City of Bainbridge Island
PLANNING & COMMUNITY DEVELOPMENT

MEMORANDUM

TO: City Council

FROM: Libby Hudson, Long Range Planning Manager
Ryan Ericson, Associate Planner

DATE: August 11, 2011

RE: Herrera Environmental Consultants Memorandum documenting
Marine Shoreline Buffer Recommendation Discussions
City Council Special Meeting of August 16, 2011

The attached memorandum -has been provided by the City's scientific consultants, Herrera Environmental Consultants, -to assist the City in developing buffer recommendations as part of the Shoreline Master Program Update process. The memo is intended to be utilized by the citizen workgroups, Planning Commission and City Council in reviewing and updating the vegetation conservation buffer and management standards.

This memo is informed by the science summarized in two documents that the City commissioned, the *Nearshore Assessment Summary of Best Available Science* (Battelle, October 2003) and the *Summary of Science Addendum* (Herrera, 2011). The memo reflects the outcome of buffer requirement discussions with Herrera and City staff, the requirements of the state Shoreline Master Program (SMP) Guidelines (WAC 173-26), and the policy direction of the citizen workgroups. In respect to vegetation conservation for the SMP Update, the state Guidelines [WAC 173-26-201(3)(d)(viii) and 173-26- 221(5)(b)] direct that the City should:

- Identify measures and regulations that address conservation of vegetation and ensure that new development meets vegetation conservation objectives;
- Assure no net loss of shoreline ecological functions and ecosystem-wide processes through a variety of measures, including setback and buffer standards;
- Identify ecological processes and functions of vegetation that are important to the local aquatic and terrestrial ecology and provide measures that conserve sufficient vegetation to maintain these functions;
- Vegetation conservation areas are not necessarily intended to be closed to use and development, but should provide for management of vegetation in a manner adequate to assure no net loss of shoreline function.

The City's existing SMP utilizes vegetation buffers known as Native Vegetation Zones (NVZ). The policy direction from the SMP Vegetation Conservation Workgroup suggests that in updating these buffers, the City should:

- Protect and restore shoreline vegetation to maintain and enhance ecological functions, human safety, personal property protection, and shoreline views and vistas. (Vegetation Conservation and Management Zones Draft Goal); and
- Establish shoreline vegetation conservation and management zones immediately upland of ordinary high water mark (OHWM) for each shoreline use and shoreline characterization, recognizing the pattern of development, shoreline ecological and ecosystem wide processes, and using current science and technical information, as described in WAC 173-26-201(2)(a). (Vegetation Conservation and Management Zones Draft Policy #6).

Developing Marine Shoreline Buffer Recommendations

The process used to develop the memorandum and the suggested range of buffers included several stages and was completed during a series of discussions with the consultant team and staff, including the following:

1. Reviewing the science related to buffers (summarized at the beginning of the memo, page 1). This was completed by Herrera.

2. Developing a concept for a two-zoned management area (buffer) that is comprised of a more protective (and more restricted use and activity) zone adjacent to the OHWM, and a more flexible zone (allowing minimal use, activity and alteration to vegetation) situated within the remaining portion of the management area. This concept is described on page 6 of the Herrera memo, under *Marine Shoreline Buffer and Riparian Protection Zone Recommendations*. The two-zoned management area concept was developed with Herrera and City staff, first agreeing on principles that met the SMP Guidelines and the policy direction of the citizen workgroup. These are outlined in the section *Agreed Principles,* page 9 of the Herrera memo.

3. Developing dimensional recommendations. The *Buffer Considerations and Recommend*ations section of the memo, page 11, was developed using the two-zone concept and developing principles that are informed by the science and the characteristics of the Bainbridge Island shoreline. Widths were then established for the management areas and applied to the proposed shoreline designations, (Table 1, page 12). This was completed by Herrera and modified by City staff to reflect the policy direction of the citizen workgroups and the proposed shoreline designation map.

Terminology

Vegetation conservation is important for managing and retaining shoreline vegetation in both the state SMP Guidelines and in the City's existing SMP (which included Native Vegetation Zones established for all shoreline designations). These management areas are intended to protect shoreline functions, primarily related to vegetation. In the scientific literature and within local shoreline master programs, these areas might be called different names, including "buffers", "setbacks" or "management areas". This can be confusing since the terms for different management tools are frequently interchanged. Technical and scientific literature refer to buffers as relatively undisturbed areas that protect ecologically sensitive areas, while planning and regulatory terminology often allows some limited disturbance of the buffer area. This document uses the planning and regulatory definition of buffers.

As a management tool, these protective areas have the following in common: the area is a designated dimensional area situated along the shoreline, measured from the OHWM landward, with adopted regulations that limit uses and activities within these areas. The width of this area may be a fixed width or a flexible width (as is proposed here).

The Herrera memo uses terminology for this protective area, describing it as a marine shoreline buffer or *Standard Buffer*, that includes an inner zone, the *Riparian Protection Zone* (RPZ), which is measured adjacent to the OHWM.

These terms are slightly different in the draft Vegetation Conservation and Management Zones regulations, in which the entire buffer is called the *Standard Shoreline Buffer* (SSB) and is comprised of two zones, the *Riparian Protection Zone* (RPZ) and the *Marine Shoreline Zo*ne (MSZ).

Revised Memorandum

The Herrera Memorandum was revised on August 11, 2011 to provide additional clarification and to correct or clarify some citations used in the document.

Herrera Environmental Consultants, Inc.

Memorandum

To Ryan Ericson, Associate Planner, and Libby Hudson, Division Manager
City of Bainbridge Island

From Amanda Azous, José Carrasquero, and Jeff Parsons,
Herrera Environmental Consultants;
Lisa Grueter, BERK

Date August 11, 2011

Subject Documentation of Marine Shoreline Buffer Recommendation Discussions

The following discussion documents thoughts and considerations with respect to marine shoreline buffers for different shoreline use designations. The discussion is based on a review of the City of Bainbridge Island's (City) existing marine shoreline buffer regulations, the City's shoreline character, nearshore assets, existing and future land uses, scientific recommendations for marine buffers, as well as discussions with City staff. This memo begins with describing what a marine shoreline buffer is and how it differs from a riparian area; followed by a summary discussion of science-based buffer recommendations; and closes with buffer recommendations for the City's shoreline management plan update. For reference, marine shoreline buffer widths currently required by the City's shoreline regulation are provided in Attachment A, and are taken from Chapter 16.12 BIMC.

