is generally less than associated with industrial and marine terminal uses in an urban area. In addition, benefits from some of these uses (e.g., residential) may be tempered by the fact that WHI is located within the 100-year floodplain and there are no urban services (e.g., sewer) provided to the site. In addition, development would require a SEC permit would may involve design or mitigation costs.

Under this option, WHI could become a conservation area. The resources protected would continue to provide ecosystem services and there would be opportunities to enhance the services.

This option would mean that West Hayden Island would not contribute toward reduction of the projected shortfall of land to meet the industrial demand. This could result in the City needing to shift policy priorities to address Title 4 of the Urban Growth Management Functional Plan. This option would not preclude a future planning effort and annexation of WHI. If annexation were postponed for many years or indefinitely, the benefits associated with new marine terminals would likely shift to another jurisdiction, such as Vancouver, which would have mixed economic consequences for Portland. Some jobs would be held by Portland residents; however the tax benefits would go to Vancouver and Washington.

This option would be inconsistent with previous legislative directions that anticipated a mix of marine terminal and open spaces uses on WHI.

5.e.8. Recommendations Based on Economic Analysis

Based solely on the economic consequences analysis of allowing, limiting or prohibiting development in significant natural resource areas, the following general recommendations are intended to optimize the economic values described in the narrative and tables above. The economic, social, environmental and energy recommendations are optimized in combination, across the issues and topics, in *Chapter 6: Recommendations* to produce an overall recommendation for the WHI and Oregon Slough study area.

Limit marine terminal development to 420 acres and open space uses to 380 acres.
This land split would take advantage of the operational and economic efficiencies associated with a larger development footprint for terminal use and rail. There would be economic benefits associated with cargo throughput and associated jobs and business and tax revenue. There would be negative impacts to ecosystem services, some of which could be minimized and/or mitigated by additional limitation as described below.

5.e.8.1 Economic Recommendation within the Heavy Industrial Zone (IH)

There is a wide range of positive and negative economic consequences associated with allowing, limiting or prohibiting industrial development within areas of significant natural resources. The primary factors to consider are trade commerce, employment, tax revenue, land supply, proximity to existing infrastructure, ecosystem services and regulatory compliance. The following economic recommendation optimizes economic values within the IH base zones.

West Hayden Island, Columbia River and Oregon Slough:

1. Limit the conflicting uses normally allowed within the IH base zone to only those uses associated with the Final Base Concept Plan; deep-water marine terminal development and associated infrastructure.

   Limiting the uses to only deep-water marine terminals takes advantage of the economic factors associated with the site – it is located on the Columbia River shipping channel, near the rail line and near Interstate-5. The site is the only site in the Portland UGB that is large enough for a modern rail loop, which is an important aspect of an economically viable terminal.

2. Limit conflicting uses associated with the Final Base Concept Plan:
   a. within wetlands,
   b. on land 50 feet of wetlands,
   c. on land within 100 ft of ordinary high water,
   d. below ordinary high water of the river, and
   e. within the river.

   Limiting conflicting uses within the water bodies, wetlands and rivers, is recommended to reduce costs to replace critical hydrologic and water quality related ecosystem services, and to advance the City's compliance with regional, state and federal regulations which may reduce the long-term costs associated with compliance (Titles 3 and 13, Clean Water Act and Endangered Species Act) Limiting conflicting uses in these areas would require most development to avoid, minimize, or mitigate for adverse impacts on the resources. Some anticipated development could skip avoiding and minimizing impacts, but would still be required to mitigate for adverse impacts to the resources. Avoiding, minimizing and mitigating for impacts would add to the cost of development.

3. Allow the uses associated with the Final Base Concept Plan on land more than 100 ft above ordinary high water of the river, except as stated in recommendation 2.

   Allowing marine terminal development, except as in recommendation 2, will provide the economic benefits of jobs, taxes and revenue. Development would not be required to mitigate for impacts on the natural resources in these areas and the ecosystem services provided by these resources would be lost. These resources include bottomland hardwood forests located in the floodplain and grasslands; both of which are important for at risk wildlife species. However, based solely on economic factors, the economic benefits of marine terminal development outweigh the ecosystems costs.

South Bank of Oregon Slough: *(Note – While this ESEE analysis is being performed for the entire inventory site, only the portions of this ESEE that apply within the area to be annexed into the City of Portland are being forward to City Council for adoption. Terminal 6 and other industrial land south of the Oregon Slough are currently located with the City of Portland and ESEE recommendations that would apply within the current city limits will not be carried forward at this time to City Council for adoption.)*

1. Strictly limit conflicting uses:
   a. on land within 100 ft of ordinary high water,
   b. below ordinary high water of the river,
   c. within the river,
   d. within wetlands,
   e. and on land within 50ft of wetlands.

   Strictly limiting conflicting uses within the river and wetlands is recommended to reduce costs to replace critical hydrologic and water quality related ecosystem services, and to advance the City's compliance with regional, state and federal regulations (Titles 3 and 13, Clean Water Act and Endangered Species Act). Limiting conflicting uses in these areas would require most development to avoid, minimize, or mitigate for adverse impacts on the resources. Avoiding, minimizing and mitigating for impacts would add to the cost of development.

2. Limit conflicting uses within high and medium ranked resources located more than 100 ft above ordinary high water of the river and more than 50 feet from a wetlands.

   Limiting additional industrial development, except as in recommendation 2, will provide the economic benefits of jobs, taxes and revenue. Development would be required to mitigate for impacts to the natural resources and the ecosystem services provided by the resources. These resources include bottomland hardwood forests, grasslands and floodplain, which are important for at risk wildlife species. Because most of this area is already developed and does not contain significant natural resources, limiting development is not expected to have a big economic impact on conflicting uses.

3. Allow conflicting uses within low ranked natural resources

   Low ranking resources within the study area include the Terminal 6 sea wall and developed floodplain. Allowing conflicting uses in these areas provides opportunities for industrial redevelopment and the associated social benefits (e.g., jobs). The impacts to the ecosystem services are negligible.

5.e.8.2 Economic Recommendation within the Open Space Zone (OS)

1. Limit in areas of significant natural resources, except strictly limit conflicting uses:
    a. Oregon Slough:
        i. on land within 100 ft of ordinary high water,
        ii. below ordinary high water of Oregon Slough,
        iii. within the Oregon Slough;
    b. within wetlands and land within 50ft of wetlands; and
    c. within high or medium ranked resources west of the BPA power line corridors.

The goods and services provided by open space uses and significant natural resources can be optimized by limiting open space uses in high and medium ranked resource areas.

Limiting conflicting uses in these areas would require development to avoid or minimize adverse impacts on the resources. This could add to the cost of development; however, open space development generally can be designed to minimize impacts on natural resources. Public trails could be allowed if designed to reduce adverse impacts on natural resource values and functions. Mitigation would be required.

Strictly limiting conflicting uses below ordinary high water in the Oregon Slough, and within wetlands and high and medium ranked resources located west of the BPA power line corridors is recommended to reduce costs to replace critical hydrologic and water quality related ecosystem services, and to advance the City's compliance with regional, state and federal regulations (Titles 3 and 13, Clean Water Act and Endangered Species Act). Note that there are no low land resources on WHI west of the BPA power line corridor.

Table 21: Summary of Economic Recommendations

Feature	Allow	Limit	Strictly Limit	Prohibit
Columbia River and land below OHW		IH, OS		
Oregon Slough and land below OHW			IH, OS	
Wetlands and land within 50 ft		IH	OS	
WHI – other high and medium ranked resources east of BPA power line corridor	IH	OS		
WHI – other high and medium ranked resources west of BPA power line corridor*			OS	
Land more than 100 ft above ordinary high water (except wetlands)	IH	OS	OS	

**there is no IH west of BPA power line corridor on WHI*

5.f Social Analysis

This section examines the social consequences of allowing, limiting or prohibiting conflicting uses for the WHI study area. The social analysis focuses on the following topics:

- Human Health and Welfare
- Historic, Heritage and Cultural Values
- Regulatory Compliance

A general discussion of each topic is presented below, followed by an analysis of the social consequences of *allowing*, *limiting*, or *prohibiting* conflicting uses that would adversely affect significant resources.

5.f.1. Human Health and Welfare

5.f.1.1 Employment Opportunities

One of the most important factors in determining human health and welfare is household income, which is dependant on employment. The reason that income has such a strong influence on health is that it determines whether people are able to make healthy choices such as living in safe, health homes and neighborhoods, eating nutritious food, fully participating in family and community life and obtaining timely and appropriate health care. Many studies have shown that people with health insurance are healthier than those with out (Mult. Co. Health Department, 2012). In the United States the risk for mortality, morbidity, unhealthy behaviors, reduced access to health care and poor quality of health care increases with decreasing socioeconomic circumstances (CDC, 2011). Research has linked unemployment to stress, depression, obesity and increases in cardiovascular risk factors such as high blood pressure (Mult. Co. Health Department, 2012).

Today, approximately 77 percent of Portland households earn enough income to be considered economically self-sufficient (City of Portland, 2012). This means more than 20 percent of Portlanders do not make enough money to cover their basic households needs. The Self-Sufficiency Index measures whether an income is sufficient to meet the basic needs of most adults, including the cost of housing, childcare, food, health care and transportation. Unlike the federal poverty measure, this standard looks at "real world" household costs, not just the cost of food. The index reflects the variation in the cost of these items by geography and the effects of taxes and tax credits on household income.

An important factor in Portland's future economic prosperity, and addressing economic equity concerns, will be maintaining and growing "family-wage" jobs. Manufacturing and distribution jobs are typically an important part of any long-term economic development strategy because often wages in these sectors are significantly higher, and they are available to those with lower levels of education, than jobs in the service sector.

Martin and Associates produced a report called *The Local and Regional Economic Impacts* of the Portland Harbor in 2011, using data compiled from 2010. (A more recent report published in 2012 provided similar numbers but was not available at the time for the analysis of the effects of WHI. See section 5.e.2.1 for more information.) The study estimated that 17,512 resident jobs in Oregon and Washington were generated by cargo and vessel activity at the public and private marine terminals in the Portland Harbor. Of these, 7,011 were generated specifically by the movement of cargo over the docks (direct jobs). Average wages of the direct jobs provided at public marine terminals in the Portland harbor is $47,760. Another 6,668 jobs were created to serve those employed by the direct jobs (e.g. restaurants, retail) and 3,833 jobs were created by firms directly related to the shipping of the cargo (e.g. maintenance and repair). In addition, it was estimated that an additional 24,685 related jobs were with firms, farms and mines that ship and receive cargo via the terminals.

Based on a maximum terminal development of 300 acres at WHI, an estimate of 1,293 direct jobs, 1,767 induced jobs and 915 indirect jobs could be created. This includes jobs on and off site within the region. Extending the interpolation of other figures to WHI, marine terminal development could generate $295 million in personal income, $234 million in business revenue, and $30 million in state and local taxes.

Multnomah County Health Department studied the employment-related health outcomes of marine terminal development on WHI. As stated in the *WHI Health Analysis*, Appendix C, "it is reasonable to expect positive impacts on health due to increases in employment as a result of the development scenario (2012)." The primary employment-related health benefits are medial insurance and paid sick leave. The report cautions that the benefits would be seen regionally and that it is no possible to determine what portion of new jobs would be held by Hayden Island and/or Portland residents versus residents of Vancouver, WA or the greater metro area.

The WHI induced and indirect jobs generated by the development scenario are also expected to have a positive impact on health. Some of the induced and indirect jobs, such as maintenance and repair services and insurance agents, would pay between $50,000 and $125,000 per year in income. Many of the induced and indirect jobs would be lower wage jobs, such as retail, making between $16,600 and $27,300 per year. The *WHI Health Analysis* found that it is likely that many of the new hires that result from direct, indirect and induced jobs would see their incomes increase (2012).

Having a good job does more than supply the means to meet physical needs, it also provides opportunities to be creative, promotes self-esteem, and provides avenues for achievement and self-realization. Research presented in the *WHI Health Analysis* indicated that the effects of unemployment include impacts on psychological function, including anxiety and depression, and correlate with impacts on physical function as measured increased utilization of health services. Research also points to financial strain as strong mechanism through which unemployment contributes to ill health. In addition it has been found that unemployment "compounds the effects of unrelated (stressful) life events".

The *WHI Health Analysis* presented a 2012 informational piece published by the American Psychological Association states that "the current state of the economy continues to be an enormous stressor for Americans...Unemployed workers are twice as likely as their employed counterparts to experience psychological problems such as depression, anxiety, psychosomatic symptoms, low subjective well-being, and poor self esteem. The piece continues, "Like unemployment, underemployment...is unequally distributed across the U.S. population, with women, younger workers, and African Americans reporting higher rates of involuntary part-time employment and low pay, as well as higher proportions of "discouraged" workers who have given up on searching for a job. Additional documentation is provided addressing effects of unemployment and underemployment on families, communities, and different populations.

5.f.1.2. Access to Nature and Recreation

Access to natural areas and open spaces has an impact on human behavior and psyche. Access can mean a range of things from viewing vegetation to bird watching to hiking or boating. Dr. Roger Ulrich of Texan A&M's Center for Health Systems and Design found that passive scenic values, such as looking at trees, reduce stress, lower blood pressure and enhance medical recovery (Ulrich et al. 1991). The presence of trees and grass can lower the incidence of aggression and violent behavior (Kuo and Sullivan, 2001b). A study of residents in public housing in Chicago found that compared with apartment building that had little or no vegetation, buildings with high levels of greenery had 52% fewer total crimes, including 48% fewer property crimes and 56% fewer violent crimes (Kuo and Sullivan, 2001a). Common green areas in neighborhoods can also increase community ties and support networks. Studies have shown that exposure to natural environment enhances children's cognitive development by improving their awareness, attention, reasoning and observational skills (Louv, 2005).

In a 2004 City of Portland Parks and Recreation survey, park users identified a need for new natural wildlife areas for recreational purposes like bird watching and nature/wildlife observation (Godbe, 2004). Another study found that Portland homeowners would rather live near urban natural areas than other types of open

space (Lutzenhiser, 2001). The 2009 East Hayden Island plan provided useful information about what resident's value about living on the island. Common values include:

- the river lifestyle,
- a close-knit community,
- access to the water for viewing, swimming and boating
- improved connectivity on the island for walking and biking, additional parks and trails
- access to nature and wildlife
- protection of open space for wildlife , and
- improving riparian health of the Columbia River and North Portland Harbor

In 2010, ENTRIX, a project consultant for the first phase of this WHI planning effort, completed a report which provided recreational context and identified recreational development opportunities on and around the island. The report notes that currently, authorized recreation access on WHI itself is limited to the beaches. Land-based recreation activities in the vicinity are concentrated at other public recreation sites both on East Hayden Island and on the mainland. However, a number of water-based activities occur in the Columbia River surrounding WHI, including sailing, motorized boating, kayaking, canoeing, and fishing. Several marinas and other water access points exist on East Hayden Island (in private ownership), at other points along the Columbia River, and along the Willamette River in Portland.

Potential recreational activities that 1) would further the goals outlined in the City of Portland Parks and Recreation report, and 2) are compatible with trends in outdoor recreation and the vision for recreation established by Hayden Island residents, include: boat access, trails, picnic areas and other developed facilities, and natural areas. The location and size of potential recreation facilities would need to consider compatibility between recreational activities, between recreation and potential industrial activities, and between recreation and wildlife and wildlife habitat conservation. Appropriate management, including physical separation with screening and buffering between potentially conflicting uses, could help improve compatibility between uses.

Currently, the only park on East Hayden Island is Lotus Isle Park, located at North Tomahawk Island Dr. The park includes a new play ground, paved paths, picnic tables and many large trees. Water access is not provided at the park. Based on Portland Parks and Recreation targets for park acreage per capita, Hayden Island is currently underserved with parks; this is partially due to the transportation constraints between the island and the mainland.

Recreation has multiple health benefits. The *WHI Health Analysis* (Appendix B) documented that for people who are inactive, even small increases in physical activity can yield numerous health benefits (2012). Exercise improves overall health which reduces public and private health care costs, improves quality of life, and may help people live longer (Nieman, 1998). Activities such as walking in forested areas help boost the immune system (Sachs and Segal, 1994). In addition, the Centers for Disease Control and Prevention strongly recommends improving access to places for physical activities such as biking or hiking trails to reduce the risk of cardiovascular disease, diabetes, obesity, selected cancers and musculoskeletal conditions.

Open spaces and natural areas in the WHI study area provide not only areas to recreate, but also an opportunity for Portlanders to learn about environmental science, natural history, and cultural history of the Columbia River, islands and the Pacific Northwest. Natural areas and open spaces provide "living laboratories" for active educational programs. Many schools use natural areas as a focal point of interdisciplinary studies. For example, Whitaker Ponds in the Columbia Slough Watershed is utilized by schools year-round as a living laboratory. This model of learning has been shown to improve critical thinking skills, achievement in standardized tests and improved student attitudes about learning and civility toward others (Leiberman and Hoody, 1998).

Vegetated landscapes, parks and scenic views each contribute a "sense of place" and personal attachment to particular locations. People are socially connected to the entirety of the built and natural environmental by walking, biking and driving through areas with street trees, gardens, parks and other open spaces. Natural resources and open spaces create a sense of identity and visual variety in the city. Trees, open spaces and

water bodies help define the visual appeal the Portland area. People also identify with urban landscapes including river harbors and marinas, airports, new and old structures, workplaces, museum, restaurants and stores, parks and golf courses, and other gathering spaces. Portland is often identified by pictures of the cityscape, Mt. Hood and the Columbia and Willamette rivers. This identification with nature has been demonstrated to improve mental health (Mult. Co. Health Department, 2012).

In the WHI study area, views of local and regional features including the Columbia River, Mt. St. Helens and Mt. Hood, industrial areas, and bridges contribute to the scenic character of this area and of city as a whole.

In addition, WHI provides a visual amenity in itself. WHI is visible to travelers crossing the I-5 bridge and to boaters on the Columbia River. The beach, below ordinary high water, is open to the public and many residents walk the beach to view the scenery. Existing natural resources like these can soften or buffer the appearance, noise, and other impacts of urbanization.

5.f.1.3. Air Quality

Based on the *WHI Health Analysis* (Appendix B), there is sufficient evidence to reasonably expect increases in local and regional air pollution related to the development scenario (2012). Analyses of air quality tend to categorize pollutants in two categories: federally-regulated criteria pollutants and less-regulated air toxics. The development scenario is likely to result in substantial increases in both of these categories. The following information is from the *WHI Health Analysis*:

Criteria pollutants are contaminants that fall under federal air quality ambient concentration standards. There are six criteria pollutants:

- particulate matter (PM10 and PM2.5)
- ground-level ozone (smog)
- carbon monoxide
- sulfur oxides
- nitrogen oxides
- lead

The Portland airshed currently meets all existing federal standards for criteria pollutants.

Air toxics are contaminants that do not have a federal ambient concentration standard limiting their emission. Air toxics include:

- diesel particulate matter (DPM)
- benzene
- polycyclic aromatic hydrocarbons (15 PAH)
- metals including manganese, nickel and lead

The State of Oregon has adopted ambient air benchmark concentrations – or health-based goals – for more than fifty air toxics. Benchmark concentrations are intended to decrease adverse health consequences of air pollution by reducing air toxics to levels that an individual (including a sensitive individual) could breathe for a lifetime without increasing their cancer risk by 1 in a million or experiencing non-cancer health effects. Some air toxic levels in Portland exceed Oregon's benchmarks, and are projected to continue exceeding them for at least the next five years.

Greenhouse gases are a combination of pollutants, including two criteria pollutant that contribute to global warming. The primary greenhouse gases are carbon dioxide, methane, nitrous oxide and fluorinated gases. Changes to the environment that result from global warming will likely impact health (e.g., through flooding, heat injury, injuries from severe weather, and changes in infectious disease patterns).

Impacts to Health

Criteria pollutants including total suspended particulate matter, fine particulate matter, sulfur dioxide, ozone, and nitrogen dioxide exacerbate and contribute to respiratory illness. Particulate matter (PM) from motor exhaust is especially of concern. Fine particles less than 10 or 2.5 micrometers in diameter (PM10 and PM2.5), stay suspended in the air for long periods of time and can be inhaled deeply into the lungs. Particulate matter exposure contributes to, and exacerbates, respiratory problems including asthma. Air toxics such as polycyclic aromatic hydrocarbons (PAHs) and formaldehyde, are also linked to respiratory illness, including asthma.

Criteria pollutants including fine particulate matter, carbon monoxide, and ozone contribute to cardiovascular disease and its symptoms such as chest pain. Reviews and recent studies reveal that PM2.5 exposure causes cardiovascular dysfunction and related mortality and reduces life expectancy. Air toxics including 1,3-Butadiene and diesel particulate matter contribute to cardiovascular disease and death. Reviews of research on ambient air pollution and health show associations between cardiovascular disease and pollution (as well as cancer).

Particulate matter is associated with different types of cancer. Air toxics such as cadmium, formaldehyde, and diesel particulate matter contribute to lung and nasal cancer. Studies on urban air pollution suggest ambient air pollutants are a risk factor for lung cancer with the estimated risk of cancer for people exposed to significant levels of pollution being up to 1.5 times that for people who are not exposed.

Some air pollutants are also greenhouse gases, which contribute to global climate change and consequent health conditions. These include heat-related illness, infectious diseases spread by rodents, insects, water and food, and injuries and deaths related to severe weather events.

Port-related Air Pollution Considerations

Port operations create somewhat distinctive air pollution concerns related to the sources and characteristics of port-generated emissions.

Marine vessels burn residual fuel oil and affect PM2.5 levels in the Pacific Northwest. A recent study modeling marine vessel emissions in the Pacific Northwest indicates that marine vessels can contribute up to 30% of monthly average PM 2.5 in urban areas and up to 50% of monthly average PM2.5 in rural/remote areas.

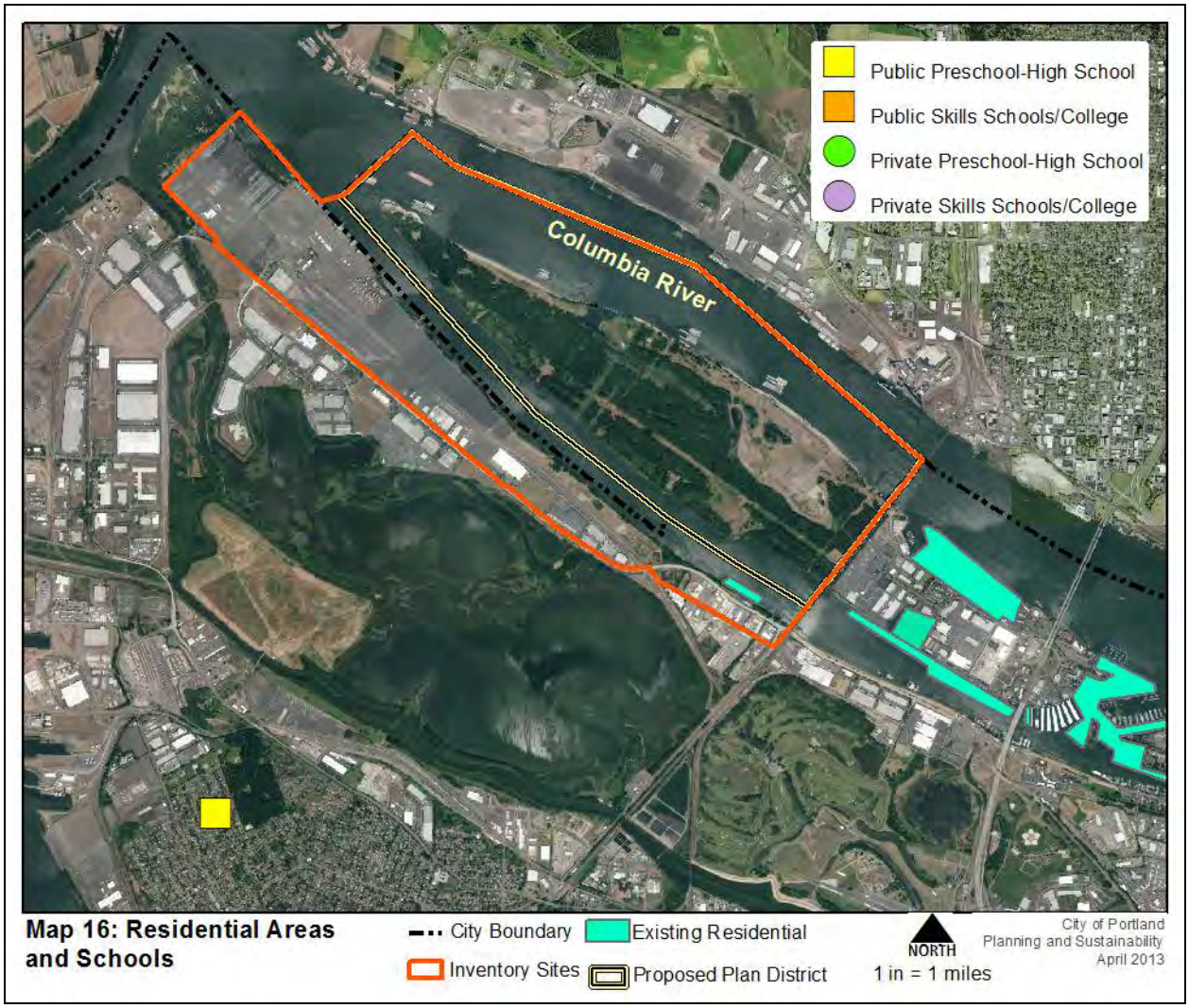
Marine vessel emissions are expected to drop in the near future. As of August 2012, the International Maritime Organization (IMO) agreed to include North America in an Emissions Control Area where emissions from sulfur and nitrogen oxides must be controlled within 200 nautical miles of the coast. Fuel sulfur content is expected to drop to 1% in 2012 and 0.1% in 2015 (Kotchenruther, 2012).

Emissions from rail operations are also an issue, with diesel particulate matter and PAH-15 being the most concerning rail emissions. The California Air Resources Board has noted that in rail yard facilities, locomotives are typically the largest source of diesel PM emissions. Diesel-fueled trucks and other vehicles are the second largest sources. The DEQ PATS study (described more below) examined emissions from source categories, including rail activities. For rail, total estimated emissions in 2017 are predicted to be 2-10 times benchmark, and concentrated within approximately one mile of rail corridors.

Rail yard idling is the most concentrated source of rail emissions in the PATS area. California and Washington have conducted numerous studies to look at the increased risk of cancer in relation to the distance people live from a rail yard. CARB created land use guidelines that include “Avoid siting new sensitive land uses within 1000 feet of a service or maintenance yard.” The CARB guidelines also state that: “Within one mile of a rail yard, consider possible siting limitations and mitigation approaches.”

These findings are relevant to WHI development in that the development scenario currently shows:

- Some floating home residents live about ½ mile from the outer edge of the proposed rail loop
- A majority of the homes in the manufactured home community and several floating homes on the Oregon Slough are within 1 mile of the proposed rail loop or the railroad mainline that traverses the island.



Health risks from air pollution depend on the type of air pollutants and their concentration and distribution in the environment, as well as on characteristics related to the people exposed. Intensity and duration of exposure, age, overall health status, and pre-existing health conditions are especially important. People most susceptible to severe health problems from air pollution include individuals with existing heart or lung problems, the elderly, pregnant women, children, and people who work outside. (Multn. C0. Health Department, 2012).

As stated in the *WHI Health Analysis*, there is sufficient research to reasonably expect increases in local air pollution related to primary use scenario. Currently, levels of air toxics on Hayden Island exceed the state benchmarks and could increase two to threefold under the primary use scenario. However, the scenario is expected to have minimal impact on local roadway-related greenhouse gas emissions.

Relationship to Inventoried Natural Resources

Existing natural resources can have a mitigating affect on some air quality impacts from the primary use scenario. Maintaining mature forest between the development and the neighboring residential areas can buffer the air quality impacts by filtering the air and maintaining air temperature and humidity.

Eliminating or reducing the quantity or quality of the existing natural resources may affect air quality in the local area. Maintaining some of the natural resources between industrial and residential uses may reduce the impact of some air toxins on the local community.

5.f.1.3. Water Quality and Quantity

Water quality and quantity is important for human health and safety. The Columbia River is currently water quality limited for multiple parameters. Impaired water quality can affect people recreating in the Columbia River (e.g. fishing, swimming).

Development can have a negative impact on both water quality and quantity. Point sources and non-point pollution are addressed through federal, state and local regulations and programs. Point source discharges of pollutants to rivers, streams and wetlands require permits and on-going monitoring. However, the cumulative affects of these discharges are not easily addressed through individual permits.

In Portland, non-point source pollutants are addressed through the Stormwater Management Manual (SMM). The SMM applies to new development and redevelopment involving at least 500 square feet of impervious surface (e.g., roads, parking lots and building rooftops). Runoff from the impervious surfaces must be managed for flow into pipes and streams, and treated to maintain water quality. Preference is given to treatment types that utilize natural systems such as bioswales. In the urban context, another source of non-point source pollution is erosion from construction activities, which are addressed in the City Code Title 10.

Roads and rail infrastructure and activities can negatively affect water quality; for example, hydrocarbons and heavy metals coming from break dust.

In order for development to occur WHI, significant fill to raise the current land elevation above the base flood elevation would have to occur. Filling in of the floodplain and the addition of impervious surfaces, changes the hydrologic regime on the island. Reduced flood storage capacity could potentially affect river hydraulics (e.g., deposition and scour) immediately up and downstream of the development area, potentially causing bank erosion. Mitigation actions, such as increasing flood capacity in some portions of WHI or off-site, could minimize the affects of flood plain fill associated with development.

Natural resources, such as vegetated riparian corridors and uplands, uncompacted soil, and wetlands help maintain and improve the quality of water through filtration, uptake and cycling, and providing microclimate and shade. These natural resources also help maintain a normal hydrologic cycle that contributes to groundwater recharge and stream flow maintenance. Wetlands and the active floodplain in particular provide temporary water storage, opportunity for pollutants to settle out of the water, uptake of certain pollutants by plants, and filtration of water through the soil.

5.f.1.4. Noise

Marine Terminals can be a source of noise, both from on-site loading operations, and from the associated rail and truck traffic generated by the cargo distribution. Neighborhoods in close proximity to WHI have raised noise pollution issues related to industrial uses. Noise pollution can have a number of negative consequences including reducing enjoyment of leisure activities; contributing to health effects such as hypertension, heart disease, sleep interruption, and hormonal changes; and affecting property values proximate to the noise source.

The most common health impact of noise is annoyance, or feelings of resentment, displeasure or offense when noise interferes with one's activities (Mult. Co.Health Department, 2012). However, annoyance is very subjective. Annoyance based on noise is also influenced by the time, frequency and duration of the noise. Also, the social utility of the noise such as emergency sirens.

The nearest residential areas, including floating homes and other East Hayden Island neighborhoods, are located approximately ½ - 1 mile from the proposed marine terminal development on WHI. The land uses between the proposed development site and the residential areas are industrial (e.g. auto auction yard) and commercial. The nearest residential areas on the northern part of East Hayden Island are also located approximately ½ mile from the Port of Vancouver industrial uses.

The City of Portland defines permissible sound levels by land use in Title 18 of the City Code. The maximum permissible sound level for residential areas is 55dBA for day time, minus 5dBA for night time. Maximum levels for industrial areas is 65dBA daytime, minus 5 dBA for night time. There is no difference in noise levels allowed for industrial and residential uses. The City of Portland daytime permissible sound exposure level from industrial to residential is 65dBA and 60dBA at night. Nighttime hours are between 10 pm and 7 am.

The North Portland Noise Study, drafted by the City of Portland Bureau of Development Services in 2008, documented the main sources of noise and quantified specific levels of noise in North Portland Neighborhoods (Greenbusch Group, 2008). The main sources identified include:

- Portland International Raceway (PIR)
- Railways
- Arterial cargo truck noise in residential neighborhoods
- I-5 traffic
- Airplane activity at Portland International Airport (The Greenbusch Group, 2008).

A computer noise model isolated individual noise sources because the interaction of noises makes it difficult to study just one source at a time. The study also pointed out that wind and other atmospheric conditions can influence noise levels. The following present some of the findings of the North Portland Noise study for rail and vehicle traffic.

Railway Horn Noise

Train horn noise at public grade crossings in many residential areas has been a source of frequent complaints to the City. Noise data collected for train horn noise in Kenton has exceeded 103 dBA. The North Portland Noise Study indicated that train horn noise would most likely result in levels as high as 70 dBA inside a residence with closed windows. Similar data for train horn noise in Cathedral Park revealed sound levels in the mid-60's dBA, in-residence with windows closed. Both of these noise level situations exceeded the 2009 WHO level of 40 dBA at which sleep disturbance can occur and the City of Portland permissible sound levels.

In 2010 the Federal Railroad Administration (FRA) started implementing new regulations that establish minimum (96 dBA) and maximum (110 dBA) train horn levels. In addition, the FRA has established a new method for sounding train horns at public grade crossings to lessen the impact on surrounding communities. The City's Noise Control Office will be monitoring sound levels of train horns with the implementation of the new regulations to see if there are any noticeable changes in and around some of the affected communities.

At Terminal 5 on the Willamette River, loading and unloading potash into train cars created noise impacts from the train cars bumping into one another. Developing braking techniques that minimized car bumping helped mitigate this noise impact. Another mitigation measure is forming a sound barrier with empty rail cars that helps blocks the noise of loading other cars.

Cathedral Park Neighborhood Association and Toyota at Terminal 4 have been working together to try to resolve another noise issue that has been identified by the neighborhood. During the loading and unloading of vehicles on to train cars, a sharp banging noise results from the collision of steel bridge plats. The Toyota facility has worked with the Port, neighborhood groups and the City's Noise Control Office to search for ways to reduce this noise.

Kinder Morgan's Potash facility at Terminal 5 set up perimeter monitors throughout their facility and on Sauvie Island at property lines to determine the impact of their operations. The most impactful noise events were from air traffic, the grain elevator and train car movements to and from the grain elevators. The train car noise was primarily from the train cars bumping into one another during the loading and unloading process.

Vehicle Traffic Noise

Vehicle traffic is also a major contributor to noise in North Portland neighborhoods. Normal traffic flow often includes a mix of freight vehicles, buses, and motorcycles which can raise the level of disturbance. The North Portland Noise Study specifically looked at the freight corridors of North Columbia Boulevard, North Lombard, and North Going Streets. Monitoring of sound levels for traffic noise along these streets in the surrounding communities found that many of the readings exceeded City regulations, especially in Cathedral Park and St. John's. There are federal EPA and state of Oregon Department of Environmental Quality (DEQ) guidelines for permissible levels for motor vehicles operating on public roadways. The City follows the EPA guidelines for freight transport vehicles of 10,000lbs Gross Combination Weight Rating (GCWR), and all other vehicles must comply with State DEQ levels .

The study found that St. John's and Cathedral Park Neighborhoods are impacted by regional and local truck traffic that use designated truck routes through the town center to get to the St John's Bridge; in addition, other streets that run through residential neighborhoods are also used. In 2000, the Portland Office of Transportation completed the St. John's Truck Strategy which provides recommendations for improvements to reduce freight movement conflicts in residential neighborhoods.

Relationship to Inventoried Natural Resources

Existing natural resources can have a mitigating affect on some noise impacts from the primary use scenario. Maintaining mature forest between sites or land uses can buffer noise impacts. Eliminating or reducing the quantity or quality of the existing natural resources may affect how noise impacts the local area.

5.f.1.5. Light

The International Dark-Sky Association (IDA) defines light pollution as: "Any adverse effect of artificial light including sky glow, glare, light trespass, light clutter, decreased visibility at night, and energy waste (International Dark Sky Association)." Below is a brief description of the affect of light pollution:

- Humans can experience increased fatigue because of excess light shining into the home at night from the surrounding environment.
- Frequent exposure to glare raises safety concerns for drivers or those with impaired vision.
- The poor lighting design wastes energy and contributes to greenhouse gas emissions (Benya Lighting Design, 2010).
- Light clutter is excessive lighting potentially from a variety of sources that can cause distraction; such as poorly spaced street and building lighting.
- Sky glow is a combination of all of the above especially poorly directed lighting that limits sight of night stars.

A number of factors contribute to light pollution including 1) the type of light being used, 2) an inefficient fixture, 3) lack of understanding of how much light is needed, 4) incorrect installation of timers, or 5) lack of knowledge of how to direct or redirect lighting to meet lighting needs. Some of the biggest contributors of light pollution include:

- City street lights
- Signs (e.g. Times Square)
- Outdoor sales lighting (e.g gas stations, auto dealers)
- Industrial lighting

Marine Terminals have large exterior work and storage areas that are often illuminated for safety and security reasons, as well as to allow 24-hour operation. This light can affect adjacent properties as well as wildlife in adjacent natural areas.

Natural resource can reduce negative impacts associated with light by creating a buffer between sites or land uses. Other ways to control excess lighting include shielding lights, reducing light wattage, putting lights on timers, changing street light features and requiring light shields or redirection.

5.f.1.6 Screening and Buffering

Natural resource areas and open spaces create natural screens and buffers between incompatible land uses, separating them and reducing a broad array of impacts. For example, the US Department of Agriculture reports that a 100-foot wide and 45-foot tall patch of trees (approximately 1/10 an acre) can reduce noise levels by 50 percent (1998). Trees can also reduce the off-site impacts of lighting or visual impacts from intensive development.

As noted above, noise and light are of significant concern among neighborhood residents living in close proximity to WHI. The waterways and riparian vegetation on the island can create a buffer between these uses. Trees and vegetated areas can also add soothing sounds of wind and bird song.

