

VII. CONCLUSIONS AND RECOMMENDATIONS

The objective of this report was to produce a review of the best available science (BAS) relative to the nearshore ecosystem of Bainbridge Island by incorporating nearshore information common to Puget Sound, with data specific to Bainbridge Island as appropriate. The scope of this BAS review effort is defined in WAC 365-195-900 through 365-195-925. Although not specifically required in the WAC, there are several conclusions and recommendations that can be derived from the BAS review effort. It is our intention to promote a better understanding of the nearshore ecosystem surrounding Bainbridge Island and to provide that basis for future efforts in collecting data and improving management of the nearshore zone.

The following conclusions and recommendations are based on the BAS (specific to Bainbridge Island and outside sources) and professional judgment. We have attempted to focus our conclusions toward the scientific data for specific nearshore habitats, processes, and species that reside there. Recommendations have been presented as an extension of the conclusions to assist Bainbridge Island with the next steps toward nearshore technical assessment and improved management.

A. CONCLUSIONS

1. Virtually all coastal and estuarine habitat types described for Washington State are found on or adjacent to Bainbridge Island. These habitat types include tidal freshwater marshes, river and coastal riparian vegetation, salt marshes, flats, channels, eelgrass meadows, rocky shores, and kelp forests.
2. Bainbridge Island's nearshore ecosystem plays a critical role in support of a wide variety of biological resources, many of which are commercially, culturally, aesthetically, and recreationally important to the people of the island. These resources include numerous species of invertebrates (e.g., shellfish), finfish (e.g., salmonids, baitfish, groundfish), and birds, as well as the living resources that provide feeding and refuge functions for these species. Baseline investigations of these resources, such as herring stocks and shellfish populations, for example, have been historically collected by state and federal agencies. Some of this information is dated or incomplete. Continued monitoring of these biological resources will be required to predict trends in further degradation or recovery of species.
3. Nearshore and estuarine habitats of Bainbridge Island have been impacted by shoreline modifications. Over 82% of Bainbridge Island's shoreline is currently developed, predominated by single-family residential use. Major modifications include shoreline armoring (e.g., bulkheading), fill, removal of riparian vegetation, overwater structures, and marina development. Most watersheds that connect to the coastline have been modified through the removal of riparian vegetation and alteration of hydrology. Most of the small bays are fully developed for residential or industrial use. Only two areas, Blakely Harbor and segments along the western shoreline of Bainbridge Island, are relatively unmodified.

4. Chemical contamination has probably affected some nearshore habitats. Evidence indicates that seaweed blooms (i.e., green tides) have affected eelgrass in Eagle Harbor and cause odor problems in some back bays. These blooms have been linked to heavy inorganic nitrogen load emanating from small streams, as well as to domestic waste discharges. Creosote seepage from the area surrounding Bill Point has been documented and may be affecting the quality of eelgrass and cobble habitats in the vicinity of the Point.
5. The available data regarding Bainbridge Island nearshore resources are dated and lack accuracy across all elements. Technical studies specific to Bainbridge Island are few and varied in detail and study objectives. Most were not designed to specifically address nearshore processes and targeted one habitat type or species group. New data has been collected by the City of Bainbridge Island but are not available for this report. Further data evaluation or additional studies will be required to address known data gaps. Ranking and prioritization for the filling of data gaps is critical to the City for long-range planning purposes, and has not been performed.
6. Many studies have linked the effects of shoreline modifications to changes in nearshore biological functions. Modifications affecting nearshore areas on Bainbridge Island, such as armoring, riparian vegetation removal, overwater structures, marinas, and hydrological alterations, exert effects at varying degrees on an ecosystem's controlling factors (e.g., water depth, substrate type, light level, and wave energy). Impacts that affect controlling factors within an ecosystem may be reflected in changes to habitat structure, and ultimately may be manifested as changes to functions supported by the habitat. For example, armoring-induced erosion of beaches will change the ability of the beach to support spawning of forage fish.
7. Shoreline modifications can have direct, indirect, and cumulative impacts to estuarine and nearshore marine biological resources at a site, as well as to areas well beyond the location of the modifications. In general, it is known that as the number and size of modification increases the region affected can increase. With some modifications, such as armoring of eroding feeder bluffs, the length of shoreline impacted by loss of feeder material can exceed the length of shoreline that is armored. From a landscape perspective, the cumulative impact of losses in connectivity among natural nearshore and estuarine habitats remains difficult to measure and untested.
8. Relatively little controlled research has been directed at documenting and understanding the functional impacts of shoreline modifications to biological resources. Few studies have applied rigorous, hypothesis-based testing that confirms the impacts reported in the literature. Most of the data gaps highlighted in previous reviews remain today with little advancement of the scientific database. This conclusion is presented by several other nearshore investigators (Williams and Thom 2001).
9. The best way to protect sensitive shoreline habitat is to maintain it in a natural condition. Modifications to upland, riparian, estuarine, and marine shoreline habitats can affect areas both adjacent to and far removed from the immediate site of impact. The

cumulative effects of many small modifications also have the potential to produce interactive or synergistic impacts, rather than merely additive impacts, although this remains untested.

