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Managing Coastal Armoring and Climate Change Adaptation in the 21st Century

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In response to erosion and storm events, Californians have built seawalls, revetments, and other "coastal armoring" structures along significant portions of California's coast. Coastal armoring now occupies more than 110 miles, or at least 10 percent, of the overall California coastline, including 33 percent of the southern California coastline.[1] This coastal armoring has diminished California's beaches and habitat, limited beach access and impeded coastal recreation, caused increased erosion to neighboring properties, and marred the natural beauty of the coast.

A common perception is that seawalls and revetments protect the coast. Although such armoring structures may temporarily protect property from encroachment by the sea, on beaches undergoing long-term erosion, armoring structures accelerate erosion of existing beaches and coastal habitats in the areas where they are located.[2] Coastal armoring structures placed on eroding beaches prevent coastal ecosystems from migrating inland and cut off sand supply by preventing natural erosion processes. Put simply, when placed on an eroding or retreating beach, armoring structures will cause that beach to narrow and eventually disappear. Wave energy reflecting off of shoreline armoring structures also undercuts the beach and can hasten coastal erosion in front of the structure as well as on neighboring properties, harming those properties and stimulating yet more armoring.[3] In short, many of California's beaches, and the amenities and ecosystems they provide, may inevitably disappear due to armoring.

This risk of beach loss is increasing. Over 80 percent of the California coastline is actively eroding.[4] The projected impacts of climate change along California's coast –including accelerated rates of sea level rise[5] and erosion and inundation from storms that may be more frequent and powerful – will place many coastal properties and ecosystems at increased risk of damage and loss.[6] With 85 percent of Californians living or working in areas affected by sea level rise, and California's coastal population expected to grow significantly over the coming decades, pressure to armor the coast to protect development and community infrastructure will likely intensify.[7] Unfortunately, this increased armoring will cause faster and more widespread loss of the beaches and ecosystems that make the coast so valuable to many Californians.[8] Efforts by the California Coastal

1 Gary B. Griggs, *The Effects of Armoring Shorelines—The California Experience*, in Puget Sound Shorelines and the Impacts of Armoring—Proceedings of a State of the Science Workshop, May 2009: U.S. Geological Survey Scientific Investigations Report, at 77-84 (Hugh Shipman et al. eds., 2010).

2 On beaches experiencing long-term erosion, the shoreline is undergoing a net landward movement over time. For a full analysis of armoring impacts, *see* Omar Defeo et al., *Threats to Sandy Beach Ecosystems: A Review*, 81 Estuarine, Coastal, and Shelf Science 1-12 2009); Nicholas C. Kraus, *The Effects of Seawalls on the Beach: An Extended Literature Review*, Journal of Coastal Research 1-28 (1988); *see* also Jenifer E. Dugan et al., *Ecological Effects of Coastal Armoring on Sandy Beaches*, 29 PSZNI: Marine Ecology 160, 160-170 (2008); Gary B. Griggs, *The Impacts of Coastal Armoring*, 73 Shore & Beach 13, 13-22 (2005); *but see* Gary B. Griggs et al., *The Interaction of Seawalls and Beaches: Seven Years of Monitoring, Monterey Bay, California*, Shore and Beach 21, 24, (Jul. 1994) (describing a study showing that in areas not experiencing net erosion, armoring structures do not actively induce long-term erosion.)

3 U.S. Army Corps of Engineers, *Technical Note CETN-III-8, Seawalls: Their Applications and Limitations* (1981); *see also* Griggs, *supra* note 1, at 83 (noting that further study is needed to determine the significance of accelerated erosive impacts of wave reflection and scour).

4 *See Living with the California Coast*, (Gary B. Griggs & Lauret Savoy eds., Duke University Press, 1985); Gary B. Griggs, *California's Coastline: El Niño, Erosion and Protection, in* California's Coastal Natural Hazards: Santa Barbara, California, University of Southern California Sea Grant Program 36, 36-55 (L. Ewing & D. Sherman eds., 1998).

5 Sea level in California is expected to rise by at least one foot in the next forty years and by at least four to five feet over the next century. California Climate Action Team, Coastal and Ocean Working Group, *State of California Sea-Level Rise Guidance Document* (Ocean Protection Council, Mar. 2013); National Research Council, *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future* 117, table 5.3 (National Academies Press, 2012).

6 *Id.; see also* Sara C. Aminzadeh, *Rising to the Challenge: California Coastal Climate Change Adaptation, in* Climate Change Impacts on Ocean and Coastal Law 533, 534 (Randall Abate ed., 2015).

7 Cal. Dep't of Boating and Waterways, *The Economic Costs of Sea-Level Rise to California Beach Communities*, 72 (2011), *available at* http://www.dbw.ca.gov/PDF/Reports/CalifSeaLevelRise.pdf; Cal. Natural Resources Agency, *2009 California Climate Adaptation Strategy: A Report to the Governor of the State of California in Response to Executive Order S-13-2006*, 1, 68 (2009), *available at* http://resources.ca.gov/climate_adaptation/docs/Statewide_Adaptation_Strategy.pdf.

8 Mark Baldassare, *PPIC Statewide Survey: Californians and the Environment*, Public Policy Institute of California (Feb. 2006), *available at* http://www.ppic.org/content/pubs/survey/S_206MBS.pdf.

Commission to mitigate coastal armoring will be reviewed by the state Supreme Court in the coming months, indicating the importance of this issue.[9]

In California, as in any jurisdiction, decisions about whether to armor a section of coastline—or to make alternative investments in coastal hazard reduction—are driven by interactions among social, economic, political, environmental, technical, and legal factors. To date, few have characterized these factors comprehensively, and in connection to one another, to better understand the big picture of how coastal armoring will impact California's coastline. To address the interdisciplinary nature of this problem, Stanford Law School's Environmental and Natural Resources Law & Policy Program invited a mix of legal, policy, and technical experts from California and beyond to share knowledge and suggestions regarding a range of coastal armoring issues over the course of two multi-day workshops.

We considered coastal armoring in the framework of the following goals:

- Preserving the economic, recreational and environmental value of beach and other coastal ecosystems, as well as public access to coastal resources;
- Improving regulation, mitigation, and adaptive management of armoring projects;
- Promoting the use of setbacks and other non-armoring mechanisms to avoid and mitigate long-term risks from sea level rise and related hazards;
- Promoting local land use planning in the coastal zone that makes use of a broader set of risk reduction strategies and discourages armoring;
- Promoting coastal hazard planning and mitigation approaches that incorporate sea level rise considerations and favor non-armoring solutions;
- Promoting insurance programs and regulations that do not incentivize armoring; and
- Developing and advancing financing mechanisms to support non-armoring solutions, such as nature-based coastal adaptation.

The working group's findings address how coastal decision-makers might better analyze, prevent, and mitigate shoreline armoring impacts and eliminate institutional incentives that have led to intense coastal development and maladaptive responses to coastal changes.[10] The working group's key findings and recommendations for improving shoreline armoring management statewide are described below.[11]

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California's "armored coast" is the product of many ad hoc, individual public and private sector decisions favoring protection of the built environment over preservation of at-risk public trust[12] resources such as beaches, public access and recreation, wetlands, and intertidal habitats. In spite of the documented environmental, social, and economic costs of armoring, many barriers to limiting coastal armoring remain.

9 *See Lynch v. Cal. Coastal Comm'n*, 229 Cal. App. 4th 658 (2014), *cert. granted*, 339 P.3d 328 (2014) (The California Supreme Court will review the issues of whether homeowners can challenge seawall permit conditions after construction, whether the Coastal Commission can impose a 20-year limitation on a seawall reconstruction permit, and whether the permit condition which prohibited homeowners from reconstructing the lower portion of their beach access stairway down the bluff was valid.)

10 Jon Barnett & Saffron O'Neill, *Maladaptation*, 20 Global Envtl. Change 211, 211-213 (2010). Maladaptation arises when selected actions, relative to alternatives: cause a net increase in emissions of greenhouse gases; disproportionately burden the most vulnerable sectors or populations; reduce incentives to adapt in the future; create "path dependency" (i.e., commit capital and institutions to trajectories that are difficult to change in the future); or result in high economic, social, or environmental costs.

11 The initial workshop discussion and background research generated a list of fifty potential action items to reduce shoreline armoring. We organized this list into a survey, asking the workshop participants to rate each action item on a scale of one to five in terms of importance, urgency, and feasibility. From the survey responses, we highlighted the top seventeen recommendations that participants considered to be the most important, urgent, and feasible. In a second workshop, we narrowed the recommendations down to the most critical issues.

12 For detailed information on the public trust, see *infra* Sections V and VI.

1. California's laws and policies enable imprudent coastal armoring and impede strategic decision-making that might protect coastal public trust resources. In particular:

- The California Coastal Act's provision that allows armoring for "existing development" and the California Coastal Commission's interpretation and application of that provision in some cases has led to increased armoring and the loss of public trust resources.[13]
- There is a conflict in the Coastal Act between the language in Section 30235, which states the Coastal Commission "shall" allow armoring to protect existing structures, and the overarching goals and objectives of Chapter 3 of the Coastal Act, which call for protection of beach access, coastal resources, and scenic views.[14]
- The Coastal Commission needs stronger enforcement authority to adequately deter and remediate unlawful armoring structures.[15]
- Many armoring structures are installed with little to no analysis of the impacts they will have on the beach, ecosystems, or neighboring properties because property owners wait to apply for permits until there is an imminent emergency, at which time armoring structures may be installed without substantive review.[16]
- The Coastal Commission has struggled to determine and assess consistent and adequate fees as mitigation for adverse effects of armoring structures and has not addressed impacts to ecosystems or ecosystem services when calculating mitigation fees.

2. Local governments lack reliable, adequate scientific and legal information to guide their decision-making with respect to coastal armoring; they also lack financial support and regulatory incentives to appropriately consider sea level rise and related coastal hazards in their infrastructure and coastal land-use planning.

3. Among private property owners and regulators alike, there is a lack of attention to nature-based and other non-armoring responses to coastal hazards and sea level rise, in part because existing disaster relief policies, insurance programs, and inadequate mitigation fees for armoring do not sufficiently require property owners to internalize the cost of development in high-risk areas.

4. Coastal armoring remains a standard response to coastal hazards for some state-owned lands and property.

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1. Advance stronger statewide laws, policies, and funding mechanisms that discourage armoring and encourage non-armoring responses to erosion, storm events, and sea level rise. These responses include, where feasible and appropriate, natural protective infrastructure and relocating property away from coastal hazards.

- To limit the availability of armoring, resolve conflicts in the Coastal Act between language

13 *See* Cal. Pub. Res. Code § 30235 (West 2015).

14 Cal. Pub. Res. Code § 30235; *see id*. §§ 30211, 30251 (calling for protection of beach access and scenic views). When conflicts such as these arise, Coastal Act Section 30007.5 provides that they should "be resolved in a manner which on balance is the most protective of significant coastal resources." *Id*. § 30007.5; *see also id*. § 30200. However, this conflict-resolving provision is underutilized.