As a result of noise mitigation efforts at Terminal 4 on the Willamette River, a recommended vegetation buffer of at least 100 feet can reduce noise and light impacts between terminal operations and residential development. Management at other ports rely on buffers to help mitigate noise, light and other effects of port operations on adjacent neighborhoods. For example, the Port of Tacoma purchased 31 acres as a noise, visual and light buffer between the port and neighboring residential areas.

5.f.1.5. Traffic

A traffic analysis was performed for WHI using a reasonable "high impact" traffic generation scenario for a 300-acre marine terminal site that includes two auto import terminals and one bulk marine facility on WHI. The analysis is based on forecasted development as proposed by the Hayden Island Plan (City of Portland, 2009), transportation improvements associated with the Columbia River Crossing and various local street network improvements. These transportation assumptions are consistent with the Regional Transportation Plan and the City's transportation System Plan.

The analysis estimates that the total traffic growth on Hayden Island streets will grow at a higher rate than the City's average during the 2005-2035 planning period. That translates to a 2-hour p.m. peak traffic demand increase on island streets from 4,800 vehicles in 2005 to 9,8000 vehicles by 2035; this increase is not including marine terminal development on WHI or a new WHI bridge. Comparing these same time frames and assumptions, the estimated rate of increase in I-5 p.m. peak traffic demand increases from 20,700 to 27,300 vehicles (City of Portland, February 27, 2012).

A marine terminal on WHI is projected to add approximately 360 (in and outbound) total vehicles to the island's 2035 2-hour pm peak traffic demand. The 360 vehicles would account for about 5% of the island's total future p.m. peak traffic demand.

For the determination of truck impacts it is more meaningful to consider daily volumes because truck trips have different peaking characteristics than autos. The daily truck volume from WHI is estimated to be 516 vehicles. This would account for approximately 28% of total daily island truck trips in 2035. This truck estimate is based on the "high impact" scenario. The current WHI concept plan of two bulk terminals and one auto facility terminal would produce about 340 daily truck trips, which accounts for approximately 18% of total daily island truck trips in 2035. The increment of additional traffic generated from marine terminal

development on WHI is not expected to be significant in terms of traffic congestion relative to projected traffic associated with regional growth.

It is not anticipated that the additional port traffic would cause significant congestion or access problems for Hayden Island motorists. This is due in part to the planned improvements that will be made to the street system and the Interstate 5 access as part of the Columbia River Crossing project and future street improvements as laid out in the Hayden Island Plan. Hayden Island local streets are projected to experience worse traffic conditions during the weekend noon period than during the typical weekday pm peak period. This is due to the traffic associated with the commercial developments from the Janzen Beach Shopping Center. However, traffic generated from marine terminal development period would have little additional impact in weekend noon traffic since only 10% of the Port's auto and 5% of Port's truck traffic operate during the weekend.

5.f.1.6. Vulnerable Communities

In considering the consequences of development in the study area it is important to address potential impacts on vulnerable communities who often disproportionately affected by impacts such as air quality, noise, light, and traffic.

The 2010 US Census information provides general data for baseline descriptors of the population. A single census tract covers all of Hayden Island, east and west. Hayden Island's population is 2,270. Compared to the rest of the Portland Metro area, Hayden Island's population is slightly older and slightly poorer. Unemployment on the island is slightly hirer as well, 6.2% as compared to 5.8% city-wide. The median household income for Hayden Island is $46,000 which is lower than the median household income for the region, $56,000.

The community located closets to the WHI potential development site is a 440 household manufactured home community. Because the manufactured home community is only a portion of the census track that covers all of Hayden Island, there are not detailed statists about the demographics in the community. In 2008, CASA of Oregon conducted an affordable housing survey and collected some information about the community. Approximately 800 people live in the community and that accounts for approximately 38% of the total population on East Hayden Island. The average home value within the manufactured home community is $13,900, making the homes much more affordable than the rest of East Hayden Island. The average home sale price for all of East Hayden Island combined in 2008 was approximately $230,000 to $350,000. Roughly 54% of the residents were 55 or older and 65% were on a fixed income. Most of the residents rent their home at an average of $562 per month.

Communities like the manufactured home communities may be consider "vulnerable" because of the higher percentage of seniors, person on fixed incomes and person with pre-existing medical conditions. Looking through an equity lens, vulnerable communities may be more susceptible to the impacts of development such as air pollution or increased noise. The manufactured home community is located within 1 mile of WHI and in close proximity to the current Columbia River Crossing project.

It is difficult to determine the exact health implications of potential development on WHI with more detail about the types, location and extent of the terminals that would be present. The ECONorthwest Cost/Benefit Analysis recommends a local Health Impact Assessment be completed. Please see the above sections for examples of best management practices.

5.f.2. Historic, Heritage and Cultural Values

The Columbia River and WHI are important to the history, heritage and culture of the region.

Portlanders place a high value on the environment and quality of life. The Oregon state symbols reflect this value. The Oregon state bird is the Western Meadowlark, which is currently a state-listed Species of Concern and has been early extirpated from the city due to loss of native grasslands. Western Meadowlark use habitat on WHI. Portland's City Bird, the Great Blue Heron, is also found on the island. Fourteen runs of the state fish, the Chinook salmon, use the Columbia River and all fourteen are federally listed as Threatened or Endangered. The beaver is Oregon's state animal and still resides in many of Portland's waterways and is found in WHI study area.

Portland's identification with nature and wildlife is reflected in many ways. The Audubon Society of Portland is over 100 years old and is the largest chapter of the national Audubon Society. Many Portlanders are avid bird-watchers. Local festivals, Wild Arts Festival, Raptor Road Trip, and annual migratory bird festival at Ridgefield Wildlife Refuge in Washington state are attended by thousands of residents.

Metro has recognized the importance of fish and wildlife and their habitats by adopting the regional "Nature in Neighborhoods" program in 2005. This program establishes regional baseline requirements to protect fish and wildlife habitat and water quality. The requirements focus on protecting, conserving and restoring natural resource functions and values in riparian corridors. Establishing this program reflects the importance of environmental quality to the residents of the Metro region, including Portlanders.

There is a long history of human inhabitance in the study area. A short summary of the history and current cultural values, focusing on natural resources, is provided below. It is intended to illustrate the long history humans have had with the Columbia River and WHI and some of the cultural values humans place on the natural resources. These cultural and historic values are associated both with the location of Hayden Island at the confluence of the Columbia and Willamette rivers and with the island itself. If these values were adversely affected it would be difficult or impossible to mitigate for the impacts.

5.f.2.1. Native American Historic and Cultural Values

The first Europeans to explore the Columbia and Willamette Rivers arrived in the late 18th century. Prior to that, the area was populated by various aboriginal tribes who settled along sections of these rivers for 6,000 to 9,000 years. The creation stories of these tribes held that the people were created in these places. The rivers provided a travel route for trade of goods among tribes, and it also provided a rich diversity of food that was fairly obtainable for most of the year. Besides fish that could be caught over a period of several months a year, and game and fowl that could be hunted, Native peoples also gathered plants that were available much of the year in the temperate climate. Among the most common and well-known was the wapato, a bulb that was gathered and also traded as European traders and settlers arrived.

In the Portland area, Native American settlements were located on the north and south shores of the Columbia River and near the mouth of the Willamette River, with a population in the early 19th century of several thousand. Settlements were documented by the first explorers of this area in the late 18th century, by Lewis and Clark in their exploration of both rivers in 1804-06, and since that time by historians throughout the 19th and 20th centuries. Permanent settlements were identified by long-house buildings that were occupied by several families. Temporary settlements were also documented, which were often located in close proximity to the permanent ones. These were typically occupied either by the permanent residents during warmer months, or by kin relations who traveled from other parts of the area to supplement their food stocks as they ran out.

While evidence of settlements has been documented or suggested in specific or possible areas on the Columbia River, there is no record of settlement by Native populations on Hayden Island. Records of settlements are provided in various ways: written histories by European explorers who made observations in

their travels, or made contact with Native peoples; trade histories with European settlers; artifacts found by collectors, and later by archaeologists; structures and other extant evidence of permanent or temporary settlements; oral histories from Native people; and field studies that have been done in the latter 20th century. Artifacts that were typically found in this area include tools made from stone for fishing, gathering, hunting, and food processing; cracked stone from ovens for smoking and baking; trade goods, including ceramics; and remnants of buildings.

There is mention of Hayden Island and neighboring islands in historical journals by Lewis and Clark and others, but such writings did not mention people inhabiting those islands. Settlements were recorded on the north and south sides of the Columbia, on Sauvie Island, and to its south at the mouth of the Willamette. There is speculation among historians and archaeologists of this area about the various tribes that populated it over the centuries, up until the time of European discovery and subsequent settlement. Generally it is believed that a number of Chinook tribes inhabited the area, and specific to this section of the south side of the Columbia and mouth of the Willamette were the Multnomahs. Other tribes in the vicinity on the north and south shores included (but were not limited to) the Clatsop, Clatskanie, Cascades, Kalapuya, and Cathlamet; some of those shared similarities in dialect, and others did not. The Native population changed dramatically following European settlement and the subsequent malaria outbreak that devastated the population of many Native villages that had traditionally settled these rivers. This occurred in the early 1830s; following that time, different tribes began to populate the area from all directions, including the Clackamas, Cowlitz, and Klickitat, coming from tributaries of the Columbia.

Several factors pose challenges to a complete archaeological study of the island: the regular flooding of the island; its history for the past century as a disposal site for dredging and road construction debris; construction of the highway, railroad and other infrastructure on the east side of the island; and development during the 20th century, first of an amusement park in the 1920s, later replaced by a shopping center, and residential development that has occurred over the past few decades.

The cultural resources study prepared by Willamette Associates in 1986, *A Cultural Resources Study of the Proposed Hayden Island Marine Industrial Park,* included a report from field studies of the entire island. As indicated in the report, no artifacts were found in the study of the island's aboriginal area. That, in combination with the absence of accounts of any settlements on the island, led the author to conclude that "native use of the project area was so limited as to leave no archeological or written record." Nonetheless, there was likely activity on the island by Native people who stopped there to hunt, fish, and gather plants, who were either inhabitants of nearby settlements or traveled from areas less abundant in natural resources (see next section). This likelihood of use is supported by oral traditions of members of the Confederate Tribes of the Grand Ronde who are of Chinookan descent. The rich variety of food availability in this area of the Columbia basin offered the Native peoples the opportunity to travel within close proximity to their permanent settlements to find year-round food for themselves and for trading. (A Phase 2 archaeological study of WHI has not been conducted to date.)

5.f.2.2. Post European Settlement – Brief History and Cultural Values

Hayden Island

The first mapping of the island was done in 1841 and shows Hayden Island as the largest of three islands, separated by channels. The island was called Menzies Island on the early maps of the area. At this time, it was about 800 acres in size, although annual flooding caused shifts in its size over centuries.

The first documented European settlement on Hayden Island was that of Gay and Mary Jane Hayden, who settled there after purchasing the land claim in 1851 from the original owners, who never inhabited it and likely did not have a legal claim. Mary Jane Hayden documented this purchase of 760 acres on the island's north shore, where the Haydens built a log house, and raised beef and hay. Historians have concluded that the settlement was on the western half of the island, on the north side. They stayed for five years. During this time they were forced to move across the river to Vancouver several times when spring flooding did not allow

them to remain on the island. After five years they abandoned their land claim but were able to acquire homestead rights, which allowed them to sell the property in 1869 to cattle ranchers.

In her writings of this time, Hayden mentioned the Klickitat tribe that occupied the north shore of the Columbia opposite the island, and that the tribe's "leader" regularly hunted on the island. The Klickitat was one of the tribes that moved to the area for a relatively short period following the malaria epidemic of the early 1830s that greatly reduced the population of the aboriginal groups who resided in the area, so their coexistence was for the brief time when the tribe settled nearby and the Haydens occupied the island. She also noted in her writings that there was a large camp on the south side of the island. Archeologists have concluded that the described camp was a temporary camping stop for Natives who were traveling the river for food gathering. There is no artifact evidence in the archaeological study of either the Hayden settlement or the aboriginal camp.

The island was used for cattle grazing and holding, and probably hay production, by its subsequent owners through the early 20th century. A farmstead is indicated on maps from the 1880s, but it is unknown when that was built or if it coincides with the Hayden's settlement. There is speculation that the Hudson Bay Company pastured cattle there. In 1905 the land was purchased by the Portland Railway Company which soon after became Portland Railway Light and Power Company.

The geographic makeup of Hayden Island is relevant to this discussion because much of the island as it exists today did not exist at the time preceding and up to European settlement. The railroad line was constructed in 1884, bisecting the island east and west. Dikes were created beginning in the 1890's until World War I. The entire island retained its pastoral quality through the early 20th century until the highway connecting Oregon and Washington was built across the eastern end of the island in 1917. In the 1920s, use of the island for dredge disposal began, continuing through the 20th century. All of these activities resulted in substantially more land mass than the 800 acres documented prior to European settlement.

Early development of the eastern side of the island followed construction of the highway, with the dredging operations, and development of the amusement park in 1926. The park remained until the 1960s, when it was replaced by a shopping center. Subsequently the eastern side of the island was developed throughout the latter 20th century with housing, offices and commercial development, while the western side has retained a relatively natural character.

Today, Hayden Island is home to approximately 2100 people residing in floating homes and a large manufactured home community. There are multiple businesses including the Jantzen Beach Mall, two hotels and industries such as the auto auction yard located. Transportation facilities including I5 and the BNSF rail road cross the island.

Portland Harbor

As Portland has developed over the past 200 years, the Willamette and Columbia Rivers have played a key role. Beginning in the early 1800's, European settlement occurred at the confluence of the Willamette and Columbia rivers due to the abundant natural resources and opportunities for trade. In 1907, the Seattle Portland & Spokane Railroad excavation occurred next to Smith and Bybee Lakes and shortly afterward, the Swift Interests stockyard and meatpacking plant began to operate on the south side of the Columbia River's Oregon Slough. Other stockyard and meatpacking businesses followed.

Between 1917 and 1919, landowners in the Columbia River floodplain formed the Multnomah County Drainage District #1, Peninsula Drainage District #1, and Peninsula Drainage District #2 for flood control purposes. In a 1918 letter to the U. S. Army Corps of Engineers, the Board of Supervisors of Multnomah County Drainage District No. 1 wrote:

> *(T)he sole object of the proposed district improvement is to make productive by creating conditions favorable to its full use for agricultural purposes...Such an improvement will be an aid to the development of the enclosed and adjacent lands for industrial and commercial purposes and can in no way interfere with such development.*

One result was that levees were built to keep the Columbia River and the Columbia Slough from flooding levee-protected areas.

World War II's jobs drew people to Portland. The Kaiser Company, owner of the Oregon Shipbuilding Corporation, bought a 650-acre parcel of leveed land between the Columbia Slough and Columbia River and constructed the new town of Vanport, the largest public housing project in the U.S. at the time. Vanport was also located near the Expo Center, which is immediately south of Hayden Island. The Vanport Flood occurred on Sunday, May 30, 1948. Heavy rains, snowmelt, and warm weather contributed to unusually high water levels in northwest rivers for several weeks. Floodwaters broke through the railroad embankment/levee on the west edge of Vanport. Within two hours, Vanport was destroyed, and approximately16,900 residents were displaced. The next day, the Denver Avenue levee east of Vanport gave way. Levees all along the Columbia River broke, and the entire floodplain, from the Sandy River to the Willamette, was inundated. Vanport was never rebuilt. In the aftermath of the flood, the levees were reconstructed and, in some cases, reinforced and raised to withstand a 100-year flood event.

Natural Environment

The value Portlanders placed on the environment was reflect in city plans including the 1903 Olmsted vision for a 40-mile loop trail that encompassed Portland and provide it's residents access to open spaces. The 40-mile loop trail is still being realized today through a system of trails throughout the city.

That value is still held by Portlanders. The Oregon state symbols reflect this value. The Oregon state bird is the Western Meadowlark, which is currently a state-listed Species of Concern and uses grassland on WHI and along the southern bank of the Oregon Slough. Five runs of the state fish, the Chinook salmon, use the Columbia and Willamette rivers and all five are federally listed as Threatened or Endangered. The beaver is Oregon's state animal and still resides in many of Portland's waterways.

Portland's identification with nature and wildlife is reflected in many ways. The Audubon Society of Portland is over 100 years old and is the largest chapter of the national Audubon Society. Many Portlanders are avid bird-watchers. Local festivals including the Wild Arts Festival and Salmon Festival are attended by thousands of residents. Many residents fish in the Columbia River and its tributaries.

Metro has recognized the importance of fish and wildlife and their habitats by adopting the regional "Nature in Neighborhoods" program in 2006. This program establishes regional baseline requirements to protect fish and wildlife habitat and water quality. The requirements focus on protecting, conserving and restoring natural resource functions and values in riparian corridors. Establishing this program reflects the importance of environmental quality to the residents of the Metro region, including Portlanders

5.f.3. Regulatory Compliance

Many different regulations address the types of natural resources that currently exist in the inventory study area (see Chapter 2: Regulatory and Policy Context). Regulatory compliance is important for City of Portland to avoid cost and liability, and because Portland values its role as a leader in sustainability and environmental management.

ESA Preventing Harm and Supporting Recovery of At-risk Species

Fourteen fish species use the Columbia River and shallow water habitats in the inventory site are listed under the federal Endangered Species Act. After the 1998 listing of steelhead trout in the Lower Columbia River, the City of Portland began developing a comprehensive, coordinated citywide response for City Council adoption (Resolution No. 35715). The City Council established an intent to avoid "take" of a listed species (i.e., harming individuals or populations or their habitat), and to assist with recovery of listed fishes. The City has since taken actions such as identifying and prioritizing City programs that could affect listed species, providing technical support to bureaus, providing oversight for activities involving federal permitting or funding, and developing a watershed management plan to help guide city actions. The protection and

enhancement of habitats critical to threatened and endangered species are important actions to aide in the recovery of listed species.

In addition, seven federally-listed Species of Concern and 40 other species identified by the City's Terrestrial Ecology Enhancement project as "special status" are found in the inventory site. Protection of habitats used by these species helps reduce the risk of additional ESA listings and associated costs. Also, some habitats on WHI could potentially be identified in the future as critical habitat or expansion areas for recovery of species listed in the future (e.g. streaked horned lark).

Title 13

Metro Title 13: Nature in Neighborhoods is the regional program that complies with portions of State Land Use Goals 5 Natural Resources, Scenic and Historic Areas, and Open Spaces and 6 Air, Water, and Land Resources Quality. By complying with Title 13, local jurisdictions are complying with Goals 5 and 6 as well. Title 13 calls for programs to avoid adversely affecting significant natural resources and mitigating for unavoidable impacts on those resources.

Metro identified WHI as a Moderate Habitat Conservation Area (HCA), recognizing its role as regionally significant natural resource area and a regionally significant industrial area. Title 13 refers to the Habitat Conservation Areas Map that identifies "...which areas will be subject to high, moderate, and low levels of habitat conservation based on Metro Council's consideration of the results of the economic, social, environmental, and energy (ESEE) consequences of protecting or not protecting the habitat, public input, and technical review, and Metro's subsequent decision to balance conflicting uses in habitat areas. (Section 2.B.) Title 13 directs local jurisdictions to adopt clear and objective development approval standards that allow "limited development in High Habitat Conservation Areas, slightly more development in Moderate Habitat Conservation Areas, and even more development in Low Habitat Conservation Areas..." (Section 4.B.1.) Title 13 also directs the adoption of Discretionary development approval standards that require alternatives analysis to avoid Habitat Conservation Areas. Cities and counties are directed to "include consideration of the type of Habitat Conservation Area that will be affected by the proposed development" so that the relative urban development values and habitat values inform the determination of whether "practicable alternatives" exist. (Section 4.B.2.ii.) Title 13 directs the City of Portland to develop an area-specific "district plan" for WHI in cooperation with the Port of Portland, recognizing the unique environmental and economic conditions on WHI.

It is the intent of this project to support City of Portland compliance with Title 13. Non-compliance with Title 13 could result in loss of local authority to implement the program, loss of transportation funds, and impacts on Portland's reputation as a regional leader in innovative natural resource management approaches.

5.f.4. Social Consequences

To evaluate the potential social consequences of different natural resource protection program options, three scenarios or policy choices are assessed: allowing, limiting and prohibiting conflicting uses that would adversely affect significant natural resources in the WHI study area. The positive and negative consequences of these program choices are evaluated from the perspectives of both the conflicting uses and the significant natural resources identified in the inventory for this site. As such, the program choices would result in different mixes of positive and negative social consequences as indicated below.

In evaluating the consequences of *allowing* conflicting uses it is assumed that significant natural resources would be subject to development allowed by regulations that apply in the base zone. It is also assumed that mitigation for impacts on natural resources would not be required.

In evaluating the consequences of *limiting* conflicting uses it is assumed that rules would be established to limit the impacts of allowable development in areas containing significant natural resources. Areas containing significant natural resources could still be subject to development, but development restrictions would exist in addition to base zone regulations. For example, the type, location or extent of development could be restricted. Another example, development could be required to avoid adversely affecting natural resources where practicable, and to mitigate for unavoidable impacts. Another example would be to restrict the type of development allowed.

The recommendation to *limit* conflicting uses can also be implemented by relying on the City's existing environmental program which uses conservation and protection overlay zones or the recommendation could be implemented through specific code provisions in a plan district. Plan Districts are area-specific zoning codes that may include provisions related to natural resource management and development. Another tool are master plans, such as the Comprehensive Natural Resources Plans (CNRPs) and Natural Resource Management Plans (NRMPs) which can be established for sites in environmental overlay zones, provide another mechanism to coordinate development, natural resource enhancement, mitigation, recreation and other activities.

In evaluating the consequences of *prohibiting* conflicting uses it is assumed that the regulations would preclude all allowable development in significant natural resource areas.

Tables 22 address the potential social consequences of associated with the three programmatic approaches. Consequences are described, and further represented by these symbols:

- (+) more substantial positive than negative consequences
- (-) more substantial negative than positive consequences
- (+/-) positive and negative consequences of development are generally balanced
- (o) consequences would be neutral or negligible

Table 22.a outlines the social consequences of allowing, limiting or prohibiting identified conflicting uses from the perspective of the conflicting uses. Table 22.b provides an explanation of the consequences from the natural resource perspective.

Table 22.a: Social Consequences for Conflicting Uses

	Allow		Limit		Prohibit	
Industrial	A. Final Base Concept Plan 1. Would expand the local and regional employment, revenue and tax benefits of marine industrial development in the Columbia Harbor. 2. Would contribute to improved psychological and physical health of individuals; benefits that are associated with being fully employed and foster healthy families and communities. 3. Could reduce community health benefits associated with natural resources, such as air and water quality. 4. Would increase levels of light, noise, vibration and traffic, and reduce natural resource screening and buffering which could result in conflicts with nearby residential neighborhoods and open space uses, and negatively affect property values. 5. Would forgo the opportunity to require local mitigation of community impacts (e.g. noise, light, traffic) and the opportunity to leverage development for enhancement of public recreational opportunities and associated social benefits. 6. Would contribute to the current and historic cultural values of the industrial Portland Harbor, but would reduce the cultural values associated with natural resources at the confluence of the Willamette and Columbia Rivers B. Full Suite of Uses Allowed in Heavy Industrial Zone 1. Other uses allowed (e.g., other heavy industrial, commercial parking lot, event facility) would create social benefits and impacts similar to but likely less extensive than those associated with marine terminal development.	+/- +/-	A. Final Base Concept Plan 1. Would expand the local and regional employment, revenue and tax benefits of marine industrial development in the Columbia Harbor. 2. Would contribute to improved psychological and physical health of individuals; benefits that are associated with being fully employed, and foster healthy families and communities. 3. Should, by requiring setbacks from the river and mitigation, maintain most of the health benefits associated with natural resources, such as air and water quality. Some of those benefits would be shifted elsewhere through off-site mitigation. 4. Would maintain the opportunity to require local measures to help prevent and mitigate for community impacts (e.g. noise, light, traffic) and the opportunity to leverage development for enhancement of public recreational opportunities and associated social benefits. 5. Would contribute to the current historic cultural values of the industrial Portland Harbor, but would reduce the cultural values associated with natural resources at the confluence of the Willamette and Columbia Rivers B. Full Suite of Uses Allowed in Heavy Industrial Zone 1. Other uses allowed (e.g., other heavy industrial, commercial parking lot, event facility) would create social benefits and impacts similar to but likely less extensive than those associated with marine terminal development.	+ +	A. Final Base Concept Plan 1. Would eliminate the local and regional employment, revenue and tax benefits of marine industrial development in the Columbia Harbor. 2. Would not contribute to psychological and physical health benefits that are associated with being fully employed. 3. Would maintain community health benefits associated with natural resources, such as air and water quality. 4. Would maintain current levels of light, noise, vibration and traffic, and maintain natural resource screening and buffering. 5. Would retain the cultural values associated with natural resources at the confluence of the Willamette and Columbia Rivers 6. Would forgo the opportunity to leverage development to require enhancement of local and regional public recreational opportunities and associated social benefits. B. Full Suite of Uses Allowed in Heavy Industrial Zone 1. Would eliminate the local and regional employment, revenue and tax benefits of development in the Columbia Harbor.	+/- +/-
Open Space	A. Final Base Concept Plan 1. Would improve public access to passive recreation (e.g. pedestrian trails, canoeing), including access for people with special needs, and provide associated public health benefits (e.g. exercise, mental health). Improved access to a high quality recreation area could enhance property values in nearby neighborhoods. 2. Would maintain health benefits associated with natural resources particularly air and water quality. 3. Would maintain the benefits of natural screening and buffering between land uses.	+/-	A. Final Base Concept Plan 1. Would improve public access to passive recreation (e.g. pedestrian trails, canoeing) including access for people with special needs, and provide associated public health benefits (e.g. exercise, mental health). Improved access to a high quality recreation area could enhance property values in nearby neighborhoods. 2. Would maintain health benefits associated with natural resources particularly air and water quality. 3. Would maintain the benefits of natural screening and buffering between land uses.	+	A. Final Base Concept Plan 1. Would forego additional public access to passive recreation (e.g. pedestrian trails, canoeing) including access for people with special needs, and associated public health benefits (e.g. exercise, mental health). 2. Would maintain health benefits associated with natural resources particularly air and water quality. 3. Would maintain the benefits of natural screening and buffering between land uses. 4. Would maintain the cultural values of West Hayden Island, including preserving natural resources of cultural importance	+/-

Table 22.a: Social Consequences for Conflicting Uses

	Allow		Limit		Prohibit	
	4. Would maintain the cultural values of West Hayden Island, including preserving natural resources of cultural importance to Native Americans, and enhance opportunities to educate people about the cultural values. 5. Would maintain the scenic values and character associated with the open space portion of West Hayden Island and improve access to these visual amenities. <u>B. Full Suite of Uses Allowed in Open Space Zones</u> 1. Would maintain options for active recreation (e.g. dog parks, ball fields, community centers). 2. Could enhance the social benefits associated with more active open space uses (e.g. dog park), but could negatively affect the social benefit associated with passive open space uses (e.g. bird watching). 3. A mix of passive and active open space uses could enhance the desirability and economic value of property in nearby neighborhoods. 4. Could reduce some of the health benefits associated with natural resources particularly air and water quality. 5. Could reduce some benefits of natural screening and buffering between land uses and degrade quality of open space areas. 6. Could reduce some of the current scenic values and character associated with West Hayden Island.	+/-	4. Would maintain the cultural values of West Hayden Island, including preserving natural resources of cultural importance to Native Americans, and enhance opportunities to educate people about the cultural values. 5. Would maintain and could enhance the scenic values and character associated with the open space portion of West Hayden Island and improve access to these visual amenities. <u>B. Full Suite of Uses Allowed in Open Space Zones</u> 1. Would maintain options for active recreation (e.g. dog parks, ball fields, community centers). 2. Could enhance the social benefits associated with more active open space uses (e.g. dog park), but could negatively affect the social benefit associated with passive open space uses (e.g. bird watching). 3. A mix of passive and active open space uses could enhance the desirability and economic value of property in nearby neighborhoods. 6. Would, by limiting disturbance and requiring mitigation, maintain some or most of the community health benefits associated with natural resources, such as air and water quality. 4. Would, by limiting disturbance and requiring mitigation, maintain some or most of the benefits of natural screening and buffering between land uses and degrade quality of open space areas. 5. Would, by limiting disturbance and requiring mitigation, maintain some or most of the scenic values and character associated with West Hayden Island.	+	to Native Americans, but the opportunities to educate people about the cultural values in the study area would remain limited. 5. Would maintain the scenic values and character associated with the open space portion of West Hayden Island, but would forego enhancement of access to these visual amenities generally. <u>B. Full Suite of Uses Allowed in Open Space Zones</u> 1. The consequences are similar to those under the Final Base Concept Plan except that prohibiting uses in the open space zone would eliminate options and benefits associated with active recreation (e.g. dog parks, ball fields, community centers).	+/-

Table 22.b: Social Consequence for Natural Resources

Base Zone	Resource Ranks	Allow		Limit		Prohibit	
Industrial	**High, Medium & SHA**	A. Final Base Concept Plan 1. Would reduce existing limited recreational and educational values of the existing natural resources and forgo the opportunity to leverage development to enhance recreation and educational values on portions of West Hayden Island. 2. Would contribute to the loss of the cultural values related to natural resources and island landscapes at the Willamette/Columbia Rivers confluence; including preserving natural resources of cultural importance to Native Americans. 3. Could complicate efforts to comply with certain regional, state and federal regulatory requirements (e.g., ESA), resulting in potential liability and associated costs. 4. Could increase chance for future ESA listings of at-risk fish and wildlife species in the study area, resulting in additional regulatory costs and liabilities. 5. Would reduce scenic values and character, including quality of local bird and wildlife viewing. 6. Would reduce the benefits of natural screening and buffering between land uses. B. Full Suite of Uses Allowed in Heavy Industrial Zones 1. The consequences are similar to those under the Final Base Concept Plan, except that the magnitude of impact could be lower depending on the type of uses.	**-** **-**	A. Final Base Concept Plan 1. Would reduce existing limited recreational and educational values of the existing natural resources, but would provide the opportunity to leverage development to enhance existing limited recreational and educational values on the open space portion of West Hayden Island. 2. Would contribute to the loss of the cultural values related to natural resources and island landscapes at the Willamette/Columbia Rivers confluence; including preserving natural resources of cultural importance to Native Americans. 3. Would support efforts to comply with regional, state and federal requirements (e.g., ESA). 4. Would, by requiring mitigation, help reduce risk of future ESA listings of at-risk fish and wildlife species in the study area, and associated costs and liabilities. 5. Would reduce scenic values and character, including quality of local bird and wildlife viewing. 1. Design and mitigation requirements would help maintain the some of the benefits of natural screening and buffering between land uses. B. Full Suite of Uses Allowed in Heavy Industrial Zones 1. The consequences are similar to those under the Final Base Concept Plan, except that the magnitude of impact could be lower depending on the type of uses.	**+/-** **+/-**	A. Final Base Concept Plan 1. Would maintain existing limited recreational and educational values of the existing natural resources and forgo the opportunity to leverage development to enhance recreation and educational values on portions of West Hayden Island. 2. Would maintain cultural values related to natural resources and island landscapes at the Willamette/Columbia Rivers confluence; including preserving natural resources of cultural importance to Native Americans. 3. Would support efforts to comply with certain regional, state and federal requirements, but could complicate efforts to comply with Title 13 which recognizes the regional industrial and natural resource value of the Portland Harbor and West Hayden Island. 4. Would not increase the risk of future ESA listings of at-risk fish and wildlife species in the study area, and associated costs and liabilities. 5. Would maintain scenic values and character, including quality of local bird and wildlife viewing. 6. Would maintain the existing benefits of natural screening and buffering between land uses. *(Note – Both the Final Base Concept Plan and the full suite of industrial uses would have similar consequence under a prohibit decision.)*	**+** **+/-**
	Low	1. The effect on natural resource based social values associated with allowing industrial uses in low-ranked resource areas would be negligible. The low ranked resource areas are developed floodplain and hardened, non-vegetated riverbank at Terminal 6 which are subject to balanced cut and fill requirements.	**0**	1. The effect on natural resource based social values associated with limiting industrial uses in low-ranked resource areas would be negligible. The low ranked resource areas are developed floodplain and hardened, non-vegetated riverbank at Terminal 6 which are subject to balanced cut and fill requirements.	**0**	1. The effect on natural resource based social values associated with prohibiting industrial uses in low-ranked resource areas would be negligible. The low ranked resource areas are developed floodplain and hardened, non-vegetated riverbank at Terminal 6 which are subject to balanced cut and fill requirements.	**0**

Table 22.b: Social Consequence for Natural Resources

Base Zone	Resource Ranks	Allow		Limit		Prohibit	
Open Space	**High, Medium & SHA**	A. Final Base Concept Plan 1. Would support efforts to comply with regional, state and federal requirements (e.g., Title 13, ESA). 2. Would not increase the risk of future ESA listings of at-risk fish and wildlife species in the study area, and associated costs and liabilities. B. Full Suite of Uses Allowed in Open Space Zones 1. Could complicate efforts to comply with regional, state and federal requirements (e.g., Title 13, ESA) 2. Could increase the risk of future ESA listing of at-risk fish and wildlife species in the studies area, and associated costs and liabilities.	+ +/-	A. Final Base Concept Plan 1. Would support efforts to comply with regional, state and federal requirements (e.g., Titles 13, ESA). 2. Would not increase the risk of future ESA listings of at-risk fish and wildlife species in the study area, and associated costs and liabilities. B. Full Suite of Uses Allowed in Open Space Zones 1. Could complicate efforts to comply with regional, state and federal requirements (e.g., Title 13, ESA) 2. Could increase the risk of future ESA listing of at-risk fish and wildlife species in the studies area, and associated costs and liabilities.	+ +/-	A. Final Base Concept Plan 1. Would support efforts to comply with regional, state and federal requirements (e.g., Titles 13, ESA). 2. Would not increase the risk of future ESA listings of at-risk fish and wildlife species in the study area, and associated costs and liabilities. *(Note – Both the Final Base Concept Plan and the full suite of open space uses would have similar consequence under a prohibit decision.)*	+
	Low	The effect on natural resource based social values associated with allowing open space uses in low-ranked areas would be negligible. The low ranked resource areas are developed floodplain and hardened non vegetated riverbank at Terminal 6 which is subject to balanced cut and fill requirements.	**0**	The effect on natural resource based social values associated with limiting open space uses in low-ranked areas would be negligible. The low ranked resource areas are developed floodplain and hardened non vegetated riverbank at Terminal 6 which is subject to balanced cut and fill requirements.	**0**	The effect on natural resource based social value associated with prohibiting open space uses in low-ranked areas would be negligible. The low ranked resource areas are developed floodplain which are subject to balanced cut and fill requirements.	**0**

5.f.5. Social Consequences of Alternative Limit Scenarios

In addition to evaluating the primary use scenario for WHI based on the City Council resolution, there are other plausible scenarios that would provide for a mix of marine terminal development and open space uses on WHI and generally fit within the regional limit decision under Title 13:

1. Annexation of West Hayden Island with a use mix of 420 acre Marine Terminal/380 acres Open Space: This split reflects a use scenario presented the Urban Growth Report (Metro, 2010).
2. Annexation of West Hayden Island with a use mix of 100 acres Marine Terminal/700 acres Open Space: This split comes reflects information in the Urban Growth Report (Metro, 2010) and the Harbor Land Inventory (ECONorthwest, 2012)

Most of the research summarized in this ESEE Analysis was developed specifically for the primary use scenario. However, some of the social consequences of allowing, limiting or prohibiting the primary use scenario can be extrapolated to these use scenarios. The general social consequences are described below:

420 acre Marine Terminal/380 acres Open Space

A larger marine terminal footprint would generally result in greater operational and economic efficiencies because the turn radii could be less tight and the gradient less steep. This would allow trains to access and egress from the main rail line more quickly. The larger developable area would provide land for larger terminals and more cargo handling space. It could be extrapolated that the efficiencies and terminal would result in additional movement of cargo and have positive economic benefits associated jobs and tax revenue as compared with the primary use scenario.

The impact of more marine terminal development on public health has not been studied. Depending on the future uses, this scenario could add more automobile traffic and potentially truck traffic, to local roads. There could be more substantial impacts on air quality, noise, light and vibration than under the primary use scenario.

If it is assumed that the larger development footprint would include the footprint associated with the primary use scenario, plus additional area to the west,, then additional forest and wetland habitats would be impacted. Additional docks would also impact shallow water habitat. This could complicate compliance with local, state and federal environmental regulations. Mitigation could replace some of the impacted functions, but most mitigation would likely need to go off-site.

This option would preserve less land for passive recreation, reducing potential recreation benefits and increasing impacts on natural resource social values relative to the primary use scenario, including screening and buffering, aethetics and sense of place.

100 acres Marine Terminal/700 acres Open Space

Allowing 100 acres of marine terminal development would provide economic benefits including jobs and tax revenue, but it would likely be considerably less than a larger facility that took advantage of the rail infrastructure. The impacts on traffic are hard to extrapolate. If a smaller marine terminal results in moving cargo by ship and truck, it could increase traffic beyond what is expected under the primary use scenario.

Depending on the future uses, restricting the size of the development could reduce some of the public health impacts related air quality, noise, light or vibration. However, if traffic increased significantly due to the lack of rail, then air quality could be negatively impacted, particularly as it relates to congestion accessing Interstate 5.

Preserving 700 acres of open space would have social benefits associated with maintaining screening and buffering between existing land uses, recreation, cultural values, education and

sense of place. It would also preserve mitigation opportunities and could simplify compliance with local, state and federal environmental regulations.

