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Coastal Adaptation Policy Brief

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Living Shorelines

Introduction

Living shorelines use "plants or other natural elements, sometimes in combination with harder shoreline structures, to stabilize estuarine coasts, bays, and tributaries."[1] Living shoreline projects utilize the physical characteristics of biological structures, such as oyster reefs and marshes, to achieve both ecological and protective benefits for an area. Some living shoreline projects add biological components to already existing hard structures, such as seawalls and breakwaters.

While somewhat common in the eastern United States, west coast living shoreline projects have increased dramatically in the last decade. As communities seek protective, engineered structures to impede wave energy and slow coastal erosion, there has been a growing desire to incorporate ecological benefits into these projects. Living shorelines can range from major wetland restoration projects to smaller-scale inclusion of natural plants into a revetment. Regardless of scale, there has been a policy push by the National Oceanic and Atmospheric Administration, the Army Corps of Engineers, and the California Coastal Commission to engineer greener mechanisms that maintain the protective nature of a gray structure while incorporating natural ecosystem benefits.[2]

Living shorelines include oyster and eelgrass restoration projects intended to mimic the protective benefits of a breakwater. A breakwater is an artificial "gray" structure, often comprised of an installation of rocks or concrete.[3] They are generally built parallel to shore in shallow waters, but can also be submerged further offshore to avoid interfering with a view.[4] A living shoreline oyster reef project provides similar protective benefits, but does so by employing all or some natural stabilizing elements, such as marsh grass, coir logs, or oyster balls/bags.[5] They can take the conventional shape of a breakwater wall offshore or focus on restoring and maintaining naturally-buffering wetland and intertidal ecosystems.[6] These protective structures usually fall somewhere between these two extremes, utilizing a mixture of rocks, oyster bags, and vegetative elements to create the sought-after wave buffer.[7]

Tradeoffs

Living shorelines can provide flood protection to the communities or harbors located upland of the structure. By reducing wave action, flooding events can be minimized, and beach erosion reduced, at rates consistent with the decrease in longshore and cross-shore sediment transport.[8] Modern living shoreline designs featuring fully natural or semi-natural components can maintain these benefits and even improve them. Oyster bags have been used to repair existing artificial breakwaters,[9] while salt marsh restoration projects have been shown to provide more protection during hurricanes than manmade breakwaters.[10]

One advantage of these efforts is their cost effectiveness, since these nature-based infrastructures are expected to sustainably stabilize themselves as they grow and, therefore, will likely require less maintenance.[11]

1 *What is a Living Shoreline?*, National Oceanic And Atmospheric Administration, https://oceanservice.noaa.gov/facts/living-shoreline.html (last visited Oct. 12, 2017).

2 National Oceanic and Atmospheric Administration, Guidance for Considering the Use of Living Shorelines 4 (2015) [hereinafter NOAA Guidance]; California Coastal Comm'n, Sea Level Rise Policy Guidance 39 (2015); U.S. Army Corps of Engineers, Coastal Risk Reduction and Resilience: Using the Full Array of Measures 6-7 (Sept. 2013) [hereinafter USACE Coastal Risk Reduction].

3 NOAA Guidance, *supra* note 2, at 5.

4 USACE Coastal Risk Reduction, *supra* note 2, at 6-7.

5 Orrin H. Pilkey, Norma Longo, Rob Young & Andy Coburn, Rethinking Living Shorelines 2 (Mar. 2012), *available at* http://www.wcu.edu/WebFiles/PDFs/PSDS_Living_Shorelines_White_Paper.pdf.

6 World Bank, Managing Coasts with Natural Solutions: Guidelines for Measuring and Valuing the Coastal Protection Services of Mangroves and Coral Reefs 45 (Michael W. Beck and Glenn-Marie Lange eds., 2016).

7 Pilkey et al., *supra* note 5, at 4.

8 USACE Coastal Risk Reduction, *supra* note 2, at 6.

9 Susan Bence, *Army Corps Collaborates with UWM to Create Breakwater Habitat in Milwaukee*, UW-M Milwaukee Public Radio, Nov. 4, 2016, http://wuwm.com/post/army-corps-collaborates-uwm-create-breakwater-habitat-milwaukee#stream/0.

10 NOAA Guidance, *supra* note 2, at 11.

11 Marilyn Latta, Living Shorelines: Multi-Objective Approach and Pilot Projects 2 (May 2016).

Incorporating natural elements into these projects can also create important intertidal connectivity and reduce some of the ecological detriments, such as habitat fragmentation, that develop from implementing purely gray armoring techniques.[12]

Engineered living shoreline structures can also produce negative unintended consequences. Breakwaters incorporating living shoreline attributes can increase shoreline erosion down shore from where they are installed.[13] Further, impeding wave action in an area can hinder sediment transport, viability of sediment-dwelling organisms, and natural movement of nutrients throughout the wave column.[14] Breakwaters and installed oyster reefs can negatively affect beachgoers by impairing surfbreaks and threatening beach access. Consequently, the orientation, materials, and location of living shorelines should be analyzed—especially how each might adversely affect the ecological, social, and economic functions of the surrounding areas.[15] Littoral cell processes should be analyzed for an area of interest to determine the feasibility of proposed living shoreline approaches.[16]

The term "living shorelines" itself has potential drawbacks. For instance, the term has the potential to be misused or misappropriated because it has traditionally been used to describe a wide array of adaptation approaches, ranging from gray to green. Similarly, the term might be used to "greenwash" the environmental impacts of a structure that is more gray than green.