Marine Shoreline Buffers and Riparian Areas

Marine shoreline buffers are used in the City to regulate areas to protect the marine nearshore from the effects of land use activities (such as construction of buildings, driveways, and other infrastructure). Marine shoreline buffers may have variable widths, and use restrictions generally apply uniformly to the entire buffer area. This discussion in part serves to distinguish the concept of a marine shoreline buffer from that of a riparian area, which is an integral part of an aquatic ecosystem and, therefore, requires a more protective level of regulation.

A riparian area differs from a marine shoreline buffer in that it specifically refers to the terrestrial ecosystem directly adjacent to the marine nearshore that interacts with the aquatic environment. For example, intact riparian areas have native plant communities comprised of varying species of herbs and grasses, shrubs, deciduous trees, and coniferous stands of various ages and they are integral to the proper functioning of the nearshore. Native plant species are those species that occur or historically occurred on Bainbridge Island before European contact based upon the best available scientific and historical documentation.

Key functions supplied by riparian areas include providing large woody debris (LWD), bank stability, marine species food sources such as detritus and insects, and temperature moderation of

beach substrate. This includes providing an overhanging, complex network of branches, trunks, stems and roots that act to moderate nearshore wave energy. In contrast, marine shoreline buffers may include non-native landscaping, vegetable gardens, and lawns as well as possibly, native vegetation communities.

Because the functions provided by a riparian area are fundamental to maintaining a healthy functioning marine nearshore, it is recommended that the City designate a riparian protection zone (RPZ) with more restricted uses and assign a separate marine shoreline buffer to protect the RPZ. This would be done to protect such areas that are currently intact, and to establish an RPZ where such areas do not currently exist such as when properties re-develop, remodel or otherwise expand development. The RPZ would be treated as a conservation area to preserve the essential relationship between nearshore and shoreline ecological functions.

Some activities allowed within the RPZ would be weed removal, hazardous tree or limb removal, or shoreline oriented uses that are a high priority such as water dependent uses on private parcels or nearshore access and water enjoyment uses in public park areas.[1] This approach will help to ensure the protection of what remains of the City's intact riparian areas and will facilitate and provide more flexibility for uses within marine shoreline buffers. Policies, incentives and regulations that support restoration of riparian areas (such as through restoration of native plant communities) would benefit increases in nearshore habitat and functions and assist with showing no net loss.

Scientific Importance of Marine Shoreline Buffers and Riparian Areas

Sustaining habitats and species requires protection of the ecological functions and processes that support survival and population success, in addition to the direct protection of the habitats themselves. Without adequate habitat protection, ecological functions and key natural processes become degraded. In response to this risk, scientifically based recommended buffer widths and site-specific methods for determining buffers have been established in several sources. These sources were reviewed and reported in the City's Addendum to the Summary of Science Report (Herrera 2011) and are briefly summarized here.

Marine Shoreline Buffers

Factors relevant to the effectiveness of marine shoreline buffers, or of a given buffer width, include the type and intensity of surrounding land development and activities, influence of groundwater, stability of slopes or bluffs, soils, types of pollutants and their sources, vegetation dynamics (such as type and density), and driftwood characteristics or other habitat features that might affect the functions and values of the buffer (see for example Brennan et al. 2009). For example, slopes that are more susceptible to massive failure may require a larger buffer, particularly if existing development is contributing to an increased rate of erosion such as from poor stormwater management and a lack of stabilizing vegetation. Feeder bluffs contributing to

[1] Allowances in the RPZ are more fully discussed in recommendations starting on page 6.

spawning beaches may require a larger buffer in order to protect future development while also decreasing the future need for shoreline armoring. Parcels with marshes, lagoons, or spit / barrier / backshores likewise may require wider buffers to protect these important ecological features. Steep slopes comprised of bedrock (relatively rare in the City) or stable high bluffs (greater than 5 meters) may allow for a narrower buffer as slope stability and sediment sources would not be impacted by development.

Much of the existing riparian and buffer literature is related to freshwater systems therefore, the Aquatic Habitat Group (AHG)[2] established a technical panel of scientists in 2008 to assess the freshwater riparian scientific literature to determine its applicability to marine shoreline systems and to review available marine shoreline scientific literature where it existed. The result of the literature review, and the Marine Riparian Workshop Proceedings conducted by the scientific panel in 2008 was a consensus that freshwater riparian buffer research was conceptually applicable to marine shorelines (Brennan et al. 2009).

The data provided by the WDFW panel (Brennan et al. 2009) suggest that necessary buffer widths to achieve a high level of functional effectiveness may vary considerably depending on the site-specific characteristics and the functions to be protected. For example, in order to achieve at least 80 percent effectiveness at removing pollutants from stormwater runoff, recommended buffers varied from as little as 16 feet to as large as 1,969 feet depending on the slope, depth and type of soil, surface roughness, density of vegetation and the intensity of the land use. Buffer widths for organic matter contributions (such as plant litter and terrestrial insects) ranging between 16 and 328 feet from the shoreline, depending on site conditions, were reported by Bavins et al. (2000) for providing this function. Buffers to protect the large woody debris function important to habitat structure and shoreline stability were suggested to be between 33 and 328 feet. However, given that trees located 300 feet landward from the edge of a bluff or bank would not immediately be recruited to the beach, consideration should be given to the site's potential tree height and the current and expected rate of bluff or bank retreat when establishing buffers for providing large woody debris.

Brennan et al. (2009) found that buffer widths to support a number of specific riparian functions were identified by May (2003) and Knutson and Naef (1997). May recommended 98 feet for fine sediment control, and shade and microclimate control and 164 feet for the LWD function. Knutson and Naef recommended 138 feet for fine sediment control, 90 feet for temperature moderation, and 147 feet for LWD and litter fall functions. The panel's review indicated that recommendations for wildlife habitat protection ranged from 50 feet (specific to highly rural areas) to 328 feet.