5.f.6. Social Consequences of Not Annexing WHI

If the City decided to not annex WHI, then it would remain within Multnomah County and retain current zoning as Multiple Use Forest (MUF) and Special Environmental Concern (SEC). The types of uses allowed in the MUF zones are:

A. Forest practices and wood processing operations, sales of forest products and farm uses;
B. Residential use consisting of a single-family dwelling including a mobile or modular home, on a lot of 38 acres or more and floating homes;
C. Mining and processing of subsurface resources; and
D. Conservation areas for the protection of water, soil, open space, forest and wildlife resources.

Some of these uses have social benefits including jobs and tax benefits; however, the jobs associated with these uses is generally less than associated with industrial and marine terminal uses in an urban area. Residential uses also have social benefits due expanded housing options within the metropolitan area. However, those benefits may be tempered by the fact that WHI is located within the 100-year floodplain and there are no urban services (e.g., sewer) provided to the site.

Under this option, WHI could become a conservation area. The social consequences include preservation of natural resources for air and water quality benefits and screening and buffering; improving access to open space and recreational benefits like exercise; and preserving cultural value associated with WHI and the confluence of the Willamette and Columbia Rivers.

This option would be inconsistent with previous legislative directions that anticipated a mix of marine terminal and open spaces uses on WHI.

5.f.7 Recommendations Based on Social Analysis

Based solely on the social consequences analysis of allowing, limiting or prohibiting development in significant natural resource areas, the following general recommendations are intended to optimize the social values described in the narrative and tables above. The economic, social, environmental and energy recommendations are optimized in combination, across the issues and topics, in *Chapter 6: Recommendations* to produce an overall recommendation for the WHI and Oregon Slough study area.

Limit marine terminal development to 300 acres and open space uses to 500 acres.
This land split would still allow a marine terminal to take advantage of the rail access and moving goods by ship and rail, which would lessen impacts associated with traffic and air quality. It would also retain most of the screening and buffering and recreational benefits associated with natural resources. There would be negative social impacts, some of which could be minimized and/or mitigated by additional limitations as described below.

5.f.7.1 Social Recommendation within the Heavy Industrial Zone (IH)

Note – While this ESEE analysis is being performed for the entire inventory site, only the portions of this ESEE that apply within the area to be annexed into the City of Portland are being forward to City Council for adoption. Terminal 6 and other industrial land south of the Oregon Slough are currently located with the City of Portland and ESEE recommendations that would apply within the current city limits will not be carried forward at this time to City Council for adoption.

There is a wide range of positive and negative social consequences associated with allowing, limiting or prohibiting industrial development within areas of significant natural resources. The primary factors to consider are employment, public health, cultural values and regulatory compliance. The following social recommendation optimizes social values within the IH base zones.

1. Limit conflicting uses within areas of high and medium ranked natural resources

   Limiting conflicting uses within high and medium ranked natural resources would provide opportunities for industrial development and the associated social benefits (e.g. jobs, health insurance) while also providing an opportunity to require setbacks and vegetated buffers between industrial development and other uses such as open space. This could reduce impacts from noise, light and vibration on nearby residential development. A limit decision would also allow the City to require mitigation for adverse impacts on natural resources. Limiting conflicting uses in these areas would require most development to avoid, minimize, or mitigate for adverse impacts on the resources. Under an allow decision some the impacts on natural resource features and functions would be mitigated through state and federal permits. However, a limit decisions would allow the City to address a broader range of natural resource features and functions. This approach would advance the City's compliance with regional, state and federal regulations (Titles 13, Clean Water Act, Endangered Species Act) and reduce the risk of additional Endangered Species Act species listings.

2. Allow conflicting uses within areas of low ranking natural resources

   Low ranking resources within the study area include the Terminal 6 sea wall and developed floodplain. Allowing conflicting uses in these areas provides opportunities for industrial redevelopment and the associated social benefits (e.g., jobs). The impacts to the natural resources are negligible.

5.f.7.2 Social Recommendation within the Open Space Zone (OS)

1. Limit conflicting uses in areas of significant natural resources, except strictly limit conflicting uses:
    a. Oregon Slough:
        i. on land within 100 ft of ordinary high water (OHW),
        ii. below OHW of Oregon Slough,
        iii. within the Oregon Slough;
    b. within wetlands and land within 50ft of wetlands; and
    c. within high and medium ranked resources west of the BPA power line corridors.

Limiting conflicting uses would maintain most of the social benefits associated with the natural resources: air quality, water quality, education, and cultural resources. The limit recommendation could also allow some nature-based public recreation.

Strictly limiting conflicting uses below the ordinary high water in the Oregon Slough, wetlands and high and medium ranked resources located west of the BPA power line corridors is recommended to reduce impacts on existing natural resources, concentrate nature-based public recreation to the east, and to advance the City's compliance with regional, state and federal regulations (Titles 3 and 13, Clean Water Act and Endangered Species Act). Note that there are no low ranked resources on WHI west of the BPA power line corridor.

Both limiting and strictly limiting conflicting uses can help preserve cultural and heritage values associated with WHI.

Table 23: Summary of Social Recommendations

Feature	Allow	Limit	Strictly Limit	Prohibit
Columbia River and land below OHW		IH, OS		
Oregon Slough and land below OHW			IH, OS	
Wetlands and land within 50 ft		IH	OS	
WHI – other high and medium ranked resources east of BPA power line corridor		IH, OS		
WHI – other high and medium ranked resources west of BPA power line corridor*			OS	
Mainland – other high and medium ranked resources		IH		
Low ranked resources***	IH			

**there is no IH west of BPA power line corridor on WHI*
***there is no OS within the study area on the mainland*
****there are no low ranked resources within the OS zone*

5.f.7 Recommendations Based on Social Analysis

Based solely on the social consequences analysis of allowing, limiting or prohibiting development in significant natural resource areas, the following general recommendations are intended to optimize the social values described in the narrative and tables above. The economic, social, environmental and energy recommendations are optimized in combination, across the issues and topics, in *Chapter 6: Recommendations* to produce an overall recommendation for the WHI and Oregon Slough study area.

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        i. on land within 100 ft of ordinary high water (OHW),
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        iii. within the Oregon Slough;
    b. within wetlands and land within 50ft of wetlands; and
    c. within high and medium ranked resources west of the BPA power line corridors.

Limiting conflicting uses would maintain most of the social benefits associated with the natural resources: air quality, water quality, education, and cultural resources. The limit recommendation could also allow some nature-based public recreation.

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Both limiting and strictly limiting conflicting uses can help preserve cultural and heritage values associated with WHI.

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WHI – other high and medium ranked resources west of BPA power line corridor*			OS	
Mainland – other high and medium ranked resources		IH		
Low ranked resources***	IH			

**there is no IH west of BPA power line corridor on WHI*
***there is no OS within the study area on the mainland*
****there are no low ranked resources within the OS zone*

5.g Environmental Analysis

This portion of the ESEE analysis outlines the environmental consequences of allowing, limiting or strictly limiting conflicting uses. The natural environment in urban areas is altered and disturbed by human activities. However, human welfare depends in part on vital ecosystem services provided by natural resources such as fresh air, clean water, slope stability, food supply, shade, and access to nature. Fish and wildlife also depend on having adequate quantity and quality of habitat, even in urban areas.

The *Hayden Island Natural Resources Inventory* (April 2013) details the environmental functions provided by riparian corridors and wildlife habitat areas within the HI1: West Hayden Island and Oregon Slough inventory site. This narrative describes the general environmental functions provided by natural resources and the specific features and functions attributed to West Hayden Island, the Columbia River and the Oregon Slough.

5.g.1 Natural Resource Features and Functions

The natural resource functions identified in the Hayden Island Natural Resources Inventory are:

- **Microclimate and shade –** Open water bodies and wetlands, and surrounding trees and woody vegetation are associated with localized air cooling, increased humidity, and soil moisture. Shading from riparian vegetation also creates localized areas of cool water which is important to fish and other aquatic species.

- **Bank stabilization and control of sediments, nutrients and pollutants –** Trees, vegetation, roots and leaf litter intercept precipitation, hold soils, banks and steep slopes in place, slow surface water runoff, take up nutrients, and filter sediments and pollutants found in surface water.

- **Stream flow moderation and flood storage –** Waterways, floodplains, and wetlands provide conveyance and/or storage of stream flows, floodwaters, and groundwater discharge. Trees and vegetation intercept precipitation and promote infiltration which tempers the stream flow fluctuations or "flashiness" that often occurs in urban watersheds.

- **Large wood and channel dynamics –** Streams, riparian wetlands, floodplains and standing or downed large trees and woody vegetation contribute to the natural changes in location, configuration, and structure of stream channels over time.

- **Organic inputs, food web and nutrient cycling –** Water bodies, wetlands and nearby vegetation provide food and nutrients for aquatic and terrestrial species (e.g., plants, leaves, twigs, seeds, berries, and insects) and are part of an ongoing chemical, physical and biological nutrient cycling system.

- **Wildlife habitat/corridors –** Vegetation, water bodies and associated landscape features (e.g. downed logs) provide wildlife habitat functions such as food, cover, breeding and nesting opportunities, and migration corridors. Native and non-native vegetation patches and corridors support local native wildlife and migratory species, some of which are listed by federal or state wildlife agencies. Vegetated corridors along waterways, between waterways and uplands, and between upland habitats allow wildlife to migrate and disperse among different habitat areas, and provide access to water. Vegetation creates a buffer between human activities and wildlife. Noise, light, pollution and domestic animals all impact wildlife and vegetation can reduce those impacts.

5.g.1.1. West Hayden Island and Oregon Slough Natural Resources Inventory

The natural resources in the West Hayden Island and Oregon Slough inventory site are summarized below. For more detail please see the Hayden Island Natural Resources Inventory (February 2012).

Table 24: Summary of Natural Resource Features in HI1: West Hayden Island and Oregon Slough	
Study Area	**2,429**
River (miles/acres)	3 / 938
Stream/Drainageway (miles)	0
Wetlands (acres)	48
Flood Area (acres)*	1,891
Vegetated (acres)	786
Non-vegetated (acres)	167
Open Water** (acres)	938
Vegetated Areas >= ½ acre (acres)+	775
Forest (acres)	419
Woodland (acres)	127
Shrubland (acres)	27
Herbaceous (acres)	203
Impervious Surfaces (acres)	271
* The flood area includes the FEMA 100-year floodplain plus the adjusted 1996 flood inundation area.	
** Open Water includes portions of the Columbia River	
+ The vegetation classifications are applied in accordance with the National Vegetation Classification System specifications developed by The Nature Conservancy. The data within the primary study area and within 300 feet of all open water bodies in Portland is draft and is currently being updated based 2011 aerial photography.	

Columbia River Open Water and Shallow Water

The Lower Columbia River includes the 146 miles of river from the Bonneville Dam to the Pacific Ocean. The mainstem is free flowing and the area near Portland, river mile 100, is tidally influence.

Before the hydroelectric effects of dams impacted the river's hydrology, many of the river islands and much of its floodplain were regularly inundated with water multiple times a year. In addition to sustaining bank habitat function and bottomland hardwood forests, these natural flood events contributed to the creation and maintenance of shoal and alluvial island habitats. The dams have normalized river flows, thereby reducing peak flows and eliminating the smaller, more regular floods that historically shaped and maintained valuable river habitat resources. This has also modified the function of lower river habitat by shifting sediment budgets and food webs, changing habitat and food availability, and influencing the migratory patterns of estuarine fish and wildlife.

In addition to the hydrologic changes in the Columbia River, changes in land use have negatively affected the water quality of the Columbia River. The Lower Columbia River in the Portland area is currently on the Clean Water Act 303(d) list because it does not meet water quality standards for temperature, PCBs, PAHs, DDT and its metabolite DDE, and arsenic.

And the river banks and floodplain in the Portland area have been significantly altered through filling and bank hardening to support development. This has not only affected river hydrology, but also altered shallow water habitat location and extent. The river banks in the Portland/Vancouver area have been built up and hardened to resist erosion and prevent flooding. Large wood has been removed as well. All of this reduces channel complexity, which is an important function for ESA-listed fish and other native fishes such as lamprey and sturgeon.

Even with alteration, pollution, and other impacts, the Lower Columbia River Basin continues to provide habitat for fish and wildlife.

The confluence of the Willamette and Columbia Rivers is a regional nexus on the Pacific and Columbia River flyways. In general, birds move north-south along the Pacific flyway and birds also move east-west along the Columbia River corridor. Over 200 bird species occur in the Portland area, including resident and migratory species. Pisciverous diving birds use the near shore areas for

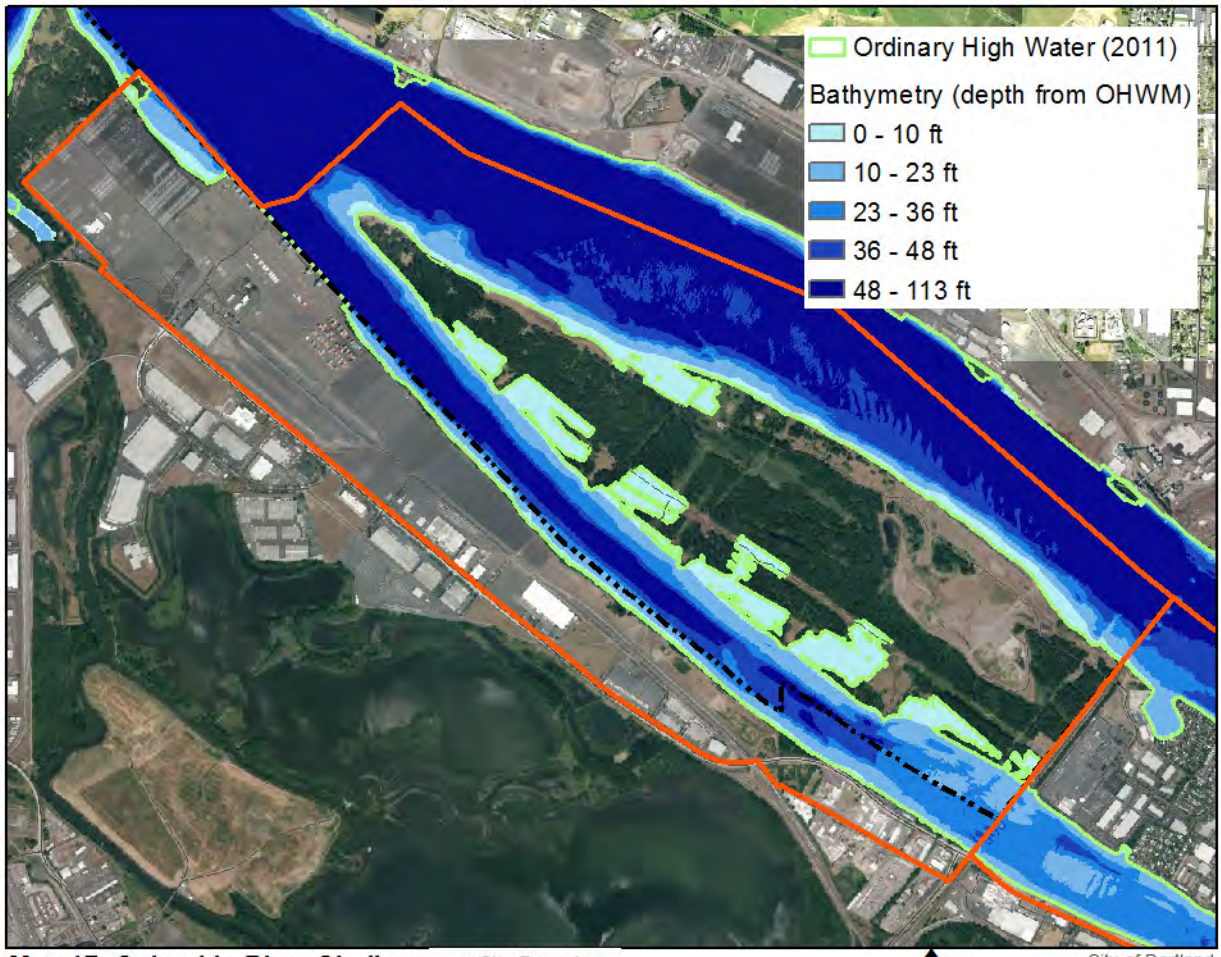
foraging: these include horned grebe, eared grebe, western grebe, surf scoter and common loon. Lesser Scaup occur in large flocks in the river feeding on aquatic invertebrates and other prey. Mudflats, shoals and beaches provides habitat for migratory shorebirds: least sandpipers, solitary sandpipers and semi-palmated plovers. All of these species have been documented using the habitats around West Hayden Island and the Oregon Slough.

The Lower Columbia River provides habitat for anadromous salmon, trout, eulachon, and Pacific Lamprey. Juvenile salmonids (salmon and trout) migrate into and overwinter in shallow water habitat. They feed and rest for quite some time before entering the ocean. As adults returning to spawn, these fish are dependent on good water quality, complex habitat and cover for predator avoidance. Habitat connectivity along the shoreline is also crucial to migratory fish survival. As both juveniles and adults move along the shoreline, they seek refugia habitats that provide opportunities to feed, rest, recharge, and hide from predators.

Chinook, chum, coho, sockeye salmon, and bull and steelhead trout are found in the Columbia River proximate to West Hayden Island. The 14 separate, evolutionarily significant units (ESUs) within these eight salmon and trout species representing more than 150 populations of of fishes that have been listed as threatened, endangered or protected under the federal Endangered Species Act. The National Marine Fisheries Service listed the Columbia eulachon for protection under the Endangered Species Act in 2011, increasing the number of ESUs that rely on the West Hayden Island area for critical habitat to 14.

Other wildlife species that use the Columbia River around West Hayden Island include white sturgeon, bald eagle. Osprey, harbor seal, California sea lion, stellar sea lion, river otter, American beaver, northern red-legged frog and western painted turtle.

The Columbia River is designated a Special Habitat Area because it is a migration corridor for fish and wildlife and provides habitat for at-risk species.



Map 17: Columbia River Shallow and Deep Water Habitat

Island Mosaic

West Hayden Island functions as one of the largest intact island habitats (830 acres) in the Lower Columbia and Willamette Rivers, third to Sauvie and Government Islands. This unique natural area provides a substantial north-south habitat connection between Vancouver Lake in Washington and the Smith and Bybee Wetlands Natural Area and a critical link in the east-west Columbia River system and habitat corridor. The relatively large, unfragmented, and complex mosaic of habitats on West Hayden Island provides a range of synergistic functions and values. WHI includes emergent and herbaceous wetlands, backwater channels and shallow water habitat, grasslands, interior forests, and bottomland hardwood forests and riparian habitats contiguous to beaches and open water river habitat. The location of West Hayden Island in the metro area, adjacent to industrial and urban land uses, serve to further elevate its importance of this habitat feature within the landscape.

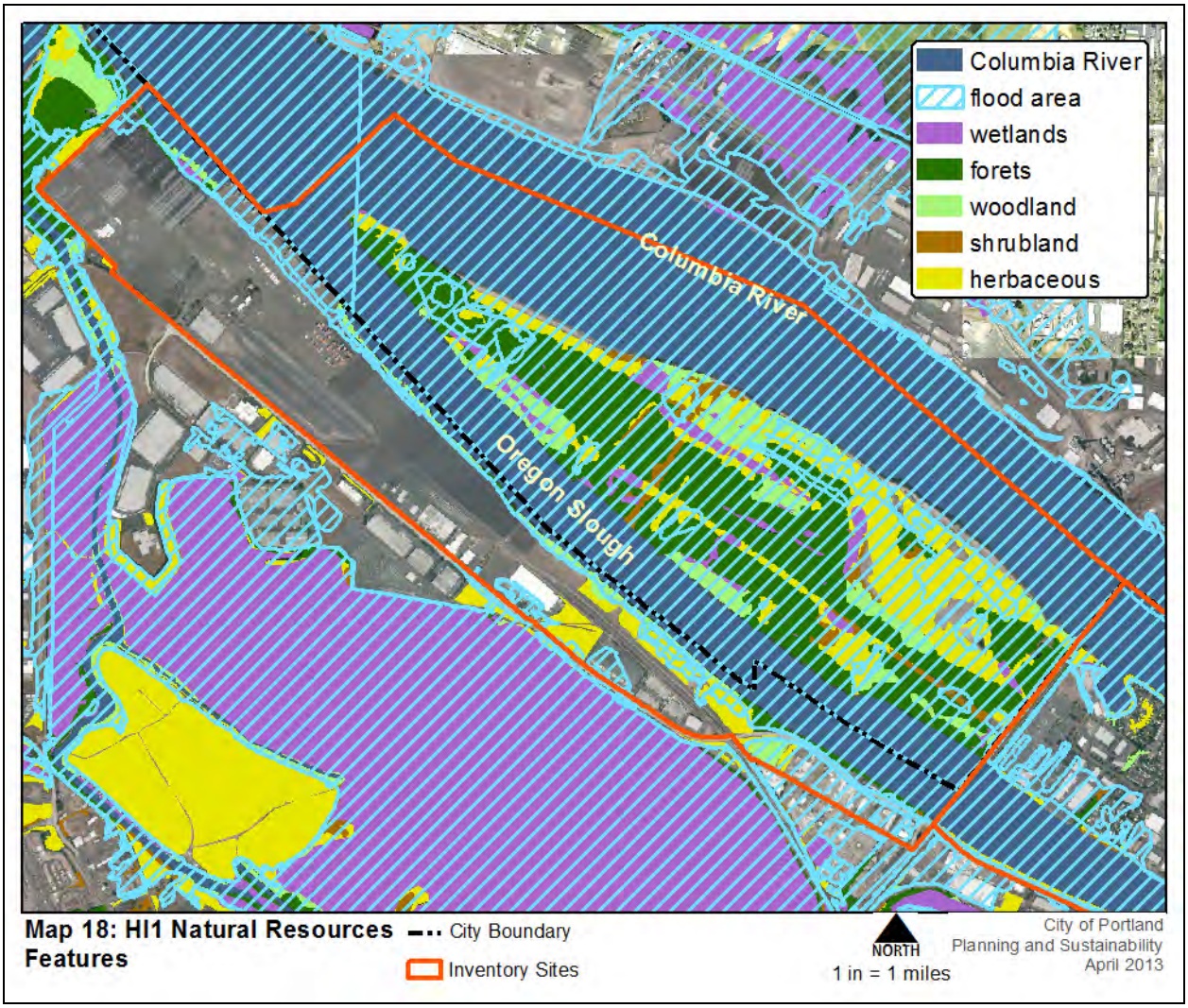
The WHI habitat complex functions as a cohesive habitat unit providing a range of life history requirements for fish and wildlife. For example, long-toed salamander their egg masses and larva rear in shallow wetlands, while adult salamanders also require forest leaf litter and downed logs for thermal protection and foraging areas.

In the early 1900's, a rock jetty, several spur dikes (groins) and pile dikes were installed on and around Hayden Island. In the 1920's, the Port of Portland, in coordination with the US Army Corps of Engineers, constructed spur dikes or rock and timber groins along the south shore of WHI and the south shore of the Oregon Slough. The US Army Corp of Engineers also constructed pile dikes made

of timber and stone along the north shore of the island in the 1920s. These were installed as a means of maintaining navigability in the adjacent Columbia River shipping channel. Six of these features that exist along the north shore may or may not be visible in the field or on aerial photography, depending on site conditions. These structures trapped sediment, directed water flows and impacted beach development along the southern side of the island. These changes affected the hydrology of the Oregon Slough, narrowing the channel and increasing the flow velocity.

The island began receiving dredged river bottom materials from local sources in the early 1900's, with the first recorded placement occurring in 1907. Placement has continued over the past 100+ years in conjunction with various channel deepening and maintenance activities. Placement of material on the island has caused the western portion of the island to increase in size by approximately 200 acres since the mid-nineteenth century resulting in increased shoreline and beach areas, increased shallow water habitat and floodplain area and additional upland habitat. The placement of dredged materials has raised the elevation of the island in some locations and disconnected the river from its floodplain. This has reduced some flood attenuation and storage in portions of the island.

All of West Hayden Island is designated a Special Habitat Area because each individual habitat that makes up the island provides unique functions and because all of the habitats function together to form a single island habitat area. West Hayden Island provides habitat for 207 wildlife species, 20 of which are considered at-risk.



Forest and Woodland Habitat

WHI and the south shoreline of the Oregon Slough in this reach contains one of the largest remnant stands of historically abundant cottonwood-ash floodplain forests in the Lower Columbia River Basin, --548 acres in total. Other nearby islands with large stands of cottonwood-ash include Sauvie Island, Government Island and Lady Island. The forest habitats on WHI represent 4% of the total remaining bottomland hardwood forests in the entire Lower Columbia River. Between the 1850's and early 1990's, the extent of the cottonwood-ahs plant community has declined by over 70% in the basin's lower watersheds (Graves et.al.,1995).

The combination of forest canopy along both banks of the Oregon Slough from the railroad bridge downstream to the end of WHI and the large stands of cottonwood-ash on WHI creates a unique habitat corridor in the Portland-Vancouver metropolitan area.

The riparian forests are characterized by black cottonwood, Oregon ash and Pacific willow as dominant tree species. The understory is dominated by several shrub species such as snowberry, gooseberry, dogwood and cottonwood and ash seedlings. The herbaceous layer is diverse and includes stinging nettle, sword fern, miner's lettuce, trailing blackberry, cleavers, and buttercup (*Ranunculus spp*.) among others. Invasive plant communities are established in areas exposed to more recent, frequent or ongoing disturbance; mainly along roads, trails, utility corridors and grazed areas. However, within the island's forests, the prevalence of Armenian blackberry and other invasive plant species quickly diminishes past the edge of habitat units; there are very few invasive plant species found within the interior of the forest habitat.

The West Hayden Island forests provide important habitat for birds, amphibians, mammals and bats, and supply near shore aquatic communities with food and cover. Breeding and migratory bird densities in local riparian cottonwood forests are high. Mature trees provide quality nesting habitat for larger birds that need big trees for their nests such as bald eagles, red-tailed hawk, great-horned owls, and a number of colonial nesters including great blue herons. Bat surveys conducted for this inventory documented the presence of four at-risk bat species in the cottonwood/ash forests of WHI: California myotis, long-legged myotis, silver-haired bat and Yuma myotis. Little brown bats were also detected.

The bottomland hardwood forests are designated a Special Habitat Area because they are part of the island habitat, function in conjunction with the other adjacent habitats, and provide stopover for migratory species. Multiple at risk species use the forest for completion of one or more life history phases.

Shrubland

On West Hayden Island there are 29 acres of shrubland habitat, most of which is found at the edge of forest and woodland areas or within the power line corridors, or are associated with wetlands.

Shrubland communities include woody plants typically less than ten feet tall with scattered open patches of grasses and forbs. Roughly half of the shrubland on WHI is dominated by dense thickets of Armenian blackberry (dominant under power line corridors) and the other half is willow dominated, often on the edges of wetlands and the river channel. Shrub thickets dominated by willows, snowberry, red osier dogwood, and Indian plum are common at the edge of wetlands and the nearshore. Some areas on the island contain the rare Columbia River willow. This habitat type is important to birds such as the willow flycatcher, as well as numerous terrestrial insects.

The shrubland habitats are designated Special Habitat Areas because they are part of the island habitat, function in conjunction with the other adjacent habitats, and provide stopover for migratory species and at risk species. .

Grasslands and Sparsely Vegetated Areas

Grasslands and sparsely vegetated areas have a predominance of grasses (in general graminoids), forbs and wildflowers, with woody vegetation comprising less than 25 percent of the area. A few large grasslands or sparsely vegetated areas are found on West Hayden Island. Vegetation species and

percent cover vegetation vary greatly in these areas due to the frequency of disturbance by deposition and maintenance of dredge spoils. Some areas are dominated by tall grasses and forbs, while others consist primarily of low dense grasses or scattered forbs, grasses and bare ground. These areas provide similar functions found in prairie, meadow or grassland habitats, and some locations support grassland-associated wildlife species. There are depressions within the grassland areas that pond with water.

One of the larger grassland areas addressed in the inventory supports grassland-associated species (Map 19). The Dredge Deposit Management Area (DDMA) is approximately 100 acres in size and is dominated by non-native grasses including cheatgrass, rat-tail fescue and rip-gut brome, and broadleaf plants such as filaree, evening primrose and horseweed. There are patches of taller shrubby vegetation that include Armenian blackberry and scotch broom. Native grassland plants found in the DDMA include lupine, Canadian goldenrod, Spanish clover, and Oregon sunshine. The placement of dredge materials and maintenance of the area mimics disturbance that once occurred naturally. The use of the area for placement of dredge materials maintains early succession vegetation and areas of bare soil. This disturbed grassland matrix offers a diversity of vegetation height and density, and provides habitat for various grassland birds including the *at-risk* songbird Western meadowlark. Other grassland-associated species that hunt and forage in the DDMA include American kestrel, northern harrier, savannah sparrow and deer mouse. Bat surveys conducted revealed the presence of five at-risk bat species in the DDMA: California myotis, hoary bat, long-legged myotis, silver-haired bat and Yuma myotis. Little brown and big brown bats were also detected. The survey did not specify the way the bats are using the DDMA. It could be an area of daily movement to and from roosting and feeding site and/or the bats could be foraging over the DDMA grasslands.

The other large grassland area is the T6 Dredge Material Handling Area located on the southern side of the Oregon Slough between the river and Marine Drive, just east of Port Terminal 6. The site contains a dredge material deposit area and three earthen cells connected by drainage pipes, constructed for the purposes of handling, dewatering and removing dredge material. While not a native grassland, the vegetation structure and density mimic a grassland habitat. The T6 Dredge Material Handling Area is dominated with non-native grasses and mosses, with pockets of blackberry and scotch broom, cottonwood and willow. Bordering the grasslands, adjacent to the Oregon Slough, is a strip of mature cottonwoods, willows and ash with some native understory including snowberry, stinging nettle, red-osier dogwood, and sword fern. Grassland-associated wildlife species documented to use the T6 Dredge Material Handling Area include American kestrel, savannah sparrow, and Western meadowlark. Western meadowlark is also an *at-risk* wildlife species. Other wildlife observed at the T6 Dredge Material Handling Area include: six osprey nests (all located on structures), red-tailed hawk, varied thrush, yellow rumped warbler, scrub jay, American gold finch, bewick's wren, Lincoln's sparrow and downy woodpecker. Also seen were coyote scat, vole holes, deer mouse and evidence of deer browsing.

The grasslands and sparsely vegetated areas of WHI are designated Special Habitat Areas because they are part of the island habitat and function in conjunction with the other adjacent habitats. The DDMA is also designated Special Habitat Area because it provides habitat that supports grassland associated species and an at risk species.

Wetlands

There are 48 acres of wetlands on West Hayden Island. The wetlands vary in size from approximately 300 square feet to 15+ acres. Wetlands are productive areas for wildlife and host a diversity of plants. In late summer, common native wildflowers include sneezeweed and western goldenrod. Other species found include flatsedge, cattail, woolly sedge and water plantain. A rare plant, the hairy water fern, has been found on the north and south side of the island. Killdeer and greater yellowlegs were observed foraging in the emergent wetlands in 2011. Sandpipers, neotropical songbirds, amphibians as well as various fish and wildlife (deer and raccoon) depend on wetlands.

Benson Pond was artificially created in the mid-1900's as a staging area for log rafts. The pond now functions as a permanently flooded palustrine aquatic bed that supports both persistent and non-persistent emergent wetland vegetation. Surrounding the aquatic features of the pond is a diverse mix of scrub-shrub wetland vegetation, and there are pockets of mature riparian trees that connect to the flooded wetland during freshets. With its flood storage capacity, the Benson Pond wetlands complex provides critical habitat for fish, including many species of ESA-listed salmon and trout; foraging habitat and refuge for waterfowl, wading birds, and diving birds; potential habitat for turtles (one painted turtle was observed in 1997); habitat for breeding amphibians; foraging habitat for insectivorous birds; and watering opportunities for wildlife.

Figure 6: Benson Pond, flooding Spring 2011

There are multiple forested palustrine wetland areas on the south-central side of the island. The wetlands are seasonally inundated to a large extent during peak flow events that backwater the Oregon Slough onto the island. These wetlands support persistent emergent wetland vegetation, such

as nettles and Pacific willow, but are dominated by reed canary grass in open areas. The wetlands provide a variety of food, cover, nesting, and denning opportunities for many aquatic and terrestrial wildlife species. The wetlands also provide direct export of organic materials to the riverine system; groundwater recharge; flood storage; and sediment, chemical, and nutrient filtering services. The south bank wetlands are inundated by the Columbia River seasonally and during flood events. This inundation provides off-channel habitat for aquatic fish and wildlife, most notably, ESA-protected salmon and trout.

Several patches of forested palustrine wetlands are found in the interior of the island. These wetlands support persistent emergent wetland vegetation, such as nettles and cottonwoods, but are dominated by reed canary grass areas around the fringe. The wetlands are seasonally flooded after the groundwater table reaches the surface, usually between November and July. These forested wetlands provide a variety of food, cover, nesting, and denning opportunities for many aquatic and terrestrial wildlife species, as well as groundwater recharge; flood storage; and sediment, chemical, and nutrient filtering services. Generally, these wetlands provide higher quality amphibian breeding habitat due to their isolation from river driven fluctuation in water levels (stable hydroperiod) and from decreased turbidity from river flows.

Several patches of various sized scrub/shrub and herbaceous wetlands are found in the interior of the island. These wetlands support persistent emergent wetland vegetation types, as well as wetland shrubs around the fringe. The wetlands are seasonally flooded after the groundwater table reaches the surface, usually between November and June. These wetlands provide a variety of food, cover and nesting for many aquatic and terrestrial wildlife species, as well as groundwater recharge; flood storage; and sediment, chemical, and nutrient filtering services. Hairy water fern, a rare aquatic plant, has been found in an open wetland.

All wetlands on West Hayden Island are designated a Special Habitat Area because they are part of the island habitat and function in conjunction with the other adjacent habitats. In addition, Benson Pond and the WHI South Bank Wetlands with a surface hydrology connection to the river during seasonal high flows also meet the following Special Habitat Area criterion because the wetlands provide habitat for 14 populations of ESA-listed fish species. The Port's mitigation wetland and some of the interior wetlands support breeding populations of Northern red-legged frogs and are designated Special Habitat Areas because they support this at risk species.

As discussed in the economic and social analyses, natural resources provide social amenities and economic benefits. Social amenities include recreation, education, buffering/screen of land uses, health and welfare, and scenery. Economic benefits include ecosystem goods and services such as flood storage, air purification, water quality, biodiversity and fisheries.

5.g.1.2. Natural Resource Services Provided to Development

As stated in the economic and social section, natural resources provide multiple services to associated development; these are called *ecosystem services*. Examples of the ecosystem services provided by natural resources include air purification, maintenance of water quality and quantity, flood storage, cooling, aesthetics, screening and buffering, and employee benefits such as opportunities for recreation and exercise. Some of these services, when displaced by development, must be replaced using infrastructure. For example, when a site is converted from a natural area to a parking lot, the hydrologic and water quality functions provided by the natural area must be replaced in the form of stormwater treatment and/or vegetation and landscaping. Another example is flood storage. When the floodplain is filled to allow for development the change in hydrology can increase the risk of flooding off-site and may be mitigated by improving flood storage elsewhere.

Existing natural resource areas in the metro region also provide opportunities for mitigation actions associated with development. There is a scarcity of large natural areas like West Hayden Island in the region where mitigation actions can be undertaken. West Hayden Island, in addition to its size, is also unique because of the mosaic of habitats that function together. Bottomland hardwood forests, floodplain, wetlands, shallow water habitats and grasslands create a contiguous island habitat that

supports over 200 species of fish and wildlife. Mitigation opportunity is an important service provided to the entire region.

5.g.1.3. Development Impacts on Natural Resources

Development can have many negative impacts on natural resources. Development reduces the overall size and complexity of existing natural resources features. Often mitigation for these impacts is required through federal, state or local regulations; however mitigation actions rarely can replace all impacted features or functions in full (ECONorthwest, 2012). Considering the relatively large size and uniqueness of West Hayden Island, fully mitigating for the impacts of the Final Base Concept Plan (e.g. removal of 300 acres of functioning natural resources) would be even more difficult within the metro region.

Development also has negative impacts to adjacent remaining habitat. Reducing the size of the habitat increase the edge to interior habitat ratio. Noise, light, dust and vibration from the development penetrates into the edge of the remaining habitat. Impacts from actions like construction can last long-after the action is completed. Physical pollution, such as chronic noise, light and movement, have negative environmental impacts, including significant changes in migration, foraging, predator-avoidance behaviors, reproductive success, and community structure of many fish and wildlife species (Barber et.al., 2009). Light pollution can affect salmon migration (Tabor, 2011) and noise pollution can have impacts on bats. Chemical pollution from industrial accidents, effluent discharge, and particulate releases also disrupt similar behavior and life history strategies of fish and wildlife. Some species can adapt to such changes to their environment; however, many others cannot.

The proposed industrial development for West Hayden Island is a marine terminal with associated infrastructure. Large ships that bring goods to port facilities can also inadvertently transport invasive plants and wildlife. Regulations have been put in place to manage the dumping of bilge water so that non-native aquatic species and other pollutants are not introduced into rivers and streams. Also, rail infrastructure, particular heavy metals from brake dust, are of concern for water quality.

Fragmentation of natural resources by trails and maintenance roads creates places where invasive plants can intrude into the habitat. People using these facilities can also have a negative impact on the resources. For example, people hiking on trails cause noise that can disturb wildlife, particularly if people bring their dogs on the hike. Leaving behind trash, pet waste, and trampled vegetation; and the act of plant/animal harvesting are common impacts that human use of natural areas conveys.