15 While recent legislation gives the Coastal Commission authority to fine property owners who illegally block public access to beaches, the Coastal Commission still must go to court to seek penalties for any other violation, such as building armoring structures without permits. See Cal. Pub. Res. Code § 30821.

16 Emergency applicants are required to reapply to the Coastal Commission for a standard permit to permanently authorize their armoring structure, subject to the usual review process. In reality, however, many applicants do not reapply and the Coastal Commission has not strictly enforced removals of temporary emergency structures. *See, e.g.*, Cal. Coastal Comm'n, Staff Report F12b (App. No. 3-12-030) (Pebble Beach Company) at 17 (June 2013) (noting that a seawall was initially installed via an emergency permit but that the applicant never applied for permanent authorization), *available at* http://documents.coastal.ca.gov/reports/2013/6/F12b-6-2013.pdf.

17 These recommendations are broken out into detailed sub-recommendations and actions items in Section VII.

in Section 30235 that states the Coastal Commission "shall" allow armoring to protect existing structures and the overarching goals and objectives of Chapter 3 of the Coastal Act.[18] This could be achieved with a legislative amendment to change "shall" to "may or" by adding more stringent conditions in Section 30235 that must be met in order for an armoring permit to be approved.[19]

- Clarify that the term "existing" in Section 30235 refers to structures existing when the Coastal Act was adopted.
- Amend state law to ensure that environmental impact analyses are conducted for armoring projects undertaken by Geologic Hazard Abatement Districts.
- Strengthen the Coastal Commission's enforcement authority to address unlawful armoring structures and ensure that the Coastal Commission and the State Lands Commission use their existing authority and discretion to curtail armoring and its impacts.
- Limit the availability of emergency seawall permits to situations in which there is a legitimate "sudden unexpected emergency" and improve mechanisms to force removal of emergency armoring structures in the absence of longer-term authorization.[20]

f. Ensure that public funding and government decision-making support sustainable climate change adaptation options and do not increase the vulnerability of infrastructure or property.

2. Ensure that local coastal planning mechanisms are used to incorporate a broader set of sustainable adaptation strategies and to discourage armoring.

- Ensure local governments have access to coastal adaptation planning and implementation funds.
- Require science-based planning for sea level rise and implementation of established plans in ways that protect public access and natural resources.
- Support integration of community planning (primarily under the state Government Code and the Coastal Act) and hazard prevention/mitigation planning (primarily under the federal Stafford Act).
- Support adoption of policies and ordinances that require the consideration of sea level rise in erosion rate calculations and setback determinations. Develop standard, transferable methodologies for factoring sea level rise into hazard analyses.

3. Support development and implementation of measures, including insurance programs and regulations, that require and/or incentivize private property owners to assume the risks of developing in high-hazard areas and that facilitate relocation away from hazardous areas.

4. Where possible, pursue non-armoring responses to sea level rise and related coastal hazards for state-owned and private lands, such as relocating development (e.g., buildings, parking areas, roadways, utilities) and using other managed retreat strategies.

5. Improve the availability of relevant data, guidance, and technical resources.[21]

18 Cal. Pub. Res. Code § 30235; *see id*. §§ 30200, 30211, 30251.

19 Section 30235 currently provides that the structure must be designed to eliminate or mitigate adverse impacts on local shoreline sand supply. *Id*. § 30235. In the absence of these changes, the Coastal Commission could argue that the conflict-resolving provision in Section 30007.5 may justify its denial of certain armoring permits. *See* Sections VI and VII for further analysis of this issue.

20 *See* Cal. Code Regs. tit. 14 § 13009 (West 2015).

21 One possible avenue for collecting relevant data is through the state's new sea level rise planning database. See A.B. 2516, 2013-2014 Leg., Reg. Sess. (Cal. 2014), *codified at* Cal. Pub. Res. Code §§ 30961-30968 (an innovative new law that requires California to develop an online database of sea level rise planning actions taken by state agencies and selected other entities.)

- Support consistent statewide monitoring of armoring impacts and compile comprehensive statewide data regarding the use, locations, and consequences of armoring.
- Support development of legal guidance that helps state and local entities conform with constitutional limitations[22] when they promote non-armoring responses to sea level rise and related coastal hazards.
- Support development of standard methodologies for calculating impacts and identifying mitigation measures that account for the full value of impacts caused by armoring, including impacts to neighboring properties and public trust resources.
- Support pilot projects that demonstrate the feasibility and value of non-armoring solutions at the community scale.

Through these recommendations and this white paper, we hope to help California avoid and reduce maladaptive armoring responses to sea level rise and related coastal hazards, and instead to encourage more sustainable adaptation strategies for public and private structures and resources alike. California's coastal managers must consider whether private property owners should be allowed to potentially sacrifice the public trust, public access to the beach, and the economic value of beaches in order to protect their own property. Similarly, in the case of government-funded projects, coastal managers should carefully consider how much taxpayer money should go toward temporarily stabilizing an otherwise eroding shoreline. A more economically and ecologically sustainable approach to addressing sea level rise and related coastal hazards is critical to California's ability to protect public access, public and private property, and coastal ecosystems now and in the future.

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Shoreline armoring structures are intended to protect coastal development by preventing wave action from eroding the shoreline and by decreasing flood or storm damage. There are several types of coastal armoring structures, the most common of which are seawalls (typically vertical walls made of concrete, steel, or wood) or rock revetments (typically sloped retaining walls made up of rocks or rip-rap). There are several other types of armoring structures, including:[23]

- Breakwaters (linear structure built offshore completely detached from land and designed to reduce wave energy along a stretch of shoreline);
- Bulkheads (a structure often utilized in lower wave energy settings; bulkheads are vertical seawalls that also retain land directly behind the structure);
- Groins (a shoreline protection structure usually built perpendicular to the shoreline to trap nearshore sediment or slow shoreline erosion);
- Cliff retaining walls (low walls used to support or retain coastal bluffs);
- Notch and cave infill (the practice of filling in seacaves with concrete in order to slow bluff erosion).

The exact type of coastal armoring structure depends on local geomorphology and other conditions. However, all armoring structures disrupt natural shoreline processes, typically in order to protect coastal development.

22 *See* U.S. Const. amend. V; Cal. Const. art. I, § 19.

23 *See generally* Cal. Coastal Comm'n Glossary, http://www.coastal.ca.gov/la/glossary.html#let_b (last visited Apr. 18, 2015).

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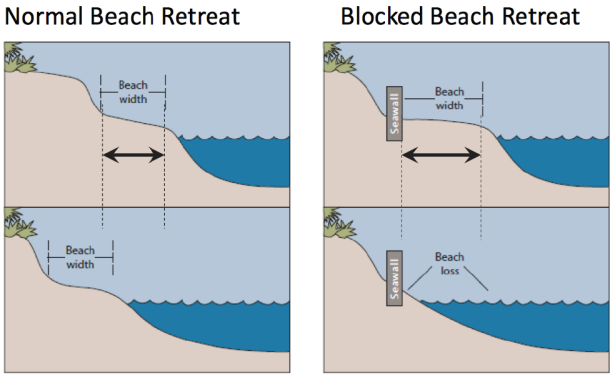
While armoring structures may temporarily protect property from encroachment by the sea, armoring ultimately undermines its intended purpose by accelerating the loss of beaches and coastal habitats. Armoring California's shoreline will ultimately result in the total loss of public beach seaward of the structure, limit beach access, and deny various forms of coastal recreation in the area influenced by the shoreline armoring.[24] In addition, these structures are often expensive to install, require costly ongoing maintenance, and can exacerbate flood risk by disrupting natural floodplain processes. Because seawalls cause increased erosion on neighboring properties, the construction of one seawall will often lead to the need for others.

A. CA EC

Shoreline armoring produces several impacts that limit sand supply and reduce the width of the beach. First, the beach area under the footprint of the actual armoring structure is lost. This is known as placement loss (see Fig. 1). For example, rock revetments can occupy over 30 feet of beach width along their entire length.[25]

E 1. *Revetment in the city of Santa Cruz showing placement loss eliminating nearly the entire beach.*[26]

Second, seawalls cause beach loss by fixing the back of the beach and preventing it from migrating inland as sea levels rise. This is known as passive erosion (see Fig. 2). Left unarmored and undeveloped, coastal ecosystems can survive storms, erosion, and rising seas by moving inland or growing vertically or laterally.[27] Armoring structures, however, prevent this migration; as sea level rises, the public beach is submerged and will gradually narrow until it no longer exists.[28]



E 2. *Diagram showing how armoring prevents beach migration and will lead to the total loss of the beach over time.*[29]

24 The negative effects of seawalls are clear and have been documented in various textbooks, scientific articles, and U.S. Army Corps of Engineers technical reports. *See, e.g.*, US Army Corps of Engineers, *supra* note 3 (stating "[s]eawalls protect only the land immediately behind them, offering no protection to fronting beaches"); *see also* Dugan et al., *supra* note 2; Griggs, *supra* note 2; Matthew Heberger et al., *The Impacts of Sea-level rise on the California Coast*. Cal. Climate Change Center, Pacific Inst. (2009), *available at* http://pacinst.org/wp-content/uploads/sites/21/2014/04/sea-level-rise.pdf.

25 Garry Griggs, *California's Retreating Coastline: Where Do We Go From Here?*, Proc. Am. Meteorological Soc. Ann. Meeting (San Diego) 83,241-43 (2005).

26 Griggs, *supra* note 1, at 80, Fig. 4.

27 Sorell E. Negro, *Built Seawalls: A Protected Investment or Subordinate to the Public Trust?* 18 Ocean & Coastal L.J. 89, 93 (2012).

28 *See* Dugan et al., *supra* note 2; Griggs, *supra* note 2.

29 Cal. Coastal Comm'n, *Handouts for Senate Budget Subcommittee 2, Coastal Climate Adaptation*, 12 (Mar. 20, 2014) [hereinafter Coastal Comm'n *Senate Budget Subcommittee Handouts*], *available at* http://www.coastal.ca.gov/climate/Handouts_SenateSubcommittee2_Mar20.2014.pdf.

Third, beach sand that would have eroded from the beach or bluff is impounded behind the structure and is not available to the beach. This is known as impoundment loss.[30] Impoundment loss leads to increased rates of erosion on down-drift properties. Fourth, wave action diffracting around the edges of seawalls during storms or high tides increases the erosion at the margins of the seawalls. These "end effects" increase the vulnerability of neighboring properties and lead to the need for more armoring (see Figs. 3 and 4).[31] Finally, there is some evidence that wave reflection also leads to a steepening of the foreshore, interrupting the long-shore transport of sand, thereby decreasing sand supply to the beach.[32]

E 3. *Revetment protecting Fort Ord showing placement loss, end effects, and impoundment loss.*[33]

E 4. *Once the building and revetment were removed, the beach recovered.*[34]

B. ACCE AC

Armoring structures limit beach access and impede various forms of coastal recreation. For example, armoring structures are physical barriers that restrict the public's access to the beach (vertical access) or along the beach (lateral access).[35] This access impediment worsens in the winter months and will likely be exacerbated by sea level rise (see Fig. 5). This access loss intensifies as the beach narrows due to erosion and the impoundment of sand behind the armoring structure.