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[2] In 1999, the governor's Salmon Recovery Office commissioned the Departments of Fish and Wildlife (WDFW), Ecology, and Transportation (WSDOT) to develop technical assistance guidance for those who want to protect and restore salmonid habitat. The scope of the program has recently broadened and now includes the promotion, protection, and restoration of fully functioning marine, freshwater, and riparian habitat through comprehensive and effective management of activities affecting Washington's aquatic and riparian ecosystems. Participation in the project has also expanded with the addition of the Washington Department of Natural Resources (DNR), Interagency Committee for Outdoor Recreation (IAC), the United States Army Corps of Engineers (USACE) and the United States Fish and Wildlife Service (USFWS) to the list of contributing agencies.

Riparian Areas

An extensive body of research and literature has emerged over the last three decades which documents the specific importance of riparian areas in providing ecological functions related to waters of the state. These functions include the following (Romanuk and Levings 2010; Brennan et al. 2009; Lemieux et al. 2004):

- Water quality maintenance
- Fine sediment control
- Large woody debris delivery and retention
- Microclimate moderation
- Nutrient delivery and retention
- Terrestrial carbon source to nearshore food webs
- Fish and wildlife habitat creation and maintenance
- Direct food support for juvenile salmonids
- Hydrologic based slope stability

There is consensus in the scientific community that marine riparian areas are critical to sustaining many ecological functions (Desbonnet et al. 1994; Brennan and Culverwell 2004; Lemieux et al. 2004; Brennan et al. 2009). Marine riparian shoreline vegetation is an important component of nearshore habitat throughout the Puget Sound region (Herrera 2007; Lemieux et al. 2004; Levings and Jamieson 2001; Redman et al. 2005) and includes both upland forested plant communities occurring on the shoreline as well as unique vegetation found only in the marine nearshore (Lemieux et al 2004). Riparian areas contain elements of both aquatic and terrestrial ecosystems that mutually influence each other (Knutson and Naef 1997; Fresh et al. 2004; Lemieux et al. 2004). For example, juvenile salmon consume terrestrially derived carbon which can extend into the low intertidal zone (Romanuk and Levings 2010), and salmon are well known conduits for returning marine derived nutrients into freshwater systems (Chaloner et al. 2002; Wipfli 2003). Beach wrack and detritus accumulated in driftwood and tree fall in the nearshore zone, provide both terrestrial and marine derived food sources for invertebrates, fish, birds, and other organisms (Lewis 2007; Brennan et al. 2009). Riparian vegetation also provides contributions of organic matter, moisture, and nutrients that assist in the establishment and maintenance of estuarine marsh plants (Eilers 1975; Williams and Thom 2001).

These interactions between riparian vegetation and the marine aquatic environment are important to the survival and population success of numerous species that depend on marine habitats. Conservation efforts which, preserve the natural processes of detritus and nutrient conveyance, and organic debris accumulation from riparian areas, are therefore important to the marine environment. The establishment of significant protection for marine riparian areas is an important management strategy for protecting marine habitat conservation areas.

In literature reviews conducted to evaluate the potential impacts of removing riparian vegetation on numerous sensitive species, several mechanisms of impact have been identified (Herrera 2007). The degree of impact to the aquatic environment depends upon the magnitude of the vegetation removal or alteration (such as size and number of trees affected, and total area cleared of vegetation). At more severe levels, riparian vegetation modification could result in the

following impacts, which would have subsequent implications for species survival and overall habitat condition:

- **Altered shade and temperature regime:** Caused by direct removal of vegetation.
- **Reduced bank and shoreline stability:** Caused by degradation of riparian vegetation, loss of vegetative cover and root cohesion, and reduced resistance to erosion. This may in turn affect aquatic habitat by increasing suspended sediments and altering riparian habitat structure.
- **Altered organic material contributions:** Caused by reduced source of leaf litter, woody debris, terrestrial insects, and other biota.
- **Altered habitat complexity and increased habitat fragmentation:** Caused by removal of native vegetation and creating habitat favored by invasive species.

There are geologic constraints on the type and density of vegetation that can establish on some areas of marine shoreline. For example, many bedrock shorelines are limited in the development of functional densities of vegetation. This is particularly relevant along the southern shoreline of the City where bedrock and overconsolidated sediments are common.

It has been shown that detritus feeding organisms may not be adapted to the leaf fall patterns or the chemical characteristics of leaves from non-native trees suggesting that riparian areas are most effective when comprised of native vegetation (Karr and Schlosser 1977). In addition, native plant species have adapted to local physical conditions such as soil, geology, and climate and therefore require less maintenance, are resistant to most pests and diseases, and require little or no irrigation or fertilizers, once established. Thus maintaining native plant species in marine riparian areas can also have consequent benefits on maintaining water quality.

In a meta-analysis review of 73 peer-reviewed studies of vegetated buffer efficacy in protecting water quality, Zhang et al. (2010) reported that forested buffers were generally found to remove more nitrogen (a limiting nutrient in marine waters) as well as phosphorus than grassed buffers. For areas with slopes up to 10 percent, predicted sediment removal efficiencies for a 33-foot (10-meter) vegetated buffer ranged from 76 to 100 percent. Removal efficiencies for nitrogen were 71 to 85 percent, and for phosphorus were 69 to 98 percent. Steeper slopes had declining removal rates.

By maintaining bank stability and contributing large wood to the aquatic environment, riparian vegetation forms and maintains habitat complexity. Riparian vegetation and large wood improve beach stability and contribute to roughness and sediment trapping (Brennan and Culverwell 2004; Gonor et al. 1988; Herrera 2005). This includes improved capacity of beaches to retain sand, a crucial substrate for forage fish spawning (Pentilla 2007).