5.d.1.5. Climate Change Adaptation and Resiliency

Climate change impacts are already evident, both globally and in Oregon, and more impacts are inevitable, if uncertain. To adapt, the region must understand and prepare for change. Portland's Climate Action Plan calls for a comprehensive review to better understand the possible and the likely impacts of climate change. The purpose is to assess climate-related vulnerabilities, and the strengths and resiliency of: local food, water and energy supplies, infrastructure, transportation and freight movement, floodplains, watersheds, public health, public safety, social services and emergency preparedness.

The City of Portland and Multnomah County are beginning that work; however, decision-making in the face of uncertainties in climate change projections, especially in regional downscaling of global climate change models, remains a challenge. Climate projections work well for some variables and poorly for others. For example, currently available model projections for the Pacific Northwest have a higher degree of certainty related to expected changes in precipitation patters and temperature increases, but are inconclusive about what should be expected for total annual precipitation or extreme weather events.

That being said, it is fairly certain that the Portland region will experience the following changes:

- Increased temperatures overall, including average, maximum and minimum temperatures in the summer and winter months (projected 0.5 ºF increase per decade).
- Changes in precipitation patterns, with more precipitation falling in mid-winter and less precipitation in the summer.

    - More precipitation falling as rain rather than as snow in lower elevation watersheds.
- Continued influence of ocean-driven weather patterns (e.g. La Nina/El Nino and the Pacific Decadal Oscillation) and swings between hot/dry and cold/wet (Oregon Climate Change Research Institute, 2010).

In addition, the Portland region may also experience:

- Changes in total annual precipitation amounts (increases or decreases).
- A change in the frequency, magnitude or duration of extreme weather events (intense rainfall, wind storms, ice and snow).

The City of Portland continues to monitor the latest science and modeling efforts to help inform adaptation planning and resiliency efforts. A vulnerability assessment, along with an adaptation plan that analyzes and prioritizes preparation actions to manage risks, is under development by the City of Portland and Multnomah County. This initial plan is expected to be completed at the end of 2012 and will focus on built infrastructure, natural resources, and health and human services. The City and County also continue to engage in related regional climate resiliency efforts, including collaborating with local jurisdictions in throughout the Willamette Valley.

Non-developed areas that provide multiple natural resource functions can play an important role in adapting to climate change in the region. Flood storage provided by active floodplains may become even more important to accommodate potential changes in flows and flood regimes. Maintaining diverse habitats and habitat corridors will be critical for resident and migratory wildlife that may be required to adapt their behaviors and life cycles to changes in air and water temperature, weather patterns, habitat ranges, and food sources.

5.g.2. Regulatory Compliance

Several regulations address the types of natural resources that currently exist in the inventory study area (see Chapter 2: Regulatory and Policy Context). Regulatory compliance is important for the City of Portland to avoid cost and liability, and because Portland values its role as a leader in sustainability and environmental protection and management. Non-compliance with environmental regulations results a greater loss of habitat and wildlife species. Please see the Social section for additional detail and explanation.

5.g.3. Transportation Mode Split

In comparing the environmental affects of transporting goods, ocean marine and barge shipping produces less CO2 omissions than any other modes of transporting goods. Shipping by train results is the second least polluting transport modes. It is anticipated that the marine terminals located on West Hayden Island would be shipping and/or receiving their goods from oversees via ocean going ships, with more localized shipping going by barge and train which both of which are more energy efficient than truck transport (Figure 7). The location of West Hayden Island on the Columbia River shipping channel and with access to both the Burlington Northern/Santa Fe and Union Pacific Railroads allows development to take advantage of these more efficient modes of transportation. From a regional standpoint, moving a greater number of goods via ship and rail can reduce the amount of fossil fuel used in transportation and reduce the per ton carbon footprint, especially since a greater volume of goods can be transported by these modes.

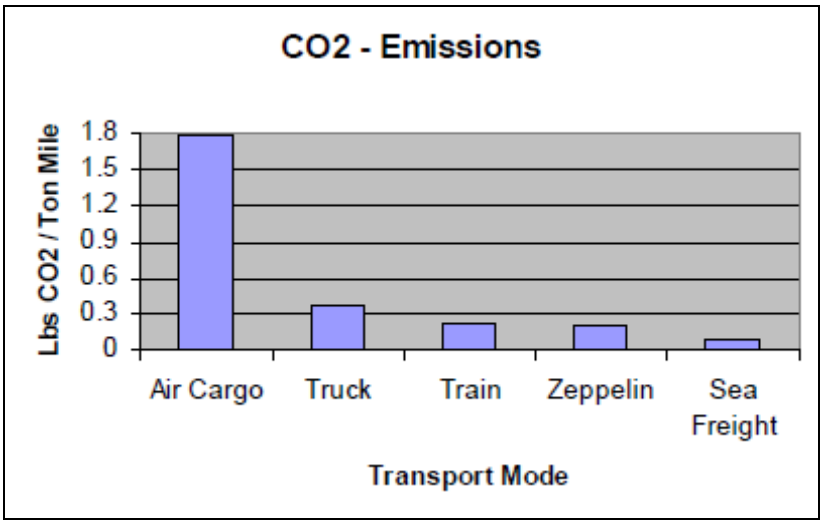


Figure 7: CO2 Emissions by Transport Mode (Flugzeuge. 1999)

5.g.4. Environmental Consequences

To evaluate the potential environmental consequences of different natural resource protection program options, three scenarios or policy choices are assessed: allowing, limiting and prohibiting conflicting uses that would adversely affect significant natural resources in the West Hayden Island study area. The positive and negative consequences of these program choices are evaluated from the perspectives of both the conflicting uses and the significant natural resources identified in the inventory for this site. As such, the program choices would result in different mixes of positive and negative environmental consequences as indicated below.

In evaluating the consequences of *allowing* conflicting uses it is assumed that significant natural resources would be subject to development allowed by regulations that apply in the base zone. It is also assumed that mitigation for impacts on natural resources would not be required.

In evaluating the consequences of *limiting* conflicting uses it is assumed that rules would be established to limit the impacts of allowable development in areas containing significant natural resources. Areas containing significant natural resources could still be subject to development, but development restrictions would exist in addition to base zone regulations. For example, the type, location or extent of development could be restricted. Another example, development could be required to avoid adversely affecting natural resources where practicable, and to mitigate for unavoidable impacts. Another example would be to restrict the type of development allowed.

The recommendation to *limit* conflicting uses can also be implemented by relying on the City's existing environmental program which uses conservation and protection overlay zones or the recommendation could be implemented through specific code provisions in a plan district. Plan Districts are area-specific zoning codes that may include provisions related to natural resource management and development. Another tool are master plans, such as the Comprehensive Natural Resources Plans (CNRPs) and Natural Resource Management Plans (NRMPs) which can be established for sites in environmental overlay zones, provide another mechanism to coordinate development, natural resource enhancement, mitigation, recreation and other activities.

In evaluating the consequences of *prohibiting* conflicting uses it is assumed that rules would be established that preclude all allowable development in significant natural resource areas.

Tables 25 addresses the potential environmental consequences associated with the three programmatic approaches. Consequences are described, and further represented by these symbols:

- (+) more substantial positive than negative consequences
- (-) more substantial negative than positive consequences
- (+/-)positive and negative consequences of development are generally balanced
- (o) consequences would be neutral or negligible

Table 25.a outlines the environmental consequences of allowing, limiting or prohibiting identified conflicting uses from the perspective of the conflicting uses. Table 25.b provides an explanation of the natural resource consequences by of these program choices by conflicting use.

Table 25.a: Environmental Consequences for Conflicting Uses

	Allow		Limit		Prohibit	
Industrial	1. Would reduce functions provided by natural resources including air purification, maintenance of water quality and quantity, flood storage, air and water cooling, organic inputs, wildlife habitat and connectivity, aesthetics, screening and buffering between land uses. Some of these impacts would extend beyond WHI. 2. Would require replacement of some lost functions with hard infrastructure (e.g. stormwater facilities, erosion control) but would not need to replace a broader range of lost functions. 3. Could increase carbon emissions associated with additional shipping of goods but shipping by water or train would produce less carbon emissions than shipping by truck and/or air. Future emissions may not be affected if the cargo demand is met elsewhere in the region. *(Note – Both the Final Base Concept Plan and the full suite of industrial uses would have similar consequence under an allow decision.)*	-	1. Would, by requiring mitigation, help maintain some or most functions provided by natural resources including air purification, maintenance of water quality and quantity, flood storage, air and water cooling, wildlife habitat and connectivity, aesthetics, screening and buffering between land uses. Some of these functions would be shifted elsewhere since off-site mitigation would be needed to maintain functions. 2. Would require replacement of some lost functions with hard infrastructure (e.g. stormwater facilities, erosion control) but would not need to replace a broader range of lost functions. Some impacts to function would require off-site mitigation. 3. Could increase carbon emissions associated with additional shipping of goods but shipping by water or train would produce less carbon emissions than shipping by truck and/or air. Future emissions may not be affected if the cargo demand is met elsewhere in the region. *(Note – Both the Final Base Concept Plan and the full suite of industrial uses would have similar consequence under a limit decision.)*	+/-	1. Would maintain functions provided by natural resources including air purification, maintenance of water quality and quantity, flood storage, air and water cooling, aesthetics, screening and buffering between land uses. 2. Would reduce local transportation related carbon emissions associated with trips generated in the study area. However, could increase carbon emission within the region if more goods are shipped by truck and/or air, rather than by water or train. *(Note – Both the Final Base Concept Plan and the full suite of industrial uses would have similar consequence under a prohibit decision.)*	+/-
Open Space	A. Final Base Concept Plan 1. Would maintain functions provided by natural resources including air purification, maintenance of water quality and quantity, flood storage, air and water cooling, organic inputs, wildlife habitat and connectivity, aesthetics, screening and buffering between land uses. 2. Would maintain opportunities for on-site natural resources mitigation and enhancement. B. Full Suite of Uses Allowed in Open Space Zones 1. Depending on the use (e.g. community center, ball field, dog park), could reduce functions provided by natural resources including air purification, maintenance of water quality and quantity, flood storage, air and water cooling, organic inputs, wildlife habitat and connectivity, aesthetics, screening and buffering between land uses and recreation. 2. Would require replacement of some lost functions with hard infrastructure (e.g. stormwater facilities, erosion control) but would not need to replace a broader range of lost functions. 3. Would reduce some opportunities for natural resource mitigation and enhancement.	+ +/-	A. Final Base Concept Plan 1. Would maintain functions provided by natural resources including air purification, maintenance of water quality and quantity, flood storage, air and water cooling, organic inputs, wildlife habitat and connectivity, aesthetics, screening and buffering between land uses. and recreation. 2. Would maintain opportunities for on-site natural resources mitigation and enhancement. B. Full Suite of Uses Allowed in Open Space Zones 1. Would, by requiring mitigation, maintain, functions provided by natural resources including air purification, maintenance of water quality and quantity, flood storage, air and water cooling, organic inputs, wildlife habitat and connectivity, aesthetics, screening and buffering between land uses and recreation. 2. Would require replacement of some lost functions with hard infrastructure (e.g. stormwater facilities, erosion control) but would need to replace a broader range of lost functions. Some functions may need to be mitigated off-site. 3. Would reduce some opportunities for natural resource mitigation and enhancement.	+ +	1. Would maintain functions provided by natural resources including air purification, maintenance of water quality and quantity, flood storage, air and water cooling, organic inputs, wildlife habitat and connectivity, aesthetics, screening and buffering between land uses and recreation. 2. Would maintain opportunities for on-site natural resources mitigation and enhancement. *(Note – Both the Final Base Concept Plan and the full suite of open space uses would have similar consequence under a prohibit decision.)*	+

Table 21.b: Environmental Consequences for Natural Resources

Base Zone	Resource Ranks	Allow		Limit		Prohibit	
Industrial	**High, Medium & SHA**	1. Would result in loss of significant environmental functions. All environmental functions would be affected by conflicting uses within area of high and medium ranked natural resources and Special Habitat Areas. 2. Could complicate efforts to comply with regional, state and federal requirements (e.g., e.g. ESA). 3. Could increase chance for future ESA listings of at-risk fish and wildlife species in the study area. 4. Could reduce, incrementally, the capacity of the region to adapt to climate change. 5. Would affect environmental functions in remaining, adjacent natural resource areas (e.g. noise, light, runoff). 6. Would forego opportunities to leverage development to help protect and improve ecological conditions and ecosystem services provided on-island and off-island (lost opportunities may have future economic costs). *(Note – Both the Final Base Concept Plan and the full suite of industrial uses would have similar consequence under an allow decision.)*	**-**	1. Would, by requiring mitigation, maintain most significant environmental functions. Some of those benefits would be shifted elsewhere through off-site mitigation. Some functions, such as habitat patch size, shape, and location, cannot easily be mitigated for, so fully compensating for loss of natural resource functions will be difficult. 2. Limitations on development would support efforts to comply with regional, state and federal requirements (e.g., ESA). 3. Would, by requiring mitigation, help avoid increased risk of future ESA listings of at-risk fish and wildlife species in the study area. 4. Would, by requiring mitigation, help retain the region's capacity to adapt to climate change. 5. Would maintain the opportunity to require mitigation for development impacts on adjacent natural resource areas (e.g. noise, light, runoff). 6. Would provide the opportunity to leverage development to help protect and improve ecological conditions and ecosystem services provided on-island and off-island (lost opportunities may have future economic costs). *(Note – Both the Final Base Concept Plan and the full suite of industrial uses would have similar consequence under a limit decision.)*	**+/-**	1. Would maintain significant functions provided by high and medium rank resources and Special Habitat Areas. 2. Would support efforts to comply with certain regional, state and federal requirements, but could complicate efforts to address Title 13 which recognizes the importance of West Hayden Island as a regionally significant industrial area and a regionally significant natural resource area. 3. Would not increase the risk of future ESA listings of at-risk fish and wildlife species in the study area. 4. Would not affect the capacity of the region to adapt to climate change. 5. Would forego opportunities to leverage development to help protect and improve ecological conditions and ecosystem services provided on-island and off-island (lost opportunities may have future economic costs). *(Note – Both the Final Base Concept Plan and the full suite of industrial uses would have similar consequence under a prohibit decision.)*	**+**
	Low	1. The loss in environmental values associated with allowing industrial uses in low-ranked resource areas would be negligible. The low ranked resource areas are developed floodplain and hardened, non-vegetated riverbank at Terminal 6 which are subject to balanced cut and fill requirements.	**0**	1. The loss in environmental value associated with limiting industrial uses in low-ranked resource areas would be negligible. The low ranked resource areas are developed floodplain and hardened, non-vegetated riverbank at Terminal 6 which are subject to balanced cut and fill requirements.	**0**	1. The loss in environmental values associated with prohibiting industrial uses in low-ranked resource areas would be negligible. The low ranked resource areas are developed floodplain and hardened, non-vegetated riverbank at Terminal 6 which are subject to balanced cut and fill requirements.	**0**

Table 21.b: Environmental Consequences for Natural Resources

Base Zone	Resource Ranks	Allow		Limit		Prohibit	
Open Space	High, Medium & SHA	A. Final Base Concept Plan 1. Would maintain most of the significant environmental functions provided by high and medium ranked natural resources and Special Habitat Areas. 2. Could create some disturbance and fragmentation, which could reduce some of the functions provided by the natural resources (e.g. intrusion by invasive plants, interior habitat). 3. Would support efforts to comply with regional, state and federal requirements (e.g., Title 13, ESA). 4. Would not increase the risk of future ESA listings of at-risk fish and wildlife species in the study area. 5. Would maintain opportunities for on-site natural resources mitigation and enhancement. B. Full Suite of Uses Allowed in Open Space Zones 1. More substantial recreational development (e.g. ball fields, community center, dog park) could reduce significant environmental functions provided by high and medium ranked natural resources and Special Habitat Areas. 2. More active recreational uses could affect environmental functions in remaining, adjacent natural resource areas (e.g. noise, light, human disturbance). 3. Could complicate efforts to comply with certain regional, state and federal requirements (e.g., Title 13, ESA). 4. Could increase the risk of future ESA listings of at-risk fish and wildlife species in the study area. 5. Would maintain some opportunities for on-site natural resources mitigation and enhancement.	+/- -	A. Final Base Concept Plan 1. Would, by requiring mitigation, maintain all of the significant environmental functions provided by high and medium ranked natural resources and Special Habitat Areas. 2. Would create some habitat fragmentation, which could reduce some of the functions provided by the natural resources (e.g. intrusion by invasive plants), but the amount of fragmentation could be limited. 3. Would support efforts to comply with regional, state and federal requirements (e.g., Title 13, ESA). 4. Would reduce the risk of future ESA listings of at-risk fish and wildlife species in the study area. 5. Would maintain opportunities for on-site natural resources mitigation and enhancement. B. Full Suite of Uses Allowed in Open Space Zones 1. Requiring development to limit disturbance and mitigate for impacts could reduce loss of significant resources and functions associated with more active open space uses.	+ +/-	1. Would significant environmental functions provided by high and medium ranked natural resources. 2. Would support efforts to comply with regional, state and federal requirements (e.g., Title 13, ESA). 3. Would not increase the risk of future ESA listings of at-risk fish and wildlife species in the study area. 4. Would maintain opportunities for on-site natural resources mitigation and enhancement. *(Note – Both the Final Base Concept Plan and the full suite of open space uses would have similar consequence under a prohibit decision.)*	+
	Low	1. The loss in environmental value associated with allowing open space uses in low-ranked resource areas would be negligible. The low ranked resource areas are developed floodplain and hardened, non-vegetated riverbank at Terminal 6 which are subject to balanced cut and fill requirements.	0	1. The loss in environmental value associated with limiting open space uses in low-ranked resource areas would be negligible. The low ranked resource areas are developed floodplain and hardened, non-vegetated riverbank at Terminal 6 which are subject to balanced cut and fill requirements.	0	1. The loss in environmental value associated with prohibiting open space uses in low-ranked resource areas would be negligible. The low ranked resource areas are developed floodplain and hardened, non-vegetated riverbank at Terminal 6 which are subject to balanced cut and fill requirements.	0

5.g.5. Environmental Consequences of Alternatives Limit Scenarios

In addition to evaluating the primary use scenario for WHI based on the City Council resolution, there are other plausible scenarios that would provide for a mix of marine terminal development and open space uses on WHI and generally fit within the regional limit decision under Title 13:

1. Annexation of West Hayden Island with a use mix of 420 acre Marine Terminal/380 acres Open Space: This split reflects a use scenario presented the Urban Growth Report (Metro, 2010).
2. Annexation of West Hayden Island with a use mix of 100 acres Marine Terminal/700 acres Open Space: This split comes reflects information in the Urban Growth Report (Metro, 2010) and the Harbor Land Inventory (ECONorthwest, 2012)

Most of the research summarized in this ESEE Analysis was developed specifically for the primary use scenario. However, some of the environmental consequences of allowing, limiting or prohibiting the primary use scenario can be extrapolated to these two scenarios. The general environmental consequences are described below:

420 acre Marine Terminal/380 acres Open Space

The environmental consequences of this option would include additional impacts on existing natural resource functions. .

If it is assumed that the larger development footprint would include the footprint associated with the primary use scenario, plus additional area to the west, then additional forest and wetland habitats would be subject to development. Interior forest habitat area would be reduced and the species that depend on interior forest could be displaced. At the same time, fragmentation and edge effects would increase, such as increased invasive plant and animal species. The synergistic relationship between the habitat types would also be reduced. Additional docks would also impact shallow water habitat.

Mitigation could replace some of the impacted functions, but most mitigation would likely need to go off-site and it is unlikely that a single mitigation location could be found to reproduce the synergy between habitat types like that found on WHI.

100 acres Marine Terminal/700 acres Open Space

This option would involve less detrimental impacts on natural resources relative to the primary use scenario. However, because this option could not accommodate a modern rail loop, a future marine terminal would move likely move cargo by ship and truck. Trucks produce more carbon emissions than rail and therefore would have more impact on air quality and greenhouse gas emissions.

If the development site is assumed to be located solely over the current Dredge Deposit Management Area, then this option could preserve all of the existing forest and interior area on WHI, supporting the existing wildlife populations including at-risk species using the forests and associated wetlands. The grassland-associated species using the dredge deposit area would still be displaced.

There would be more area for open space uses, although it is still assumed that those uses would be primarily passive recreation. Also the open space areas would be available for future mitigation associated with other projects. This scenario could simplify compliance with local, state and federal natural resource related regulations relative to the primary scenario.

5.g.6. Environmental Consequences of Not Annexing WHI

If the City decided to not annex WHI, then it would remain within Multnomah County and retain current zoning as Multiple Use Forest (MUF) and Special Environmental Concern (SEC). The types of uses allowed in the MUF zones are:

A. Forest practices and wood processing operations, sales of forest products and farm uses;
B. Residential use consisting of a single-family dwelling including a mobile or modular home, on a lot of 38 acres or more and floating homes;
C. Mining and processing of subsurface resources; and
D. Conservation areas for the protection of water, soil, open space, forest and wildlife resources.

Most of these uses conflict with natural resources and would have similar general impacts as other urban uses: clearing vegetation, grading, etc. However, depending on the use, some of the existing natural resources could potentially be preserved. For example, maintaining the island in conservation area use could maintain the functions provided by natural resources including air purification, maintenance of water quality and quantity, flood storage, air and water cooling, organic inputs, wildlife habitat and connectivity, aesthetics, screening and buffering between land uses. Other uses, such as mining or forest practices could result in more resource loss than use scenarios involving a mix of marine terminal and open space use. Residential use could preserve some resource areas but would increase fragmentation and loss of interior habitat.

This option would be inconsistent with previous legislative directions that anticipated a mix of marine terminal and open spaces uses.

5.g.7 Recommendations Based on Environmental Analysis

Based solely on the environmental consequences analysis of allowing, limiting or prohibiting development in significant natural resource areas, the following general recommendations are intended to optimize the environmental values described in the narrative and tables above. The economic, social, environmental and energy recommendations are optimized in combination in *Chapter 6: Recommendations* to produce an overall general recommendation for the WHI and Oregon Slough study area.

Limit marine terminal development to 100 acres and open space uses to 700 acres.
This land split would preserve most of the existing natural resources and associated functions and could maintain the existing bottomland hardwood forest interior area. There would be negative impacts to natural resources, some of which could be minimized and/or mitigated by additional limitations as described below.

5.g.7.1 Environmental Recommendation within the Heavy Industrial Zone (IH)

Note – While this ESEE analysis is being performed for the entire inventory site, only the portions of this ESEE that apply within the area to be annexed into the City of Portland are being forward to City Council for adoption. Terminal 6 and other industrial land south of the Oregon Slough are currently located with the City of Portland and ESEE recommendations that would apply within the current city limits will not be carried forward at this time to City Council for adoption.

There is a wide range of positive and negative environmental consequences associated with allowing, limiting or prohibiting industrial development within areas of significant natural resources. The primary factors to consider are functions including water quality, flood storage, wildlife habitat; aesthetics, screening and buffering; and regulatory compliance. The following recommendation optimizes environmental values within the IH base zones.

1. Limit conflicting uses within areas of ranking natural resources, except strictly limit conflicting uses:
    a. Columbia River:
        i. on land within 100 ft of ordinary high water (OHW),
        ii. below OHW, and
        iii. within the Columbia River; and
    b. within wetlands and land within 50ft of wetlands.

    Strictly limiting uses within the Columbia River and wetlands and adjacent land would prevent direct impacts from these high intensity land uses on critical water and riparian resources and would advance the City's compliance with regional, state and federal regulations (Clean Water Act and Endangered Species Act).

    Limiting conflicting uses outside water bodies and adjacent land would result in most development needing to avoid, minimize, or mitigate for adverse impacts on the resources. This approach would help reduce impacts of development on critical ecosystem services that contribute to public health and safety (e.g., air quality, water quality). Unavoidable impacts would be mitigated on and off site. Some anticipated development might be able to skip avoiding and minimizing impacts, but could still be required to mitigate for adverse impacts to the resources. Avoiding, minimizing and mitigating for impacts would add to the cost of development.

    Limiting conflicting uses could allow the City to require buffers between industrial and residential land uses. This approach would also help preserve the educational, historic and cultural values associated with natural resources.

2. Allow conflicting uses within areas of low ranking natural resources.

   Low ranking resources within the study area include the Terminal 6 sea wall and developed floodplain. Allowing conflicting uses in these areas provides opportunities for industrial redevelopment and the associated social benefits (e.g., jobs). The impacts to the natural resources are negligible.

5.g.7.2 Environmental Recommendation within the Open Space Zone (OS)

1. Strictly limit conflicting uses within ranking natural resource area.

   Strictly limiting uses in open space zones would prevent impacts from low to moderate intensity land uses (e.g., golf courses, ball fields) on ranked natural resources, allow for passive recreation (e.g. trails, viewing areas), preserve opportunities for natural resource enhancement, and advance the City's compliance with regional, state and federal regulations (Clean Water Act, Endangered Species Act). Development would be required to mitigate for unavoidable impacts on natural resources.

Table 26: Summary of Environmental Recommendations

Feature	Allow	Limit	Strictly Limit	Prohibit
Columbia River and land below OHW			IH, OS	
Oregon Slough and land below OHW			IH, OS	
Wetlands and land within 50 ft			IH, OS	
WHI – other high and medium ranked resources east of BPA power line corridor		IH	OS	
WHI – other high and medium ranked resources west of BPA power line corridor*			OS	
Mainland – other high and medium ranked resources		IH		
Low ranked resources***	IH			

**there is no IH west of BPA power line corridor on WHI*
***there is no OS within the study area on the mainland*
****there are no low ranked resources within the OS zone*

5.h. Energy Analysis

This section of the ESEE analysis outlines the energy consequences of allowing, limiting or prohibiting conflicting uses. The analysis addresses the following topics: transportation, infrastructure and property improvements, and on-site energy consumption, including heating, cooling, and lighting. The discussion will address both energy consumption and associated carbon footprint. A general discussion of these topics is provided below.

5.h.1. Industrial Uses

5.h.1.1. Transportation

Mode split

Energy expenditures for industry-related transportation relate primarily to travel distances from origin to destination and the mode of transportation used. Existing air, road, rail and water transportation infrastructure facilities are in close proximity to existing and proposed industries and businesses in the West Hayden Island study area, which provides opportunity to optimize transportation options to manage energy consumption.

In addition, consumption of fossil fuel energy sources results in greenhouse gas emissions to the atmosphere, which contribute to climate change.

In considering the existing marine terminal facilities at Terminal 6 and potential marine terminal facilities on West Hayden Island, ocean marine and barge shipping generate less CO2 omissions per ton-mile than other modes of transport including train, truck and air cargo (Figure #). If available marine industrial land supply in Portland or Vancouver is not sufficient to meet forecasted demand, the result could be a reduction in long-term energy efficiency and increasing carbon emissions from shifting freight to less energy-efficient modes.

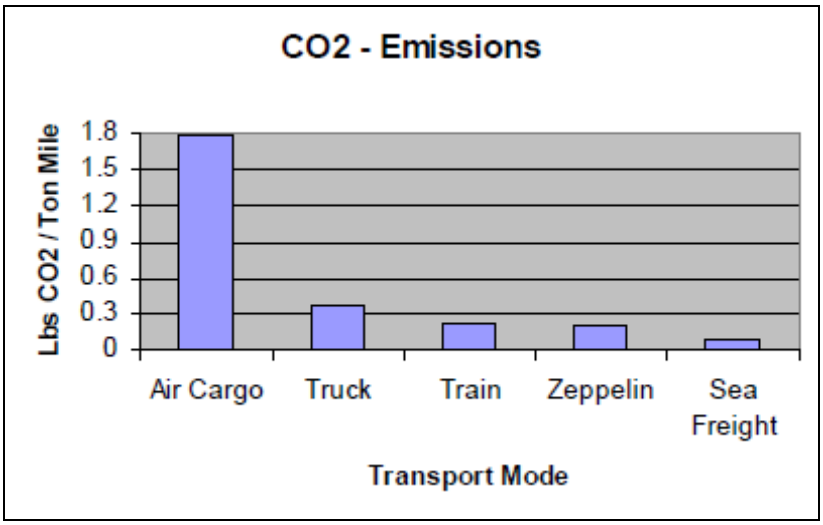


Figure 8: CO2 Emissions by Transport Mode (Flugzeuge. 1999)

It is anticipated that type of marine terminal development on West Hayden Island would ship goods via ocean-going ships. Local movement of goods to and from West Hayden Island would go by sea freight (barge) and train, which are more energy efficient than truck transport. The location of West Hayden

Island on the Columbia River shipping channel and with access to the Burlington Northern/Santa Fe and Union Pacific Railroads allows development to take advantage of these efficient modes of transportation.

From a regional standpoint, moving a greater number of goods via ship and rail can reduce the amount of fossil fuel used in transportation and reduce the per ton carbon emissions, especially since greater volumes of goods can be transported by these modes.

A number of best management practices can reduce transportation associated fuel consumption and carbon emissions. The Port of Portland is already undertaking some best management practices (e.g., air emission reduction), and is exploring others as part of a consortium of western ports. For example, the installation and use of shore power systems reduce the incidence of ship idling, which saves fuel and substantially reduces emissions. This approach is a featured element of the Port of San Diego (CA) "Green Port" strategy. The Port of San Diego also participates in a vessel speed reduction (VSR) program, which has been reported to reduce air pollutants from cruise and cargo vessels by 11-14 percent. Use of modern equipment such as automated cranes can also help increase operational and fuel efficiency.

Providing jobs close to population centers, housing opportunities, and transportation centers reduces commuter vehicle miles traveled and associated energy consumption. The existing and proposed industries and businesses in the West Hayden Island study area provide employment opportunities in close proximity to neighborhoods in Portland, OR and Vancouver, WA. The Portland metropolitan area is the largest population center along the Lower Columbia River. As such, employees within the West Hayden Island study area could live within short commute distances to work. This also provides a significant local market for certain imports such as automobiles that may be shipped to West Hayden Island. The regional availability of alternative modes of transportation, such as buses, light rail, and walking and cycling routes, can also help reduce transportation-related energy consumption. Ports can encourage the use of public transportation by providing bus and light rail transit passes for employees.

It is important to note that based on the Cargo Forecast (BST Associates, 2010), the Harbor Lands Inventory (ECONorthwest, 2010) and the Economic Opportunity Analysis (Hovee, April 2012), under the moderate and high growth scenarios for the region there is more demand for industrial land, particularly for marine terminals and rail infrastructure, then there is land supply available in the current city limits. If West Hayden Island is not developed with marine terminal facilities these facilities would have to locate elsewhere. If alternative sites were outside the Columbia River confluence area, these sites could be located further from existing infrastructure and/or large population centers. Comparatively speaking, marine terminal development on West Hayden Island would use less energy and produce less carbon emissions than development located further away from a population center and existing infrastructure.

Traffic

Transportation modeling analysis conducted by the Portland Bureau of Transportation indicates that WHI marine terminal development (assuming no WHI bridge) would account for approximately 5 percent of the total traffic volume on Hayden Island streets (City of Portland, February 27, 2012).

It is anticipated that most of additional port-related traffic would be automobiles driven by port employees rather than trucks. As described in the analysis, the makeup of the total daily traffic to and from the port would be 516 truck trips and 1,534 auto trips. This truck estimate is based on the "high impact" scenario. The current WHI concept plan of two bulk terminals and one auto facility terminal would produce about 340 daily truck trips.

Ports could help reduce traffic emissions by requiring that all trucks comply with specific air pollution standards. As part of the Columbia River Crossing project a light rail station is planned to be located on East Hayden Island. The Port could provide transit passes, van shuttles or a fleet of bikes for use to and from the station.

The EPA, through their Clean Diesel Programs, has been strengthening regulations to reduce particulate matter that has been linked to human health impacts for years. Cleaner technologies reducing diesel emissions and their impact on human health impacts have included retrofits for current truck fleets, new engines, full fleet replacement and cleaner fuels. Beginning June 1, 2006, refiners began producing ultra-low sulfur diesel fuel with sulfur levels at or below 15 parts per million (ppm) for use in heavy duty highway diesel engines.

In addition to reducing emissions from existing diesel fleets, these cleaner fuels enable the use of advanced after-treatment technologies on new engines. Technologies like particulate traps, capable of emission reductions of 90% and more, are required under new standards which began phasing in for the highway sector in 2007, and will begin taking effect in the nonroad sector in 2010.

These programs will yield enormous long-term benefits for public health and the environment. By 2030, when the engine fleet has been fully turned over, particulate matter (PM) and nitrous oxides (NOx) will be reduced by 380,000 tons/year and 7 million tons/year, respectively. This will result in annual benefits of over $290 billion, at a cost of approximately $15 billion. (EPA, Clean Diesel Home Page, 2012)

It is not anticipated that the additional port traffic would cause significant congestion or access problems for Hayden Island motorists. This is due in part to the planned improvements that will be made to the street system and the Interstate 5 access as part of the Columbia River Crossing project and future street improvements as laid out in the Hayden Island Plan. And, as noted above, WHI development will generate a relatively small amount of additional traffic and not significantly impact the future base traffic system capacity.

Other uses allowed conditionally in heavy industrial zones (e.g., commercial parking, event facility) could generate considerable additional vehicular traffic and associated fuel consumption and air emissions, though no analysis has been conducted for these potential uses. Although these uses would not involve the energy consumption associated with cargo shipping and receiving, the additional vehicular traffic could be more likely to occur during PM peak traffic periods than the traffic associated with marine terminals. This could result in more substantial localized air quality impacts. The impact could be tempered if a new light rail station is built on East Hayden Island and by providing employee incentives to encourage use of public transit, such as transit passes.

5.h.1.2. Infrastructure

Natural resources are considered part of the infrastructure of the city and are referred to as “green infrastructure”. Natural resources provide important services including flood storage, stormwater management, water quality regulation and air purification. When these functions are eliminated they must be replaced with hard infrastructure such as pipes, detention facility, treatment faculties, etc. All of West Hayden Island and portions of Terminal 6 are providing such services.

West Hayden Island is within the 100-year floodplain and therefore provides flood storage capacity. It may be unlikely that filling in portions of West Hayden Island would significantly change Columbia mainstem river elevations; it is possible that substantial fill and river bank re-configuration or hardening could create localized hydrologic impacts such as scouring, erosion and water level changes flooding affecting upstream and downstream portions of Hayden Island. This issue could be affected or exacerbated by potential impacts of climate change on ocean levels, river flows and upstream dam operation. Such changes could lead to additional hard infrastructure requirements like riprap on the river banks. In this instance, eliminating portions of the active floodplain could increase energy consumption related to producing, installing and maintaining hard infrastructure to replace the services provided by the green infrastructure.

Another example is stormwater. When development occurs, additional impervious surfaces prevent rainwater from infiltrating into the soil and being filtered before entering the receiving water body. The result is increased runoff and reduced water quality. The City of Portland requires development and redevelopment at least 500 square feet to comply with Stormwater Management Manual requirements for flow management and treatment. Energy is consumed to produce, install and maintain the stormwater facilities used to replace the services provided by natural resources.

5.h.1.3. Heating and Cooling

For many land use and development types, including some industrial development, the energy demand for heating and cooling structures can be affected by site design, building design and construction, and presence of trees, vegetation or water bodies. The orientation of buildings and vegetation to maximize solar heating in the winter and shading in the summer can reduce demand for supplemental heating and cooling. Retaining trees, vegetation and water bodies, and planting new trees and vegetation on development sites can help reduce ambient air temperature and maintain local humidity. Vegetation can also create windbreaks that slow or divert cold winter winds and reduce heat loss. Construction techniques that reduce the surface to volume ratio of a building, and the use of insulation, energy-efficient building materials, daylighting, passive ventilation, and a variety of other strategies can also help reduce building energy needs.

In the case of heavy industrial sites, specifically marine terminals such as Terminal 6 and facilities proposed in the Final Base Concept Plan for West Hayden Island, it can be challenging to retain sufficient vegetation to affect heating and cooling needs for large buildings and facilities. Although site coverage and configuration may vary (e.g., auto terminals vs. grain terminals), marine terminal sites are generally developed with extensive impervious areas for structures, indoor and outdoor storage, cargo loading and unloading, and vehicle access and maneuvering. It is possible to design some sites to maintain large areas of grassy vegetation, which would not have a large impact on building heating and cooling but could reduce the heat island affect caused by large paved surfaces.

However, there are numerous examples of marine terminals that are offsetting their energy demand through the installation of solar energy systems on rooftops. Examples include small projects like the installation of 48 solar panels on a Port of Olympia (WA) marine terminal warehouse, generating 9.36 kilowatts per year, enough power to make the building energy-neutral and to make use of harvesting incentives offered by Puget Sound Energy (citation). In contrast, New Jersey's Gloucester Marine Terminal a rooftop solar project will involve placing 27,528 individual solar photovoltaic panels that will cover 1.1 million square feet of rooftop space at the terminal. The project is estimated to cost $42 million and will generate 9MW of electricity. This is enough to cover approximately 80 percent of the Marine Terminal's energy consumption and significantly reduce the carbon emissions that would be associated with fossil fuel energy sources (citation).

Other uses allowed conditionally in heavy industrial zones (e.g., commercial parking, event facility) would generate additional heating and cooling demand, though this demand could vary significantly depending on the use and type of development. These uses would, like marine terminals, generally involve extensive areas of impervious surface (e.g., structures, paving) although it might be somewhat easier to preserve some trees and vegetated areas that could help moderate heating and cooling needs for structures. Opportunities for building design, rooftop color or green roofs, and installation of solar energy systems to help offset heating and cooling demand could be incorporated into project designs.

5.h.1.4. Lighting

The information in this section is derived primarily from the DRAFT Public Benefit/Cost Analysis produced by ECONorthwest.