Legal Considerations

Living shoreline projects are subject to the California Coastal Act and require Coastal Development Permits (CDP) to undertake.[17] Local communities hoping to utilize living shoreline components in an already-standing shoreline protective structure, such as a breakwater, must get a CDP if fifty percent or more of the breakwater is replaced.[18] Regardless of whether the project is a new installation or repair, CDPs are generally conditioned on environmental mitigation techniques; however, utilizing natural components can serve to alleviate some mitigation requirements. Additionally, proximity to dune, tidal, or wetland areas is likely to trigger the environmentally sensitive habitat area requirements of the Coastal Act.[19]

In addition to Coastal Act requirements, living shorelines are also subject to a number of other permitting and coordinating agency requirements, depending on their design. Among the possible requirements are: Clean Water Act permits and consultation with the Army Corps of Engineers for activities related to dredge, fill, and sediment alteration;[20] a State Lands Commission lease for work on public trust lands;[21] regional water quality control board approval; consultation or a certified biological assessment with the National Oceanic and Atmospheric Administration under the Endangered Species Act; and compliance with substantive and procedural provisions of the California Environmental Quality Act.[22] Furthermore, because living shoreline projects often incorporate new designs and, therefore, new potential impacts, these permitting processes may not be as uniform, or as well known, as the permit process necessary for traditional gray armoring techniques.

12 NOAA Guidance, *supra* note 2, at 9-11.

13 Usace Coastal Risk Reduction, *supra* note 2, at 7.

14 *Id.* at 11-12.

15 *See generally Groynes, Breakwaters, and Artificial Reefs* (2015), European Climate Adaptation Platform, http://climate-adapt.eea.europa.eu/metadata/adaptation-options/groynes-breakwaters-and-artificial-reefs (last visited Oct. 12, 2017).

16 For the statewide compilation of Coastal Regional Sediment Management Plans, *see* Coastal Regional Sediment Management Plans, California Sediment Management Workgroup, *available at* http://www.dbw.ca.gov/csmw/crsmp.aspx.

17 Cal. Pub. Res. Code §§ 30200-30265.5.

18 Cal. Pub. Res. Code § 30624.7; Cal. Code Regs. tit. 14, §13252(b). For an example of a breakwater restoration which did not require a CDP, see California Coastal Commission, North Coast District Deputy Director's Report of De Minimis Waivers (July 2015), *available at* https://documents.coastal.ca.gov/reports/2015/7/w8-7-2015.pdf.

19 Cal. Pub. Res. Code § 30240.

20 33 C.F.R. § 322.

21 *Application for Lease of State Lands*, State Lands Commission, http://www.slc.ca.gov/Forms/LMDApplication/LeaseApp.pdf (last visited Oct. 12. 2017).

22 Cal. Pub. Res. Code §§ 21000 *et seq.*

Examples

The San Francisco Bay Living Shorelines Project, sponsored by the Coastal Conservancy and seventeen other partners, is at the forefront of living shoreline design and monitoring projects in California. This project utilizes oyster shell-bag mounds and rejuvenated eelgrass beds to produce physical and biological benefits.[23] The Coastal Conservancy has also been involved in oyster and eelgrass shoreline, marsh restoration, and cobble and sand dune restoration efforts as part of their larger living shorelines initiative. Living shoreline projects in California have also been implemented at Cardiff State Beach,[24] San Diego Bay,[25] Newport Bay,[26] and Humboldt Bay.[27] These examples highlight how living shorelines are increasingly being integrated into sea level rise planning actions, especially those designed to protect an area while conserving its ecological integrity.[28]

Researchers

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23 *San Francisco Bay Living Shorelines Project*, State of California Coastal Conservancy, http://scc.ca.gov/climate-change/climate-ready-program/san-francisco-bay-living-shorelines-project/ (last visited Oct. 12, 2017).

24 State Coastal Conservancy, Staff Recommendation: Cardiff State Beach Living Shoreline Conceptual Plan Project NO. 15-003 (Mar. 2015).

25 Merkel & Associates, Inc., San Diego Bay Native Oyster Restoration Plan (May 2015).

26 *Shifting Towards Living Shorelines in Newport Bay*, Orange County Coastkeeper, http://coastkeeper.nationbuilder.com/living_shorelines (last visited Oct. 12, 2017).

27 Matt Baun, *Living Coastline Project Will Restore Tidal Salt Marsh at Humboldt Bay*, U.S. Fish & Wildlife Service Field Notes (Mar. 14, 2017), https://www.fws.gov/FieldNotes/regmap.cfm?arskey=36946.

28 San Francisco Bay Conservation and Development Commission, Draft Final San Francisco Bay Conservation and Development Commission Strategic Plan Update 2017-2020 8 (June 2017); *see also* Latta, *supra* note 11, at 2.

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