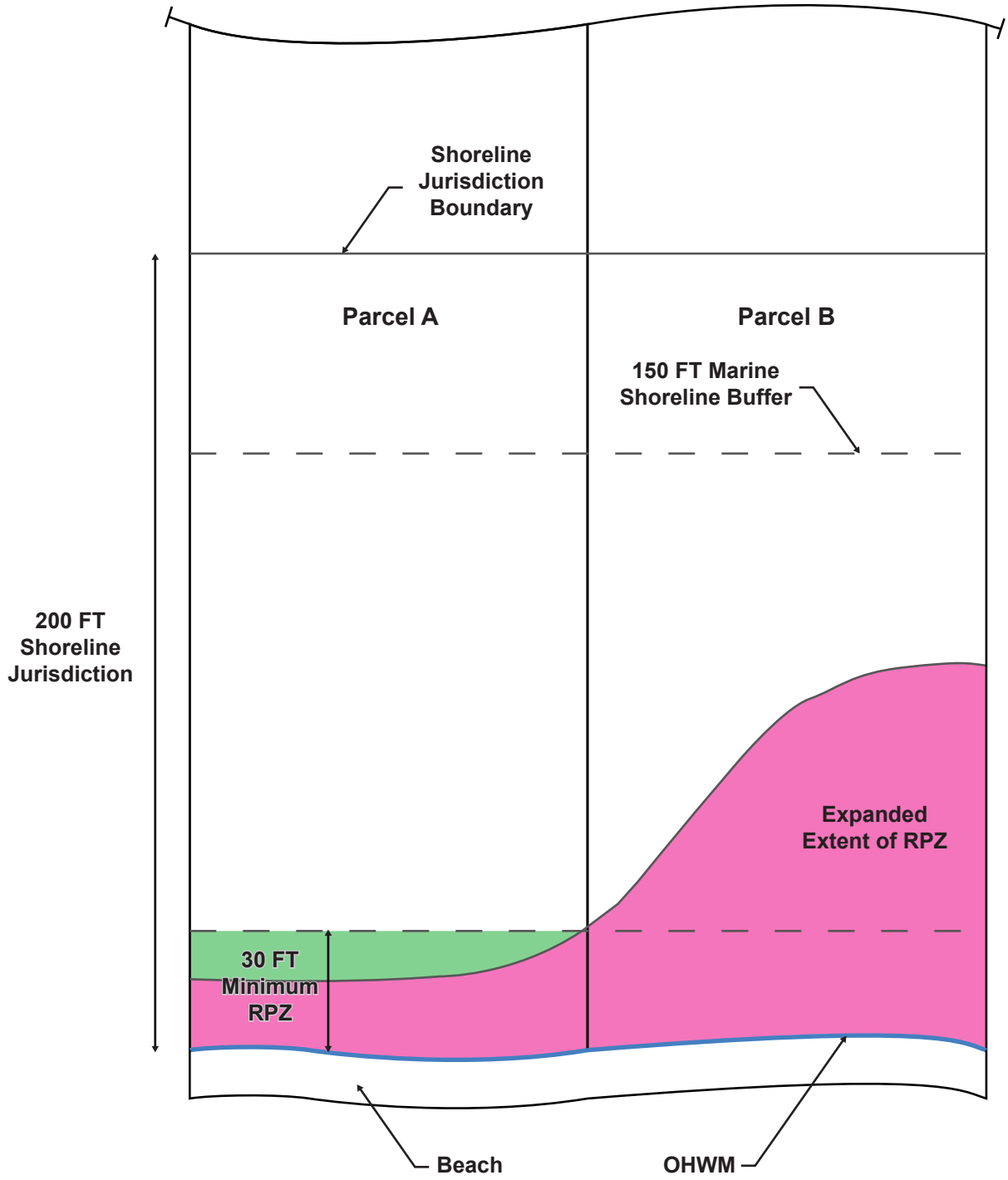
Herrera (2005) suggested that driftwood and tree fall at the top of the beach may also stabilize the upper beach area by slowing littoral drift and reducing wave-induced erosion). It has been suggested that estuarine wood can affect water flow and the subsequent formation of bars and mudbanks (Gonor et al. 1988). The contribution to habitat complexity along marine shorelines may be maximized if trees that fall to beaches remain in place (Herrera 2005).

Marine Shoreline Buffer and Riparian Protection Zone Recommendations

City of Bainbridge Island shorelines are predominantly developed (over 82 percent [Battelle 2003]) which limits the City's ability to require wide buffers that are protected through regulation as conservation areas. Therefore, our recommendations have focused on protecting intact riparian habitat by limiting uses within this ecologically important zone, allowing for a less restrictive marine shoreline buffer landward of the riparian area that would protect the RPZ as well as provide some buffer functions; and by suggesting the City provide regulatory thresholds and landowner incentives to restore native riparian habitat whenever possible. In addition, the recommendations are informed by the City's desire to limit the number of non-conforming structures therefore, existing distances to residential structures from the shoreline are considered. These agreements and assumptions are described in *Agreed Principles* on page 8 and *Buffer Considerations and Recommendations* on page 10.

We recommend that in areas with existing properly functioning riparian habitat, the RPZ would be a minimum of 30 feet but it could extend up to the full width of a standard marine shoreline buffer if intact native riparian vegetation were present. This recommendation is based on the minimum area necessary to achieve a measure of riparian functions including protecting water quality, and providing shade, microclimate moderation, LWD, litterfall and insect food sources (Christensen 2000; Bavins et al. 2000; Zhang et al. 2010). Any areas not comprised of intact native riparian vegetation would be limited by the provisions of a standard marine shoreline buffer for the shoreline use designation. In areas entirely lacking native riparian vegetation, the City would still establish a minimum 30-foot RPZ zone and, as parcels meet re-development thresholds, the City would require that native vegetation be established within the minimum 30-foot RPZ. In the Natural shoreline designations, the RPZ would be a minimum of 100 feet because of the heightened ecological values found in these areas and their absence of existing development.

Figure 1 illustrates two typical parcels (for this example, they are located within a Shoreline Residential Conservancy use designation) where intact native vegetation varies between 20 feet and 95 feet. For these parcels, the RPZ would range from 30 to 95 feet. In the area currently lacking native vegetation within the 30-foot minimum RPZ, landowners would be required through mitigation, or encouraged through incentives to restore native plant species as described above. In cases where riparian habitat is restored such as to provide mitigation for development impacts or in response to Shoreline Restoration Plan recommendations, such activities could potentially provide the City with no net loss of shoreline ecological functions and potentially a net gain.



Legend

- Extent of Native Vegetation
- Area to be Restored Over Time

Shoreline Use Designation: Shoreline Residential Conservancy
Lot type: Deep (greater than 200 feet)
Bank type: Low

Figure 1.
Example of Riparian Protection Zone (RPZ)

N

0 20 40 80
Approximate scale in feet

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Marine shoreline buffers are recommended to be specific to each shoreline use designation and to be as wide as possible to provide as much protection as is feasible with consideration of existing structure setbacks from the shore.