Marine terminals such as Terminal 6 and a new marine terminal on West Hayden Island involve extensive lighting systems. In addition to indoor lighting needs, lighting is generally required for large expanses of work area outdoors and the possibility of loading and unloading operations continuing 24-hours a day. Worker safety regulations require a minimum amount of illumination. To reduce the energy consumption and relate costs of lighting, port operators can switch to newer technology bulbs that use energy more efficiently and install timers that turn off lights when not in use.

For other uses allowed conditionally in heavy industrial zones (e.g., commercial parking, event facility) similar measures (e.g. automated timers to turn off lights, using lower energy use bulbs) could be implemented to reduce the affects of lighting.

5.h.2. Open Space Uses

The Final Base Concept Plan for West Hayden Island proposes passive recreational uses including walking trails, a trailhead with small parking facility and potentially a non-motorized boat launch. Types of energy use would include:

- raw materials and development of the recreational facilities
- maintenance of the facilities
- potential, but minimal, lighting at the parking/trail head and/or non-motorized boat launch

These energy impacts of these types of uses would be relatively low. And similar to industrial uses, improving open space opportunities near major population centers provides opportunities for people to recreate without traveling long distances. This helps reduce vehicle miles traveled and associated fuel consumption and carbon emissions.

There would be some increase in traffic to and from the island as more people choose to spend time enjoying the open space portion of the island. However, the size of the parking lot and the types of recreational facilities would not support many users at a given time. In addition it is anticipated that many of the primary users would be residents of East Hayden Island and other nearby neighborhoods. Traffic would likely be heaviest on weekends which would not coincide with peak traffic periods so fuel use and emissions associated with idle time would be minimal. Therefore transportation related energy consumption and carbon emissions should be low.

Other uses that are allowed in the Open Space zone include dog parks, ball fields and community centers. These types of facilities would require more energy to develop, operate and maintain. For example, ball fields typically include lighting for evening games; community centers require lighting, heating and cooling. In addition, these types of uses would generate more traffic than passive recreational uses resulting in more energy consumption and carbon emissions.

5.h.3. Energy Consequences

To evaluate the potential energy consequences of different natural resource protection program options, three scenarios or policy choices are assessed: allowing, limiting and prohibiting conflicting uses that would adversely affect significant natural resources in the West Hayden Island study area. The positive and negative consequences of these program choices are evaluated from the perspectives of both the conflicting uses and the significant natural resources identified in the inventory for this site. As such, the program choices would result in different mixes of positive and negative energy consequences as indicated below.

In evaluating the consequences of *allowing* conflicting uses it is assumed that significant natural resources would be subject to development allowed by regulations that apply in the base zone. It is also assumed that mitigation for impacts on natural resources would not be required.

In evaluating the consequences of *limiting* conflicting uses it is assumed that rules would be established to limit the impacts of allowable development in areas containing significant natural resources. Areas containing significant natural resources could still be subject to development, but development restrictions would exist in addition to base zone regulations. For example, the type, location or extent of development could be restricted. Another example, development could be required to avoid adversely affecting natural resources where practicable, and to mitigate for unavoidable impacts. Another example would be to restrict the type of development allowed.

The recommendation to *limit* conflicting uses can also be implemented by relying on the City's existing environmental program which uses conservation and protection overlay zones or the recommendation could be implemented through specific code provisions in a plan district. Plan Districts are area-specific zoning codes that may include provisions related to natural resource management and development. Another tool are master plans, such as the Comprehensive Natural Resources Plans (CNRPs) and Natural Resource Management Plans (NRMPs) which can be established for sites in environmental overlay zones, provide another mechanism to coordinate development, natural resource enhancement, mitigation, recreation and other activities.

In evaluating the consequences of *prohibiting* conflicting uses it is assumed that rules would be established that preclude all allowable development in significant natural resource areas.

Tables 27 addresses the potential energy consequences associated with the three programmatic approaches. Consequences are described, and further represented by these symbols:

- (+) more substantial positive than negative consequences
- (-) more substantial negative than positive consequences
- (+/-)positive and negative consequences of development are generally balanced
- (o) consequences would be neutral or negligible

Table 27.a outlines the energy consequences of allowing, limiting or prohibiting identified conflicting uses from the perspective of the conflicting uses. Table 27.b provides an explanation of the natural resource consequences by of these program choices by conflicting use.

Table 27.a: Energy Consequences for Conflicting Uses

	Allow		Limit		Prohibit	
Industrial	A. Final Base Concept Plan 1. Would increase energy consumption associated with additional shipping of goods but shipping by water or train would require less energy and have a smaller carbon footprint than shipping by truck and/or air. 2. Would require energy to construct marine terminal and infrastructure facilities, including infrastructure to address the loss of natural resource functions such as stormwater management and flood storage. 3. Could increase energy use and carbon footprint associated with traffic congestion in and near the study area. 4. Would reduce potential future regional transportation infrastructure needs by consolidating development near existing water, rail, and road infrastructure. 5. Would reduce potential future transportation energy demand by maintaining employment opportunities in close proximity to existing population centers. 6. Would require energy for lighting and building operations. B. Full Suite of Uses Allowed in Heavy Industrial Zones 1. The consequences could vary considerably depending on the use(s). Other uses allowed in industrial zones (e.g. commercial parking, event facility) could increase energy use and carbon footprint associated with traffic congestion.	+/- +/-	The types of consequences of a limit decision would be similar to the consequences of an allow decision, except that a limit decision: 1. Would provide the opportunity to require best management practices to reduce energy consumption and carbon footprint related to shipping (e.g. emission reduction) and on-site facilities and operations(e.g. alternative energy sources, energy efficient light bulbs, waste minimization and recycling of construction materials, traffic management measures). *(Note – Both the Final Base Concept Plan and the full suite of industrial uses would have similar consequence under a limit decision.)*	+/-	1. Would reduce local transportation energy demand associated with trips generated in the study area. However, could increase energy consumption and carbon footprint if more goods are shipped by truck and/or air, rather than by water and train. 2. Would maintain benefits provided by existing natural resources (e.g. stormwater management, flood storage), preventing the need for energy to construct required infrastructure (e.g. stormwater management facilities, fill). 3. Could increase future regional transportation infrastructure needs if future development is located further from existing rail, and road infrastructure. 4. Could increase transportation energy demand by moving employment opportunities further away from the population. 5. Would not require additional energy demands related to on-site heating, cooling, lighting, and other operational needs. *(Note – Both the Final Base Concept Plan and the full suite of industrial uses would have similar consequence under a prohibit decision.)*	+/- +/-
Open Space	A. Final Base Concept Plan 1. Would maintain most functions provided by existing natural resources (e.g., stormwater management, flood storage). 2. Could avoid future increases in transportation energy demand by enhancing recreational opportunities near population centers and existing transportation infrastructure. 3. By providing only passive recreational facilities, would have negligible impact on energy needs associated with lighting and infrastructure (e.g. stormwater, flood management). 4. Could reduce infrastructure requirements for adjacent land uses by retaining on-site services provided by natural resources. B. Full Suite of Uses Allowed in Open Space Zones 1. Could help avoid future increases in transportation energy demand by enhancing recreational opportunities in close	+	A. Final Base Concept Plan The consequences of a limit decision are similar to the consequences of an allow decision, except that a limit decision would provide the opportunity to require best management practices that could reduce impacts on natural resource functions and on-site energy consumption (e.g. pervious parking or trail surfaces). B. Full Suite of Uses Allowed in Open Space Zones 1. Could help avoid future increases in transportation energy demand by enhancing recreational opportunities in close proximity to population centers and existing transportation infrastructure. 2. Would increase energy needs associated with buildings (e.g. heating and cooling), lighting, landscape irrigation, and infrastructure (e.g. stormwater, flood management), however a limit decision retains the opportunity to require energy efficient technologies and best management practices to reduce energy	+ +/-	A. Final Base Concept Plan 1. Would maintain functions provided by existing natural resources. 2. Would forego opportunity to enhance recreational opportunities in close proximity to population centers and existing transportation infrastructure. B. Full Suite of Uses Allowed in Open Space Zones The consequences are similar to those under the Final Base Concept Plan. Prohibiting the full range of active open spaces uses would also prevent additional increases energy consumption and carbon footprint associated lighting, heating, cooling, infrastructure and traffic congestion.	+/- +/-

Table 27.a: Energy Consequences for Conflicting Uses

	Allow		Limit		Prohibit	
	proximity to population centers and existing transportation infrastructure. 2. Would increase energy needs associated with buildings (e.g. heating and cooling), lighting and infrastructure (e.g. stormwater, flood management).	+/-	consumption.			

Table 27.b: Energy Consequences for Natural Resources

Base Zone	Resource Ranks	Allow		Limit		Prohibit	
Industrial	**High, Medium & SHA**	1. Would reduce the energy benefits derived from natural resources; some of those services (e.g. stormwater management) would be replaced with infrastructure. 2. Additional carbon emissions would contribute to climate change, which could affect the future flood regime of the Columbia River and the impacts of flooding within the study area.	-	1. Could, by requiring mitigation, maintain some of the energy benefits derived from natural resources; some of those benefits would be shifted elsewhere through off-site mitigation. 2. Additional carbon emissions would contribute to climate change, which could affect the future flood regime of the Columbia River and the impacts of flooding within the study area. Requiring best management practices could reduce additional carbon emissions associated with energy consumption.	+/-	1. Would maintain benefits and functions provided by existing natural resources, prevent energy demand associated with replacing those functions. 2. Would prevent additional carbon emissions in the study area, but could result in a net increase in carbon emissions if port facilities are sited further from major population centers.	+
	Low	Low ranked resources in the study area is the developed floodplain at T6, which provides flood storage and is subject to balanced cut and fill requirements. The energy consequences allowing additional industrial use in the developed floodplain should be negligible.	**0**	Low ranked resources in the study area is the developed floodplain at T6, which provides flood storage and is subject to balanced cut and fill requirements. The energy consequences of limiting additional industrial use in the developed floodplain should be negligible.	**0**	Low ranked resources in the study area is the developed floodplain at T6, which provides flood storage and is subject to balanced cut and fill requirements. The energy consequences of effect prohibiting additional industrial use in the developed floodplain should be negligible.	**0**
Open Space	**High, Medium & SHA**	<u>A. Final Base Concept Plan</u> 1. Would maintain most of the benefits and functions (e.g., energy and nutrient cycling, stormwater management, flood storage) derived from natural resources. <u>B. Full Suite of Uses Allowed in Open Space Zones</u> 1. More intensive recreational development (e.g. ball fields, community center) would reduce the benefits derived from natural resources; energy would be required to construct infrastructure to replace some of those benefits (e.g. stormwater management).	+ -	<u>A. Final Base Concept Plan</u> 2. Would maintain most of the benefits and functions (e.g., energy and nutrient cycling, stormwater management, flood storage) derived from natural resources. <u>B. Full Suite of Uses Allowed in Open Space Zones</u> 1. Could, by requiring low impact development and mitigation, maintain the some benefits derived from existing natural resources; reducing the need for energy to apply fill or replace the functions with infrastructure. Some of those benefits could be shifted elsewhere through off-site mitigation	+ +	1. Would maintain most of the benefits and functions (e.g., energy and nutrient cycling, stormwater management, flood storage) derived from natural resources. 2. Would maintain benefits and functions provided by existing natural resources, prevent energy demand associated with replacing those functions. *(Note – Both the Final Base Concept Plan and the full suite of industrial uses would have similar consequence under a prohibit decision.)*	+
	Low	N/A - Open space uses are not anticipated in low ranked resource areas.	**o**	N/A	**0**	N/A	**0**

5.h.4. Energy Consequences of Alternate Limit Scenarios

In addition to evaluating the primary use scenario for WHI based on the City Council resolution, there are other plausible scenarios that would provide for a mix of marine terminal development and open space uses on WHI and generally fit within the regional limit decision under Title 13:

1. Annexation of West Hayden Island with a use mix of 420 acre Marine Terminal/380 acres Open Space: This split reflects a use scenario presented the Urban Growth Report (Metro, 2010).
2. Annexation of West Hayden Island with a use mix of 100 acres Marine Terminal/700 acres Open Space: This split comes reflects information in the Urban Growth Report (Metro, 2010) and the Harbor Land Inventory (ECONorthwest, 2012)

Most of the research summarized in this ESEE Analysis was developed specifically for the primary use scenario. However, some of the energy consequences of allowing, limiting or prohibiting the primary use scenario can be extrapolated to these two scenarios. The general energy consequences are described below:

<u>420 acre Marine Terminal/380 acres Open Space</u>
A larger marine terminal footprint would generally result in greater operational and economic efficiencies because the turn radii could be less tight and the gradient less steep. This would allow trains to access and egress from the main rail line more quickly. The larger footprint would provide land for larger terminals and more cargo handling space. It could be extrapolated that greater efficiencies and larger terminals would result in additional movement of cargo.

The additional operational and economic efficiencies could increase total energy consumption associated with additional shipping of goods, while potentially decreasing consumption per unit of production. However, shipping by water or train would require less energy and have a smaller carbon footprint than shipping by truck and/or air.

The additional employees or shifts, and cargo associated with larger terminal facility could increase energy use and carbon footprint associated with traffic congestion in and near the study area.

By consolidating development near existing water, rail and road infrastructure, providing more space for development could reduce future regional transportation infrastructure needs and associated energy consumption.

This scenario could increase energy consumption associated with constructing marine terminals and infrastructure facilities, including infrastructure to address the loss of natural resource functions such as stormwater management and flood storage.

<u>100 acres Marine Terminal/700 acres Open Space</u>
One of the primary purposes of the City Council resolution was to accommodate a 10,000 unit train on the site to take advantage of shipping goods by ship and rail. A 100-acre site could not fit that size of a train. Therefore the types of cargo moved through a smaller facility could be restricted and there could be a shift to ship/truck which use more energy and produce more carbon emissions than ship/rail.

Also, depending on the mode of transportation to move the cargo, there could be impacts on traffic. Moving goods by ship and truck could increase congestion at the Interstate 5 interchange on WHI.

5.h.5. Energy Consequences of Not Annexing WHI

If the City decided to not annex WHI, then it would remain within Multnomah County and retain current zoning as Multiple Use Forest (MUF) and Special Environmental Concern (SEC). The types of uses allowed in the MUF zones are:

A. Forest practices and wood processing operations, sales of forest products and farm uses;
B. Residential use consisting of a single-family dwelling including a mobile or modular home, on a lot of 38 acres or more and floating homes;
C. Mining and processing of subsurface resources; and
D. Conservation areas for the protection of water, soil, open space, forest and wildlife resources.

These uses would reduce functions provided by existing natural resources (e.g., stormwater and flood management), requiring energy to address these issues. These uses would could also require energy for buildings, lighting and infrastructure. Depending on the use, this option could increase traffic and congestion and associated energy consumption. The exact magnitude of these consequences has not been studied.

5.h.6 Recommendations Based on Energy Analysis

Based solely on the energy consequences analysis of allowing, limiting or prohibiting development in significant natural resource areas, the following general recommendations are intended to optimize the energy values described in the narrative and tables above. The economic, social, environmental and energy recommendations are optimized in combination in *Chapter 6: Recommendations* to produce an overall general recommendation for the WHI and Oregon Slough study area.

Limit marine terminal development to 300 acres and open space uses to 500 acres. This land split would still allow a marine terminal to take advantage of the rail access and moving goods by ship and rail, lessening impacts associated with traffic and energy consumption. There would be negative energy impacts related to the natural resources, some of which could be minimized and/or mitigated by additional limitations as described below.

5.h.6.1 Energy Recommendation within the Heavy Industrial Zone (IH)

Note – While this ESEE analysis is being performed for the entire inventory site, only the portions of this ESEE that apply within the area to be annexed into the City of Portland are being forward to City Council for adoption. Terminal 6 and other industrial land south of the Oregon Slough are currently located with the City of Portland and ESEE recommendations that would apply within the current city limits will not be carried forward at this time to City Council for adoption.

There is a wide range of positive and negative energy consequences associated with allowing, limiting or prohibiting industrial development within areas of significant natural resources. The primary factors to consider are energy consumption and carbon footprint, infrastructure, and traffic congestion. The following recommendation optimizes energy values within the IH base zones.

1. Allow conflicting uses within ranking natural resource areas

   Allowing conflicting uses within areas of ranking natural resources would take advantage of the existing deep-water navigation channel and existing infrastructure of Interstate 5 and two main line rail roads. It would reduce the need for additional regional transportation infrastructure and would support moving cargo via ship and rail, which uses less energy than transport by truck.

   It also takes advantage of the location of WHI in the middle of two dense population centers, which would reduce the energy consumption related to employee travel.

5.h.6.2 Energy Recommendation within the Open Space Zone (OS)

1. Limit conflicting uses within area of ranking natural resources.

   Limiting conflicting uses allowed in open space zones will preserve most energy benefits provided by natural resources while preventing increased transportation energy demand by limiting the types of recreation to those that have negligible traffic impacts. Passive recreation, as opposed to more intense recreation like ball fields, requires less infrastructure, lighting or maintenance and associated energy consumption.

Table 28: Summary of Energy Recommendations				
Feature	**Allow**	**Limit**	**Strictly Limit**	**Prohibit**
High Ranked Resources	IH	OS		
Medium Ranked Resources	IH	OS		
Low ranked Resources*	IH			

**there is no OS within the study area on the mainland*

Chapter 6: West Hayden Island ESEE Results

6.a. Summary of ESEE Recommendations

Chapter 5 describes the economic, social, environmental and energy consequences of different levels of natural resources protection and provides a recommendation for each of these factors. The recommendations are summarized below. In this chapter each of the recommendations is brought together into one recommendation that seeks to optimize across topics and issues.

Note – While this ESEE analysis is being performed for the entire inventory site, only the portions of this ESEE that apply within the area to be annexed into the City of Portland are being forwarded to Portland City Council for adoption. Terminal 6 and other industrial properties within the inventory site that is south of the Oregon Slough are currently located with the City of Portland and ESEE recommendations that would apply within the current city limits will not be carried forward at this time to City Council for adoption. Recommendations that apply to those areas are not summarized below.

6.a.1 Economic Recommendation

One of the economic recommendations is to limit marine terminal development to 420 acres and open space uses to 380 acres. This land split would take advantage of the operational and economic efficiencies associated with a larger development footprint for terminal use and rail. There would be economic benefits associated with cargo throughput and associated jobs and business and tax revenue. There would be negative impacts to ecosystem services, some of which could be minimized and/or mitigated.

In addition to the land split recommendation there are recommendations for specific resource features within the Heavy Industrial (IH) and Open Space (OS) base zone.

6.a.1.1 Economic Recommendation within the IH base zone

West Hayden Island, Columbia River and Oregon Slough:

1. Limit the conflicting uses normally allowed within the IH base zone to only those uses associated with the Final Base Concept Plan; deep-water marine terminal development and associated infrastructure.

   Limiting the uses to only deep-water marine terminals takes advantage of the economic factors associated with the site – it is located on the Columbia River shipping channel, near the rail line and near Interstate-5. The site is the only site in the Portland UGB that is large enough for a modern rail loop, which is an important aspect of an economically viable terminal.

2. Limit conflicting uses associated with the Final Base Concept Plan:
   a. within wetlands,
   b. on land 50 feet of wetlands,
   c. on land within 100 ft of ordinary high water,
   d. below ordinary high water of the river, and
   e. within the river.

   Limiting conflicting uses within the water bodies, wetlands and rivers, is recommended to reduce costs to replace critical hydrologic and water quality related ecosystem services, and to advance the City's compliance with regional, state and federal regulations which may reduce the long-term costs associated with compliance (Titles 3 and 13, Clean Water Act and Endangered Species Act) Limiting conflicting uses in these areas would require most development to avoid, minimize, or mitigate for

adverse impacts on the resources. Some anticipated development could skip avoiding and minimizing impacts, but would still be required to mitigate for adverse impacts to the resources. Avoiding, minimizing and mitigating for impacts would add to the cost of development.

3. Allow the uses associated with the Final Base Concept Plan on land more than 100 ft above ordinary high water of the river, except as stated in recommendation 2.

   Allowing marine terminal development, except as in recommendation 2, will provide the economic benefits of jobs, taxes and revenue. Development would not be required to mitigate for impacts on the natural resources in these areas and the ecosystem services provided by these resources would be lost. These resources include bottomland hardwood forests located in the floodplain and grasslands; both of which are important for at risk wildlife species. However, based solely on economic factors, the economic benefits of marine terminal development outweigh the ecosystems costs.

South Bank of Oregon Slough: *(Note – While this ESEE analysis is being performed for the entire inventory site, only the portions of this ESEE that apply within the area to be annexed into the City of Portland are being forward to City Council for adoption. Terminal 6 and other industrial land south of the Oregon Slough are currently located with the City of Portland and ESEE recommendations that would apply within the current city limits will not be carried forward at this time to City Council for adoption.)*

1. Strictly limit conflicting uses:
   a. on land within 100 ft of ordinary high water,
   b. below ordinary high water of the river,
   c. within the river,
   d. within wetlands,
   e. and on land within 50ft of wetlands.

   Strictly limiting conflicting uses within the river and wetlands is recommended to reduce costs to replace critical hydrologic and water quality related ecosystem services, and to advance the City's compliance with regional, state and federal regulations (Titles 3 and 13, Clean Water Act and Endangered Species Act). Limiting conflicting uses in these areas would require most development to avoid, minimize, or mitigate for adverse impacts on the resources. Avoiding, minimizing and mitigating for impacts would add to the cost of development.

2. Limit conflicting uses within high and medium ranked resources located more than 100 ft above ordinary high water of the river and more than 50 feet from a wetlands.

   Limiting additional industrial development, except as in recommendation 2, will provide the economic benefits of jobs, taxes and revenue. Development would be required to mitigate for impacts to the natural resources and the ecosystem services provided by the resources. These resources include bottomland hardwood forests, grasslands and floodplain, which are important for at risk wildlife species. Because most of this area is already developed and does not contain significant natural resources, limiting development is not expected to have a big economic impact on conflicting uses.

3. Allow conflicting uses within low ranked natural resources

   Low ranking resources within the study area include the Terminal 6 sea wall and developed floodplain. Allowing conflicting uses in these areas provides opportunities for industrial redevelopment and the associated social benefits (e.g., jobs). The impacts to the ecosystem services are negligible.

6.a.1.2 Economic Recommendation within the OS base zone

1. Limit in areas of significant natural resources, except strictly limit conflicting uses:
    a. Oregon Slough:
        i. on land within 100 ft of ordinary high water,
        ii. below ordinary high water of Oregon Slough,
        iii. within the Oregon Slough;
    b. within wetlands and land within 50ft of wetlands; and
    c. within high or medium ranked resources west of the BPA power line corridors.

The goods and services provided by open space uses and significant natural resources can be optimized by limiting open space uses in high and medium ranked resource areas.

Limiting conflicting uses in these areas would require development to avoid or minimize adverse impacts on the resources. This could add to the cost of development; however, open space development generally can be designed to minimize impacts on natural resources. Public trails could be allowed if designed to reduce adverse impacts on natural resource values and functions. Mitigation would be required.

Strictly limiting conflicting uses below ordinary high water in the Oregon Slough, and within wetlands and high and medium ranked resources located west of the BPA power line corridors is recommended to reduce costs to replace critical hydrologic and water quality related ecosystem services, and to advance the City's compliance with regional, state and federal regulations (Titles 3 and 13, Clean Water Act and Endangered Species Act). Note that there are no low land resources on WHI west of the BPA power line corridor.

Table 29: Summary of Economic Recommendations

Feature	Allow	Limit	Strictly Limit	Prohibit
Columbia River and land below OHW		IH, OS		
Oregon Slough and land below OHW			IH, OS	
Wetlands and land within 50 ft		IH	OS	
WHI – other high and medium ranked resources east of BPA power line corridor	IH	OS		
WHI – other high and medium ranked resources west of BPA power line corridor*			OS	
Land more than 100 ft above ordinary high water (except wetlands)	IH	OS	OS	

**there is no IH west of BPA power line corridor on WHI*

6.a.2 Social Recommendation

One of the social recommendations is to limit marine terminal development to 300 acres and open space uses to 500 acres. This land split would still allow a marine terminal to take advantage of the rail access and moving goods by ship and rail, which would lessen impacts associated with traffic and air quality. It would also retain most of the screening and buffering and recreational benefits associated with natural resources. There would be negative social impacts, some of which could be minimized and/or mitigated by additional limitations as described below.

In addition to the land split recommendation there are recommendations for specific resource features within the Heavy Industrial (IH) and Open Space (OS) base zone.

6.a.2.1 Social Recommendation within the IH base zone

1. Limit conflicting uses within areas of high and medium ranked natural resources

   Limiting conflicting uses within high and medium ranked natural resources would provide opportunities for industrial development and the associated social benefits (e.g. jobs, health insurance) while also providing an opportunity to require setbacks and vegetated buffers between industrial development and other uses such as open space. This could reduce impacts from noise, light and vibration on nearby residential development. A limit decision would also allow the City to require mitigation for adverse impacts on natural resources. Limiting conflicting uses in these areas would require most development to avoid, minimize, or mitigate for adverse impacts on the resources. Under an allow decision some the impacts on natural resource features and functions would be mitigated through state and federal permits. However, a limit decisions would allow the City to address a broader range of natural resource features and functions. This approach would advance the City's compliance with regional, state and federal regulations (Titles 13, Clean Water Act, Endangered Species Act) and reduce the risk of additional Endangered Species Act species listings.

2. Allow conflicting uses within areas of low ranking natural resources

   Low ranking resources within the study area include the Terminal 6 sea wall and developed floodplain. Allowing conflicting uses in these areas provides opportunities for industrial redevelopment and the associated social benefits (e.g., jobs). The impacts to the natural resources are negligible.

6.a.2.2 Social Recommendation within the OS base zone

1. Limit conflicting uses in areas of significant natural resources, except strictly limit conflicting uses:
   a. Oregon Slough:
      i. on land within 100 ft of ordinary high water (OHW),
      ii. below OHW of Oregon Slough,
      iii. within the Oregon Slough;
   b. within wetlands and land within 50ft of wetlands; and
   c. within high and medium ranked resources west of the BPA power line corridors.

   Limiting conflicting uses would maintain most of the social benefits associated with the natural resources: air quality, water quality, education, and cultural resources. The limit recommendation could also allow some nature-based public recreation.

   Strictly limiting conflicting uses below the ordinary high water in the Oregon Slough, wetlands and high and medium ranked resources located west of the BPA power line corridors is recommended to reduce impacts on existing natural resources, concentrate nature-based public recreation to the east, and to advance the City's compliance with regional, state and federal regulations (Titles 3 and 13, Clean Water Act and Endangered Species Act). Note that there are no low ranked resources on WHI west of the BPA power line corridor.

   Both limiting and strictly limiting conflicting uses can help preserve cultural and heritage values associated with WHI.

Table 30: Summary of Social Recommendations				
Feature	**Allow**	**Limit**	**Strictly Limit**	**Prohibit**
Columbia River and land below OHW		IH, OS		
Oregon Slough and land below OHW			IH, OS	
Wetlands and land within 50 ft		IH	OS	
WHI – other high and medium ranked resources east of BPA power line corridor		IH, OS		
WHI – other high and medium ranked resources west of BPA power line corridor*			OS	
Mainland – other high and medium ranked resources		IH		
Low ranked resources***	IH			

**there is no IH west of BPA power line corridor on WHI*
***there is no OS within the study area on the mainland*
****there are no low ranked resources within the OS zone*

6.a.3 Environmental Recommendation

One of the environmental recommendations is to limit marine terminal development to 100 acres and open space uses to 700 acres. This land split would preserve most of the existing natural resources and associated functions and could maintain the existing bottomland hardwood forest interior area. There would be negative impacts to natural resources, some of which could be minimized and/or mitigated by additional limitations as described below.

In addition to the land split recommendation there are recommendations for specific resource features within the Heavy Industrial (IH) and Open Space (OS) base zone.

6.a.3.1 Environmental Recommendation within the IH base zone

1. Limit conflicting uses within areas of high and medium ranking natural resources, except strictly limit conflicting uses:
    a. Columbia River:
        i. on land within 100 ft of ordinary high water (OHW),
        ii. below OHW, and
        iii. within the Columbia River; and
    b. within wetlands and land within 50ft of wetlands.

    Strictly limiting uses within the Columbia River and wetlands and adjacent land would prevent direct impacts from these high intensity land uses on critical water and riparian resources and would advance the City's compliance with regional, state and federal regulations (Clean Water Act and Endangered Species Act).

    Limiting conflicting uses outside water bodies and adjacent land would result in most development needing to avoid, minimize, or mitigate for adverse impacts on the resources. This approach would help reduce impacts of development on critical ecosystem services that contribute to public health and safety (e.g., air quality, water quality). Unavoidable impacts would be mitigated on and off site. Some anticipated development might be able to skip avoiding and minimizing impacts, but could still be required to mitigate for adverse impacts to the resources. Avoiding, minimizing and mitigating for impacts would add to the cost of development.

Limiting conflicting uses could allow the City to require buffers between industrial and residential land uses. This approach would also help preserve the educational, historic and cultural values associated with natural resources.

2. Allow conflicting uses within areas of low ranking natural resources.

Low ranking resources within the study area include the Terminal 6 sea wall and developed floodplain. Allowing conflicting uses in these areas provides opportunities for industrial redevelopment and the associated social benefits (e.g., jobs). The impacts to the natural resources are negligible.

6.a.3.2 Environmental Recommendation within the OS base zone

1. Strictly limit conflicting uses within ranking natural resource area.

Strictly limiting uses in open space zones would prevent impacts from low to moderate intensity land uses (e.g., golf courses, ball fields) on ranked natural resources, allow for passive recreation (e.g. trails, viewing areas), preserve opportunities for natural resource enhancement, and advance the City's compliance with regional, state and federal regulations (Clean Water Act, Endangered Species Act). Development would be required to mitigate for unavoidable impacts on natural resources.

Table 31: Summary of Environmental Recommendations

Feature	Allow	Limit	Strictly Limit	Prohibit
Columbia River and land below OHW			IH, OS	
Oregon Slough and land below OHW			IH, OS	
Wetlands and land within 50 ft			IH, OS	
WHI – other high and medium ranked resources east of BPA power line corridor		IH	OS	
WHI – other high and medium ranked resources west of BPA power line corridor*			OS	
Mainland – other high and medium ranked resources		IH		
Low ranked resources***	IH			

**there is no IH west of BPA power line corridor on WHI*
***there is no OS within the study area on the mainland*
****there are no low ranked resources within the OS zone*

6.a.4 Energy Recommendation

One of the energy recommendations is to limit marine terminal development to 300 acres and open space uses to 500 acres. This land split would still allow a marine terminal to take advantage of the rail access and moving goods by ship and rail, lessening impacts associated with traffic and energy consumption. There would be negative energy impacts related to the natural resources, some of which could be minimized and/or mitigated by additional limitations as described below.

In addition to the land split recommendation there are recommendations for specific resource features within the Heavy Industrial (IH) and Open Space (OS) base zone.

6.a.4.1 Energy Recommendation within the IH base zone

1. Allow conflicting uses within ranking natural resource areas

   Allowing conflicting uses within areas of ranking natural resources would take advantage of the existing deep-water navigation channel and existing infrastructure of Interstate 5 and two main line rail roads. It would reduce the need for additional regional transportation infrastructure and would support moving cargo via ship and rail, which uses less energy than transport by truck.

   It also takes advantage of the location of WHI in the middle of two dense population centers, which would reduce the energy consumption related to employee travel.

6.a.4.2 Energy Recommendation within the OS base zone

1. Limit conflicting uses within area of ranking natural resources.

   Limiting conflicting uses allowed in open space zones will preserve most energy benefits provided by natural resources while preventing increased transportation energy demand by limiting the types of recreation to those that have negligible traffic impacts. Passive recreation, as opposed to more intense recreation like ball fields, requires less infrastructure, lighting or maintenance and associated energy consumption.

Table 32: Summary of Energy Recommendations

Feature	Allow	Limit	Strictly Limit	Prohibit
High Ranked Resources	IH	OS		
Medium Ranked Resources	IH	OS		
Low ranked Resources*	IH			

**there is no OS within the study area on the mainland*

6.b. Recommended ESEE Decision

With the intent of optimizing 1) the positive, negative, neutral and negligible consequences associated with conflicting uses described in the Chapter 5, and 2) the pros and cons of the factor-specific recommendations presented above (including the different alternative scenarios for splitting land between heavy industrial and open space uses), the recommended ESEE decision:

Within the Proposed WHI Plan District

- Limit industrial development to 300 acres;
- Limit primary industrial uses to those that require access to the deep-water shipping channel
- Limit industrial uses below ordinary high water and within the Columbia River;
- Limit industrial uses within wetlands and on land within 50 feet of wetlands;
- Allow industrial uses on land;
- Strictly limit open space uses within wetland and on land within 50 feet of wetlands;
- Strictly limit open space uses on land west of the BPA power line corridor; and
- Limit open space uses on land east of the BPA power line corridor.

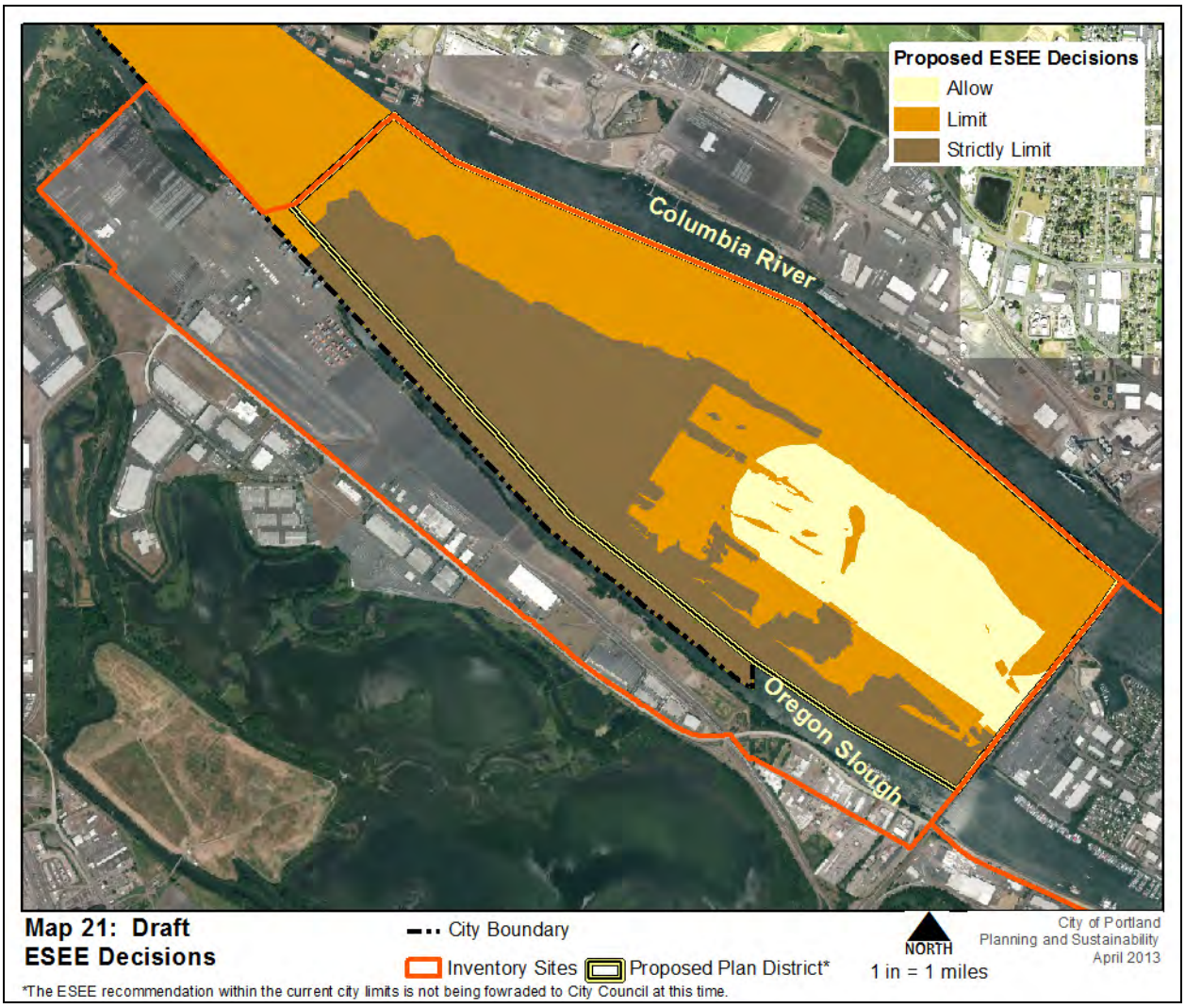
Note: The following recommendations are not being forward to the public hearing process at this time.
On the mainland and portions of the Oregon Slough outside of the proposed WHI Plan District is:

- Strictly limit industrial uses below ordinary high water and within the Oregon Slough;
- Limit industrial uses within high and medium ranked resources located above the ordinary high water mark of the Oregon Slough; and
- Allow industrial uses within low ranked resources.

Table 33: Recommended ESEE Decision for the West Hayden Island Study Area

Base Zone	Significant Natural Resources			
	Columbia River and Land Below Ordinary High Water	**Oregon Slough and Land Below Ordinary High Water**	**Wetlands and Land Within 50 Feet**	**Significant Resources on Land***
Industrial (IH)	**Limit industrial development to 300 acres and limit primary industrial uses to those requiring access to the deep-water shipping channel**			
	Limit	**Strictly Limit**	**Limit**	**Allow**, except **limit** within high and medium ranking resources on the mainland**
Open Space (OS)	**Strictly Limit**	**Strictly Limit**	**Strictly Limit**	**Limit**, except **strictly limit** west of the BPA Power Line Corridor

*Land includes natural resource features located above the ordinary high water of the Columbia River or Oregon Slough; or located more than 50 feet from a wetland.
** The recommendation for resources located on the mainland, which is the southern bank of the Oregon Slough, are not being forwarded to the public hearing process at this time.