E 5. *Under winter beach conditions, these temporary protection structures in Malibu significantly reduced lateral and vertical access.*

30 Seawalls and other structures interrupt the sediment transport process from eroding bluffs and cliffs, which provide 5 to 30 percent of the sand to California's beaches. See Griggs, *supra* note 1, at 81; see *also* Michael Slagel & Gary Griggs, *Cumulative Loss of Sand to the California Coast by Dam Impoundment* (2006), *available at* http://www.dbw.ca.gov/csmw/PDF/Slagel&Griggs CA Dam Manuscript.pdf. In a system where a significant percentage of sediment supply is blocked by dams, the cumulative impacts of additional sand supply reduction are concerning. *Id.*

31 J. Peter Byrne & Jessica Grannis, *Coastal Retreat Measures, in* The Law of Adaptation to Climate Change: U.S. and International Aspects, 269 (Michel B. Gerrard & Katrina Fischer Kuh eds., 2012). Depending on the extent to which they affect nearby coastal properties, seawalls can be a private nuisance. See Meg Caldwell & Craig Holt Segall, *No Day at the Beach*, 34 Ecology L.Q. 533, 558 (2007).

32 The impacts in this paragraph are often referred to together under the umbrella term "active erosion." The scientific community has not reached a consensus on the significance of the active erosive impacts of wave reflection and scour. See Griggs, *supra* note 1, at 82-83 (noting the lack of studies on the impact seawalls have on enhancing erosion due to wave reflection and scour); see *also* Dugan et al., *supra* note 2.

33 Coastal Comm'n *Senate Budget Subcommittee Handouts, supra* note 29, at 12. The revetment blocks the natural migration of the beach.

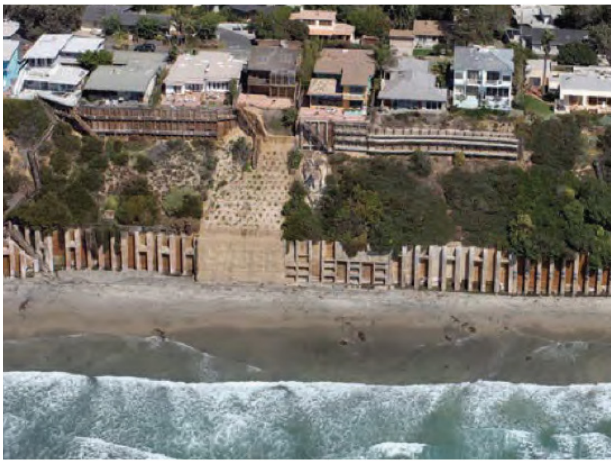
34 *Id.*

35 Griggs, *supra* note 1, at 81; see Caldwell & Segall, *supra* note 31, at 555.

Wave reflection off the armoring structure can also degrade the quality of a surfing area or make it unsafe for swimmers to enter the water, further diminishing recreational opportunities.[36]

C. AE E C E EC

While some coastal armoring structures are designed to look like dunes or blend in with the coastal bluffs, many more contrast harshly with the natural landscape and are visually unappealing. Coastal armoring's visual effect negatively impacts coastal communities, where tourism, aesthetics, and community character are vital.[37]



E 6. *Armoring marring the shoreline in Encinitas, in northern San Diego County, 2010.*[38]

D. EC CA E EC

Shoreline armoring and the resultant beach loss will also reduce and eliminate intertidal (i.e., the area between the low and high tide lines) and supratidal (i.e., the zone of the beach immediately above the high tide line) sandy beach habitat, thereby impacting shorebirds and coastal flora and fauna. The reduction in beach width limits the sandy area available for nesting, breeding, spawning and feeding, and the armoring structure itself often limits the mobility of some intra-tidal species by creating a physical barrier.[39] According to a 2008 study of coastal armoring on sandy beaches, armored beaches had significantly fewer and smaller intertidal macro-invertebrates, three times fewer shorebirds, and four to seven times fewer gulls and other birds than unarmored beaches.[40]

E. EC VC E EC

In addition to these physical and ecological impacts, coastal armoring reduces the economic benefits of beaches. Some economic benefits—such as tourist expenditures in coastal communities and property values—are relatively easy to measure, but the economic value of ecosystem services provided by coastal habitat is more difficult to quantify. As such, while armoring may significantly reduce the ecosystem services that a coastal habitat provides, these impacts are often ignored or undervalued because the economic impacts of ecological loss are difficult to quantify, especially when compared to the easily computed potential cost of damage to the built environment that may result from coastal hazards.[41]

Researchers have been able to quantify the loss in coastal recreation associated with beach loss using various methodologies. Numerous studies indicate that most visitors prefer a wider beach

36 *See* L. Benedet et al., *Impacts of Coastal Engineering Projects on the Surfability of Sandy Beaches*, 75 Shore & Beach 3, 3-20 (2007); Bradley E. Scarfe et al., *Sustainable Management of Surfing Breaks: Case Studies and Recommendations*, 25 Journal of Coastal Research 684, 684-703 (May 2009); *see also* J. William Kamphuis, *Introduction to Coastal Engineering and Management* 371 (World Scientific Publishing Co., 2000) (noting that seawalls can create dangerous flow conditions).

37 The Coastal Commission is tasked with protecting the scenic views and character of the coast; therefore, most LCPs include language and objectives related to community character and aesthetics. *See* Cal. Pub. Res. Code § 30251.

38 Photo courtesy of Kenneth and Gabrielle Adelman of the California Coastal Records Project, http://www.californiacoastline.org/.

39 Dugan et al., *supra* note 2.

40 *Id*.

41 There are two current efforts underway to examine the value of beach habitat in terms of restoration costs, one for the California Coastal Commission and one for The Nature Conservancy. See *infra* Sections VI and VII for further discussion of mitigation fees.

(at least up to 250-300 feet). By reducing beach width, armoring structures also reduce the carrying capacity of the beach and thus reduce attendance and the local expenditures from beachgoers.[42] The reduction in beach width also potentially creates a loss in the "existence value" of the beach (i.e., how much people who never go to a beach may be willing to pay to preserve it) and the "option value" of the beach (i.e., the value of preserving a beach to provide an option to enjoy it in the future).[43]

Armoring structures also have an overall negative impact on beach community property values. In a 2003 study in the Southeast US, building a seawall increased individual waterfront property values but lowered the property value of non-waterfront properties, leading to a net property value loss in the community.[44] Moreover, as more and more seawalls are built, waterfront property values ultimately decline: the first few property owners to armor significantly benefit, but as more neighbors follow suit, property values drop to about where they started.[45] Thus, seawalls confer a small private and temporary economic benefit to some waterfront property owners but impose larger economic costs on the community.[46]

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Finally, armoring comes at a high social cost. First, under the state's current armoring policies, private property owners are often allowed to potentially damage public trust resources and public access to the beach in order to protect their own property. This loss of access to and use of the beach raises environmental justice concerns, as the segment of the public that uses public beaches is typically not the same segment of the public that protects shoreline structures. Second, the installation of a seawall creates a community perception of stability and can lead to an intensification or densification of coastal uses that are dependent on the seawall for protection.[47] Finally, permitting of armoring structures can be damaging to the social fabric of a community in the form of unforeseen and significant litigation costs, as neighbors fight neighbors over end effects of seawalls.[48] These armoring impacts are significant on a broader scale because social cohesion and social capital are a vital part of community resilience.[49]

42 For an analysis of the recreational and economic effects of reduced beach width, see Linwood Pendleton, et al., *Estimating the Potential Economic Impacts of Climate Change on Southern California Beaches*, 109 Climatic Change 277, 277-298 (2011).

43 These values are difficult to quantify but are nevertheless important. *See* Linwood Pendleton & Judith Kildow, *The Non-Market Value of Beach Recreation in California*, 74 Shore & Beach 34, 34–37 (2006).

44 Warren Kriesel & Robert Friedman, *Coping With Coastal Erosion: Evidence For Community-Wide Impacts*, 71 Shore & Beach 19, 19-23 (2003).

45 *Id*.

46 This study is currently being replicated in California. *See* John Lynham & Qingran Li, *Are Seawalls Correlated with Lower Property Values in California?* (forthcoming 2015).

47 Some proposed seawalls would protect not only older homes, but also new homes, which were permitted only on the condition that no future seawall would be necessary to protect them. These seawalls not only flout the prohibitions in Coastal Act § 30253, but also encourage future risky coastal development as new homebuilders reap the protective benefits of seawall applications from older homes. *See* Cal. Coastal Comm'n, Staff Report, Th17a (App. No. 4-12-043) at 3 (Dec. 11, 2014) [hereinafter Coastal Comm'n Broad Beach Staff Report] *available at* http://documents.coastal.ca.gov/reports/2014/12/Th17a-12-2014.pdf.

48 For example, Nantucket is now totally divided over this issue, portending future conflicts around the nation as sea levels rise and storms become increasingly damaging. *See, e.g.*, David Abel, *Homeowners Battle Erosion, Neighbors On Nantucket: Critics Call System of Tubes and Trenches a Threat to Island's Topography*, The Boston Globe, Sep. 19, 2014, http://www.bostonglobe.com/metro/2014/09/28/battleover-bluff-nantucket/L41admApMtz3ZGqsO8XlTI/story.html.

49 A major survey conducted by the Associated Press-NORC Center for Public Affairs Research after Superstorm Sandy to learn how neighborhood characteristics and social factors related to recovery and resilience showed that the level of trust in a community was an important signal of resilience and rebuilding. *See Resilience in the Wake of Superstorm Sandy* (June 2013), *available at* http://www.apnorc.org/PDFs/Resilience%20in%20Superstorm%20Sandy/AP_NORC_Resilience%20in%20the%20Wake%20of%20Superstorm%20Sandy-FINAL_fxd.pdf. These findings support "extant literature . . . that factors such as social network connectedness, social cohesion, trust, and community bonds facilitate social interaction and information exchange. This reservoir of social resources can then be drawn upon in the event of a disaster." *Id*.

. t t - t ?