Agreed Principles

Following is a list of generally agreed on principles.

1. Buffer recommendations are policy driven as well as science based. The City's land use patterns, public access, and public uses of the shoreline are considered factors.

2. The ability of a buffer to provide multiple functions and benefits is closely linked to its width, although other factors such as topography, slope, vegetation (type and condition), soil type, and buffer management also determine its effectiveness. In general, wider buffers are more protective of nearshore resources.

3. Buffers widths could be established on each reach or within a management area based on site-specific characteristics. The type and condition of riparian vegetation (coverage of native forest and shrubs) or upland topography (high bluff/low bank) will guide the buffer width as well as adjacency to important ecological features such as marshes, lagoons, and spit / barrier / backshores. Other factors that could be considered include soil type, slope, degree of anthropogenic disturbance, and adjacent land uses.

4. Buffer widths can vary but should have a more protective inner zone such as the suggested RPZ that protects native riparian vegetation and could have a more permissive outer zone where decks, gardens, and some amount of impervious area is allowed potentially contingent on use of Low Impact Development stormwater management techniques.

5. The goal of the RPZ is to protect native vegetation to the extent possible, however limited water dependent uses would be allowed due to their intrinsic need to be in-water or at the water's edge.

6. Protection and restoration of the RPZ is also intended to provide habitat connectivity such that over time there would be long stretches of native riparian habitat along the City's shore. Therefore, where intact native vegetation is present wider buffers are recommended for some use designations.

7. The RPZ would allow for limited development, subject to a maximum of 300 square feet or 10 percent of the RPZ whichever is less, of structures

per parcel related to water dependant uses such as boathouses, ramps, and stairways to the beach. In addition, one 4-foot wide trail would be allowed for beach access. Structures or trails exceeding those thresholds would require a variance.

8. While there will be prescriptive standards, flexibility will be achieved by a marine shoreline buffer range that considers different development conditions and uses, and by allowing an option for a qualified professional to prepare a habitat management plan or "critical areas stewardship plan" similar to Jefferson County's SMP example.

9. Properties along the Aquatic Conservancy use designation would not be allowed to have reduced buffers.

10. Properties within a Natural Area use designation would be prohibited from any shoreline development in the RPZ except for one 4-foot wide trail for beach access.

11. When a project will result in impacts and require mitigation measures, the mitigation would include restoration of the native plant ecosystem. For example mitigation activities could include re-establishing native dune grasses, forests or other habitat communities, as natural conditions would warrant for the site.

12. Lots may be provided an exception to buffer standards (e.g., lots less than a certain depth where the combination of setbacks and typical building footprint would not allow for use of the property).

13. Buffer averaging allowing variable widths would provide flexibility and can be protective of nearshore functions and resources.

14. Existing developed properties with wider shoreline parcels would be allowed to have variable buffer widths (narrower in front of existing structures and wider when moving laterally from the building and perpendicular from the shoreline).

15. We note that critical saltwater environments are based on presence of primary species which means most if not all of the City shoreline areas need some level of nearshore habitat protection (based on WAC173-26).[3]

[3] **From 173-26 WAC:** Critical saltwater habitats include all kelp beds, eelgrass beds, spawning and holding areas for forage fish, such as herring, smelt and sandlance; subsistence, commercial and recreational shellfish beds; mudflats, intertidal habitats with vascular plants, and areas with which priority species have a primary association. Critical saltwater habitats require a higher level of protection due to the important ecological functions they provide. Ecological functions of marine shorelands can affect the viability of critical saltwater habitats. Therefore, effective protection and restoration of critical saltwater habitats should integrate management of shorelands as well as submerged areas.

Buffer Considerations and Recommendations

To bracket the range of various buffer widths from the scientific literature, we considered the following:

- Existing development regulations
- Future land use
- The City's existing environmental buffers
- Existing shoreline character (physical & biological) and nearshore assets
- Recently adopted marine shoreline management plans from Puget Sound jurisdictions
- A review of the distance of existing residential structures from the OHWM (to consider the City's desire to limit the number of new non-conforming structures)

Table 1 shows the mean, median, and standard deviation of the distance between the ordinary high water mark (OHWM) and existing primary residential structures for each shoreline use designation as determined by a GIS analysis of 2009 aerial photographs of land cover on the City's shorelines (data provided by the City). These distances were used to identify typical existing conditions for each proposed use designation.

Table 1 also indicates the suggested RPZ and marine shoreline buffer widths for each proposed use designation that resulted from our review of scientific literature, the City's existing shoreline regulations, existing shoreline character, the distance of existing structures from the shoreline, nearshore assets, existing and future land uses, and discussions with City staff. A minimum and a maximum marine shoreline buffer is offered that would vary based on existing parcel conditions where shallow lots (lots less than 200 feet from the OHWM) or high bluff shoreline parcels would have narrower buffers and deeper lots (lots greater than 200 feet from the OHWM) or those with 65 percent coverage of native trees and shrubs within the RPZ, low banks, marshes, lagoons or spit / barrier / backshores would have wider buffer requirements. The table also distinguishes buffer requirements for developed lots versus undeveloped lots in the Shoreline Residential Conservancy use designation. Existing City regulations require a 115-foot buffer on estuarine wetlands. That requirement is recommended for developed lots in the Shoreline Residential Conservancy use designation in order to reduce the number of non-compliant structures, and it is expanded to 150 feet for undeveloped lots in order to advance shoreline protection when future development occurs.

Figure 2 illustrates an example configuration of the RPZ and marine shoreline buffer for a parcel with low bank waterfront, 65 percent canopy cover, and a Shoreline Residential use designation.

The recommendations do not distinguish between water-oriented and non-water oriented uses. Allowances for water-oriented uses would be part of the formal code development process.