6.b.1. Explanation of the Recommended ESEE Decision

WHI is uniquely situated at the confluence of the Columbia and Willamette Rivers in the middle of a metropolitan area. This location provides access to the deep water shipping channel as well as other transportation infrastructure including two rail lines, Interstate 5 and the Portland International Airport. WHI is also unique as compared to other sites in the Portland Harbor because of its size, which can accommodate a 10,000 unit train loop, and because the site is uncontaminated.

This location is also unique and significant for fish and wildlife. The Columbia River is the migration route for many fish species, including ESA-listed species, to and from the Pacific Ocean. WHI is also located along the Pacific Flyway for migrating birds and functions as an important habitat link between other regional features like Smith and Bybee Wetlands, Vancouver Lake, Shillapoo Wildlife Area, Ridgefield Wildlife Refuge to the north and south and the Columbia River Gorge, Sandy River Delta and Sauvie Island to the east and west.

As a result, WHI is unique in Portland and the region, both in terms of the economy and environment. This economic and environmental uniqueness is paramount to understanding the recommended decision. Below is a description and rationale for the recommended decision.

Columbia River and Land Below Ordinary High Water within the IH Zone
The Columbia River is the deep water navigation channel and major transportation corridor for the region. The Columbia River is maintained by dredging to a depth of 43 feet, which is three feet deeper than the Willamette River resulting in larger ocean-going vessels being able to utilize marine terminals on Lower Columbia River.

The Columbia River is also critical habitat for federally-listed fishes and a major migration corridor for hundreds of other fish and wildlife species. The shallow water located all around the island is critical habitat for fish, particularly out-migrating juvenile salmon, and waterfowl.

A limit decision provides the opportunity to continue utilizing the Columbia River channel to transport goods and services that require the deep-water access, while ensuring that negative impacts on natural resource features and functions are avoided, minimized, or mitigated.

Columbia River and Land Below Ordinary High Water within the OS Zone
As stated above the Columbia River is critical habitat for federally-listed fishes and a major migration corridor for other wildlife. Open space uses should be limited to passive recreation including viewing areas and canoeing and kayaking. A strictly limit decision would allow continued maintenance, repair and replacement of existing structures and development of new environmentally-sensitive passive recreation the OS zone below ordinary high water and within the River. A strictly limit decision ensures that negative impacts on natural resource features and functions are avoided, minimized or mitigated.

Oregon Slough and Land Below Ordinary High Water within the IH and OS Zones
The Oregon Slough also provides critical habitat for federally-listed fishes and a migration corridor for other fish and wildlife. Because the Oregon Slough is not maintained as a deep-water navigation channel, there is less impact from shipping and wider areas of shallow water habitat than on the Columbia River. There are existing industries on the banks of the Oregon Slough that are river dependant and use barges, but do not require the deep-water channel. The Oregon Slough also provides opportunity for passive recreation including canoeing and kayaking.

A strictly limit decision allows for continued industrial uses, including maintenance, repair and replacement of existing river-dependent industrial uses, while preserving the natural resources for fish, wildlife and passive recreation. A strictly limit decision would allow for new development under a very narrow set of circumstance, such as that which is necessary for access, while ensuring that negative impacts on natural resource features and function are avoided, minimized, or mitigated.

Wetlands and Land within 50 Feet of Wetlands within the IH and OS Zones
Significant wetlands also exist on land, above and below ordinary high water, proposed for open space OS and IH zoning. Wetlands are important natural resource features that provide hydrologic, water quality and wildlife functions. A combination of limit and strictly limit decisions for wetlands and land within 50 feet will contribute towards compliance with federal and state regulations like ESA and CWA.

IH - WHI area is the only location in Portland for a combined deep-water marine terminal and modern 10,000 unit train loop. There are associated benefits of this type of facility including family-wage employment, income, tax revenue and investing in existing infrastructure. There are no other sites in the Portland Urban Growth Boundary that are large enough to accommodate a modern rail loop. Development on this land would contribute to the industrial land supply which is needed help meet forecasted demand for marine terminals and to comply with State Land Use Goal 9.

A limit decision for wetlands and land within 50 feet of wetlands reflects the relative, economic and social value of proceeding with deep-water marine terminal in combination with a modern rail loop. A limit decision also recognizes the important hydrologic, water quality and wildlife habitat functions provided by these wetlands and would allow the City to require mitigation for unavoidable impacts.

OS - The wetlands in the OS are associated with forests and shallow water habitats, some of which are seasonally inundated from the Columbia River and important for at-risk and federally-listed fish and wildlife species. The use scenario for the open space area consists of natural resource protection and passive recreation. The strictly limit decision would allow for passive recreation provided it avoids the wetlands. A strictly limit decision would allow for new development under a very narrow set of circumstance, such as that which is necessary for access, while ensuring that negative impacts on natural resource features and function are avoided, minimized, or mitigated.

Significant Natural Resources on Land*

IH on WHI - On WHI, the area proposed for industrial zoning, contains significant bottomland hardwood forest used by *at-risk* wildlife species and habitat that is important to grassland-associated species. This area also provides the rare opportunity to develop a deep-water marine terminal and a modern 10,000 unit train loop, and to provide important benefits including family-wage employment, income, and tax revenue. There are no other sites within the Portland Urban Growth Boundary that are large enough to accommodate a modern rail loop. Development on this land would contribute to the industrial land supply which is needed help meet forecasted job demand and to comply with State Land Use Goal 9. An allow decision would facilitate development of this area, recognizing that more than 500 acres of natural resources is recommended to be retained on WHI.

IH on Mainland - Existing industrial land on the mainland south of the Oregon Slough is already developed as a deep-water marine terminal. The remaining natural resources are contained in a narrow band of trees and wildlife habitat corridor along the Oregon Slough, which includes habitat important to grassland-associated species.. A limit decision applied to uses within high and medium ranked natural resources would allow existing uses to continue, along with maintenance, repair or replacement of existing facilities. A limit decision would also allow the City to require that adverse impacts on high and medium ranked resource areas to be avoided, minimized or mitigated, which would help retain habitat connectivity between the mainland and portions of WHI that are proposed to be preserved in open space. *Note: This recommendation is not being forward to the public hearing process at this time.*

OS - Within the proposed open space areas on West Hayden Island, strictly limiting conflicting uses west of the Bonneville Power Administration's power line corridor would preserve the forest, woodland, and wetlands complexes. This large habitat area provides interior habitat for a diverse array of at-risk wildlife species. Strictly limiting conflicting uses within these resource areas, including the land within 50 feet of wetlands would preserve the important riparian and wildlife habitat functions provided by those resource features. Limiting conflicting in the remaining proposed open space area would provide opportunities for passive recreation and education. The mix of limiting and strictly limiting conflicting uses would also help preserve historical and cultural values, and maintain the aesthetic, screening and buffering values associated with the natural resources.

*Land includes natural resource features located above the ordinary high water of the Columbia River or Oregon Slough; or located more than 50 feet from a wetland.

6.c. Implementation Tools

The ESEE decision is proposed to be implemented through the application of IH base zoning to 315 acres and OS base zoning to 497 acres of WHI on land; additional IH and OS base zoning would be applied to the Columbia River and Oregon Slough. It is also recommended that the decision be implemented through the development of zoning regulations and maps applied to a new WHI Plan District. Within the plan district:

1. Where there is a *strictly limit* decision, it is recommended that conflicting uses be restricted to a narrow set of environmentally appropriate uses such as natural resource enhancement, hiking trails, a boat launch without a dock structure and driveways to access and maintain recreation infrastructure and enhancement sites. The code should require negative impacts to natural resource features and functions avoided and minimized and unavoidable impacts to be mitigated (see #3 below).

2. Where there is a *limit* decision, it is recommended that the zoning code require conflicting uses to avoid and minimize negative impacts on natural resource features and functions, except as follows within the IH base zone of the WHI Plan District:
    - Columbia River and land below the ordinary high water: It is recommended that a limit decision not include a requirement to avoid impacts on natural resource features and functions located below the ordinary high water mark or within the Columbia River in IH base zone. This reflects the fact that a marine terminal is river dependant and necessarily will impact the water and shallow water habitat. However, the limit decision should include analysis of measures to minimize impacts on these features and functions and actions to mitigate unavoidable impacts.
    - Wetlands and land within 50 feet: It is recommended that a limit decision not include a requirement to avoid or minimize impacts on wetlands within the IH base zone. It is anticipated under the use scenario that these wetlands will be filled in order to develop the rail loop and marine terminal facilities. However, the important functions provided by the wetlands should be maintained through mitigation.

3. Where there is either a *limit* or *strictly limit* decision, all unavoidable negative impacts to features and functions should be mitigated. Mitigation for unavoidable impacts should result in no net loss of features or functions and account for:
    - location of the mitigation site,
    - timing of the mitigation action in relation to the timing of impacts,
    - time to achieve desired future condition of the mitigation actions,
    - relationship between the mitigation site and adjacent habitats and land uses, and
    - monitoring needed to ensure the mitigation is successful.

4. The code should provide exemptions and/or a non-discretionary review track for conflicting uses with minimal and definable impacts on natural resource feature and functions; and a discretionary review track for other proposed conflicting uses. Under either review track, mitigation for unavoidable impacts to features and function should be mitigated.

Established methodologies should be used to assess impacts on wetlands and shallow water habitat and mitigation necessary to fully compensate for the impacts. However, currently there is no established methodology to assess bottomland hardwood forest impacts and mitigation. As part of the WHI Phase II project, the City of Portland Bureau of Environmental Services developed a mitigation framework for the bottomland hardwood forests on WHI (Appendix C: City of Portland WHI Forest Mitigation Framework). The *Framework* provides a methodology to arrive at appropriate mitigation ratios that fully compensate for unavoidable impacts to bottomland hardwood forest features and functions and the location, timing and desired future condition of mitigation actions. Through the WHI planning process, the *Framework* was vetted and endorsed by the WHI Advisory Committee and was generally endorsed by the Oregon Department of Fish and Wildlife as an appropriate tool to determine WHI forest impacts and compensatory mitigation actions. It is recommended that the *Framework* be considered when designing mitigation programs to implement the ESEE decision.

6.d. Impact Area Recommendations

The City is electing to rely in part on Metro's ESEE decision to *allow* conflicting uses in Impact Areas and rely on existing programs in lieu of applying additional restrictions on development. However, it is also recommended that regulations be established to create a buffer and transition area between heavy industrial uses and natural resources in the form of setbacks established in the zoning code. Specifically, within the WHI Plan the following setbacks are recommended:

- Within the IH base zone to limit the impacts of development on the natural resources to be protected.

- Within the IH base zone landward from the ordinary high water of the Columbia River to preserve existing resource features and functions, including vegetation and sandy beaches, limit development impacts to those necessary to access the deep-water shipping channel, and limit recreation to beach access and require mitigation for the impacts of recreation structures on the natural resources.

- Within the OS base zone to preserve existing tree canopy and understory vegetation that will provide a noise, light and vibration buffer between development and the natural resources to be protected.

Finally, this ESEE Analysis acknowledges, as does Metro in the Title 13 ESEE Analysis, that significant natural resources are affected cumulatively by development activities throughout the full extent of a watershed. Although it is not feasible to address entire watersheds through the Goal 5 process, the City will continue to take actions to protect and improve watershed conditions and functions in the impact area and throughout Portland's watersheds. For example all development must currently meet the City's erosion control and stormwater management requirements. Certain activities will also be subject to tree preservation and replacement requirements. In addition, the City will continue to educate land owners and encourage the use of best management practices and low impact development to reduce impacts to significant natural resources.

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Appendix A: WHI ESEE Technical Work Session Summary

West Hayden Island Economic, Social, Environmental, Energy Analysis Technical Work Session
April 24th, 2012 – 8:30 a.m. to noon, 1900 SW 4th Ave., Room 2500 B
(technical reviewer list attached)

Four main topic areas were identified at the West Hayden Island ESEE Analysis Technical Work Session on April 24th, 2012. These topic areas are:

1. Metro's Title 13 "limit" decision and the City's ability to customize a decision through a local ESEE Analysis.

2. Assumptions related to the current county zoning on West Hayden Island

3. The depth and breadth of issues covered within the ESEE narratives as compared to requirements of the Goal 5 rule and the specific recommendations of the ESEE

4. Performing a Health Impact Assessment to inform the ESEE analysis

Below is a summary of each issue, a staff response and how the ESEE analysis will be updated to address the issue.

1. Title 13 Limit Decision

Title 13, adopted by the Metro Council in September 2005, established the Nature in Neighborhoods program to protect, conserve and restore significant riparian corridors and wildlife habitat. Metro completed the necessary State Land Use Goal 5 steps to inventory existing natural resources and perform a regional ESEE Analysis.

Metro describes that a decision to limit conflicting uses:

> "strikes a balance between completely developing the Goal 5 riparian and upland wildlife resources and protecting them. This alternative provides opportunities including developing lands in ways that minimize negative environmental and economic tradeoffs; supporting the goals embodied by the 2040 Design Types and protecting the most important habitats. ...The economic tradeoffs for this alternative depend on the degree of limitation on development actions: lightly limit, moderately limit, or strictly limit.....The limit scenario will generate a more equitable distribution of positive and negative economic tradeoffs...Development interests and the resources will both experience positive and negative economic tradeoffs." *(Appendix C, Economic Report and Literature Review, Ord. No. 05-1077C, Attachment 3 to Exhibit F)*

Ultimately Metro established a limit decision for conflicting uses on WHI and designated it as a Moderate Habitat Conservation Area, acknowledging the important natural resource and economic values of WHI. The Title 13 program also directs the City of Portland to create an area-specific district plan for WHI in cooperation with the Port of Portland.

The City decided to follow the State Land Use Goal 5 steps to supplement and update Metro's natural resource inventory and ESEE analysis to inform the local decision of annexing WHI into the city and the preparation of a plan district. City staff first produced an updated natural resource inventory in

collaboration with technical experts; the Hayden Island Natural Resources Inventory – Riparian Corridors and Wildlife Habitat, 2012 (HINRI). Next, staff performed a conflicting uses analysis and described the ESEE consequences of allowing, limiting or prohibiting conflicting uses within significant natural resources areas as identified in the HINRI.

During technical review of the City's draft ESEE analysis, some reviewers asked if the City has the authority to reexamine the consequences of allowing, limiting or prohibiting conflicting uses within natural resources area on WHI because of the Metro limit decision that applies to all of WHI. Reviewers also questioned the approach to focus the ESEE on a specific scenario of uses on WHI as set forth in the City Council Resolution 36805 and in the Final Base Concept Plan.

The City's ESEE Analysis for WHI is being done under the auspices of Metro's Title 13 limit decision and designation of Moderate Habitat Conservation Area for West Hayden Island and the study area generally. The City and Metro staff believe that the City has the authority and that it is appropriate to follow State Land Use Goal 5 steps to update, supplement, and hone the Metro Title 13 natural resource inventory and ESEE decisions, and to develop a customized district plan for WHI or other parts of the City.

In carrying forth Metro's limit decision, the City is not considering as part of this ESEE completely allowing conflicting uses on the whole 800 acres nor completely prohibiting conflicting uses on the whole WHI. Staffs are focusing on a specific land split between industrial development and open space, as directed by City Council.

Next steps: The ESEE introduction will be updated to include more explanation of the relationship between Metro Title 13's limit decision and a finer grain analysis by the City. Staff will also described, generally the consequences of a different land split – more or less industrial land – relative to the primary land use scenario of 300 acres industrial land and 500 acres open space.

2. County Zoning

In 1977, Multnomah County designated WHI "Natural Resource, Multiple Use Forestry" because the need for future urban uses had not yet been identified. In 1982, the county changed the designation from "Natural Resources" to a "Significant Environmental Concern" overlay, and stated that any long term environmental and recreational losses from urban uses would be identified and addressed in the local community planning process. The adopting ordinance also stated that future use of WHI is anticipated to be marine industrial.

Also in 1982 the regional government (Metro) expanded the Urban Growth Boundary (UGB) to include WHI. In conjunction with the UGB expansion, Multnomah County re-designated West Hayden Island from "Multiple Use Forestry" to "Future Urban" use within the Multnomah County Framework Plan, but the zoning remained Multiple Use Forestry (MUF). (Note: This is similar to the City's comprehensive plan designations that indicate the future desired use while the zoning remains static.) The impetus for both regional actions was to provide a future site for waterfront industrial and marine terminal uses. In the City's ESEE Analysis Technical Draft, staff described this history of legislative decisions.

Some technical reviewers suggested that the Goal 5 rule requires the City to consider potential conflicting uses under existing zoning in the ESEE Analysis. It was suggested that uses under the current zoning and their consequences should be addressed under the "prohibit" scenario.

The City concurs that Goal 5 requires local jurisdictions to evaluate the consequences of the existing zoning, which in this case is the Multnomah County zones.

Next Steps: In addition to generally considering the consequences of a different industrial/open space land split, the ESEE will be updated to include a general evaluation of the consequences were the City to decide not to annex WHI and it remain within Multnomah County.

3. Depth and Breadth of Information and Consequences Addressed in the ESEE Analysis

The ESEE Analysis is a framework that informs land uses decisions regarding whether to allow, limit or prohibit conflicting uses in areas with significant natural resources. However, the consequences of different decisions have economic, social, environmental and energy consequences that can be localized and/or far reaching geographically and cumulatively. There are also primary, secondary and tertiary impacts. The City has taken the approach to include relevant information and consider the broad range of consequences in the analysis to inform decisions to allow, limit or prohibit conflicting uses that could negatively affect significant natural resources.

Some technical reviewers asked if the ESEE should take such an expansive approach to including issues and topics, or if a narrow approach that only deals with the consequences from the perspective of natural resources is more appropriate.

While the ESEE decisions will inform land use actions to address natural resources, the City's approach of including a thorough explanation of consequences provides the community and City decision makers a better understand the full affects of the options, recommendations, and the proposed program. The City believes this is consistent with the intent and requirements of the Goal 5 rule.

Next Step: The ESEE methodology will be updated to explain the relationship between the narratives, trade-off tables and recommendations. The report will be clear that not all of the issues addressed in the narratives and trade-off tables are expected to be directly addressed by the program recommendations of the ESEE decision and that there are other programmatic tools, such as Intergovernmental Agreements, that could address these issues.

4. Health Impact Assessment

The ESEE Analysis Technical Draft includes a description of human health and welfare as it relates conflicting uses on WHI. Information in the ESEE comes from multiple sources including the WHI Public Costs and Benefits Draft report (ECONorthwest, 2012) and Local Impacts Report (Bureau of Planning and Sustainability, 2011). The Cost/Benefit report recommends the completion of a Health Impact Assessment to information the annexation decision.

Some of the technical reviewers re-iterated the importance of doing a HIA to better understand the consequences of developing a marine terminal.

State Land Use Goal 5 requires that jurisdiction uses existing information when performing an ESEE analysis. Local jurisdictions are not required to develop new information (beyond completing a natural resources inventory). Therefore, a HIA is not a necessary step for completion of the ESEE. That being said, the community feels that a HIA is an important piece of information for the City to make a decision regarding annexation and marine terminal development.

Next Steps: While an HIA is not necessary to complete the ESEE work, the City acknowledges the importance of understanding health impacts when making the full WHI program recommendation. Therefore, staff will synthesize all the human health and welfare information currently being used to inform the ESEE Analysis and the project as a whole. The City will ask the Multnomah County Health Department to review that information and provide a letter explaining what additional information would be provided in a HIA, when in the development process a HIA can/should be completed, how long it would take to complete and how much it would cost. This information will be presented to the Planning and Sustainability Commission and the City Council during the hearings process.

WHI ESEE Technical Reviewers	
Name	**Organization/Affiliation**
Jeff Smith	ILWU
Jodi Guetzloe-Parker	Columbia Pacific Building Trades
Joe Cortwright	Impresa Consulting
Fletcher Beaudoin	PSU
Dennis Yee	Metro
Greg Theisen	Port of Portland
Jennifer Thompson	USFWS
Mike Houck	PSC / UGI
Dave Helzer	BES
Jennie Klein	LCREP - Stewardships Program Mgr
Chirs Collins	LCREP - Chief Scientist
Michael Murphy	PSU
Amanda Punton	DLCD
Michael Karnosh	Confederated Tribes of Grand Ronde
Ben Duncon	Multnomah County Health
Besty Clapp	Multnomah County Health
Dave Brook	Energy Expert

Appendix B: West Hayden Island Health Report

The report is available at www.portlandoregon.gov/bps/article/420207

Appendix C: City of Portland WHI Forest Mitigation Framework

ENVIRONMENTAL SERVICES
CITY OF PORTLAND

City of Portland
RIVERS OFFICE
Office of Healthy Working Rivers

Bureau of Planning and Sustainability
Innovation. Collaboration. Practical Solutions.

City of Portland WHI Forest Mitigation Framework

Bureau of Environmental Services and the Office of Healthy Working Rivers
Final March 22, 2012

This memorandum provides a mitigation framework for the permanent loss of floodplain forest on West Hayden Island (WHI). Some additional considerations for natural resource mitigation are included. This science-based forest mitigation approach is derived from established practices for natural resource impacts. The framework is a functional approach with the objective of "no net loss" of forest resources from development impacts. Financial costs for forest mitigation are not addressed; cost estimates can be generated based on this framework. This framework tool quantifies proposed mitigation actions on WHI and identifies the balance of remaining mitigation required to meet no net loss.

In other words, this framework and tool serve to answer the question: What mitigation is required for no net loss of floodplain forest functions from proposed WHI development?

Contents:

1. Summary of Forest & Woodland Habitat Functions from Hayden Island Natural Resources Inventory

West Hayden Island functions as one of the largest intact island habitats (830-950 acres depending on river stage) in the Lower Columbia and Willamette Rivers, third to Sauvie and Government Islands. Located on the Pacific Flyway, the island provides vital stopover and nesting habitat for birds traveling thousands of miles between North, Central, and South America. At the local scale the natural area provides a substantial north-south habitat connection between Vancouver Lake and the Smith and Bybee Wetlands Natural Area, and a habitat anchor on the Columbia River corridor. The industrial and urban landscape adjacent to the island serve to further elevate its significance within the landscape. The relatively large, unfragmented, and complex mosaic of habitats on WHI provides a range of functions and values. WHI includes emergent and herbaceous wetlands, forested wetlands, backwater channels, grasslands, interior forests, and bottomland hardwood forests and riparian habitats contiguous to beaches and shallow, open water river habitat.

WHI and the south banks of the Oregon Slough contain one of the largest remnant stands of historically abundant cottonwood-ash floodplain forests in the Lower Columbia River Basin, 548 acres in total, 480 of which is located on WHI. These riparian forests are characterized by black cottonwood, Oregon ash and Pacific willow as principal tree species. The understory is dominated by several native shrub species such as snowberry, gooseberry, dogwood and cottonwood and ash seedlings. The herbaceous layer is diverse and includes stinging nettle, sword fern, miner's lettuce, trailing blackberry, cleavers, and buttercup

(*Ranunculus spp*.) among others. Invasive plant communities are established in areas exposed to more recent, frequent or ongoing disturbance; mainly along roads, trails, utility corridors and grazed areas. However, within the island's forests, the prevalence of Armenian blackberry and other invasive plant species quickly diminishes past the edge of habitat units; there are very few invasive plant species found within the interior of the forest habitat. The forest's large size and contiguous condition provides extensive interior habitat that supports area-sensitive wildlife populations.

The island's forests provide important habitat for birds, amphibians, mammals and bats, and supply near shore aquatic communities with food and cover. Breeding and migratory bird densities in the area's riparian cottonwood forests are high. Nine at-risk* species of birds and at-risk Northern red-legged frogs use the forests on WHI. Large trees provide quality nesting habitat for birds such as bald eagles; snags and downed wood support pileated woodpeckers, white-breasted nuthatches and other wildlife. Bat surveys conducted for the *Hayden Island Natural Resources Inventory* (HINRI) revealed the presence of four at-risk bat species in the cottonwood/ash forests of WHI: California myotis, long-legged myotis, silver-haired bat and Yuma myotis.

The cottonwood/ash forest on WHI is identified as a Special Habitat Area (SHA) in the HINRI. The forest meets the following criteria: it supports myriad at-risk species, such as peregrine falcons and breeding willow flycatchers; it is a unique and rare habitat type; and it serves as a stopover and breeding ground for dozens of migratory avian species, such as Pacific-slope flycatchers, Bullock's orioles, Swainson's thrushes and yellow warblers.

Across nearly the entire forest the primary vegetation layers are present: herbaceous, shrub, sub-canopy and canopy. Standing and downed large wood provide critical structural elements for multiple plant and animal species production. A variety of wetland types are naturally integrated into the forest habitat. Land use practices that include filling the floodplain on the island have altered natural flow patterns across the landscape; however large areas of forest are still inundated several times per year. This flooding maintains key, natural habitat-forming processes within the floodplain forest of the Lower Columbia River.

The forests located along the shoreline, within, and around shoreline wetlands support 14 ESA protected populations of salmon and trout, and Pacific Eulachon, by creating and maintaining critical habitat that provides multiple functions for fish: food, rearing, resting, predator avoidance, and sediment transport/capture.

Additional functions provided by the forest on WHI: microclimate and shade, flow moderation, water storage, bank forming processes, pollution and nutrient control (carbon, nitrogen), large wood capture and recruitment to the channel, organic inputs, food web and nutrient cycling. These functions also support ESA listed fish as well as special status wildlife species.

WHI is identified as a "Conservation Opportunity Area" by the Oregon Department of Fish and Wildlife in the Oregon Conservation Strategy (OCS) due to its large size, unique position on the landscape, and multiple "strategy" (priority) habitats including riparian forests. Black Cottonwood forests like those found on WHI are specifically highlighted in the OCS due to their immense value to wildlife. The City of Portland has also identified black cottonwood floodplain forests as a Special Status Habitat.

* "at-risk" species have been identified as in decline and of conservation concern by USFWS, NOAA, ODFW, and/or the OR Biodiversity Information Center: includes threatened, endangered, candidate, concern, sensitive, imperiled, and rare species.

2. Assumptions

- Existing conditions are based on the Hayden Island Natural Resources Inventory (HINRI).
- Impacts are based on Worley Parsons Final Base Concept Plan.
- "Baseline" represents the current conditions on WHI: 480 acres of existing, mostly contiguous floodplain forest comprised primarily of ash and cottonwood within the active or historic

Columbia River floodplain. Portions of the 480 acres flood several times per year. No net loss is measured against baseline.

- WHI floodplain forest is part of a unique island habitat mosaic in the river's estuary. The forest is healthy and receives a high relative rank in the NRI.

- The island's location at the confluence of the Pacific Northwest's two largest rivers adds to the unique significance of the resource.

- The goal of this mitigation is "no net loss" of bottomland floodplain forest functions, measured against baseline conditions. The mitigation methodologies outlined below provide valid frameworks to derive a "no net loss" of functions framework for floodplain forests on WHI.

- Any off site forest mitigation location will be within the active and/or historic floodplain of the Columbia River. It will be adjacent to the river channel and to wetlands and/or contain wetlands within the existing or future forest. It will receive regular (at least annual) inundation from the river; river inundation can be across the entire site or across a portion of the site.

- Any off site forest mitigation will be on a single site, not split up among multiple smaller sites.

- Any mitigation site(s) will be protected from development in perpetuity.

- This memorandum does not address recreation impacts

3. Developing the Mitigation Framework

The City's ratio approach is based on established practices in use by other agencies regulating natural resources. The City has followed this approach because there are no established mitigation methods or standards for floodplain forest in the Pacific Northwest. The ratios from existing practices have not been transposed to generate forest ratios; rather the emphasis is on how ratios change proportionally for different mitigation activities (i.e. preservation vs. enhancement), and how ratios adjust for distance from impact site, adjacency to other habitats, the quality/rarity of the resource, chance of success, and temporal loss.

4. Mitigation Terminology

The terms used in this document are based on definitions used for wetland mitigation in Publication #06-06-011a from WA Dept of Ecology, Corps, and EPA (see Documents Referenced Section 10).

Re-establishment is a form of *restoration* where habitat is fully re-established on a site where it is absent, but formerly occurred. Re-establishment includes re-introduction of hydrologic processes and vegetation that result in highly functioning habitat. This approach results in a gain in habitat acreage and an increase in functions and key ecological process provided by the habitat.

Rehabilitation is a form of *restoration* similar to e*nhancement*, but also involves improving/restoring larger scale environmental processes like flooding. This approach is used to improve existing *degraded* habitat and reaps larger benefits than enhancement. It does not increase habitat acreage, but can significantly improve function.

Enhancement is a process to improve/enhance/heighten functions of *existing functioning habitat* through invasive plant species removal and native planting. This approach does not increase habitat acreage, but modifies condition of existing vegetation structure. It does not address environmental processes like flooding.

Preservation ("Protection/Maintenance") is removing an imminent threat or cause of decline of a forest habitat. Typically completed through acquisition of land or easements. Results in net loss of habitat

acreage, but can preserve multiple functions long term and prevent additional loss. Preservation includes stewardship commitment.

Creation ("Establishment") is the process of creating a habitat where is did not previously (historically) exist. This approach results in a gain in habitat acreage. *Note: This approach is not suitable for WHI forest mitigation because it implies the site would be outside the floodplain. The City assumes the mitigation location will be located within the floodplain; therefore it is not included as an option in this framework.*

Figure 1: The following diagram from Publication #06-06-11a compares this terminology with traditional mitigation terms.

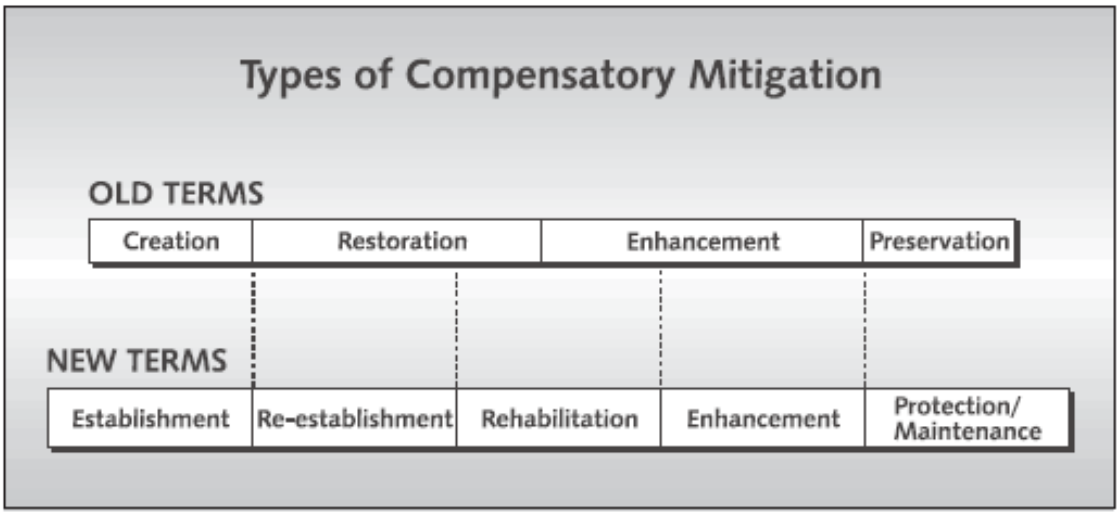


Figure 1. Old and new terms for types of compensatory mitigation.

5. Example Mitigation Programs

This section summarizes four different approaches to natural resource mitigation that are used to derive the mitigation framework.

5a. Wetland Mitigation Approach use by Washington Department of Ecology, US Army Corps of Engineers, and the US Environmental Protection Agency in Washington State

The three above agencies have adopted an approach to wetland mitigation in Washington state as detailed in Publication #06-06-011a *Wetland Mitigation in Washington State Part 1: Agency Polices and Guidance.* The various mitigation requirements (sequencing, ratios, etc.) are based on a "no net loss" of function goal. The agencies scale mitigation ratios based on type of mitigation activity, resource quality and rarity. Following the terms defined earlier, the relative ratios are summarized in this table for four mitigation methods ("Creation" is excluded because it is assumed the WHI forest mitigation site will be within the Columbia River floodplain context that currently or has historically supported this habitat type):

Table 2. Relative ratios for mitigation methods summarized from Publication #06-06-11a

lower ratios ----------→ higher ratios			
re-establishment	rehabilitation	enhancement	preservation

Example ratios from Publication #06-06-11a to show relative requirement for types of mitigation for Category II wetlands:

- Re-establishment: 3:1
- Rehabilitation 6:1
- Enhancement 12:1
- Preservation 10:1 – 20:1 (case by case)

Table 1a from Publication #06-06-011a (Appendix A) shows the framework of mitigation ratios; how these are applied varies project by project. Lower quality wetlands (Category IV, III) require lower ratios while higher quality (Category I, II) require higher ratios. Rare habitats like forested wetlands also push ratios higher (for example 6:1 to 24:1 depending on mitigation activity for forested wetlands).

The HINRI report has identified WHI floodplain forest as unique and "high" relative quality/quantity due to the river confluence location, relatively large size, contiguous interior area, and adjacency/integration of other habitats (wetlands, shallow water, grasslands, river channel) creating a diverse habitat mosaic.

5b. Wetland Mitigation Approach use by Oregon Department of State Lands

The Oregon Department of State Lands (DSL) regulates wetlands and other waters of the state. In Oregon, compensatory wetland mitigation must meet minimum replacement ratios and replace lost functions and values as determined through an approved functional assessment method. DSL's mitigation program contains several principal objectives: replacement of lost functions and values; local replacement for locally important functions and values; mitigation area should be self-sustaining with minimal long term maintenance; mitigation sites must meet suitability criteria; and projects must minimize temporal loss. The goal of DSL's principal objectives is to direct compensatory mitigation to the appropriate location and ecosystem processes that will result in successful and meaningful mitigation.

DSL requires minimum ratios for compensatory mitigation to maintain the total area of the state's resource base and to replace functions that may be size dependent. DSL uses standard mitigation terminology, including enhancement, creation, and restoration.

DSL's minimum compensatory mitigation ratio requirements for wetlands:
Restoration: 1:1
Creation: 1.5:1
Enhancement: 3:1

Although DSL guidance refers to these older terms, in practice mitigation requirements have evolved and guidance for implementing them has changed significantly. When using enhancement as a compensatory mitigation tool, the applicant must address causes of hydrologic degradation. They do not approve enhancement projects based solely on vegetation. Additionally, for enhancement projects, a "zone of influence" is identified. Enhancement credits would apply only to the areas clearly affected by a reversal of the cause of degradation.

DSL requires use of the appropriate functions and values assessment methodology for the region, hydrogeomorphic (HGM) type, and area of impact. In the Portland area, these include the HGM-based Assessment of Oregon Wetland and Riparian Sites – Willamette Valley Ecoregion - riverine impounding, slope, or flats subclasses (reference-based method) and the Oregon Rapid Wetland Assessment Protocol (ORWAP). Both of these methods are designed very specifically for wetlands and therefore of limited value in assessing the floodplain forest ecosystem, but are useful in understanding the relationship of functional assessments to the mitigation process.

The compensatory mitigation approach used by DSL employs a combination of approaches and weighting factors including ratios, function and value assessments, wetland class (in-kind requirement), site location considerations, and temporal loss.

5c. Vegetated Corridor Mitigation Requirements under Clean Water Services Environmental Review Design and Construction Standards (Chapter 3)

Clean Water Services (CWS) uses the following table to determine mitigation ratios for impacts to vegetated corridors. The ratios are for replacement (or "re-establishment", meaning a new planting where no vegetated corridor currently exists). Ratios increase with distance from impact area. Based on CWS definitions, the condition of the impact habitat on WHI is "good". The NRI has ranked the impact habitat as "high."

CWS also allows "enhancement" of existing vegetated corridors at a minimum ratio of 2:1 if all the following criteria are met: 1) proposed enhancement site is unlikely to be enhanced in the future, 2) the habitat to be enhanced is "marginal" or "degraded", and 3) the enhanced habitat is permanently protected by easement.

Table 1 – from Clean Water Services Environmental Review Design and Construction Standards

Replacement Mitigation Ratios Required for Approved Encroachments into a Vegetated Corridor

Location of Replacement Mitigation	Condition of Vegetated Corridor to be Replaced		
	Good	Marginal	Degraded
On development site:	1:1	1:1	1:1
Off-Site:			
Less than 0.25 miles from site and within same drainage basin.	1.5:1	1:1	1:1
0.25 miles or more from site and within same drainage basin.	1.75:1	1.25:1	1.25:1
Different drainage sub-basin (Drainage sub-basin must be located within the Tualatin River Basin and no further than 1 mile outside the District's Boundary).	2:1	1.5:1	1.5:1

5d. Proposed Habitat Mitigation Approaches from the WHI Mitigation and Enhancement Subcommittee

Mitigation and enhancement subcommittee member the Port of Portland has proposed a forest mitigation ratio of 1:1 with efforts focused on preservation and enhancement on-site. Metro has not proposed any specific ratios for consideration.

Portland Audubon had provided the following recommended "effective ratios" and rationale for natural resource mitigation for WHI impacts vis-à-vis the WHI Mitigation and Enhancement Subcommittee:

> "Spatial ratios and timing and time horizon would be the priority criteria. We recommend using an "effective ratio" type approach to mitigation: it essentially has multipliers both on the debit (resource impact) and the credit (resource compensation) components of the equation.
>
> Debits are weighted by the importance of the resources that will be lost (e.g., H (3:1), M (2:1), L (1:1) and the credits are weighted by the type of mitigation (e.g., restoration (1:1), creation (1.5:1) and preservation and/or enhancement (3:1). The debit side of the ratio is multiplied by the credit side of the ratio to derive a larger overall effective ratio. For example: H -Debit x Preservation Credit = 3 x 3 for an effective ratio of 9:1.
>
> Additional consideration should be given to the timing of the actions---increased credit for advance mitigation; increased mitigation for time lags. An additional package of actions should be added above and beyond these mitigation activities in order to achieve the "net increase" in ecological function. Consideration needs to be given to the fact that the function of the remaining habitat on the island will be impacted as well by the loss of complexity, loss of overall size of the natural area and disturbance factors."