Potential responses to sea level rise generally fall into three categories: protection (e.g., armoring structures), accommodation (e.g. elevating structures above inundation levels), and retreat (e.g. prohibiting or relocating development and infrastructure).[50] Of these, retreat strategies promote the ability of natural systems (e.g., beaches, dunes, wetlands) to respond to sea level rise and migrate landward, ensuring their survival. In turn, these systems provide co-benefits for coastal communities: coastal ecosystems can serve as protective buffers against sea level rise and storm events while continuing to provide access, recreation opportunities and other social benefits. For example, the value of wetlands in protecting coastal communities against floods globally has been estimated at $6,923 per hectare per year.[51]

In addition to retreat strategies, "living shoreline" adaptation approaches have been gaining popularity. Living shorelines substitute natural vegetation for hard armoring structures, relying on "natural methods for shoreline erosion control that do not sever existing connections between riparian, intertidal, estuarine and aquatic areas essential for water quality, ecosystem services, and habitat values."[52] While some limited use of structural materials may be necessary, it is important to minimize or avoid these stabilization structures; otherwise, traditional erosion control structures can be misleadingly dubbed "living" simply because they contain a vegetative component. In California, the Department of Parks and Recreation has shown that stabilizing shorelines with methods such as vegetating dunes can be effective in protecting some coastal parks.[53] However, as with beach nourishment,[54] it is not effective in areas subject to high-energy wave action, as experienced along much of California's ocean coastline.[55] Thus, in many places in California, there will be few natural protective infrastructure options; in these areas, selective, thoughtful relocation will be the only "soft" alternative. For these reasons, it is critical to assess the coastal protection services provided by coastal habitats on a site-specific basis and to employ site-specific strategies in a way that improves overall coastal resilience.

50 *See* Megan M. Herzog & Sean Hecht, *Combatting Sea-Level Rise in Southern California: How Local Governments Can Seize Adaptation Opportunities while Minimizing Legal Risk*, 19 Hastings W.-Nw. J. Envtl. L. & Pol'y 463, 558-59 (2013). For a complete discussion on the non-armoring tools and strategies available to local governments to respond to sea level rise, see Jessica Grannis, *Adaptation Tool Kit: Sea Level Rise And Coastal Land Use*, Georgetown Climate Center (Oct. 2011); for a more thorough discussion of nature-based solutions and managed retreat, see James G. Titus, *Rolling Easements* at 167 (June 2011), *available at* http://www2.epa.gov/sites/production/files/documents/rollingeasementsprimer.pdf.

51 *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (Christopher B. Field et al. eds., Cambridge: Cambridge University Press, 2012).

52 Orrin H. Pilkey et al., *Rethinking Living Shorelines*, Program for the Study of Developed Shorelines, Western Carolina University, 3 (March 1, 2012). For example, The San Francisco Bay Living Shorelines Project involves using structural and organic materials to reinforce the shoreline, minimize coastal erosion, and maintain coastal processes while protecting, restoring, enhancing, and creating natural habitat for fish and aquatic plants and wildlife. *See San Francisco Bay Living Shorelines Project*, http://www.sfbaylivingshorelines.org/sf_shorelines_about.html.

53 Ellen Hanak & Georgina Moreno, *California Coastal Management with a Changing Climate*, Public Policy Institute of California, 11-12 (2008), *available at* http://www.ppic.org/content/pubs/report/R_1108GMR.pdf.

54 While beach nourishment—the process of trucking or pumping sand onto eroding beaches—is appropriate in some circumstances, its performance in the face of sea level rise and storms is uncertain. Even with groins to help keep the sand in place, maintaining beach width on California's eroding beaches will require continued costly upkeep and delivery of sand. Robert S. Young, *A Broad Perspective on the Impacts of Seawalls on Beaches from a Scientific and Regulatory Perspective with Implications for the Southampton Town Trustees' Coastal Easement*, Program for the Study of Developed Shorelines, 14 (July 2011); *see also* U.S. Army Corps of Engineers et al., *Draft Coastal Regional Sediment Management Plan for the Santa Cruz Littoral Cell*, Coastal Sediment Management Workgroup (Apr. 2015), *available at* http://www.dbw.ca.gov/csmw/pdf/Santa_Cruz_Littoral_Cell_CRSMP_Draft_8April2015.pdf. Finally, the choice of where to source the sand and whether the sand grains are similar to and will provide the equivalent ecological function as the native sand is a matter of substantial debate. *See, e.g.*, Coastal Comm'n Broad Beach Staff Report, *supra* note 47.

55 Hanak & Moreno, *supra* note 53, at 11-12. Coastal habitat restoration may provide superior wave protection by diffusing wave energy rather than absorbing it, as hard armoring structures do, but the protection is most effective in bays or estuaries where waves are smaller. *Id*.

. C f t t t ?

Armoring decisions along the California open coast—as distinct from those in San Francisco Bay[56]—are governed primarily by the state Constitution, the California Coastal Act, and additional portions of the Public Resources Code that address development on state tidelands and submerged lands. The Coastal Commission, local governments, and State Lands Commission carry out these laws.

This Section first explains the Coastal Commission's authority to regulate armoring and how and when this planning and regulatory authority is transferred to local governments. Then, it examines the State Lands Commission's role and the role of other public agencies in shaping armoring decisions as trustees or managers of land and infrastructure. Finally, part B of this Section provides an overview of the most relevant laws and policies that govern coastal armoring decisions.

A. E DEC A E

f t C f C t C t

Enacted by the state legislature in 1976, the California Coastal Act establishes a comprehensive framework for planning and regulation of land and water uses, including armoring, along the coast. Within this framework, local governments are encouraged to use their authority to regulate land use to guide development, consistent with state policies provided in Chapter 3 of the Act. The Coastal Commission is charged with protecting and advancing statewide interests, also in accordance with Chapter 3, using a combination of planning, oversight, and regulatory authorities. (Chapter 3 policies addressing armoring are discussed in detail below.)

Local Coastal Programs (LCPs) are the principal means by which local governments, working in conjunction with the Coastal Commission, implement the Coastal Act. An LCP is a combination of land use plans, maps, and zoning ordinances that determine how the Coastal Act will be applied to specific instances of coastal development.[57] Each local government is charged with developing one or more LCPs for areas of the coastal zone within its jurisdiction, and amending or updating those LCPs as circumstances change.[58] The Coastal Commission is to review each proposed LCP and, as appropriate, certify it once the LCP is found to be consistent with the Coastal Act.[59] Upon certification, authority to regulate coastal development—exercised through issuance of coastal development permits (CDPs)—in the LCP area is transferred from the Coastal Commission to the local government.[60]

This transfer of permitting authority gives local governments authority to regulate many proposed emergency and permanent armoring projects. However, the Coastal Commission retains its "original" jurisdiction to regulate development in areas that lack LCPs.[61] The Coastal Commission also retains original regulatory jurisdiction over proposed development on tidelands, submerged lands, public trust lands, and certain other areas within a specific distance of the shore, as well as over most major public works projects.[62] Finally, the Coastal Commission

56 Because the challenges posed by sea level rise in San Francisco Bay are distinct from those facing the open coast, they are not specifically addressed by this paper. Armoring decisions along San Francisco Bay are separately administered pursuant to the McAteer-Petris Act and the San Francisco Bay Plan. McAteer-Petris Act, Cal. Gov't Code §§ 66600–66661 (West 2015); S.F. Bay Conservation and Dev. Comm'n, S.F. Bay Plan, *available at* http://www.bcdc.ca.gov/laws_plans/plans/sfbay_plan.shtml.

57 *See* Cal. Pub. Res. Code § 30108.6.

58 *See id*. §§ 30500–30525.

59 *See id*. § 30512.

60 *See id*. § 30600.

61 *See id*. §§ 30519, 30601.

62 *See id*. §§ 30519, 30600–01.

has appellate jurisdiction over particular local government decisions, including approvals of development between the sea and the first public road paralleling the sea.[63] In light of these authorities, the Coastal Commission often exercises either original regulatory or appellate jurisdiction over applications for permits to develop armoring structures.[64]

f t t t C

The State Lands Commission administers state-owned land below the mean high tide line, including state tidelands and submerged lands, which it holds for the benefit of the state's citizens and in keeping with the public trust.[65] The State Lands Commission's responsibilities include identifying the location of the mean high tide line for purposes of determining the extent of state ownership and protecting the public trust lands within its jurisdiction.[66]

Pursuant to the Public Resources Code, the State Lands Commission must issue a lease prior to the development of armoring structures on tidelands or submerged lands that are under state ownership and control.[67] State Lands may also review permit applications submitted to the Coastal Commission for armoring structures that may encroach on those lands.[68] As discussed below and in Section VII, State Lands Commission lease conditions and permit review procedures can be important tools for protecting tidelands and submerged lands – and the broad range of benefits these public trust resources provide for current and future generations – from unnecessary impacts of coastal armoring.

f t A

Other state agencies, such as the State Coastal Conservancy[69] and the Department of Parks and Recreation,[70] may play potentially significant roles in armoring decisions as trustees and managers of coastal resources.[71] Perhaps most importantly, Caltrans, which plans, develops, and manages many of the state's roads, makes significant capital investments with public funds and can influence the need for and use of coastal armoring in a wide array of circumstances.[72]

63 *Id*. § 30603(a).

64 However, which legal standards apply to coastal armoring applications depends on where the armoring structure is located and whether the jurisdiction in which the property is located has a certified LCP. For permits over which the Coastal Commission has original or appellate jurisdiction, the Coastal Commission applies the standards established in the certified LCP and the public access policies of the Coastal Act. *See* Cal. Pub. Res. Code § 30603(b). For permits in areas with no certified LCPs, the Coastal Commission applies the standards and policies set forth in the Coastal Act. *See id.* at § 30604(a). Because most public and private property within the coastal zone is managed under LCPs, LCPs policies have significant impacts on land use decisions.

65 *See* Cal. Const., art. X, § 3; Cal. Civ. Code § 670; Cal. Pub. Res. Code § 6301. For more general information about the State Lands Commission's jurisdiction, *see* http://www.slc.ca.gov/About_The_CSLC/About_The_CSLC_Home_Page.html.

66 Cal. Pub. Res. Code § 6009.1. State Lands' must administer its public trust lands solely in the interest of the public and must take reasonable steps to "take and keep control of and to preserve the trust property[,] . . . to enforce claims that are part of the trust property . . . [and] to defend actions that may result in a loss to the trust." *Id*. To that end, State Lands can cause the removal of seawalls on ungranted state lands. *See id.* §§ 6216.1, 6302, & 6312. State Lands also has oversight responsibility for tidelands or submerged lands that have been granted to local jurisdictions to ensure that the uses of those lands are consistent with the public trust. *Shoreline Protective Structures*, Staff Report to the California State Lands Comm'n, 12 (2001) [hereinafter *State Lands Armoring Report*], *available at* http://www.slc.ca.gov/Reports/Shoreline_Protective_Structures/Shoreline_Protective_Structures_Report.pdf.

67 Cal. Pub. Res. Code § 6224.3(a) and (g); *see also* Cal. Pub. Res. Code §§ 6216, 6501.1, 6321, 6327.

68 Letter from Charles Warren, Exec. Officer, State Lands Comm'n, to Peter Douglas, Exec. Director, Coastal Comm'n (Aug. 12, 1993) (outlining the agreed upon process to improve coordination between the Coastal Commission and State Lands Commission) (on file with author); *State Lands Armoring Report, supra* note 66, at 16.