Table 1. Suggested Range of Riparian Protection Zones and Marine Shoreline Buffers by Use Designation.[a]

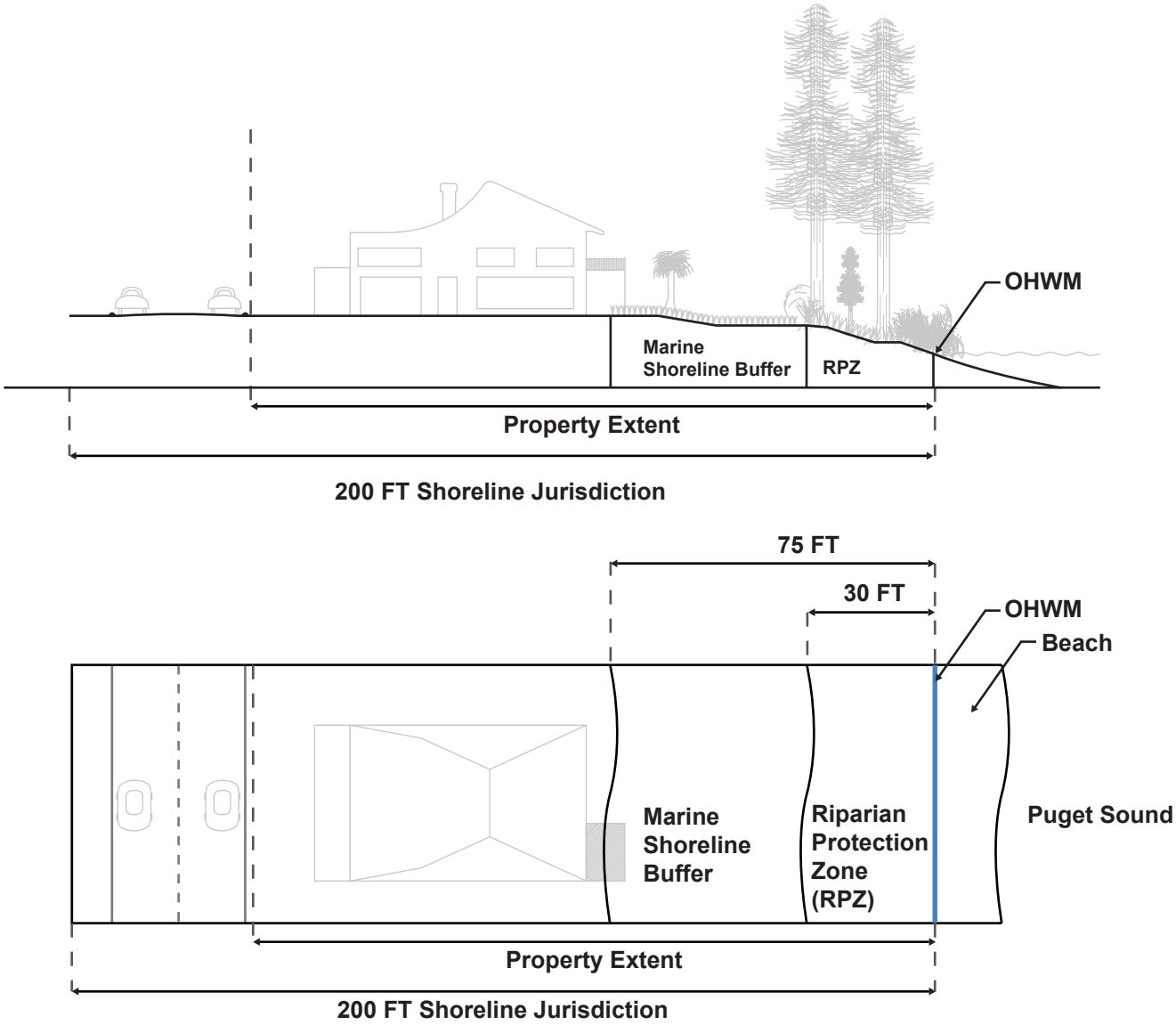
Existing Distances from Shoreline to Primary Residential Structures (use designations are **bold**)	Riparian Protection Zone (RPZ) (inner buffer zone)	Minimum Standard Buffer (encompasses inner RPZ and outer marine shoreline buffer)	Maximum Standard Buffer (encompasses inner RPZ and outer marine shoreline buffer)
Urban Mean 59.8 feet Median 20.1 feet STD 72.1 feet	Minimum 30 feet from OHWM	Minimum 30 feet from OHWM [b]	30 feet from OHWM [b]
Shoreline Residential Mean 69.7 feet Median 60.2 feet STD 46.2 feet	Minimum 30 feet from OHWM up to standard buffer width	Condition: Shallow lots [c] or high bluff Standard Buffer: 50 feet from OHWM [b]	Condition: 65% coverage of native forest and shrub vegetation in RPZ [d], and low bank, or marshes, or lagoons, or spit / barrier / backshores Developed - Standard Buffer: 75 feet from OHWM Undeveloped - 75 feet from OHWM unless adjacent to Aquatic Conservancy then 150 feet
Shoreline Residential Conservancy Mean 88.2 feet Median 86.3 feet STD 55.9 feet	Minimum 30 feet from OHWM up to standard buffer width	Condition: Shallow lots [c] or high bluff Standard Buffer: 75 feet from OHWM [b]	Condition: 65% coverage of native forest and shrub vegetation in RPZ [d], and low bank, or marshes, or lagoons, or spit / barrier / backshores Standard Buffer: 115 feet from OHWM for developed lots 150 feet from OHWM for undeveloped lots
Island Conservancy Mean 144.9 feet Median 180.8 feet STD 62.9 feet	Minimum 50 feet from OHWM up to standard buffer width	Condition: Shallow lots [c] or high bluff Standard Buffer: 100 feet from OHWM [b]	Condition: Deeper lots [c], low bank, marshes, lagoons, spit / barrier / backshores Standard Buffer: 150 feet from OHWM
Natural Mean 145.3 feet Median 169.7 feet STD 53.8 feet	Minimum 100 feet from OHWM up to standard buffer width	Condition: High bluff Standard Buffer: 200 feet from OHWM [b]	Condition: Low bank or feeder bluff, marshes, lagoons, spit / barrier / backshores Standard Buffer: 200 feet from OHWM [b]

[a] The suggested minimum and maximum buffers are based on existing distances to residential structures from the shoreline in addition to science-based recommendations for shoreline and nearshore protection. The suggested ranges could be refined further based on additional GIS based analysis of City shoreline conditions.