The impacted forest habitat on WHI is ranked by the HINRI as "high" relative quality/quantity habitat. Re-establishment receives a higher ratio in this approach due to its increased chance of failure. Using the 3x "high" multiplier and effective ratio approach results in the following ratios:

- Rehabilitation (Restoration): 3:1
- Re-establishment (Creation): 4.5:1
- Enhancement & Preservation 9:1

6. Impacts to Floodplain Forest on WHI

Overlaying the Final Base Concept with the Hayden Island NRI results in two separate impacts to floodplain forest habitat on WHI:

1) Permanent loss of 140 acres of bottomland floodplain forest on WHI ranked as a high relative quality/quantity resource by the NRI. All of the natural resource functions provided by this 140 acres will be lost (functions were summarized earlier in Section 1).

2) Fragmentation, smaller patch size, decreased interior to edge ratio, simplification, and disturbance on the remaining 340 forest acres on WHI. This is an indirect impact of the marine industrial development, which is considered a high impact land use adjacent to a natural resource area.

    a) The existing edge of the forest stand is a "porous" edge, transitioning to the open herbaceous cover of the dredge management area, wetlands, clumps of trees and shrubs, and the beach and river channel. The new edge will be a "hard" edge with ongoing light, noise and vibration disturbance, and severely limited "porosity" for terrestrial wildlife.

    b) The resulting forest stand will be smaller with a higher ratio of edge to interior area. This will reduce interior area functions like microclimate and suitability to interior specialist wildlife species (i.e. at-risk pileated woodpeckers)

    c) The resulting stand will have reduced presence of interior wetland habitat, simplifying the forest habitat and making it unsuitable to some wildlife species like pond-breeding amphibians (i.e. at-risk northern red-legged frogs).

    d) The resulting stand will be impacted by the amount of fill required to raise the industrial development area up and out of the floodplain. This will further alter hydraulic processes on the island such as groundwater recharge, stormwater runoff, and surface water (rainfall and flood events) dispersion. Additionally, the fill footprint will further alter the flood prism in this tidal environment.

Development buffers are widely used to address adverse edge effects on sensitive habitats. A 200-foot buffer from the terminal development footprint results in an indirect impact area of 18 acres for the forest habitat. The adverse effect of the industrial land use is most severe at the initial edge and gradually decreases as the distance from development increases. As you move into the forest interior functions like microclimate emerge and edge effects like nest predation decrease. Because the edge effect is gradual across the length of the buffer, 50 percent of the acreage (nine acres) is added to the impact bringing the total forest impact to **149 acres** (see Appendix B for map of impact zone).

Because the new edge degrades intact habitat, the 18 acre indirect impact zone cannot count toward mitigation measures. In other words, actions to improve habitat within the indirect impact zone are not credited.

Inclusion of the nine indirect impact acres quantifies the adverse *edge* effects of impact #2. However, other negative effects are not addressed: reduced total interior area, smaller patch size, and stand simplification (less wetlands). These are harder to quantify and this framework does not account for these negative impacts at this time.

In ecological terms, bigger is often better. WHI forest is part of a dynamic habitat mosaic uniquely located at the confluence of the Willamette and Columbia Rivers. In a synergistic effect, WHI's large size (~900 acres) further enhances functions provided by location and natural integration of multiple habitats. Even if the impacted functions were fully replaced (to the extent possible) with an off-site ~400 acre project, there will still be a loss of synergy from the island's size, natural resources and location. In other words, two separate 450 acres islands do not provide all of the exact same functions as a single 900 acre WHI. The loss of synergistic effect is difficult to quantify and is not fully addressed in this framework.

7. City of Portland Mitigation Framework for Floodplain Forest Impacts on West Hayden Island

Table 3. The City's mitigation requirements to meet "no net loss" of forest functions are derived from the following base ratios plus or minus any relevant modifiers.

Mitigation Method	Base Ratio
Re-establishment	3:1
Rehabilitation	6:1
Enhancement	12:1
Preservation	15:1

Temporal Loss vs. Gain Modifiers: These factors address either losses or gains in available functioning habitat in the time between the impact and the full establishment of a mitigation site. In contrast to habitats like grasslands or wetlands, forest habitat has an inherently long delay in reaching full function. It is estimate that a newly planted stand of floodplain forest will take 80-100 years to reach the level of function currently provided at the WHI impact site. Full function not only relates to the height of the trees, but also to soil conditions, presence of snags and downed wood, and native shrub and sub-canopy layers of vegetation.

The current time frame for the development is 10-20 years. It is likely there will be a time lag between the impact and the creation and full function of an off-site forest mitigation project. However, it is also possible that some advanced mitigation may result in a temporal gain in habitat function. For example, a short term action that re-introduces frequent river flows into a cottonwood stand that has been disconnected from the river would create a near term improvement in function.

The base ratios incorporate temporal loss based on a mitigation project that is constructed concurrent with resource impacts. The temporal modifiers account for additional temporal loss expected with forest mitigation as well as potential temporal gains.

Table 4. These temporal ratio modifiers apply to Re-establishment, Rehabilitation, and Enhancement. *They do not apply to Preservation*. "Desired Future Condition" (or DFC) refers to the condition where a project has been fully established and is providing all the intended functions.

temporal loss	temporal gain
+ 0.1 to base ratio for each decade until desired future condition attained	- 0.5 from base ratio for every 5 years of concurrent desired future condition functions provided by advanced mitigation

On-site vs. Off-site Ratio Modifiers: On-site mitigation is often preferred by regulating agencies. However, because WHI floodplain forest is relatively healthy and high value, it has limited capacity to benefit from on-site mitigation. In order to meet no net loss, off-site mitigation will likely be required. As stated earlier, it is assumed off-site mitigation will occur within the current/historic Columbia River floodplain. The hydrogeomorphic reaches referenced in the table are delineated in the USGS Columbia River Estuary Ecosystem Classification report; reach F/6 is the Middle Tidal Flood Plain Basin and reach G/7 is the Upper Tidal Flood Plain Basin (see Documents Referenced).

Table 5. On-site and Off-site modifiers

mitigation location	base ratio modifier
on-site	divide base ratio by 1.5
0-5 miles from WHI	no change in base ratio
> 5 miles but within Columbia River Estuary hydrogeomorphic Reaches F or G	multiply base ratio by 1.5

Island Mosaic Habitat Modifier: The adjacency and natural integration of WHI's floodplain forest with shallow water, multiple wetland types, wide open herbaceous areas, and two Columbia River channels makes it significantly more valuable. This function of this island mosaic can be hard to quantify. As stated earlier, in order to maintain "no net loss" of functions provided by WHI floodplain forest, it is assumed any off-site mitigation will be located within the active and/or historic floodplain of the Columbia River. Mitigation will be on an island adjacent to the river channel and to multiple wetlands and/or contain wetlands within the forest. The site will receive regular (at least annual) inundation from the river; river inundation can be across the entire site, or across a portion of the site. *This modifier only applies to off-site.*

Table 6. Island Mosaic Modifiers

Island Mosaic	base ratio modifier
forest mitigation is on an island and naturally integrated into a diverse floodplain habitat mosaic	no change to base ratio
forest mitigation site <u>not</u> on an island, rather a stand alone habitat patch; or <u>not</u> integrated with other floodplain habitats	multiple base ratio by 1.5

Table 7 on page 12 provides a summary of base ratios and how the modifiers affect base ratios. Table 8 on page 13 provides forest mitigation requirements in acres for WHI based on a set of project-level assumptions.

8. WHI Floodplain Forest Mitigation Method Examples (for either On-site or Off-site projects)

The mitigation terms were defined earlier in Section 4; here we provide examples of how each of the mitigation methods would be applied on-the-ground for impacted floodplain forest habitat:

Re-establishment: existing condition is a site within the floodplain that has been cleared and filled: vacant land, agriculture, dilapidated residential, ball fields etc. The site was historically floodplain forest and/or wetlands. Hydrologic processes are re-introduced into the site, grading removes fill and re-establishes channels or basins, and extensive dense planting efforts establish cottonwood/ash/willow vegetation community and large downed wood is added. Functions are significantly improved and there is a gain in habitat acreage.

Rehabilitation: existing condition is a relatively healthy cottonwood/ash forest but historic hydrologic processes that have been reduced or eliminated by humans. A regular flood regime is reinstated and the forest now receives full or partial inundation during periods of high water. Vegetation enhancement activities would also be included. Functions are significantly improved, but there is no gain in habitat acreage.

Enhancement: existing condition is cottonwood/ash forest with some tree regeneration, a shrub layer that is a mix of native and non-native species. Ground covers are a mix of natives and non-natives. All the primary vegetation layers are present, but non-native cover is adversely affecting the forest. By controlling non-native plants and planting new natives at a relative low density, total native cover is increased and non-native cover is reduced. Tree regeneration is boosted. The result is forest functions are slightly improved with no gain in acreage.

Preservation: existing condition is a floodplain ash/cottonwood forest interspersed with wetlands and the river floods on a regular basis. Site is under an imminent threat and is purchased and brought into permanent conservation status. Or the land maintains same ownership, but a change in zoning and/or legal instruments bring the resource under permanent protection. A land steward is identified and funded. Functions are not improved and there is no gain in habitat acreage.

9. Other Mitigation Considerations

- This mitigation framework does not address **wetlands**, however, on WHI wetlands are naturally integrated into the floodplain forest. Mapped wetlands overlap with mapped forest and areas of forest that flood are both wetlands and non-wetlands. Restoration concepts are being considered for on-site wetlands to meet City mitigation requirements. Expansion of wetland areas by increased frequency and magnitude of flooding on WHI will likely also result in enhanced functions for floodplain forest. Should actions like these occur, they should be credited on site as "rehabilitation" mitigation activities.

- As stated earlier, the off-site forest mitigation will include a **wetland** component within or directly adjacent. Therefore, it logical to infer some wetland mitigation credit could be gained off-site.

- At-risk **northern red-legged frogs** use the floodplain forest for active season (non-breeding movement) life stages and utilize three specific interior wetlands for breeding, including the Port mitigation wetland. All of these wetlands are within the proposed development footprint and would be eliminated (see Amphibian Inventory for supporting details). Given this at-risk species severe vulnerability to this development, significant mitigation measures must be considered. Current on-site wetland mitigation concepts focus on enhancing shoreline wetlands, however these are not suitable for red-legged frog breeding requirements due to their variable hydroperiods. Mitigation for this species could take the form of newly created wetlands within the remaining forest or actions off-site. The City is consulting with regional experts to ascertain mitigation actions with the best chance of success for supporting this at-risk species.

- In the process of developing this mitigation framework, the City looked at a *draft* version of the Willamette Partnership's **functional assessment tool for Western Floodplain Habitat**. This tool was created as a join effort between Paul Adamus, Defenders of Wildlife, and the Willamette Partnership. The tool is currently in draft form and has not been formally released by the Willamette Partnership; therefore it is not available to formally incorporate in this mitigation framework.

  The rapid assessment tool examines a total of 30 indicators of various floodplain functions. The assessment assigns a score to six different categories for the user, which are then weighted for the final overall score. The six categories are; landscape context, non-invasive species, vegetation structure and distribution, flooding regime, rare species, and risk/stressors.

  Three of the six categories had a weighting factor of three, one had a weight factor of two, and two categories had no weight factor. The three most heavily weighted categories are landscape

context, flooding regime, and risk/stressors. These categories give the best indication of properly functioning processes as they relate to floodplains.

While the Western Floodplain Habitat assessment method will be a valuable tool to assist in assessing impacts and potential mitigation, it gives a relative score, so the assessment is useful as a means to inform policy decisions or to compare relative values of impact and/or mitigation sites.

- City Council Resolution #36805 called for continued planning for at least 500 acres as open space and no more than 300 acres of land for marine terminal development. The resolution referenced the Community Working Group's (CWG) project principles as guidance. One of the principles is that the project should result in a "**net increase in ecosystem functions**". This mitigation framework's objective is "no net loss". In order to meet the CWG's goal, additional actions that improve natural resources are required.

- **Preservation** of remaining habitat on site is a valid mitigation method if certain conditions are met. The action causing the preservation is the change in zoning (current is MUF-19) to open space zoning. Additional measures for permanent protection are needed such as environmental overlays, plan district code, deed restriction, agreements and/or easements.

Table 7. Summary of base ratios and modifier affects on base ratios.

Mitigation Method	**Base Ratio**	**location modifier** for on-site ÷ 1.5	**location modifier** for 0-5 miles from WHI = no change to base ratio	**location modifier** for > 5 miles from WHI x 1.5	**temporal loss & gain modifiers** = varies by project	**island mosaic modifier** site is on island and floodplain habitat mosaic = no change to base ratio	**island mosaic modifier** site is not on island or a floodplain habitat mosaic x 1.5
Re-establishment	3:1	2:1	3:1	4.5	varies	3:1	4.5
Rehabilitation	6:1	4:1	6:1	9:1	varies	6:1	9:1
Enhancement	12:1	8:1	12:1	18:1	varies	12:1	18:1
Preservation	15:1	10:1	15:1	22.5:1	varies	15:1	22.5:1

Table 8. Floodplain Forest Mitigation Package

Below is a mitigation package for forest impacts on WHI. With some project-level assumptions, the conclusion is preserving and enhancing the remaining forest on site mitigates for **51.6** impact acres, leaving a balance of **97.4** impacts acres to mitigate off-site. Therefore, actions on-site account for roughly a third of the mitigation needed. Another 390 acres of land, where re-establishment is employed, is needed to achieve no net loss.

Because a specific off-site location has not been identified, and no specific projects have been proposed on site, some assumptions have been made about how mitigation efforts will be directed. The package below is based on the Port of Portland's stated preference for mitigating on-site. It is assumed, based on conversation to date, that a mix of mitigation methods will be employed. Once on-site opportunities are exhausted, off-site mitigation could take the form of any mitigation method or a combination of methods. Re-establishment is included below for off-site and it is the preferred off-site method, as it should result in an eventual net increase in habitat acreage. Enhancement and Rehabilitation will increase functions, but not acreage. Preservation results in a net loss of acreage compared to baseline.

The impact to forests is **149 acres** (direct loss + 50% of indirect impact). The available remaining forest habitat for mitigation on WHI is 322 acres (remaining 340 – 18 indirect impact zone).

Mitigation Method	base ratio	location modifier	temporal modifier	island habitat modifier	impact acres applied to ratio	total acres mitigation required	**on-site mitigation available**	**off-site mitigation required**	impact acres mitigated out of 149 total required (% of 149)
Preservation	15:1	on-site ÷ 1.5 = 10:1	n/a	n/a for on-site	149	1,490	322		32.2 acres (22%)
Enhancement	12:1	on-site ÷ 1.5 = 8:1	gain – 1.0[a] = 7:1	n/a for on-site	116.8[b]	817.6	103[c]		19.4 acres (13%)
Remaining Mitigation:									
Re-establishment	3:1	off-site < 5 mile = no change	loss + 1.0[d] = 4:1	site is on an island = no change	97.4	390		390	97.4 acres (65%)
Other Methods to achieve off-site mitigation for the remaining 97.4 impact acres. Only **one** of these is needed, these are not additive. Re-establishment (above) is the preferred off-site method; acreages below illustrate what requirements are for other methods. Includes same assumptions about locations and timing.									
Rehabilitation	6:1	off-site < 5 mile = no change	gain – 1.0[a] = 5:1	site is on an island = no change	97.4	487		487	97.4 acres (65%)
Enhancement	12:1	off-site < 5 mile = no change	gain – 1.0[a] = 11:1	site is on an island = no change	97.4	1,071.4		1,071.4	97.4 acres (65%)
Preservation	15:1	off-site < 5 mile = no change	n/a	site is on an island = no change	97.4	1,461		1,461	97.4 acres (65%)

[a] assumes ten years to DFC for enhancement (reveg shrub layer, supplement tree regeneration, etc) and then 10 years to development impact = 10 year temporal gain.
[b] each action mitigates for part of impact and that acreage is subtracted from the next method; on-site preservation mitigated for 22% (322 of 1,490) of the requirements because only 322 acres are available. The next enhancement calculation is based on the remaining balance of 116.8 acres
[c] the HINRI vegetation inventory determined that approximately 103 acres of the remaining forest habitat would need treatment of the shrub layer for invasive Armenian Blackberry and also non-native herbaceous cover. The remaining 219 acres have either trace or no non-native cover and enhancement will not provide measurable lift in plant community composition.
[d] assumes 100 years to DFC with full function comparable to impact site

This is an example scenario that makes a set of project-level assumptions. Depending on location/project/method, acreages can be generated using base ratios and modifiers for any type of approach.

10. Documents Referenced

Oregon Department of State Lands (DSL), 2011. *A Guide to the Removal Fill Process.* Produced by the Oregon Department of State Lands, Salem, Oregon. November 2011.

Columbia River Estuary Ecosystem Classification—Concept and Application: U.S. Geological Survey Open-File Report 2011-1228, 54 p. Simenstad, C.A., Burke, J.L., O'Connor, J.E., Cannon, C., Heatwole, D.W., Ramirez, M.F., Waite, I.R., Counihan, T.D., and Jones, K.L., 2011,

Wetland Mitigation in Washington State - Part 1: Agency Policies and Guidance. Department of Ecology, U.S. Army Corps of Engineers (Seattle District), U.S. Environmental Protection Agency (Region 10). Publication # 06-06-011a. March 2006.

Hayden Island Natural Resource Inventory (HINRI) Report. Public Review Draft June 2011. City of Portland Bureau of Planning and Sustainability.

Design and Construction Standards Environmental Review Chapter 3 Sensitive Areas and Vegetated Corridors. Clean Water Services, Washington County, OR. June 2007.

Amphibians and Reptiles of West Hayden Island, Multnomah County, Oregon. Rombough Biological. Prepared for the City of Portland Bureau of Environmental Services. August 2011.

Appendix A.

Table 1a from Publication #06-06-11a (WA Ecology, Corps, EPA). Details the framework of mitigation ratios; how these are applied varies project by project. Lower quality wetlands (Category IV, III) require lower ratios while higher quality (Category I, II) require higher ratios. Rare habitats like forested wetlands also push ratios higher (for example 6:1 to 24:1 depending on mitigation activity).

Table 1a. Mitigation ratios for western Washington.

Category and Type of Wetland Impacts	Re-establishment or Creation	Rehabilitation Only[21]	Re-establishment or Creation (R/C) and Rehabilitation (RH)[21]	Re-establishment or Creation (R/C) and Enhancement (E)[21]	Enhancement Only[21]
All Category IV	1.5:1	3:1	1:1 R/C and 1:1RH	1:1 R/C and 2:1 E	6:1
All Category III	2:1	4:1	1:1 R/C and 2:1 RH	1:1 R/C and 4:1 E	8:1
Category II Estuarine	Case-by-case	4:1 Rehabilitation of an estuarine wetland	Case-by-case	Case-by-case	Case-by-case
Category II Interdunal	2:1 Compensation must be interdunal wetland	4:1 Compensation must be interdunal wetland	1:1 R/C and 2:1 RH Compensation must be interdunal wetland	Not considered an option[22]	Not considered an option[22]
All other Category II	3:1	6:1	1:1 R/C and 4:1 RH	1:1 R/C and 8:1 E	12:1
Category I Forested	6:1	12:1	1:1 R/C and 10:1 RH	1:1 R/C and 20:1 E	24:1
Category I - based on score for functions	4:1	8:1	1:1 R/C and 6:1 RH	1:1 R/C and 12:1 E	16:1
Category I Natural Heritage site	Not considered possible[23]	6:1 Rehabilitation of a Natural Heritage site	R/C Not considered possible[23]	R/C Not considered possible[23]	Case-by-case
Category I Coastal Lagoon	Not considered possible[23]	6:1 Rehabilitation of a coastal lagoon	R/C not considered possible[23]	R/C not considered possible[23]	Case-by-case
Category I Bog	Not considered possible[23]	6:1 Rehabilitation of a bog	R/C Not considered possible[23]	R/C Not considered possible[23]	Case-by-case
Category I Estuarine	Case-by-case	6:1 Rehabilitation of an estuarine wetland	Case-by-case	Case-by-case	Case-by-case
NOTE: Typical ratios for preservation are discussed in Section 6.5.5.					

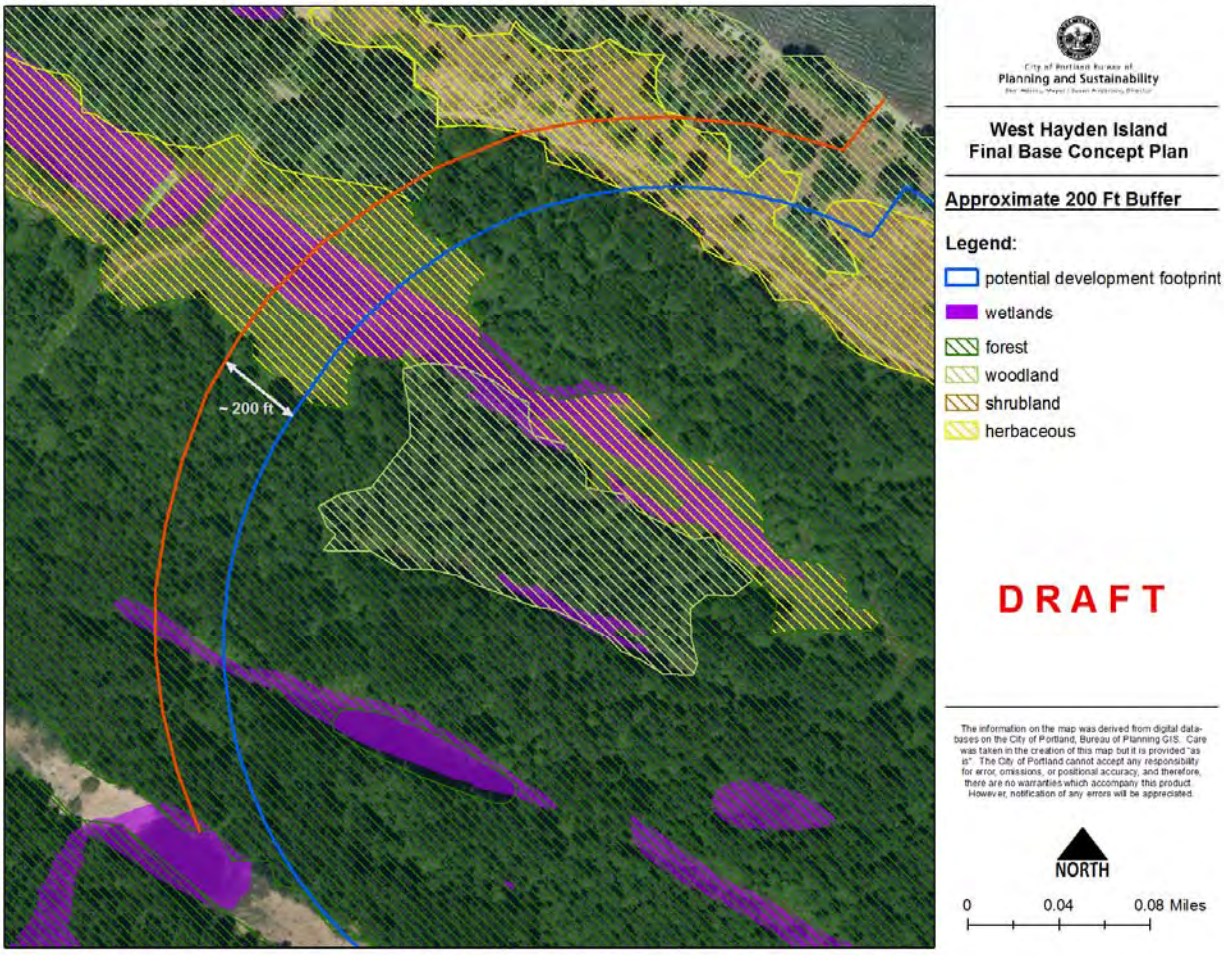
21 These ratios are based on the assumption that the rehabilitation or enhancement actions implemented represent the average degree of improvement possible for the site. Proposals to implement more effective rehabilitation or enhancement actions may result in a lower ratio, while less effective actions may result in a higher ratio. The distinction between rehabilitation and enhancement is not clear-cut. Instead, rehabilitation and enhancement actions span a continuum. Proposals that fall within the gray area between rehabilitation and enhancement will result in a ratio that lies between the ratios for rehabilitation and the ratios for enhancement (see Appendix H for further discussion).

22 Due to the dynamic nature of interdunal systems, enhancement is not considered an ecologically appropriate action.

23 Natural Heritage sites, coastal lagoons, and bogs are considered irreplaceable wetlands because they perform some functions that cannot be replaced through compensatory mitigation. Impacts to such wetlands would therefore result in a net loss of some functions no matter what kind of compensation is proposed.

Appendix B.

Map of 18 acre indirect impact zone on forest habitat.


~ 200 ft
City of Portland Bureau of
Planning and Sustainability
West Hayden Island
Final Base Concept Plan
Approximate 200 Ft Buffer
Legend:
potential development footprint
wetlands
forest
woodland
shrubland
herbaceous
DRAFT
The information on the map was derived from digital data-bases on the City of Portland, Bureau of Planning GIS. Care was taken in the creation of this map but it is provided "as is". The City of Portland cannot accept any responsibility for error, omissions, or positional accuracy, and therefore, there are no warranties which accompany this product. However, notification of any errors will be appreciated.
NORTH
0
0.04
0.08 Miles

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ADDENDUM
CITY OF PORTLAND WHI FOREST MITIGATION FRAMEWORK
August 16, 2012

This document provides background documentation for the City of Portland's West Hayden Island (WHI) Forest Mitigation Framework (hereafter referred to as the "framework"). The framework was provided to the WHI mitigation sub-committee on March 22, 2012. This Addendum is in response to inquires from the Port of Portland requesting documentation on the development and rationale behind the framework. Please refer to the framework for full details.

The framework was developed as a flexible tool to quantify a variety of mitigation proposals aimed at replacing the permanent loss of high functioning, high quality floodplain forest currently present on WHI. Note that the framework only addresses the floodplain forest habitat type; other riverine habitats are also impacted by this proposed development and addressed using different methods.

The City's framework was developed specifically for WHI forests and tailored to specific functions provided by the site and what would be required to replace those features and functions. Evaluating projects on a case by case basis in light of conditions on the ground is an approach shared by nearly all regulatory agencies.

Contents

1.0 Goal of Mitigation

It's important to state that the City's goal for floodplain forest mitigation is to replace the entire suite of functions that the existing forest conditions on WHI currently provide. In other words, mitigation will have been fulfilled when the unique suite of ecological functions provided by WHI forest is replaced. The City's framework quantifies what it will take to bring the floodplain forest ecosystem back up to its existing baseline function (or no-net-loss). It is possible to quantify this because the science we have drawn from to develop the framework is based on this concept.

The Portland City Council resolution cited the Community Work Group's goal of a "net gain in ecosystem function" as guidance for the annexation project. City staff have operationalized this goal into two steps. The first step is in-kind replacement of natural resource features and functions. In-kind replacement brings the ecosystem functions back to baseline conditions. The second step is to pursue additional ecosystem enhancements that will provide a gain in function. The second step can be everything from additional tree plantings, to more acres of wetland creation, to retrofitting a building with a habitat roof. By setting a benchmark in the framework for returning floodplain forests back to baseline (step one), it's logical that "net gain" for floodplain forests can be defined as additional effort above and beyond this threshold.

2.0 Existing Conditions

The framework starts by defining the existing conditions in the WHI forest. This becomes the benchmark for determining how much mitigation is necessary to return to the baseline condition.

The existing floodplain forests on WHI are a high quality example of a rare type of habitat in the Lower Columbia River. The WHI forest represents 4% of the total floodplain forest between the Bonneville Dam and the Pacific Ocean. The dominant trees are black cottonwood and Oregon ash; some of the trees within the impact zone are at least 150 years old. Extensive characterization of WHI habitats are found in the *Hayden Island Natural Resources Inventory* (HINRI, 2012) as well as two supplemental memos on forest conditions (BES, 2012 and BES, 2011). City staff and contractors collectively spent hundreds of hours on the ground on WHI studying this resource. The HINRI identifies the floodplain forest as a Special Habitat Area that provides high relative rank riparian corridor functions. A narrative description of ecological functions provided by the floodplain forest is provided in section 1 of the framework.

In summary, five of the primary attributes of WHI floodplain forests are:

a) **Scale** – The large size of the WHI forest is very important. Many species prefer or are dependent on large habitats with interior areas that are not heavily impacted by edge effects and surrounding noise, light, vibration, etc. These large habitats are increasing rare in our fragmented landscapes.

b) **Location** – WHI is uniquely located at the confluence of the two largest rivers in our region. Confluence sites like this provide tremendous value for terrestrial as well as

aquatic species. Its proximity to urbanization also creates a riverine habitat oasis for fish and wildlife species in the Metro area.

c) **Age** – The forested area proposed for impact is at least 100 years old. It includes some Oregon ash trees that are at least 150 years old. Few sites in the Lower Columbia have ash trees this old; this provides unique conditions for plants and wildlife that are difficult, if not impossible, to replicate (BES, 2012). The older age fosters unique features like soil conditions and dead wood that wildlife need.

d) **Rarity** – The bottomland cottonwood/ash floodplain forest covering most of WHI is a high quality example of a rare habitat type in the Northwest. This forest type only occurs in large riverine floodplains and is disappearing from our ecosystems. This finding is consistent with multiple assessments by other agencies.

e) **Health & Complexity** – Within the Lower Columbia River estuary, WHI is a relatively healthy floodplain habitat. The canopy is essentially completely native trees. Portions of the site – including those with minimal invasive cover - are considered "reference condition" by experienced ecologists for this habitat. This is due to the presence of all the primary native vegetation layers, varied age classes, vegetation regeneration, deep leaf litter, and standing/downed wood. The health of the forest is reflected by the presence of 13 at-risk terrestrial wildlife species.

Findings by other natural resources agencies support the City's conclusion that WHI forests are unique and high value. Below is a list of designations specifically for WHI as well as designations for the type of forest habitat found on WHI.

2.1 Designations for WHI Highlighting Ecological Importance

a) The Oregon Department of Fish and Wildlife (ODFW) has identified and mapped WHI as a **Conservation Opportunity Area** (COA) within the state (ODFW, 2009). COAs are defined in Oregon as "those areas where the likelihood of successful conservation is strongest, and the conservation needs of wildlife and their habitats would be best met" (ODFW, 2005). COAs are selected through a three step process of computerized site selection, validation of the results using expert opinion, and peer review. WHI meets COA criteria because it supports priority habitats and species and is extremely valuable on a local and regional landscape context as a riverine island that connects both terrestrial and aquatic ecological systems (S. Barnes, pers. comm.).

b) **ODFW Category 1 or 2 habitat:** ODFW has a comprehensive habitat mitigation policy that is applicable to state owned lands on WHI and includes habitat categories and associated mitigation goals and strategies (Oregon Administrative Rule 635-415-0000 – 635-415-0025). Category 1 is defined as irreplaceable, essential and limited and the mitigation goal is no loss of habitat quantity or quality. The mitigation strategy for Category 1 is avoidance. Category 2 is defined as essential and limited with the mitigation goal of no net loss of habitat quantity or quality and to provide a net benefit of habitat quantity or quality. The mitigation strategy for Category 2 is in-kind and in-proximity. As a member of the WHI Public Advisory Committee, ODFW has made preliminary category determinations for habitats on WHI (ODFW, 2011).

ODFW's preliminary determination is Category 1 or 2 for WHI's mature riparian bottomland forest; Category 2 for wetlands and shallow water; and Category 2 to 4 for the dredge deposit management area. Its is very significant that ODFW is considering a Category 1 determination for forests while other habitats such as wetlands and shallow water fall into Category 2. This is primarily due to the forest's age, size, health and location. In the ODFW policy Category 1 is irreplaceable habitat with a mitigation policy of avoidance.

c) NOAA Fisheries has identified the shorelines of WHI as **Critical Habitat** for 11 ESA-listed Columbia River salmon and steelhead, as well as the Columbia Eulachon. Floodplain forests on WHI provide both direct and indirect benefits to these listed taxa.

d) WHI is identified as a **Habitat of Concern** (HOC) in Metro's 2005 Inventory of Regionally Significant Habitat. The HOC designation is a tool used in Metro's inventory to identify unique, rare or declining habitats not captured by their riparian GIS model. The following HOC criteria are relevant to WHI: island, connectivity corridor, and rare habitat type: bottomland hardwood forests (floodplain forests).

e) WHI is also ranked as **Riparian/Wildlife Class 1** combined relative resource ranking in Metro's Inventory of Regionally Significant Habitat. Class 1 is the highest rank and signifies that a habitat is providing the full suite of ecological functions associated with riparian habitat. This includes microclimate and shade, sediment, pollution and nutrient cycling flow moderation, large wood dynamics, wildlife habitat, and other important functions (Metro, 2005).

The above designations refer to WHI specifically. In addition to site level evaluations, the type of forest habitat found on WHI has been identified in multiple regional conservation plans. Depending on the context, this habitat is referred to as floodplain forest, cottonwood gallery, bottomland hardwood forest, or bottomland riparian. The habitat type can also be described more specifically as plant communities or associations at various scales.

f) **Priority Habitat** by Partners in Flight, a coalition biologists and ornithologists from research organizations, academia, the Bureau of Land Management, US Forest Service, and the US fish and Wildlife Service. Oregon/Washington PIF have identified riparian deciduous woodlands such as those on WHI as a Priority Habitat in their plan for the lowlands of Oregon and Washington. Features and conditions considered important within this habitat: large canopy trees, sub-canopy/tall shrub foliage, dense understory, snags, and large, structurally diverse patches. All are present within WHI forests. PIF has set several biological targets for this habitat including maintaining existing stands, maintain existing contiguous tracts > 50 acres, and retaining all cottonwoods > 22 inch diameter breast height (PIF, 2000).

g) **High Priority Plant Association/Ecological Element** in the Oregon Natural Areas Plan, produced by the Oregon Biodiversity Information Center at PSU's Institute for Natural Resources. In the Willamette Valley Ecoregion, the plan has identified riparian areas comprised of Oregon ash, black cottonwood, and snowberry as a high priority (the highest rank) ecosystem element or plant association. The dominant

native shrubs in WHI forests are red-osier dogwood and snowberry. The primary factor driving the ranking in the state plan is the risk that the plant community will disappear from the landscape. Risk is assessed base on rarity, threats, ecological fragility, and the "adequacy and viability of protected occurrences" (ONHAC, 2010).

h) ODFW identified riparian habitats a **Strategy Habitat** in the Oregon Conservation Strategy (OCS) (ODFW, 2005). Strategy habitats are habitats in decline and are a major focus of the state's conservation planning and priorities. Floodplain forests are a special type of riparian habitat are specifically called out in the OCS for their immense value to wildlife. ODFW describes cottonwood forests such as those on WHI as a **keystone habitat**, meaning they "have a large impact on the ecosystem relative to their abundance on the landscape." (ODFW, 2005)

3.0 Development of Base Forest Mitigation Ratios & Modifiers

The purpose of the City's framework is to provide a sound mechanism for evaluating a range of forest mitigation proposals. The framework provides flexibility and options by mixing and matching types of mitigation, different geographies, and different timeframes.

There is no established methodology in place to quantify compensatory mitigation of impacts to estuarine island floodplain forest habitat. Therefore, in order to develop a mitigation framework, staff turned to existing best practices in the region for natural resource mitigation. The first step was to select programs with parallel conditions and extrapolate best practices to produce a sound, defensible approach. Staff reviewed a number of agency programs and built the approach on science-based principles. Extensive documentation of the approach is detailed in the framework document.

One of the programs with an approach applicable to WHI is the Washington State Department of Ecology (DOE) wetland mitigation program (Washington Department of Ecology, 2006). Certain core elements of the program are relevant and transferable to WHI floodplain forests, such as consideration for the rarity of the habitat and the level of effort needed for different mitigation activities (preservation vs. enhancement vs. new plantings). DOE is required to use best available science and their program was jointly developed with the US EPA and US Army Corps. Extensive documentation and rationale for principles that are applied to WHI can be found in the DOE background documents. The DOE approach has undergone comprehensive peer review, has been formally adopted, and it is now an established best practice in mitigation.

An essential element of the DOE program is the relationship among types of mitigation. Mitigation actions including re-establishment, enhancement and preservation do not provide equal ecological benefit per unit of area. The DOE approach provides a consistent, science-based, and extensively reviewed method to address these differences. Using re-establishment as a starting point, the DOE formula states that rehabilitation requires twice the area for of that re-establishment, and enhancement requires four times more area than re-establishment. Preservation necessitates an independent set of ratios.

Natural resource mitigation seeks to replace natural features that are lost to development. Re-establishment is a form of mitigation where an area that was formerly habitat is converted back into habitat thereby adding new habitat area to ecosystem. Other forms of

mitigation such as enhancement or rehabilitation improve upon existing habitats to increase or enhance ecological functions. With an enhancement/rehabilitation approach, the end result from development is less total habitat area, but the remaining habitat is improved. See *Definitions* below for additional explanation and refer to Sections 4 and 8 of the framework.