69 The Conservancy purchases property or property interests to meet the policies and objectives of the Coastal Act. *See* Cal. Pub. Res. Code §§ 31104.1; 31105.

70 The Department of Parks and Recreation and the State Parks Commission also manage important coastal resources, including near-shore marine reserves and many state beaches and coastal state parks. *See* Cal. Pub. Res Code §§ 501, 530.

71 In addition, the Ocean Protection Council could play an important role in coordinating all of the state coastal and ocean management agencies coastal adaptation efforts and policy development that does not depend so much on coastal armoring. *See* Cal. Pub. Res Code §§ 35500–35650.

72 *See* Caldwell and Segal, *supra* note 31, at 545 n.63.

B. E A A E A EC C A A A DEC

The California Coastal Act is the primary law regulating armoring. It not only establishes the overall framework for regulating coastal development, but it also contains substantive policies that directly address coastal armoring. Applicable law can also be found in:

- Local planning documents and implementing zoning ordinances,
- Public Resources Code provisions governing development on state tidelands and submerged lands,
- The common law public trust doctrine,
- State constitutional provisions protecting public access to tidelands, and protecting private property rights,
- The California Environmental Quality Act (CEQA), and
- State and federal insurance regulation and disaster relief laws.[73]

These laws are discussed more fully below.

C t A t

The Coastal Act establishes statewide coastal management goals of protecting public access, recreational opportunities, natural resources, and coastal scenic and aesthetic qualities, "consistent with the … constitutionally protected rights of private property owners."[74] These goals are an important backdrop for the two Coastal Act policies that expressly address coastal armoring, which can be jointly summarized as allowing armoring structures if existing coastal development is in jeopardy of being lost to erosion and if certain conditions are met.[75]

The Coastal Commission must liberally construe and further the objectives of the Coastal Act.[76] This includes complying with state Constitutional and Coastal Act provisions to protect and maximize the public's right to access and enjoy the coast.[77] The Coastal Act also charges the Coastal Commission with protecting and enhancing coastal resources, ensuring balanced resource use, ensuring priority of coastal-dependent uses (which excludes residential uses), and encouraging coordinated planning.[78] Specifically, the purposes of the Coastal Act are to:

> (a) Protect, maintain, and, where feasible, enhance and restore the overall quality of the coastal zone environment and its natural and artificial resources.
>
> (b) Assure orderly, balanced utilization and conservation of coastal zone resources taking into account the social and economic needs of the people of the state.
>
> (c) Maximize public access to and along the coast and maximize public recreational opportunities in the coastal zone consistent with sound resources conservation principles and constitutionally protected rights of private property owners.
>
> (d) Assure priority for coastal-dependent and coastal-related development over other development on the coast.
>
> (e) Encourage state and local initiatives and cooperation in preparing procedures to implement coordinated planning and development for

73 For further discussion on state and federal insurance regulation and disaster relief, *see infra* Section VI.

74 Cal. Pub. Res. Code § 30210.

75 *See id*. §§ 30235, 30253.

76 The Coastal Act is to be liberally construed to achieve the purposes of the Act. Cal. Pub. Res. Code § 30009.

77 *See* Cal. Const. art. X, § 4.; Cal. Pub. Res. Code § 30001.5(c).

78 Cal. Pub. Res. Code § 30001.5.

> mutually beneficial uses, including educational uses, in the coastal zone.[79]

The California legislature also recognizes that the scenic and visual qualities of coastal areas are an important public resource and requires the Coastal Commission to protect them, requiring that: "Permitted development shall be sited and designed to protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural land forms, to be visually compatible with the character of surrounding areas, and, where feasible, to restore and enhance visual quality in visually degraded areas."[80]

The purposes of the Coastal Act and the objectives outlined above should be considered when analyzing the two main provisions in the Coastal Act that govern open coast shoreline armoring permitting in California, Sections 30253 and 30235. Section 30253 prohibits new development if it would require a coastal armoring structure. Section 30253 specifically states:

> New development shall do all of the following:
>
> (a) Minimize risks to life and property in areas of high geologic, flood, and fire hazard.
>
> (b) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.[81]

However, Section 30235 provides that armoring structures shall be allowed to protect *existing* structures if certain use and design conditions are met. Section 30235 provides that:

> Revetments, breakwaters, groins, harbor channels, seawalls, cliff retaining walls, and other such construction that alters natural shoreline processes *shall* be permitted when required to serve coastal-dependent uses or to protect existing structures or public beaches in danger from erosion and when designed to eliminate or mitigate adverse impacts on local shoreline sand supply.[82]

The tension between preserving the natural environment and permitting shoreline armoring caused in part by Section 30235 has been exacerbated by the Coastal Commission's interpretation of what constitutes "existing development" vs. "new development." When read together, Coastal Act Sections 30253 and 30235 suggest that "existing development" refers to development that existed prior to the passage of the Coastal Act in 1977. However, the Coastal Commission has instead often interpreted "existing" to mean structures that existed at the time the application for shoreline armoring was made.[83] Consequently, the universe of development subject to "grandfathering" under Section 30235 was substantially expanded to include any shoreline development that the Coastal Commission had approved. While no consistent interpretation of "existing" has emerged, leading to continued regulatory uncertainty, the Coastal Commission's current practice of imposing a "no future armoring" condition upon newly proposed shoreline development helps to limit the number of properties eligible for armoring.[84]

79 *Id*. § 30001.5.

80 *Id*. § 30251.

81 *Id*. § 30253.

82 *Id*. § 30235 (emphasis added).

83 *See* Herzog & Hecht, *supra* note 50.

84 For a discussion of the controversy around armoring of post-Coastal Act structures, see Todd Cardiff, *Conflict in the California Coastal Act: Sand and Seawalls*, 38 Cal. W. L. Rev. 255 (2001). For an example of a "no future armoring" condition, see Cal. Coastal Comm'n, Staff Report W6A (App. No. 1-13-0990) at 7 (Feb. 2014) (application to build a new home in Humboldt County), *available at* http://documents.coastal.ca.gov/reports/2014/2/W6a-2-2014.pdf.

Local governments can play a key role in shaping shoreline policy and planning to avoid the need for armoring. In addition to LCPs, local governments develop planning documents such as general plans, capital improvement plans, and hazard mitigation plans, which can enhance community resilience by guiding how a community prepares for and responds to sea level rise.[85] For example, general plans that include information and provisions regarding non-armoring sea level rise adaptation strategies can help to shape land-use decisions. Similarly, the implementing zoning ordinances of general plans and LCPs can contain specific adaptation strategies. These can include increased setbacks for new development, changes to local zoning which restrict certain development, requiring new structures to be elevated, facilitation of managed retreat for existing development, and preserving undeveloped lands to allow for retreat.[86] Many of these strategies are discussed in the recommendations Section below.

t t

As noted above, the State Lands Commission has the power to permit certain coastal property owners to construct armoring structures below the mean high tide line, so long as those structures "do not unreasonably interfere with the uses and purposes reserved to the people of the State."[87] State law now affirmatively requires a lease for development of armoring structures on tidelands and submerged lands.[88] If an armoring structure is installed without the requisite lease or permit, the State Lands Commission has the authority to impose monetary penalties and to require that the violator remove the armoring structure at the violator's expense.[89]

The State Lands Commission also has the discretion to charge rent for those armoring structures.[90] Historically, the State Lands Commission waived rent for protective structure leases when it determined that a public benefit accrued from the armoring;[91] however, in the past several years, State Lands Commission has begun to charge rent.[92] Charging rent for armoring structures located on public trust lands has been met with resistance from affected agencies and landowners, in part because coastal rents can be expensive: state law currently allows rents to be based on nine percent of appraised land value.[93] Some coastal property owners have challenged the State Lands Commission's jurisdiction rather than pay rent for occupying property they believe they own in fee.[94]

In addition, charging rent or prohibiting armoring may be problematic for the State

85 Incorporating sea level rise considerations into capital planning processes may help reduce the need for armoring to protect new infrastructure. *See, e.g.*, City and County of San Francisco, *Guidance for Incorporating Sea Level Rise in to Capital Planning in San Francisco: Assessing Vulnerability and Risk To Support Adaptation* (Sep. 2014), *available at* http://www.acfloodcontrol.org/SFBayCHARG/pdf/sf_slr_guidance.pdf.

86 For a more complete discussion of possible local government strategies to adapt to sea level rise, see Grannis, *supra* note 50; Herzog & Hecht, *supra* note 50; Michael Allan Wolf, *Strategies For Making Sea-Level Rise Adaptation Tools "Takings Proof,"* 28 J. Land Use & Envtl. L. 157 (2013).

87 Cal. Pub. Res. Code § 6321.

88 *See id*. § 6224.3(a) and (g) (adopted 2012)

89 *See id*. § 6224.3(b)(e)(f).

90 *See id*. § 6321.2 (providing that the State Lands Commission *may* collect rents).

91 *State Lands Armoring Report, supra* note 66, at 1. The alleged public benefits that the State Lands Commission has cited include: providing protection for public roads, highways and utilities, protecting the base of eroding coastal bluffs, and providing safety to the public by reducing the potential of bluff collapse. *Id.* at 13-14.

92 *See, e.g.*, State Lands Comm'n, Revision of Rent Agreement, Item C 36 (December 2014) (Item C 36), *available at* http://archives.slc.ca.gov/Meeting_Summaries/2014_Documents/12-17-14/Voting_Record.htm.

93 Cal. Code Regs, tit. 2, art. 2, § 2003(a); *State Lands Armoring Report, supra* note 66; Annual rents for protective structures can exceed $4000. *Id.* at 2.

94 *See, e.g., Public Lands: State Lands Commission: Violations, Hearing on A.B. 2664 Before the Senate Committee on Natural Resources and Water*, 2009-2010 Leg., Reg. Sess. (Cal. 2010) (bill analysis noting that the "The State Lands Commission is consistently in litigation over cases that involve a person building a structure on state lands without proper authorization or violating an application if they did request permission"), *available at* http://www.leginfo.ca.gov/pub/09-10/bill/asm/ab_2651-2700/ab_2664_cfa_20100607_112708_sen_comm.html; *see also Public Lands: State Lands Commission: Violations, Hearing on A.B. 2082 Before the Assembly Committee on Judiciary*, 2011-2012 Leg., Reg. Sess. (Cal. 2012) (bill summary prepared by Anthony Lew and describing State Lands litigation around collecting rents), *available at* http://www.leginfo.ca.gov/pub/09-10/bill/asm/ab_2651-2700/ab_2664_cfa_20100607_112708_sen_comm.html.