[b] Or 50 feet from edge of geologic hazard; whichever is greater.

[c] Shallow lots measure 200 feet or less from the OHWM and deeper lots measure greater than 200 feet from the OHWM.

[d] 65 percent coverage of native forest and shrub vegetation in the RPZ based on the 2009 aerial image or an approved clearing permit since 2009.



Shoreline Use Designation:	Shoreline Residential
Lot type:	Deep (greater than 200 feet)
Bank type:	Low

Figure 2.
Example Configuration of RPZ in Relation to Marine Shoreline Buffer

N

0 20 40 80

Approximate scale in feet

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ATTACHMENT A

Current Marine Shoreline Buffer Requirements and Allowed Buffer Uses in the City of Bainbridge Island

Current Marine Shoreline Buffer Requirements and Allowed Buffer Uses in the City of Bainbridge Island

16.20.130 Fish and wildlife habitat conservation areas:

C.1. Development standards for marine critical areas are defined in the city's shoreline master program, Chapter 16.12 BIMC and are summarized in SMP Table 4-2 below.

SMP Table 4-2. Use-related Development Standards Matrix from Chapter 16.12 BIMC.

Key (See Key in Table 4-1) of current SMP

	Upland Environments				
Development Standards	Natural	Conservancy	Rural	Semi-rural	Urban
Aquaculture					
Setback					
Water-dependent	N/A	0	0	0	0
Water-related	N/A	25	25	25	25
Nonwater-oriented	N/A	100	100	100	100
Upland	N/A	30	30	30	30
Boating Facilities					
Setbacks					
Accessory structures	N/A	50	N/A	50	25
Water-dependent	N/A	0	N/A	0	0
Dry moorage	N/A	N/A	100	100	100
Height Limits					
Dry Moorage	N/A	N/A	N/A	30	30
Buildings	N/A	N/A	20	20	20
Commercial					
Native vegetation zone (from OHWM)					
Water-dependent	N/A	N/A	N/A	0	0
Water-enjoyment	N/A	N/A	N/A	50	25
Nonwater-oriented	N/A	N/A	N/A	50	50
Buildings	N/A	N/A	N/A	30	30
Forest Practices					
Native vegetation zone:	N/A	N/A	100	100	100
Industrial Development					
Native vegetation zone (from OHWM)					
Water-dependent	N/A	N/A	N/A	N/A	0
Water-related	N/A	N/A	N/A	N/A	25
Recreational Development					
Native vegetation zone					
Nonwater-oriented, general	N/A	200	200	200	100

Development Standards	Upland Environments				
	Natural	Conservancy	Rural	Semi-rural	Urban
Campsites, picnic areas, and related	N/A	50	50	50	25
Access roads, restrooms, and accessory structures	N/A	75	75	75	50
Parking	N/A	100	100	100	50
Golf course, playfields, intensive use areas	N/A	100	100	100	100
Residential Development (dwellings)					
Native vegetation zone	N/A	100	50	50	25
Transportation					
Native vegetation zone					
Trails	0	0	0	0	0
Water-dependent	N/A	0	0	0	0
Utilities (primary)					
Native vegetation zone					
Distribution lines	N/A	N/A	N/A	50	25
Buildings	N/A	N/A	N/A	50	25
Height Limits:					
Buildings, storage tanks, accessory uses	N/A	N/A	50	20	20
Distribution poles	N/A	N/A	50	30	30

Herrera Environmental Consultants, Inc.

Memorandum

To	Ryan Ericson, Associate Planner, and Libby Hudson, Division Manager City of Bainbridge Island
From	Amanda Azous, Herrera Environmental Consultants
Date	August 31, 2011
Subject	Clarification on Herrera August 11, 2011 Documentation of Marine Shoreline Buffer Recommendation Discussions Memo

This memo is to provide further explanation of the scientific basis for the recommendation to the City of Bainbridge Island (City) that a minimum 30-foot Riparian Protection Zone (RPZ) be instituted as part of a dual-zone management system (provided in Herrera's August 11, 2011, memo to the City: *Documentation of Marine Shoreline Buffer Recommendations*). It is important to note that the RPZ is intended to be a subset of a regulated buffer (which is wider than 30 feet for all use designations except for Urban). The RPZ has the specific purpose of protecting existing intact native vegetation that is directly adjacent to the marine environment. The RPZ also provides a regulatory framework for restoring native vegetation to this zone as future development and re-development occurs, particularly where this zone has been degraded. Restoring native vegetation to this zone would help the City achieving its goal of no net loss of shoreline ecological functions over time.

The RPZ is intended to be more restrictive of uses and development than the remainder of the regulated buffer required in each use designation. Any disturbances or allowed activities within this zone would include mitigation that restores native vegetation within and/or adjacent to the RPZ to the extent feasible. The goal of regulating vegetation characteristics in the RPZ is to strengthen the functions provided by native vegetation in the portion of the 200-foot shoreline jurisdiction where the most benefit would accrue, which is the area directly adjacent to marine waters.

Scientific Recommendations for Marine Riparian Buffers

Both Battelle (2003) and Herrera (2011) review and discuss science-based recommendations for buffer widths to protect various shoreline functions. In general, the reviews found that the wider the buffer, the more effective it will be for protecting the marine environment. Nevertheless, in developed environments it is not always possible to prescribe the largest buffer one might find recommended in the literature. Both literature reviews clearly establish that buffers have a key role in protecting aquatic habitat and resources and both suggest that necessary buffer widths vary considerably depending on the site-specific functions and characteristics. For example, in order to achieve at least 80 percent effectiveness at removing pollutants from stormwater runoff, the buffer required can vary from as little as 16 feet to as large as 1,969 feet depending on the slope, depth and type of soil, surface roughness, density of vegetation and the intensity of the

land use. Table 1 provides a summary of a number of studies that examined buffer requirements that were reviewed for both documents, as well as for the August 11, 2011, buffer recommendations memo. The table indicates that suggested buffers are dependent on the function being protected as well as site-specific characteristics but that in general, the wider buffers are, the more effective they are in providing a diversity of functions. In addition, studies Herrera reviewed suggest that a narrower buffer, fully vegetated with native trees and shrubs, may perform more effectively than a wider buffer comprised of non-native landscaping and/ or lawn.