10. The design and location of shoreline structures can significantly affect relative impacts to nearshore biological resources. For example, seawalls and bulkheads with solid vertical surfaces (e.g., concrete, wood, and steel) built waterward of MHW may have greater impacts on shoreline biological processes than gradually sloping, rock riprap revetments built above MHW (Williams et al. 2001). Hardened structures have more impact than soft (e.g., coarse sand/large woody debris) armoring alternatives. Additionally, dock structures that are supported above the substrate by piles appear to result in less impact to the nearshore than those built to rest on the substrate. For further reference on this topic, refer to *Overwater Structures: Marines Issues* by Nightingale and Simenstad (2001b). Similarly, overwater structures that are constructed with light-penetrating materials affect the photic zone of the nearshore to a lesser degree than those without those features.
11. Alternatives to hard shoreline armoring, such as beach nourishment and marine riparian vegetation enhancement, use natural materials and may often be a better alternative to minimize damage to habitats and resources. Armoring should be avoided if not necessary. There is a need to systematically examine the long-term success or relative benefits of these natural shoreline components as habitat to nearshore species.
12. Properly designed estuarine restoration projects can return a habitat to a close approximation of its condition prior to disturbance. Restoration, enhancement and creation of estuarine areas are promoted by local, state and federal agencies to improve fish habitat. However, restoration actions vary widely in their “success” rate. The potential for success varies depending on the degree of disturbance that exists at the site and within the landscape where the restoration site is located. In addition, the process of restoring a site may have associated negative impacts in the short term and should be carefully considered in the project evaluation. Additional guidance on this topic can be found in Williams and Thom (2001).
13. Bainbridge Island has some experience and success with smaller nearshore restoration projects. The City should continue to monitor and learn from this experience and seek additional opportunities for restoration and enhancement.

B. RECOMMENDATIONS

1. A baseline inventory of Bainbridge Island nearshore habitat and processes should be produced from Island-specific data supplemented with other databases. This inventory should be used for determining habitat trends, locating critical areas for protection or restoration, and identifying nearshore ecosystems most at risk to cumulative impacts. Base maps should be continually updated for all marine and estuarine shorelines of Bainbridge Island to promote increased understanding and better management.
2. Bainbridge Island should strive to fill data gaps by working independently and in close coordination with other jurisdictions and agencies. Investigators should follow established, accepted methods to collect data (WDNR, WDOE, WDFW, EPA). The city should coordinate data available from agencies and Tribes. If appropriate, Bainbridge Island residents and volunteer groups should be involved in collection and management of data.
3. Bainbridge Island should develop a realistic nearshore management strategy for the Island. The goal of this plan would be to reduce or eliminate new human-induced stressors to the nearshore environment, coupled with restoration and protection of existing systems. The City should identify usable management units for this effort. Units may be drift cells based upon physical parameters, shoreline characteristics reflective of current zoning characteristics, or other methodologies. The City should work in concert with other regional nearshore management activities and strategies (e.g., Kitsap and King Counties, Puget Sound Nearshore Science Team sponsored by the US Army Corps of Engineers) to stay current with progress made by neighboring jurisdictions. This management plan should include the following items, some of which are not yet developed by the City:
 - a) A section to educate and inform residents of Bainbridge Island about the importance of the nearshore environment
 - b) Policies that promote nearshore protection and impact avoidance and provide incentives to support policy
 - c) A nearshore monitoring/adaptive management strategy.
4. Sensitive marine nearshore and estuarine habitat and ecological functions should be protected and restored by avoiding shoreline structural modifications altogether. Protection and conservation of ecologically important natural areas must be prioritized from a landscape perspective, especially those sites recognized for their importance to shoreline processes (e.g., sediment dynamics) and biological functions (e.g., fish migratory corridors or spawning and nursery habitats).
5. Bainbridge Island should evaluate and update current policies to reflect Best Available Science. Best available science is not static. New information is published continuously. Policy and regulation development, to be truly adaptive, must be updated frequently with new information.

6. Bainbridge Island should identify and pursue restoration and preservation projects. This should include the prioritization of areas targeted for restoration and protection. These areas should be identified as sensitive, and policies associated with these areas should reflect long-term protection goals.
7. Phased restoration of natural processes and ecological functions should be achieved through the strategic removal of unnecessary shoreline structures, especially in areas with particularly high rates of shoreline armoring and habitat structural modification. Restoration project planning must be complete and include a site assessment to ensure that the site is as correct as possible for the type of restoration planned and that any modifications needed to correct problems with the site are fully understood and carried out. Restoration is intended to result in a net benefit to the ecosystem, but restoration actions should be considered relative to the potential for success in order to maximize the net benefits.
8. A thorough physical and biological assessment on a site-specific basis must be carried out to fully understand and document the potential direct, indirect and cumulative impacts prior to permitting any shoreline modifications around Bainbridge Island. Evaluations of potential effects of proposed shoreline modifications for a section of Bainbridge Island must consider carefully how these functions will be affected prior to allowance of any modifications to take place. The assessment must be site-specific, landscape sensitive, and scientifically rigorous enough to fully document the need for the modification, balanced by potential (including cumulative) impacts. Measures for protecting critical habitats must incorporate principles of landscape connectivity and extend to activities outside of their conveniently defined boundaries.
9. When definitive scientific information is lacking but potential impacts are likely to occur, the City of Bainbridge Island should err on the side of caution to reach conservative decisions that favor natural ecological functions. The nearshore, including the riparian areas, has been extensively altered, and any unaltered or mildly altered areas likely have enhanced value to preserving remaining habitat functions. Enhancing and restoring these areas to provide a net benefit to habitat functions should be strongly considered.
10. Where new shoreline modifications must occur, impacts should be minimized by pursuing alternative techniques (e.g., setbacks, vegetation, beach nourishment) and natural structure placement strategies. The pressure to allow shoreline armoring along Bainbridge Island is expected to continue and possibly increase as more difficult properties are targeted for development. The City should develop solid professional relationships with scientists and local agencies to maintain up-to-date knowledge of new techniques, options for armoring, and proper avenues to review and process permit applications.