Lands Commission due to the ambulatory nature of the mean high tide line and the difficulty of determining whether a structure is in fact situated on state lands at any particular time in a highly dynamic physical environment. Recently, the State Lands Commission has begun adding language to its title settlements and boundary line agreements to indicate that lands that are currently not part of the public trust, but may be inundated by sea level rise in the future, will be subject to a public trust easement.[95] To date, these agreements only cover around one percent of the coast.[96] In the absence of such agreements, the legal status of seawalls that were lawfully built on private property—but may now be located on public trust lands due to sea level rise and shoreline erosion—remains untested by California courts.

tD t

The public trust doctrine requires that the state hold certain coastal resources in perpetual trust for the benefit of the public and that the state protect those resources. The public trust includes both submerged waters and the public beach below the mean high tide line.[97] California courts have interpreted the public trust broadly to include maintaining the ecological values of public lands and waters, fishing, public recreation, and the preservation of tidelands in their natural state.[98] The public trust doctrine thus provides an important basis to prohibit or otherwise regulate armoring structures that would disrupt ecosystem function and/or encroach on public access or use of the tidelands or coastal waters.[99]

B t t t

The Coastal Commission and other coastal managers must carry out their mandates consistent with statutory and constitutional parameters, including those related to the exercise and protection of private property rights.[100] The scope of private property rights thus plays an important role in any government efforts to formulate coherent shoreline armoring and managed retreat policies. Such private property rights include "acquiring, possessing, and protecting property, and pursuing and obtaining safety, happiness, and privacy."[101] In addition, the takings clause of the 5th Amendment to the United States Constitution prohibits the taking of private property for public use without just compensation.[102] On the other hand, it is well settled that governments may place reasonable conditions on the use of property,[103] including,

95 Sample title settlement language:
> The boundaries of lands freed of the Public Trust as established by, and conveyances made pursuant to, this Agreement are intended to be fixed and not subject to change by erosion, accretion, reliction or submergence, whether due to natural or artificial causes. However, should lands freed of the Public Trust become submerged or subject to the ebb and flow of the tide below the elevation of mean high water from waters of the San Francisco Bay, whether due to either erosion or sea level rise ("Inundation"), those lands, for so long as Inundation exists, shall be subject to the Public Trust easement; provided, however, that the Public Trust easement shall not attach unless and until Inundation has existed continuously for five years. Prior to the attachment of the Public Trust Easement, neither the Public Trust Easement nor the Commission shall prevent the right of the owner(s) of those lands to reclaim or otherwise restore them to their pre-Inundation condition so long as activities evidencing the exercise of such right (which may include the submittal of an application for a required permit) have commenced within one year of Inundation.

E-mail from Jennifer Lucchesi, Exec. Officer of the State Lands Commission to Margaret Caldwell, Director of Stanford Law School's Environmental & Natural Resources Law and Policy Program (Dec. 8, 2014) (on file with authors).

96 *State Lands Armoring Report, supra* note 66, at 1, 13. The Report states that where the boundary is uncertain, the project is often allowed to proceed without a permit: "Such projects are allowed to proceed with the caveat that *if the boundary is established and shows the improvements to be located on sovereign lands*, the private party will enter into a lease with the CSLC or remove the structure occupying state lands." The problem with this approach is that boundary determinations are expensive and time consuming, so enforcement may be challenging. Id. at 13.

97 *See, e.g., City of Berkeley v. Superior Court*, 26 Cal. 3d 515, 521 (1980) ("When California was admitted to statehood in 1850, it succeeded to title in the tidelands within its borders not in its proprietary capacity but as trustee for the public.")

98 *Nat'l Audubon Soc'y v. Superior Court*, 658 P.2d 709, 718-19 (Cal. 1983) (noting that California fulfills its public trust duties when it preserves trust lands "as open space, and as environments which provide food and habitat for birds and marine life").

99 *Nat'l Audubon Soc'y*, 658 P.2d at 718–19.

100 For example, the Coastal Commission is instructed to maximize public access to, and recreational opportunities in, the coastal zone consistent with public safety needs and private property rights. Cal. Pub. Res. Code § 30210.

101 Cal. Const., art. I, § 1.

102 *Nollan v. Cal. Coastal Comm'n* (1987) 483 U.S. 825, 833-834 (*Nollan*).)

103 *See id., Dolan v. City of Tigard*, 512 U.S. 374 (1994); *Koontz v. St. Johns River Water Mgmt. Dist.*, 133 S. Ct. 2586 (U.S. 2013).

as the Coastal Act does, prohibiting seawalls for new development and requiring the presence of mitigating conditions for seawalls on existing development. The *Lynch* case, currently before the California Supreme Court, explores where the line between reasonable and unconstitutional mitigating conditions for seawalls should be drawn.[104] In addition, private property rights never include the right to create a nuisance.[105] Under California law, local governments have the authority to prevent and to abate nuisances; this includes the authority to declare armoring which encroaches on public land to be a public nuisance and to require its removal without providing just compensation.[106] Ultimately, in light of these Constitutional, statutory, and common law considerations, advocates have argued that the Coastal Commission, State Lands, and local governments can and should pursue other management options beyond armoring structures to adapt to sea level rise while still respecting the rights of property owners.

E t t

Finally, state law requirements, such as those to assess and mitigate or avoid the environmental impact of any projects requiring state approval, provide an opportunity to shape armoring decisions along the open coast. Unfortunately, this process is being circumvented in some situations.

The California Environmental Quality Act (CEQA) requires state and local agencies to identify the significant environmental impacts of the projects they approve or undertake and avoid or mitigate those impacts, if feasible.[107] Shoreline armoring structures, given their potential for significant environmental effects, are typically reviewed under CEQA or a functionally equivalent environmental review process.[108] Environmental review is critical to identifying the effects of armoring structures on coastal resources and thinking through strategies and alternatives in order to avoid, reduce, or mitigate those impacts. However, because CEQA does not apply to "[s]pecific actions necessary to prevent or mitigate an emergency,"[109] many armoring structure applicants have circumvented this important substantive review process in two ways: 1) by applying for an emergency permit, or 2) by forming and applying for a seawall permit as a Geological Hazard Abatement District (GHAD),[110] under which improvement projects are classified as emergencies and exempted from CEQA review.

These issues—along with the other major concerns with California's approach to armoring—are analyzed in more detail in Section VI below. Section VII proposes recommendations—working both within the current legal framework and proposing legislative changes—to help address these challenges and reduce fortification of the open coast.

104 *Lynch*, 229 Cal. App. 4th at 661-665.

105 *See* Cal. Civ. Code § 3479 (defining nuisance); *see also* Aminzadeh, *supra* note 6, at 544-545 (noting that "a public nuisance can be found for activities that endanger public life or health, obstruct the free use of property, interfere with the enjoyment of life or property, or unlawfully obstruct the free passage or use of navigable waters.")

106 *Scott v. City of Del Mar*, 58 Cal. App. 4th 1296, 1305-06 (1997) (holding that the city's removal of a seawall did not constitute inverse condemnation because the "legislature has the power to declare certain uses of property a nuisance and such use thereupon becomes a nuisance *per se*.") *See also* Cal. Pub. Res. Code § 30005 (providing that the Coastal Act does not limit a city or county's ability to declare, abate, or prohibit nuisances).

107 Cal. Pub. Res. Code § 21002; *see also* Cal. Code Regs. tit. 14, §§ 15021(a)(2), 15092(b) (Westlaw 2015).

108 This takes the form of CEQA review by the State Lands Commission or a similar analysis by the Coastal Commission: The Coastal Commission's regulatory program pursuant to the Coastal Act has been certified by the Secretary of the Natural Resources Agency as the functional equivalent of an environmental impact report ("EIR") for compliance with CEQA. Cal. Pub. Res. Code § 21080.5; Cal. Code Regs. tit. 14, §15251(c).

109 Cal. Pub. Res. Code §§ 26559; 21080(b)(4).

110 A GHAD is an independent, state-level public agency that can construct "improvements" on public or private lands to prevent, mitigate, abate, or control a geologic hazard such as coastal erosion. Cal. Pub. Res. Code Ann. § 26580.

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Despite a comprehensive and clear body of knowledge about the negative impacts of coastal armoring, provisions within the Coastal Act, as well as the Coastal Commission's and local governments' interpretation and application of those provisions, enable the continued armoring of the open coast. Local governments also lack the financial, legal, and regulatory incentives from the Coastal Commission to update or certify their LCPs to include policies that address sea level rise and coastal hazards. As discussed below, the funding currently provided by the Ocean Protection Council to local governments to address sea level rise is likely on orders of magnitude too low. Compounding these issues, state and federal insurance and disaster relief policies fail to facilitate retreat and encourage redevelopment in hazardous areas. Finally, state entities continue to default to coastal armoring in the face of coastal hazards in spite of public trust obligations.

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Several aspects of California's regulatory and management approach enable the continued armoring of the coast, as a result of:

- Conflicts and scientific inaccuracy within the Coastal Act;
- The Coastal Commission's interpretation of Coastal Act provisions;
- The lack of review and frequent permanent extension of emergency permits;
- The lack of environmental review for certain armoring projects;
- The Coastal Commission's lack of sufficient enforcement authority to consistently deter and remediate unlawful armoring structures;
- Inconsistent and under-calculation of appropriate development setbacks in light of sea level rise;
- Inconsistent and under-calculation of mitigation fees; and
- Liberal redevelopment policies and nonconforming use policies that perpetuate the status quo and thwart managed retreat.

These issues are discussed in turn below.

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As a threshold matter, the California Coastal Act Section 30235 providing that the Coastal Commission "shall" allow armoring for existing development has led to a proliferation of hard armoring structures.[111] In addition, Section 30235 contains an unsound scientific premise: it calls for allowing armoring "to protect existing structures or public beaches in danger from erosion," when in reality, armoring does not protect—and rather hastens the disappearance of—public beaches in danger of erosion.[112] In addition, armoring structures cannot be built in a way that eliminates all impacts.

Section 30235 is also problematic because it conflicts with other sections of the Coastal Act that call for protection of coastal resources, public access, and scenic views.[113] In particular, because armoring causes the disappearance of

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111 *Id*. § 30235.

112 While it is true that groins can be used to trap sand to protect and enhance a particular stretch of beach, this beach enhancement will occur at the expense of downdrift beaches. Thus, the Legislature must take a broader view of the effects of armoring when re-examining this Section.