Table 1. Riparian buffers functions and width recommendations in the literature.

Riparian Function	Range of Buffer Widths (feet) to Achieve ≥ 80% Effectiveness and Literature Cited	Minimum Buffer Width (Approximate) Based on FEMAT Curve to Achieve ≥ 80% Effectiveness [a]
Water quality	16 ft: Schooner and Williard (2003) for 98% removal of nitrate in a pine forest buffer 1969 ft: Desbonnet et al (1994, 1995) for 99% removal 33 ft: Zhang et al. (2010) for 85% removal of nitrogen with trees (71% with mixed grass and trees) 33 ft: Zhang et al. (2010) for 98% removal of phosphorus with trees (69% with mixed grass and trees)	82 ft: sediment 197 ft: TSS 197 ft: nitrogen 279 ft: phosphorus
Fine sediment control	82 ft: Desbonnet et al (1994/1995) for 80% removal 299 ft Pentec Environmental (2001) for 80% removal 33 ft: Zhang et al. (2010) for 91% removal of sediment on 5% slope with grass and trees; 86% removal on 10% slope with grass and trees	82 ft: (sediment) 197 ft: (TSS)
Shade/Microclimate	56 ft: Belt et al 1992 IN Eastern Canada Soil and Water Conservation Centre (2002) for 90% effectiveness 125 ft: Christensen (2000) for 80% temperature moderation	121 ft (0.6 SPTH*)
Large woody debris	33 ft: Christensen (2000) for 80-90% effectiveness 328 ft: Christensen (2000) for 80-90% effectiveness	131 ft (0.65 SPTH*)
Terrestrial carbon source to nearshore food webs	16 to 328 ft: Bavins et al (2000)	80 ft (0.4 SPTH)
Hydrology/slope stability	Consensus is that for steep slopes affecting critical areas such as feeder bluffs, a site specific analysis by a qualified professional is necessary to determine a specific buffer width.	Recommendations are based on protecting property and not critical areas. Buffers widths are provided for a range of slope conditions but do not consider underlying geology.

[a] FEMAT data in this table are based on Site Potential Tree Height (SPTH) equal to 200 feet.

Scientific Basis for 30-foot Riparian Protection Zone

Based on the significant variability in buffer recommendations, we endeavored to develop a strategy for the City that would, over time, improve the ecological functions within the current residential development pattern found along most of the City's shoreline (over 82 percent developed [Battelle 2003]), while also allowing for some flexibility for landowners to make use of the shoreline. Therefore, we focused on maintaining and restoring intact riparian habitat located directly adjacent to marine waters by designating it an RPZ, limiting uses within this ecologically important zone, and providing mechanisms and strategies for increasing native vegetation within and adjacent to the RPZ over time.

This minimum RPZ width of 30 feet is based on the ability to achieve 70 percent or greater effectiveness at protecting water quality, and providing shade, microclimate moderation, large woody debris, litterfall and insect food sources (Christensen 2000; Bavins et al. 2000; Zhang et al. 2010) (see Table 2). The remainder of the regulated buffer required for each shoreline designation augments the protection for ecological functions provided by the RPZ, and therefore provides added conservation strategies for protecting marine riparian functions and critical saltwater habitats. This dual-zone management system described in Herrera's August 11, 2011, memo and illustrated in Figures 1 and 2 within that memo, works together to increase the functions typically provided by a single standard marine shoreline buffer through conserving and, over time, adding native vegetation in the most critical zone of the buffer.

Table 2. Approximate effectiveness provided by 30-foot RPZ (Christensen 2000; Bavins et al. 2000; Zhang et al. 2010).

Function	Percent Effectiveness within 30 Feet of OHWM	Comment
Water quality maintenance	71 - 98	Assumes trees or mixed grass and trees
Fine sediment control	86 - 91	Assumes trees or mixed grass and trees
Shade and microclimate moderation	100	Trees and other over-hanging vegetation must be present on the shore.
Large woody debris	80 -90	Trees must be present on the shore
Terrestrial carbon source to nearshore food webs	80	Trees and other over-hanging vegetation must be present on the shore.
Terrestrial wildlife habitat	Unknown	Highly dependent on species of wildlife to be protected
Hydrologic based slope stability	Unknown	Highly dependent on specific site conditions

OHWM = Ordinary High Water Mark

An RPZ containing native trees and shrubs would promote the recruitment of organic matter, nutrients, and macroinvertebrate prey items to the marine environment which are reduced or absent when riparian vegetation is not present on the shoreline (Brennan et al. 2004; Sobocinski 2003; Williams et al. 2001). Detritus feeding organisms are often not able to adapt to the leaf fall

patterns or the chemical characteristics of leaves from non-native plants, which is one reason why shoreline vegetation should be native species for maximum effectiveness (Karr and Schlosser 1977). Native plant species are adapted to local physical conditions such as soil, geology, and climate and therefore require less maintenance, are resistant to most pests and diseases, and require little or no irrigation or fertilizers, once established. Thus maintaining native plant species adjacent to the shoreline helps maintain water quality. Also, trees located close to the shore, form and maintain habitat complexity by stabilizing banks and contributing large wood to the aquatic environment.

Another important protection feature is that the RPZ would extend up to the full width of a standard marine shoreline buffer wherever intact native riparian vegetation were present but would be a minimum of 30 feet.

In areas entirely lacking native riparian vegetation, the City would still establish a minimum 30-foot RPZ and, as parcels met re-development thresholds, the City would require that native vegetation be established within the minimum 30-foot RPZ. In the Natural shoreline designation, the RPZ would be a minimum of 100 feet because of the heightened ecological values found in the areas within this shoreline designation and their absence of existing development.

In summary, the 30-foot RPZ is a subset of a dual-zone system, intended to preserve existing native trees and shrubs, and restore them when possible, to increase their presence adjacent to the shoreline and protect important shoreline functions. This strategy will provide opportunity to significantly improve over time shoreline functions over existing City conditions, where degradation exists or continues to occur. The implementation of the RPZ as a component of a regulated buffer will allow the City to effectively stem the loss of shoreline resources due to loss of native shoreline vegetation and, in conjunction with regulations addressing activities allowed in the remainder of the regulated buffer, assist the City with meeting its goal of no net loss of shoreline ecological functions.

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