The DOE formula is essential because a mix of methods has been and continues to be part of the various mitigation proposals for WHI forests. Ultimately, this allows for flexibility with different options to achieve compensatory mitigation.

In the process of determining appropriate and adequate mitigation, the DOE guidance clearly emphasizes that each project should be evaluated on a case by case basis. Consideration should be given to the specific impact and how any proposed mitigation will compensate. The following factors are some of those considered when evaluating mitigation and are relevant to WHI:

- The quality of the impacted resource
- Any unique, rare or important functions that will be lost
- Location (many factors, including wildlife corridors)
- Time it will take to replace lost functions
- Experience of the implementing entity

DOE provides a set of mitigation ratios in table 1a (included in the framework and here again as Attachment A). The ratio table addresses quality of habitat impacted and type of mitigation action undertaken. DOE guidance is clear that these are not prescriptive for all projects, but used as a starting point with consideration of factors (including the above list) that will change ratios:

> "In addition to the risk of failure and the temporal loss, a higher or lower mitigation ratio may be required based on the nature and effectiveness of the mitigation itself and tradeoffs associated with out-of-kind and off-site mitigation." – Washington Department of Ecology, 2006

When the City developed the framework, there was no specific mitigation proposed. The City started with appropriate base ratios and then added multipliers for distance and the unique functions provided by an island and habitat mosaic at the Willamette/Columbia River confluence. The City also included an additive factor for time. This allowed the City to define geographic limits of mitigation and evaluate any potential proposal.

It is important to understand that in the framework that the City uses, the starting point is the base ratio for re-establishment; all other ratios are generated from that number. In order to select a set of base ratios, the City evaluated table 1a and selected the ratios for Category II wetlands (3:1 re-establishment, 6:1 rehabilitation, 12:1 enhancement). These are the starting points that the modifiers apply to. Starting with base ratios and adjusting them for project specific factors is entirely consistent with the DOE approach.

The DOE uses a category system to rate wetlands. Category I is the highest value, Category II is high quality, Category III is considered average or typical, and Category IV is low quality and degraded. Because WHI floodplain forest is a high quality, rare and unique natural resource, the City determined the second category was a reasonable parallel condition.

The rationale for ratios that are higher than 1:1 is provided in the DOE guidance document as well as DOE's Appendix 8-F to Wetlands in Washington State Volume 2 (Granger, 2005). Essentially, at a minimum mitigation ratios need to account for temporal loss and risk of failure. Research has shown that high rates of failure and gaps in time have resulted in less than 1:1 replacement of wetland resources. Adding a factor of 1 for each is considered minimally adequate as a starting point on any mitigation project. This brings the base ratio for re-establishment up to 3:1, which is the number used for Category II in the DOE framework. Because of the long time horizon for desired forest conditions to develop, and the need to credit advanced mitigation, the frameworks includes a temporal modifier (described later).

The DOE ratios assume the level of function provided by the mitigation site is equal to that provided by the impact site. This is an essential element because it ensures equal replacement of lost ecological functions.

3.1 Risk of Failure Removed From Base Ratios

During the process of evaluating the Port's initial Government Island proposal, Port staff communicated to City staff that due to the Port's successful track record with mitigation, risk of failure should not be applied to their proposal. City staff agreed and removed risk of failure from the base ratios. The revised, lower base ratios are: 2:1 re-establishment, 4:1 rehabilitation, 8:1 enhancement. This effectively dropped the base ratio to Category III in the DOE framework, reflecting wetland resources that are considered average or typical.

Table 3 contains all the revised ratios and modifiers used in the City's framework and is included as Attachment C.

3.2 Definitions

The City of Portland developed the framework specifically to address the loss of high functioning floodplain forest on WHI. In a mitigation arena where multiple methods of mitigation are proposed, it's essential to define types of mitigation. The City saw benefit in the definitions used by the DOE, the Corps and EPA in the DOE guidance document. The definitions separate activities in a clear way that is transferable to floodplain forests. Because different mitigations actions do not provide equal ecological benefit per unit area, the DOE guidance links ratios to each category of mitigation.

In order to make the definitions most useful in a floodplain forest context, the City adapted the language to the site and habitat type. However, the principle of the definition remained completely intact as it was carried over to the framework. The different methods each have a ratio, which allows for flexibility in proposals and a clear, consistent way to quantify mitigation when methods are combined.

Definitions are included in Section 4 on page 3 of the framework. For further clarity, the framework also includes example projects under each mitigation definition (Section 8 page 9).

To add additional clarity on this topic, the principle differences between the primary four methods are summarized:

- **Re-establishment** is the act of creating new habitat in a place that was former habitat. Most importantly, this results in a gain in habitat area (acreage).

- **Rehabilitation** is the reintroduction of environmental processes into an existing degraded habitat. This provides significant functional lift, but does not produce a gain in habitat area (acreage). In the WHI context, this would be introducing or increasing the extent and/or frequency of flooding into an existing forest stand that has been disconnected from the river. Rehabilitation has not been proposed thus far in the WHI process.

- **Enhancement** is the act of improving structural conditions (usually vegetation) in an existing degraded habitat. This provides some functional lift, but less than rehabilitation. It does not produce a gain in habitat area (acreage).

- **Preservation** reduces the risk of additional habitat removal in the future. However, it does not produce a gain in habitat area (acreage). Preserving the remaining WHI forest is an appropriate mitigation method; however, this action does not contribute towards replacing lost functions.

4.0 Unique Attributes of WHI Location

West Hayden Island is a unique location at the confluence of the Willamette and Columbia Rivers; this is supported by the following ecological and biological examples. These attributes reflect the rationale behind prioritization of on-site and in-proximity mitigation, and the increase in effort required for off-site mitigation. For fish and wildlife species, staff focus here on at-risk species and ESA-listed fish. For the purposes of the City framework, these can be considered surrogates for the hundreds of resident and migratory species that depend on the Confluence area. This is not a complete list, but illustrative of the types of functions the framework seeks to replace.

> "Acceptable compensation (whether on-site or off-site) should be a part of a network or *corridor* connecting significant habitat areas or other open space areas whenever possible. When evaluating proposals, agencies keep in mind the natural patterns and corridors in the watershed. As described earlier, rivers and streams function as freeways for the movement of wildlife, water, sediments, and nutrients. Where applicable, compensatory mitigation should contribute to and preserve these corridors to support and maintain the functions of the watershed." – Washington Department of Ecology, 2006

a) Upper Willamette River (UWR) basin juvenile Chinook use the shorelines of WHI. The near shore floodplain forests on WHI provide a direct benefit to these fish. Interior floodplain forests on the island have an indirect - but significant - relationship with the high quality salmonid habitat along the shore. Recent genetic analysis of juvenile salmon and steelhead use of near shore habitat on WHI indicates a strong presence of UWR Chinook. In contrast, these fish found have not been found to venture further up the Columbia River in any significant numbers. Sampling around the perimeter of Hayden Island yielded an UWR Chinook catch rate of 24% of 273 individuals (NWFSC 2009). Sampling at the mouth of the

Sandy River yielded a much smaller presence of UWR Chinook, with 6% of 426 individuals (Sather, 2009). However, it's not possible to determine if these UWR Chinook arrived at the Sandy from the Willamette or if they are from genetic stock used in past hatchery practices (Gregory, 2012). A statement from Port consultant ENVIRON on fish use at Government Island is consistent with this fact (Port of Portland, 2012). Because the Chinook found around Hayden have a higher likelihood of natal ties to habitat in the Upper Willamette, it is expected that mitigating damages to Hayden Island habitat much further upstream of the Willamette-Columbia confluence will not produce a direct benefit to these ESA-listed fish.

b) Situated at the confluence of the Willamette and Columbia, WHI serves an ecological nexus for the two largest river basins in the Northwest. At-risk Northern red-legged frogs provide a good example of how this serves a specific species. WHI supports a reproducing population of these frogs. Their center of activity on WHI is the cluster of small interior wetlands in the middle of the island surrounded by the oldest stand of cottonwood and ash forest. The wetlands provide egg laying sites, the forest canopy and deep leaf litter provides cool moist active season habitat. Generally, these frogs can be expected to live out their entire lives on WHI. However, from time to time, some will leave WHI to seek out new habitats and others will arrive at WHI to occupy the site.

Under current existing conditions, the WHI population has easy access to both the Willamette and Columbia Rivers. Columbia and Willamette frogs can recruit to the island and WHI frogs can disperse to either basin. This facilitates genetic exchange between to the two major basins, bolstering genetic diversity and promoting species viability.

The preferred development footprint on WHI eliminates the majority of the Northern red-legged frog habitat on the Island. When this Northern red-legged frog population is severely impacted, the best chance to replicate this unique function is to provide on-site or in-proximity habitat replacement. A mitigation project any distance upstream on the Willamette or in either direction on the Columbia will not provide the same critical linkage between basins.

c) Bald eagles provide a similar example to Northern red-legged frogs of how WHI serves as an "ecological crossroads." Or, one might say a "hub" on a wildlife corridor network. This species relies on large trees and forests along major river corridors for nesting, roosting, hunting, and perching. Multiple pairs nest along the Willamette River in Portland and distribution continues south into the valley concentrated along the main stem Willamette River. The Lower Columbia also provides a major habitat corridor and is home to one of the densest populations of eagles in the Northwest. WHI, situated at the junction of these two major eagle corridors, provides excellent eagle habitat. When forested habitat is lost on WHI, in-proximity mitigation provides the best chance to replicate this "service" to two major eagle populations/corridors.

At the local site scale, forested habitat on WHI provides nesting and roosting opportunities with access to high quality foraging areas at Smith and Bybee wetlands, Vancouver Bottoms, on Sauvie Island, and along both Columbia and Willamette river channels.

Eagles provide a good example of how WHI lies at in the intersection of two major fish and wildlife corridors. Hundreds of species in addition to eagles utilize these corridors, many traveling hundreds of miles along them. Mitigating with high quality habitat in close proximity to the confluence will preserve unique ecological functions provided at this

corridor intersection. This is consistent with the goal of addressing natural patterns on the landscape and preserving fish and wildlife corridor functions.

d) At a Metro regional scale WHI is an integral part of a fish and wildlife habitat complex found at the confluence of the Willamette and Columbia Rivers. It provides a north-south link between the Smith and Bybee Wetlands and the Willamette River to the south and Shillapoo Wildlife Area, Vancouver Lake and Ridgefield NWR to the north. WHI also provides an east-west link between Government Island and Portland Airport to the east and Sauvie Island to the west. WHI lies at the center of this "Confluence Complex."

What does this mean exactly? Neotropical migratory songbirds can serve as an illustrative example. In the spring, these migrants are moving north from the tropics, some will stop in the metro area on sites like WHI to breed and others will push farther north. This group includes orioles, warblers, vireos, flycatchers, martins and other species. On a typical day in early May these neotropical migrants are moving north along the Willamette river corridor and Willamette bluff. They use both urban habitats and natural areas. As they move along, they key into larger habitat patches and tend to concentrate and linger at them. After Willamette bluff, they will move through Smith and Bybee wetlands and then on to extensive forest habitat on WHI. After WHI, they will continue north through Vancouver bottoms, on to Sauvie Island and Ridgefield NWR.

Once the habitat is lost on WHI, the best chance to replicate or "re-build" this integral part of the "Confluence Complex" is to provide in-proximity habitat mitigation. A natural area like Government Island will also support similar neotropical migrants in migration, but it does not provide the same integral link within a cluster of habitat at the Willamette/Columbia River confluence.

In terms of selecting location for mitigation, the DOE guidance states:

> "compensation should occur in a location where the targeted functions can be reasonably performed and sustained…" - Washington Department of Ecology, 2006

Because WHI performs unique functions related to the Willamette/Columbia River confluence, it's logical that mitigation should occur on-site (ideal) or in close proximity to the confluence. Increased effort is required for off-proximity mitigation actions in order to replace the features and functions lost.

4.1 In-Proximity vs. Off-Proximity

In the process of evaluating potential locations for WHI forest mitigation, it's important to define geographies and understand how they relate to mitigation goals. To be most effective, mitigation is evaluated on a project specific basis. This is consistent among agency approaches. Oregon Department of Fish and Wildlife (ODFW) has developed a comprehensive habitat mitigation policy that is applicable to WHI and includes definitions that assist in delineating geographic boundaries (Oregon Administrative Rule 635-415-0000 – 635-415-0025). The following definitions and guidance were provided by ODFW biologist Susan Barnes and are directly applicable to WHI wildlife and their habitats (ODFW, 2001):

In-Proximity

"In-Proximity Habitat Mitigation" refers to mitigation measures that are completed within, or in proximity to the area affected by a development action. The policy defines "in proximity" to mean within the same home range or watershed (depending on the species or population being considered) of the species or population being impacted by the development. The choice between a watershed or home range should be based on which scale has the highest likelihood to benefit the species or population that is directly affected by the activity. The intent is that mitigation sites be chosen such that the greatest possible benefit to fish and wildlife can be achieved, but also so that the eventual benefits are provided to the impacted population. Choosing the appropriate scale for siting mitigation should include consideration for the mobility of the species of concern. For mobile species, it is acceptable to site mitigation projects farther away from the project site if it is reasonably expected that the population using the project site will eventually utilize the mitigation site. If the primary species affected by the development has low mobility, it will be necessary to locate mitigation activities on, or in very close proximity to the project site.

Off-Proximity

"Off -Proximity Habitat Mitigation" refers to mitigation measures that are completed outside the area required for in-proximity mitigation, but within the physiographic province of the development action. This standard provides flexibility to allow for the maximum potential benefits of mitigation to fish and wildlife species to be realized through site selection. Where off-proximity mitigation is acceptable, project proponents would be allowed to identify potential mitigation sites that are most suitable to habitat replacement. These sites must still be within the province of the project, though.

Among the hundreds of wildlife species using WHI, the HINRI has documented 13 terrestrial at-risk species or "species of concern" that use the floodplain forest habitat. These include nine birds, four bats, and one amphibian.

As outlined by the above in-proximity definition, a choice should be made between a watershed scale and a home range scale with consideration for less mobile species. Following the guidance in the definition, less mobile at-risk species home ranges should define in-proximity area in order to ensure "the eventual benefits are provided to the impacted population."

The intent of using home range criteria to delineate in-proximity geography is to ensure the impacted local population will be able to move to and colonize the replacement habitat. The distance they can be expected to move is defined by their home range. In other words, when a development impact removes habitat and the new, replacement habitat is located within the target species home range, then they would hypothetically be able to move to the new habitat. In practice, this often means locating mitigation on the project site, or in very close proximity.

With regards to watershed scale, WHI is positioned at the "bottom" of the Columbia River watershed in the broad, historic floodplain at the confluence with the Willamette River and its floodplain. The Columbia watershed is a vast area including multiple western states and British Columbia; obviously this watershed scale is not appropriate for WHI mitigation.

The City framework requires that any mitigation be within the Columbia River historic floodplain and limited to the two USGS defined reaches: Middle Tidal Flood Plain Basin and

Upper Tidal Flood Plain Basin (Simenstad, 2011). This geography is consistent with the Columbia River corridor portion of the fifth field HUC (10 digit: 1709001202). This extends downstream to the mouth of the Lewis River and upstream to Reed Island, which is just upstream from the mouth of the Sandy River. This area includes the Willamette River from its mouth to Multnomah Channel.

Viable on-site mitigation is the preferred approach by the City of Portland as well as other regulatory agencies. However, on WHI the remaining acreage outside the development footprint is comprised of high quality forests and other habitats with limited area and capacity to accommodate forest mitigation. There are some opportunities for forest enhancement on-site and the City supports pursuing these.

From a practical standpoint, onsite work is limited and cannot provide adequate mitigation for forest impacts. Therefore, the City framework assumes the most likely and beneficial location for mitigation is off WHI, but within proximity to the Willamette River confluence. Preserving this proximity allows the chance to replicate unique ecological functions provided by WHI's location, including support for at-risk species.

The City defines in-proximity as off WHI, but within five miles. Five miles was originally chosen to maintain a close proximity to the mouth of the Willamette River and based on best professional judgment of the habitat requirements of the overall assemblage of species found on the island. Following ODFW definitions and guidance, the City assessed home ranges for at-risk species with variable mobility and determined that a five mile range for in-proximity was appropriate.

Some of the 13 at-risk species in WHI forests are highly mobile while others are not. Northern red-legged frogs and white-breasted nuthatches ("slender-billed") have limited mobility and serve to help define in-proximity. Both are year round residents on WHI and have been documented to breed there. White-breasted nuthatch home ranges are 25-37 acres and a pair will spend all year within that territory (Grubb, 2008). Northern red-legged frogs are also year round residents on the island, breeding in wetlands and moving into adjacent forest where soil moisture is suitable (Rombough, 2011). Aside from occasional immigration or exodus, individual frogs will spend their entire lives on WHI.

In contrast breeding band-tailed pigeons are highly mobile and may move as much as 30 miles in a day during the breeding season (Sanders, 2006). However, ODFW guidance stipulates that the lowest mobility species should delineate in-proximity mitigation. Depending on the distance, it feasible that low mobility at-risk species (white-breasted nuthatch and Northern red-legged frog) may be able to colonize a very close proximity mitigation site from WHI.

It's more certain that more mobile at-risk species would be able to utilize an in-proximity site within five miles. Bald eagle breeding home ranges in the Lower Columbia Estuary average 8.38 *square miles* (Issacs and Anthony, 2006). This equates to 1.63 mile radius from a nest or center point of a circle. Therefore an in-proximity site within five miles would likely accommodate a WHI eagle's breeding home range, but an off-proximity site beyond five miles clearly would not. Although the eagle home range could justify a tighter distance than 5 miles, other ecological functions associated with confluence operate at a larger scale (corridor connection, assemblages of species and habitats). To best capture the suite of functions, the geographic limit for in-proximity is set at five miles.

Consistent with the ODFW definitions, off-proximity is then defined as greater than five miles from WHI.

4.2 Distance Modifier

WHI provides a singularly unique location at the confluence of two major Northwest rivers. Location of mitigation is a key consideration. The objective of the distance modifier is to provide a flexible geography in which to complete mitigation while adequately addressing how ecological function changes with location. It is an established best practice in natural resource mitigation that on-site ratios are lower and off-site ratios are higher.

Recognizing the limits of on-site forest mitigation, the framework adopts a three tiered geographic approach: on-site, in-proximity (within 5 miles of WHI), and off-proximity (> 5 miles, but within the two USGS defined Columbia River reaches). The intent of the in-proximity area is to maintain the influence of the river confluence area and the unique ecological functions associated with it. In-proximity mitigation also seeks to accommodate at-risk wildlife species with limited mobility per the ODFW guidance.

Table 1. The framework ratios relative to distance.

Mitigation Method	base ratio	on-site (base ratio ÷ 1.5)	in-proximity 0-5 mile from WHI (no multiplier)	off-proximity > 5 miles from WHI (base ratio x 1.5)
Re-establishment	2:1	1.3:1	2:1	3:1
Rehabilitation	4:1	2.6:1	4:1	6:1
Enhancement	8:1	5.3:1	8:1	12:1
Preservation	15:1	10:1	15:1	22.5:1

Anticipating that in-proximity is the best and most likely location for replacement of unique ecological functions, the base ratios for the framework are applied to in-proximity mitigation. The base ratios are then divided by 1.5 for onsite work. The objective for the on-site credit is to *prioritize and incentivize* mitigation on WHI with low ratios (i.e. 1.3:1 for re-establishment). To achieve a comparable effect for off-proximity, the base ratios are multiplied by 1.5. The intent of the off-proximity multiplier is to address limited mobility for certain at-risk wildlife species and recognize that unique functions associated with the confluence cannot be replaced.

The 1.5 multiplier is derived in part from Clean Water Services' (CWS) vegetated corridor mitigation requirements (CWS, 2007). The CWS program has refined and improved its approach for over a decade and is now an established best practice for regional mitigation. CSW's ratio table is included as Attachment B (and on page 6 of the City's framework). They

identify 4 distinct geographies related to drainage basins and ratios increase as one moves away from the impact site. CWS uses an additive factor to increase ratios as distance increases. The additive factors are larger for higher quality habitat (this is consistent with the DOE approach in that higher quality habitats warrant increased mitigation) The CWS ratio table and modifiers only address a single type of mitigation (re-establishment).

In evaluating the CWS approach, the City opted to use a modest multiplier for distance, rather than an additive factor. As mentioned earlier, an essential element of the City framework is the proportional relationship between mitigation methods and their associated ratios. An additive factor would unequally or disproportionally affect the ratios for different mitigation methods. A low multiplier of 1.5 maintains a simple, logical progression of ratios as the mitigation moves from on-site to in-proximity to off-proximity. For re-establishment the sequence is 1.3:1 for onsite, 2:1 for in-proximity, and 3:1 for off-proximity. The 1.5 multiplier also allows the framework to utilize a set of ratios for preservation that are within the acceptable range of 10:1 to 20:1 identified by the DOE. For preservation, the sequence is 10:1 for on-site, 15:1 for in-proximity, and 22.5:1 for off-proximity. Most importantly, the distance multiplier preserves the proportional relationship between mitigation methods.

5.0 Unique Ecological Functions Provided by Old Age of Impacted Stand

A review of aerial photography dating back to 1935 establishes the age of the impacted floodplain stand. The 1935 image (Attachment D) shows the forest stand with the same linear depressions that are wetlands within the forest today. The 1935 image also shows some small gaps in the canopy at the east end of the impact zone (east of the current dredge area). These gaps can be seen progressively filling in to their current full condition in later aerial photographs (i.e. 1948, 1977).

If one conservatively assumes the trees in the 1935 image are only 20 years old, then the vast majority of the stand is at least 100 years old. Using historic this historic imagery and on the ground surveys, staff therefore conservatively assume that the impact stand is 100 years old for the purposes of mitigation. Many of the unique ecological functions provided by the forest are derived from its advanced age and the conditions that it supports. Therefore 100 years is the time horizon for a newly planted stand to develop the target functions that are provided today.

The floodplain forest that will be lost on WHI contains some Oregon ash trees that are at least 150 years old. Oregon ash trees this old have previously been documented from only a few sites along the Lower Columbia River (BES, 2012). In addition to rare “old growth” Oregon ash specimens, the age and overall complexity of WHI impact forests provide unique conditions/functions that are the target for mitigation. Per the definition of temporal loss (below), mitigation is not complete until these target functions are provided. Unique conditions result from the presence of all the primary native vegetation layers, varied age classes, vegetation regeneration, deep leaf litter, and standing/downed wood. The health of the forest is reflected by the presence of 13 at-risk terrestrial wildlife species. A few examples of at-risk species follow; these can be considered surrogates (or “umbrella species”) for the hundreds of plants and animals that occur on WHI.

On WHI terrestrial dispersal of Northern red-legged frogs is concentrated in the older stand of trees that will be lost to development. This central stand on the island is older than forests to the west and south. As a result, the forest floor has a deeper, more developed layer of leaf litter that retains soil moisture better than younger stands where faster draining sandier soils are found. This older forest also surrounds the wetlands the frogs are using for egg laying. Because Northern red-legged frogs lack the ability to burrow or climb, they are restricted to moist soil surfaces (Rombough, 2011 & Rombough pers. comm.). This species can be expected to use the younger dryer stands on WHI during periods of active precipitation. However, the fact that they shun the younger stands on WHI (approx 60-70 years old) highlights the fact on a local riverine island with similar soils suitable conditions will not develop in a forest mitigation site for at least 100 years.

Bald eagles provide another example of how the advanced age of a forest provides critical functions. While many ecological functions are provided by a cottonwood tree as it matures, bald eagles in Oregon build nests in trees that are 42 – 67.2 inches diameter at breast height (dbh), or 3.5 - 5.6 feet in diameter (Issacs and Anthony, 2006). The City's memo on tree age documents several Oregon ash and black cottonwoods within the impact zone that are greater than four feet in diameter. Under typical conditions, a nine year old black cottonwood is about 7 inches dbh and a 60 year old is about 24-30 inches dbh (SWCA, 2007). As a forest mitigation site develops, Bald eagles will not able to utilize newly planted trees as nest sites until they are in the range of 80 to 100 years old.

Once cottonwood and ash trees have developed to full maturity, they will slowly senesce and convert into snags, then fall down and provide downed wood on the forest floor. Along with larger, older live trees, at-risk pileated woodpeckers rely on these snags and downed wood for nest and forage sites. Downed wood on the forest floor also provides microclimates utilized by many other organisms. Similarly, in older growth phases cottonwood and ash tree bark develops deep groves and interstitial spaces that are used by bats as roost sites (and many other organisms). At-risk bats also rely on cavities in old trees and hollowed out snags as roost habitat.

In summary, very large live trees and senescent elements (leaf litter, snags, downed wood) of a mature forest provide critical functions for at-risk wildlife species and these are some of the target functions for WHI forest mitigation. In other words, the mitigation site will not be ready for species of concern to "move in" for about 100 years.

5.1 Time Modifier

Best practices in natural resource mitigation mandate that mitigation must be tailored to specific project impacts. The permanent loss of area and specific functions inform the goals of project level mitigation. In addition to location, a consideration of timing is also essential.

> **Definition of temporal loss**
> "Temporal loss is the loss of functions between the time an impact occurs and the time the functions are re-established. In the context of wetland mitigation, it is the loss of functions that occurs between the time functions are lost at an impact site and the time those functions are fully replaced at a mitigation site." - Washington Department of Ecology, 2006

For WHI floodplain forest, many of the unique functions provided are a result of the advanced age of the impact stand. The long gap in time it will take for these conditions to develop at a mitigation site justify an additional consideration for temporal loss in the mitigation ratio. A mechanism to credit advanced mitigation is also needed.

- "Increases in mitigation ratios are appropriate under the following circumstances:
  - A long time will elapse between the loss of wetland functions at the impact site and establishment of wetland functions at the mitigation site.

- Reductions in mitigation ratios are appropriate under the following circumstances:
  - The proposed actions for compensation are conducted in advance of the impact and are shown to be successful."

- Washington Department of Ecology, 2006

DOE guidance emphasizes the mitigation ratios provided are starting point on which to evaluate mitigation needs. Factors such as the time horizon to attain desired replacement functions should be considered. As described earlier, the greater than 1:1 base ratios include a minimum consideration for temporal loss (Granger, 2005). However mitigation for a mature floodplain forest will take longer to develop than a typical wetland mitigation project, therefore an additional temporal factor is warranted. This approach is supported by the increase ratio in DOE table 1a for Category I forest wetlands which is 6:1 for re-establishment. This is a 50% increase over other Category I resources and twice that for Category II. The 6:1 forested wetland ratio in table 1a is 3 times what the City is using as re-establishment ratio for the framework (2:1). The 6:1 ratio is justifiable in the DOE guidance because forested wetlands are rare and they take longer to develop than other vegetation communities. Both of these concepts also hold true for WHI floodplain forests.

Another consideration with the temporal modifier is that floodplain forest *enhancement* actions will achieve desired functions much faster than re-establishment actions. Forest treatments that control invasive understory, re-establish a native shrub component, and inter plant native tree saplings are widely and successfully implemented in our region. If these enhancement actions are implemented well in advance of the impact, there is an opportunity to provide concurrent function where the mitigation site is fully functional prior to impact providing a temporal gain. This is the case with proposed forest enhancements and they are credited as temporal gains in the City's evaluation.

If floodplain forest re-establishment is implemented in advance there is a chance to reduce the temporal loss, but realistically its not possible completely eliminate the temporal loss. The framework is designed to credit advanced mitigation in this manner and credits have been applied to the proposed Government Island plantings based on the schedule provided by the Port.

The temporal modifier is additive and not a multiplier; it is either added or subtracted from the ratio. In the formula sequence, the temporal factor is added after the location modifier, so it is not multiplied or amplified beyond a factor of 1.0. The modifier is + 1.0 for loss and is based on the 100 year time horizon for floodplain forest development to desired function. This allows for increments of 0.1 per decade. The temporal gain modifier is – 1.0 for each decade of concurrent function provided (applicable to enhancement actions). It can also be applied as – 0.5 in case the desired function can be achieved within 5 years.

Table 2 – The Framework's Temporal Modifier. "Desired Future Condition" (or DFC) refers to the condition where a project has been fully established and is providing all the target functions.

temporal loss	temporal gain
+ 0.1 to for each decade until desired future condition attained	- 1.0 for each decade of concurrent desired future condition functions provided by advanced mitigation can also be expressed as: - 0.5 for every 5 years of concurrent desired future condition functions provided by advanced mitigation

Temporal credits and debits were applied following this method when the City evaluated the Port's proposed mitigation on Government Island as detailed in the City response (City of Portland, 2012). Although enhancement actions on WHI or Government Island were not proposed at that time, the temporal credit was applied to suggested enhancement options on WHI or Government Island that would help close the mitigation gap.

To summarize how these are applied: assume that today is year zero and the project impact is at year 30. An advanced forest re-establishment action is implemented today in year zero. It takes 100 years to achieve the desired functions. Because the impact is in year 30, the mitigation gets a 30 year jump start resulting in a 70 year gap from impact until the mitigation site achieves the target functions. The result is a temporal addition to the ratio of + 0.7. If the mitigation project were implemented at the same time as impact, the temporal addition would be the full +1.0.

In the same time scenario, a forest enhancement action is implemented today in year zero. Assuming the enhancement action takes 10 years to reach full functions, this will result in a 20 year overlap of concurrent function provided by both the mitigation site and impact site. For the two full decades of concurrent function a credit of – 2.0 is subtracted from the ratio.

As mentioned earlier, these time factors are added/subtract after the distance modifier so the effect is not amplified and it is limited to a maximum addition of + 1.0 to any ratio.

6.0 Island Mosaic Habitat Modifier

WHI is an estuarine island situated in the center of the Columbia river's main stem channel. Islands provide unique ecological features such as high ratios of shoreline to interior area and increased isolation from terrestrial disturbance and predation. Part of the objective of this modifier is to prioritize locating mitigation on an estuarine island in the Columbia River in order to replace ecological functions associated with the island landform.

The other objective of this modifier is to locate floodplain forest mitigation within a mosaic of estuarine floodplain habitats. The adjacency and natural integration of WHI's floodplain forest with shallow water, multiple wetland types, wide open herbaceous areas, and two Columbia River channels makes it significantly more valuable. This synergistic habitat

effect results in an ecological whole that is greater than the sum of its parts. The intent of this modifier is to recognize that a cottonwood/ash planting on a 50 acre plot bounded on one side by the river and three sides by warehouses would not have the same value as a 50 acre plot planted on a site like Government Island or Sauvie Island.

The City chose a 1.5 multiplier rather than an additive factor to preserve the proportional relationship among mitigation methods. The city combined these landscape considerations into a single multiplier and they are presented as an "or" choice in the framework. This means it only applies if neither criterion is met. In other words, a project does not need to meet both the island and habitat mosaic criteria (but this is ideal to best replace ecological function). A mitigation site could be on the mainland and within a mosaic and the modifier would not apply. And the site could be on island but not within a mosaic and the modifier would not apply. To date, this modifier has not been applied to any proposals.

7.0 Using Wetland Mitigation as a Model for the Floodplain Forest Framework

How can the City base most of its framework on wetlands when floodplain forests are a different habitat type? This is a reasonable question. Staff's process was to select programs with parallel conditions and extrapolate best practices to produce a sound, defensible approach. There are a number of good reasons and rationales for drawing from the wetland mitigation field. The guidance provided by DOE, the Corps and EPA is applicable for the following reasons:

1) The basic principles of mitigation are sound and based on best available science. There is a large body of scientific research that backs up these mitigation ratios.

2) The program quantifies the effort needed for different mitigation actions (preservation vs. enhancement vs. new planting). This provides flexibility and options to achieve mitigation by mixing and matching approaches.

3) The program addresses gaps in time and risk of failure. In applying the Mitigation Framework to WHI, City staff removed the risk of failure part of the ratio due to the Port's track record of success in mitigation projects.

4) The program follows established and widely accepted natural resource mitigation practices – not new experimental approaches.

5) The program addresses the rarity and quality of the habitat; the floodplain forests on WHI are an excellent example of a high quality habitat that is disappearing from the state and the Northwest.

6) Although the underlying principles are more important than the type of resource, wetlands are in fact an appropriate habitat to use as a basis for WHI forest mitigation because:

    i) Hydrology is a component of both floodplain forests and wetlands. The forest is essentially part of the river and this habitat type is only found in large river

floodplains. In a floodplain, ground water and surface water hydrology combine with soils to foster conditions needed to support this habitat's key plant species.

ii) This is an undeveloped floodplain forest. On sites such as this, wetlands are often naturally integrated into a floodplain forest greatly enhancing the forest's ecological value. On WHI there are 8 wetlands within the impacted forest, and 3 or 4 directly adjacent.

7) The DOE approach has an explicit method of quantifying natural resource mitigation, providing the City and Port with the ability to equitably replace target functions and improve upon them, thereby achieving a net gain in ecosystem function.

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Attachment A.

Table 1a from Publication #06-06-11a (WA Ecology, Corps, EPA). Details the framework of mitigation ratios; how these are applied varies project by project. Lower quality wetlands (Category IV, III) require lower ratios while higher quality (Category I, II) require higher ratios. Rare habitats like forested wetlands also push ratios higher (for example 6:1 to 24:1 depending on mitigation activity).

Table 1a. Mitigation ratios for western Washington.

Category and Type of Wetland Impacts	Re-establishment or Creation	Rehabilitation Only[21]	Re-establishment or Creation (R/C) and Rehabilitation (RH)[21]	Re-establishment or Creation (R/C) and Enhancement (E)[21]	Enhancement Only[21]
All Category IV	1.5:1	3:1	1:1 R/C and 1:1RH	1:1 R/C and 2:1 E	6:1
All Category III	2:1	4:1	1:1 R/C and 2:1 RH	1:1 R/C and 4:1 E	8:1
Category II Estuarine	Case-by-case	4:1 Rehabilitation of an estuarine wetland	Case-by-case	Case-by-case	Case-by-case
Category II Interdunal	2:1 Compensation must be interdunal wetland	4:1 Compensation must be interdunal wetland	1:1 R/C and 2:1 RH Compensation must be interdunal wetland	Not considered an option[22]	Not considered an option[22]
All other Category II	3:1	6:1	1:1 R/C and 4:1 RH	1:1 R/C and 8:1 E	12:1
Category I Forested	6:1	12:1	1:1 R/C and 10:1 RH	1:1 R/C and 20:1 E	24:1
Category I - based on score for functions	4:1	8:1	1:1 R/C and 6:1 RH	1:1 R/C and 12:1 E	16:1
Category I Natural Heritage site	Not considered possible[23]	6:1 Rehabilitation of a Natural Heritage site	R/C Not considered possible[23]	R/C Not considered possible[23]	Case-by-case
Category I Coastal Lagoon	Not considered possible[23]	6:1 Rehabilitation of a coastal lagoon	R/C not considered possible[23]	R/C not considered possible[23]	Case-by-case
Category I Bog	Not considered possible[23]	6:1 Rehabilitation of a bog	R/C Not considered possible[23]	R/C Not considered possible[23]	Case-by-case
Category I Estuarine	Case-by-case	6:1 Rehabilitation of an estuarine wetland	Case-by-case	Case-by-case	Case-by-case
NOTE: Typical ratios for preservation are discussed in Section 6.5.5.					

21 These ratios are based on the assumption that the rehabilitation or enhancement actions implemented represent the average degree of improvement possible for the site. Proposals to implement more effective rehabilitation or enhancement actions may result in a lower ratio, while less effective actions may result in a higher ratio. The distinction between rehabilitation and enhancement is not clear-cut. Instead, rehabilitation and enhancement actions span a continuum. Proposals that fall within the gray area between rehabilitation and enhancement will result in a ratio that lies between the ratios for rehabilitation and the ratios for enhancement (see Appendix H for further discussion).

22 Due to the dynamic nature of interdunal systems, enhancement is not considered an ecologically appropriate action.

23 Natural Heritage sites, coastal lagoons, and bogs are considered irreplaceable wetlands because they perform some functions that cannot be replaced through compensatory mitigation. Impacts to such wetlands would therefore result in a net loss of some functions no matter what kind of compensation is proposed.

Attachment B.

Mitigation Ratio Table from Design and Construction Standards Environmental Review Chapter 3 Sensitive Areas and Vegetated Corridors. Clean Water Services, Washington County, OR. June 2007.

Replacement Mitigation Ratios Required for Approved Encroachments into a Vegetated Corridor

Location of Replacement Mitigation	Condition of Vegetated Corridor to be Replaced		
	Good	Marginal	Degraded
On development site:	1:1	1:1	1:1
Off-Site:			
Less than 0.25 miles from site and within same drainage basin.	1.5:1	1:1	1:1
0.25 miles or more from site and within same drainage basin.	1.75:1	1.25:1	1.25:1
Different drainage sub-basin (Drainage sub-basin must be located within the Tualatin River Basin and no further than 1 mile outside the District's Boundary).	2:1	1.5:1	1.5:1

Attachment C.

Table 3. City of Portland WHI Floodplain Forest Mitigation Framework. Summary of base ratios and modifiers. Modified from 3/22/12 framework; risk of failure removed resulting in lower base ratios.

Mitigation Method	on-site base ratio ÷ 1.5	0-5 miles from WHI = no change to base ratio	for > 5 miles from WHI base ratio x 1.5	island mosaic site is on island and floodplain habitat mosaic = no change to base ratio	island mosaic site is not on island or a floodplain habitat mosaic base ratio x 1.5	temporal loss & gain modifiers = varies by project timeline
Re-establishment	1.3:1	2:1	3:1	2:1	3:1	varies
Rehabilitation	2.6:1	4:1	6:1	4:1	6:1	varies
Enhancement	5.3:1	8:1	12:1	8:1	12:1	varies
Preservation	10:1	15:1	22.5:1	15:1	22.5:1	n/a

Attachment D.