113 *See* Cal. Pub. Res. Code § 30200(a) (incorporating by reference the coastal resource protection policies of § 30001.5); *see also id*. § 30251. For example, armoring structures that are not visually compatible with the character of the surrounding area – or armoring applications that do not consider feasible alternatives to armoring in order to minimize the alteration of natural landforms – are inconsistent with Section 30251.

the beach in front of it, Section 30235 directly conflicts with Section 30211, which provides that development[114] "shall not" interfere with the public's right to access or use dry sandy or rocky beaches.[115] When policy conflicts such as these arise, Coastal Act Section 30007.5 provides that they should "be resolved in a manner which on balance is the *most protective* of significant coastal resources."[116] However, this conflict-resolving provision has not been utilized to restrict armoring, because the use of the word "shall" in Section 30235 has made the Coastal Commission hesitant to deny armoring permits. In particular, the use of the word "shall" gives the impression that this is a mandatory provision, which may therefore not be subject to the conflict-resolving provision in Section 30007.5. However, in *Sierra Club v. Cal. Coastal Comm'n*, the court found that Section 30233—a similar "mandatory" policy which provides that the diking, dredging, and filling of coastal waters *shall* be permitted if certain conditions are met and shall be carried out to avoid significant disruption to the environment—was subject to the conflict-resolving provision because it conflicts with other policies in the Coastal Act.[117] The court held that Section 30233 must be interpreted in light of other provisions in the Act and that "literal construction should not prevail if it is contrary to the legislative intent apparent in the statute."[118] In this instance, the legislative intent apparent in the Coastal Act—that conflicts be resolved in a manner that is most protective of significant coastal resources and that areas of special biological significance be restored—supported the court's holding that the Coastal Commission could resolve the conflict in the manner most protective of coastal resources in the long term.[119] The Coastal Commission could point to the court's reasoning in *Sierra Club* to support future decisions to prohibit armoring where armoring would undermine the Coastal Act's prohibition on interfering with the public's right to access or use dry sandy or rocky beaches.[120]

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The Coastal Commission's interpretation of the term "existing" in the absence of any regulations or legislation that define that term has also been inconsistent. While many believe that the term "existing" should apply only to those structures in existence when the Coastal Act was passed, the Commission has often interpreted existing to mean "existing at the time of the [coastal armoring] permit application."[121] This reading is problematic because it essentially undermines Section 30253's prohibition on armoring for new development: a new homebuilder can decouple the home building permit application and seawall permit application such that the new house is considered existing at the time it applies for a seawall. The advent of "no future armoring" conditions imposed upon newly proposed shoreline development has remedied this somewhat, but many structures built post-Coastal Act were approved without "no future armoring" conditions and may still be eligible for seawalls without a legislative or regulatory clarification that the term "existing" means pre-Coastal Act.

114 "Development" includes armoring structures. *See* Cal. Pub. Res. Code § 30106.

115 *Id*. § 30211.

116 *Id*. § 30007.5 (emphasis added); *see also id*. § 30200(b) (further providing that where "the commission or any local government in implementing the provisions of this division identifies a conflict between the policies of [chapter 3], Section 30007.5 shall be utilized to resolve the conflict . . . .")

117 *See Sierra Club v. Cal. Coastal Comm'n*, 19 Cal. App. 4th 547, 561-562 (1993) (emphasis added).

118 *Id*.

119 *Id*. (noting that the Commission has the power "to permit significant short-term disruption in order to provide long-term benefits.")

120 See *infra* Section VII for more discussion on this issue.

121 For example, just after a new cliff-top home in Pismo Beach was built in 1997, the homeowners applied for a seawall to protect the house. The Coastal Commission eventually approved the seawall for the now "existing" house. *See* Charles F. Lester, *An Overview Of California's Coastal Hazards Policy*, in Living with the Changing California Coast (Gary Griggs, ed., Berkeley, University of California Press, 2005), (citing Cal. Coastal Comm'n, Appeal Staff Report, W12b (Appeal No. A-3-PSB-02-016) (Aug. 6, 2003), *available at* http://documents.coastal.ca.gov/reports/2003/8/W12b-8-2003.pdf.)

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Another major problem with California's policies and Coastal Commission practices concerns the emergency permitting process and the frequent extended authorization of emergency armoring structures. Emergency approval of armoring structures does not create a vested right for permanent authorization by the Coastal Commission.[122] However, after an armoring structure has been installed, it becomes politically difficult to deny permanent authorization or require removal of the seawall, since the development at issue must have been found to be "in danger" without the revetment in order for the emergency permit to have been issued in the first instance. There are also financial and engineering difficulties surrounding seawall removal: not only is removal expensive, but armoring structures also change the geomorphology of the coast, making it less stable than it would have been had the structure never been built.[123] With potentially increasing storms and rising sea levels, this "back door" approach to armoring—which allows for virtually no analysis of impacts to public resources or of alternative strategies for preventing harm to people or property—merits reform.

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Some armoring applicants have also been able to circumvent the environmental review process for seawalls by forming Geological Hazard Abatement Districts (GHADs). A GHAD is an independent, state-level public agency that can construct "improvements" on public or private lands to prevent, mitigate, abate, or control a geologic hazard such as coastal erosion.[124] Such "improvements" are statutorily deemed to be "specific actions taken to prevent or mitigate an emergency within the meaning of [CEQA]."[125] Because "[CEQA] does not apply to … [s]pecific actions necessary to prevent or mitigate an emergency," armoring projects undertaken by GHADs are considered exempt from CEQA.[126] Thus, GHADs could operate without any environmental review, including consideration of alternatives that would minimize environmental impacts. In the most significant recent example, homeowners in the Malibu Broad Beach area formed a GHAD and relied on the provisions in CEQA and in the GHAD section of the Public Resources Code to categorize a major armoring project as an "improvement" and approve it without conducting CEQA review.[127] This "loophole" is problematic because environmental review is critical to identifying the effects of armoring structures on coastal habitat and to thinking through strategies and alternatives in order to avoid, reduce, or mitigate those impacts.

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The Coastal Commission could use stronger enforcement authority to carry out a strategic policy on coastal armoring. While recent legislation gives the Coastal Commission authority to fine property owners who illegally block public access to beaches, the Coastal Commission still must go to court to seek penalties for any other violation, such as building armoring structures without permits.[128] Absent stronger enforcement powers, landowners can flout the Coastal Commission's authority and drag out the armoring review process. Resorting to litigation to penalize such illegal actors is an expensive and time-consuming proposition for the Coastal

122 *Barrie v. Cal. Coastal Comm'n*, 196 Cal. App. 3d 8 at 17-118 (1987).

123 Lester, *supra* note 121, at 150.

124 Cal. Pub. Res. Code §§ 26580; 26505.

125 *Id*. §§ 26601; 26559.

126 *Id*. §§ 21080(b)(4); 26601; 26559.

127 The Broad Beach GHAD relied on Pub. Res. Code Section 26559 to file a Notice of Exemption from CEQA. *See* Coastal Comm'n Broad Beach Staff Report, *supra* note 47, at 6.

128 *See* Cal. Pub. Res. Code § 30821 (eff. June 20, 2014).

Commission, ultimately impeding the Coastal Commission's ability to enforce the Coastal Act and the state Constitution.

[illegible]

The Coastal Commission requires in-lieu mitigation fees for impounded sand and lost recreation value to help mitigate the adverse impacts from armoring. However, whether the fees are adequate, both statutorily and practically, and whether the fees are used appropriately to preserve coastal resources is questionable.

Over time, the Coastal Commission has applied different methodologies to determine the value of lost recreation, leading to potential underestimates for lost recreation fees and litigation over mitigation fee determinations.[129] These methods range from a simple linear consumer surplus-based model at Ocean Harbor House in Monterey, to more complex amenity-loss models in Solana Beach, to a method based on values of adjacent property.[130] Inconsistent calculations have made it difficult for applicants or policy makers to know how proposed projects will be assessed and mitigated, and inadequate fees do not sufficiently require property owners to internalize the cost of development in high-risk areas. Finally, although armoring causes ecological impacts, to date, the Coastal Commission has not addressed impacts to ecosystems or ecosystem services when calculating mitigation fees.[131]

Even where the Coastal Commission does use a standardized mitigation calculation approach and consistently implements in-lieu fees—as it does for mitigation of sand loss due to impoundment—the extent to which those fees capture the actual loss is questionable.[132] Currently, the Coastal Commission relies on models created by coastal engineers to predict impacts of seawalls on sand supply. These models are rarely, if ever, tested for reliability after the fact to confirm their validity. Increased short- and long-term monitoring of the effects of armoring structures on sand supply and general beach loss—both on the project site and on adjacent properties and beaches—is necessary to improve these models, to increase our knowledge of the full impacts of seawalls, and to improve mitigation fee calculation to better account for and avoid armoring impacts.

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Most LCPs contain minimum setbacks to ensure that new development will be safe for its entire "economic life," usually for 50 to 100 years.[133] This economic life assumption is based in part

129 *See, e.g., Ocean Harbor House Homeowners Ass'n v. Cal. Coastal Comm'n*, 163 Cal. App. 4th 215, 223 (2008). For more information on valuation of ecosystem services, see Costanza, R., Wilson et al., *The Value of New Jersey's Ecosystem Services and Natural Capital*, Gund Institute for Ecological Economics, (Jul. 2006); Pendleton et. al, *supra* note 41; Fabien Quétier & Sandra Lavorel, *Assessing Ecological Equivalence in Biodiversity Offset Schemes: Key Issues and Solutions*, 144 Biological Conservation 2991, 2991–2999 (Dec. 2011).

130 *See* Cal. Coastal Comm'n, Staff Report Th9a (App. No. 3-02-024) (Oct. 2004) (Ocean Harbor House) (calculating a $13.00 per-person per-day average beach expenditure based on the economic beach valuation method) [hereinafter Coastal Comm'n Ocean Harbor House Staff Report] *available at* http://www.coastal.ca.gov/sc/Th9a-10-2004.pdf; Cal. Coastal Comm'n, Staff Report F8b (App. No. 2-11-009) at 7-9, 44 (Jul. 2014) (Pacifica) (calculating a $33.18 per sq. ft. of lost beach fee to mitigate access and recreation impacts based on a real estate valuation methodology), *available at* http://documents.coastal.ca.gov/reports/2014/7/F8b-7-2014.pdf; Cal. Coastal Comm'n, Staff Report WED 8e (App. No. 6-05-72) at 25-26 (Sep. 2005) (Las Brias Condominium, Solana Beach), *available at* http://www.coastal.ca.gov/sd/W8e-10-2005.pdf.

131 *See, e.g., Ocean Harbor House*, 163 Cal. App. 4th at 223 (noting that the Coastal Commission staff's valuation did not account for the "'value of non-quantifiable benefits of the recreational beach resource'" or other '"benefits such as potential habitat and aesthetic values.'") The literature on valuing the loss of beach habitat is also limited, and there are no well-established standards for valuing the loss of the ecological services. There is a clear need for more research on the ecosystem functions and services provided by sandy beaches and the non-market values associated with those services in order to assess fees for lost beach ecosystem services.

132 *See* Cal. Coastal Comm'n, *Report on In-Lieu Fee Beach Sand Mitigation Program: San Diego County*, 1997, *available at* http://www.coastal.ca.gov/pgd/sand1.html. For an example of sand supply mitigation fees attached as permit conditions to shoreline hardening projects, *see, e.g.*, Cal. Coastal Comm'n, Staff Report W16a (App. No. 6-13-0437) at 8-9 (May 2014), *available at* http://documents.coastal.ca.gov/reports/2014/5/W16a-5-2014.pdf.

133 *See generally* Mark J. Johnsson, *Establishing Development Setbacks From Coastal Bluffs, in* Proceedings: California and the World Ocean '02: Revisiting and revising California's Ocean Agenda 396-416 (Orville T. Magoon et al. eds., Reston, Virginia, Amer. Society of Civil Engineers, 2005) (originally drafted by Johnsson, Coastal Commission Staff Geologist, as a memorandum to the Coastal Commission), *available at* http://www.coastal.ca.gov/W-11.5-2mm3.pdf; *see also* Cal. Coastal Comm'n, *Local Coastal Program Update Guide*, Section 8-6, (Jul. 2013) [hereinafter LCP Update Guide] *available at* http://www.coastal.ca.gov/lcp/LUPUpdate/LCPGuidePartI_Full_July2013.pdf.

upon erosion rate calculations conducted by geotechnical consultants.[134] However, there is no consistent methodology for calculating erosion rates, leading to huge discrepancies in actual erosion rate calculations – even for the same site. For example, one homeowner in Pismo Beach submitted back-to-back permit applications in which the geotechnical evaluation for the house building permit estimated the erosion rate at three inches per year while the seawall application estimated the erosion rate at two feet per year.[135] The opportunity for applicants to provide self-serving geologic reports that underestimate the appropriate setback frustrates the Coastal Act's goals of avoiding shoreline protection for new development.

In addition, there has been no consistent method for considering sea level rise in erosion rate and setback determinations. The Coastal Commission currently relies largely on static methods for determining bluff-top setbacks.[136] While the Coastal Commission has attempted to bring light to calculating setbacks, the general approach of coastal development permit applicants "has been to simply extrapolate historic long-term erosion rates into the future, and establish setbacks at a particular predicted future shoreline position."[137] This approach—known as the "deterministic approach—is problematic because the *historic* bluff retreat rate may not accurately predict the *future* bluff retreat rate or episodic bluff erosion events, which are likely to increase due to sea level rise or other conditions.[138] The Coastal Commission could use more progressive methods for calculating setbacks to help insure that future armoring will not be necessary.[139]

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Finally, redevelopment and nonconforming use[140] provisions in LCPs help perpetuate the status quo of armoring by thwarting managed retreat. Although setback policies are designed to ensure that no armoring is necessary for the economic life of the structure, "structures do not really die so much as metamorphose into 'new and improved' structures in the same place."[141] This is due in large part to liberal redevelopment policies and nonconforming use policies which allow owners to rebuild up to 50% of their structure without having to conform to current setback and other zoning requirements.[142] In reality, this means that many structures will likely need to be protected by seawalls past the end of their economic life once the original setback is no longer sufficient. In future LCP amendments, more closely tailored definitions of redevelopment for nonconforming structures will be essential to facilitating planned retreat.[143]

134 Lester, *supra* note 121, at 144-146. Coastal Commission staff then determine the specific setbacks on a case-by-case basis based on erosion rate determinations and incorporate them into Coastal Development Permit conditions.

135 *Id*. at 146.

136 Note that calculating setbacks for beach-level development is more straightforward than for bluff-top development. For beach-level development, setbacks are calculated by analyzing historic wave rush-up in conjunction with a "100 year storm" analysis; projected sea level rise is then added to this analysis. Johnsson, *supra* note 133.

137 *Id*. at 1.

138 *Id*.

139 Because the Coastal Commission is constrained by the substantial evidence rule that governs judicial review of agency decisions, bolstering the administrative record with evidence supporting a deviation from the traditional deterministic approach to calculating setbacks would help the Coastal Commission move towards new calculation methods. *See Ocean Harbor House*, Cal. App. 4th at 226-227 (outlining standard of review for Coastal Commission decisions); *Sierra Club v. Cal. Coastal Comm'n.*, 19 Cal. App. 4th 547, 556-557 (citing *Topanga Ass'n. for a Scenic Cmty v. Cnty of* L.A., 522 P.2d 12 (1974)) (stating that the court must find both that substantial evidence supports the agency's findings and that the findings support the decision.)

140 A nonconforming use is a use or structure that no longer meets the current zoning requirements due to changes in zoning after the use was initiated. In the coastal context, this usually describes structures that were built before a more restrictive setback or other requirements were adopted. Typically, these nonconforming uses or structures are allowed to continue for a certain period of time, with the expectation that they will eventually be eliminated. *See* Cecily Talbert Barclay & Matthew S. Gray, *Curtin's California Land Use and Planning Law 66* (2012).

141 Lester, *supra* note 121, at 148.

142 As the Executive Director for the Coastal Commission has noted, "it is not uncommon to see nonconforming structures essentially be redeveloped, through progressive changes…" *Id*. at 149.

143 See *infra* Section VII for recommendations on redevelopment and nonconforming use policies.

B. CA E EED BE E A A D E DEC A EA E E EA D C A A A

The Coastal Commission does not have statutory authority to require that local governments update their LCPs, or certify uncertified areas, to include emerging sea level rise policies. The Coastal Commission also lacks strong case law to support progressive responses to sea level rise. Finally, despite new funding in the Coastal Commission's 2013 budget which was expanded in 2014-2015, the financial resources that the State has provided to both the Coastal Commission and local governments to date are still inadequate to sustain a large scale effort to undertake and complete LCP preparation and updating in a timely and meaningful fashion.

The majority of the state's LCPs were certified decades ago and have not been updated to include policies that are specific to sea level rise.[144] In addition, only 73% of the state's coastal planning areas have been certified, leaving large swaths of the southern California coast, in particular, uncertified.[145] Certifying these areas is a significant challenge to advancing progressive sea level rise policies, especially since local governments currently have few incentives to do the heavy lifting on LCPs that can be time-consuming, complicated, and expensive.

In the absence of applicable LCP language, local governments and the Coastal Commission attempt to address sea level rise impacts through direct application and interpretation of Coastal Act policies regarding hazards, shoreline erosion, protective devices, and to a lesser extent, resource protection policies. However, the application of those policies is uneven. In the Commission's existing Local Coastal Program Update Guide, which was revised in July 2013, sea level rise is only mentioned as an "issue" to be considered, not as a stand-alone hazard (though the Guide does mention that sea level rise policies are under development).[146] The few concrete examples of existing LCP sea level rise policies provided (e.g., Marina Del Rey, City of Dana Point Harbor) in the Guide are all different in scope and detail, and therefore do not provide consistent direction for local jurisdictions.[147]

The Coastal Commission made an important effort to provide a clearer framework to Coastal Commission staff and local governments to address sea level rise in its 2013 Draft Sea-Level Rise Policy Guidance. However, the Sea-Level Rise Guidance exhibits a number of deficiencies including:

1. Omission of legal analysis to provide local governments with a better understanding of their rights and obligations with respect to both private property owners and the public under the Coastal Act, the Public Trust Doctrine, California Environmental Quality Act, and current "takings" case law under the United States Constitution.[148]
2. Placing the onus on local governments to carry the majority of the adaptation burden —without sufficient specific guidance—while emphasizing that the Coastal Commission is only providing guidance rather than requirements that a politically constrained local

144 *See* Cal. Coastal Comm'n, *Summary of LCP Program Activity in FY 13-14*, (Oct. 20, 2014), *available at* http://www.coastal.ca.gov/la/FY13_14_LCPStatusSummaryChart.pdf.

145 *Id*. Despite an initial requirement that LCPs for all segments were to be submitted for certification by 1981, the deadline was extended and eventually dropped. Moreover, only five periodic reviews have ever been completed. *See* Cal. Pub. Res. Code § 30517.5; Cal. Coastal Comm'n, *Local Coastal Program Periodic Reviews / ReCAP*, http://www.coastal.ca.gov/recap/rctop.html (last visited Dec. 15, 2014).

146 LCP Update Guide, *supra* note 133.

147 *Id*. at § 8, 3-4.

148 For a good example of the type of assurances and analysis local governments need, see Bill Higgins, Andrew Schwartz, and Barbara E. Kautz, *Regulatory Takings and Land Use Regulation: A Primer for Public Agency Staff* (Jul. 2006), *available at* http://www.ca-ilg.org/sites/main/files/file-attachments/resources__Takings_1.pdf

government could fall back on.[149]

While the Coastal Commission is to be applauded for taking the lead on these issues, stronger and more substantive guidance would be more useful to local governments.

C. E E AC CE E A D ADE A E EC A E A A E E C A A A A D

Another challenge facing the California coast is inadequate financing or incentives for non-armoring responses to coastal hazards, including, specifically, inadequate mechanisms to encourage relocation of structures out of harm's way. This challenge is due in part to regulations and insurance programs which do not require property owners to internalize the cost of living in high-risk areas.

Insurance and disaster relief programs have a potentially important role to play in building coastal resilience because they provide financial mechanisms that can help communities recover from storm events. In reality, however, many insurance and relief programs miss this opportunity to enhance coastal resiliency and reduce the likelihood of future armoring by encouraging redevelopment in hazardous areas. Together, the National Flood Insurance Program, federal and state disaster relief and hazard grant programs, and the state's interference with property insurance rates, all may play a role in incentivizing maladaptation.

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The federal government provides flood insurance through the National Flood Insurance Program ("NFIP") and provides financial assistance to flood victims through disaster relief programs.[150] While these programs do help communities recover from flood damage, they increase vulnerability in two significant ways. First, the combination of subsidized insurance and disaster relief encourages property owners to assume more risk than they would personally want to bear, increasing exposure to coastal hazards. Second, the Federal Emergency Management Agency's (FEMA) disaster relief policies focus on expediting rebuilding and restoring communities to their pre-storm conditions. These are discussed in turn below.

Despite its good intentions, the National Flood Insurance Program is heavily flawed. Premiums tend to be highly subsidized because of improper risk projections and because very few communities have participated in hazard mitigation.[151] NFIP is over-exposed and has not been able to collect sufficient premiums to cover the possibility of catastrophic loss.[152] NFIP also allows grandfathering of subsidized premiums when flood zones are reclassified.[153] These subsidized premiums tend to encourage property owners to increase their hazard exposure and will likely result in more armoring.

149 *See generally* Cal. Coastal Comm'n, California Coastal Commission Draft Sea-Level Rise Policy Guidance (Oct. 2013), *available at* http://www.coastal.ca.gov/climate/SLRguidance.html. Several local governments noted that the draft policy does not provide sufficiently concrete guidance. *See, e.g.*, Comment Letter from the City of Santa Cruz to the Coastal Commission re: Draft Sea-Level Rise Policy Guidance (Jan. 15, 2014), *available at* http://www.coastal.ca.gov/climate/slr/comments/CityofSantaCruz.pdf.

150 NFIP was created in response to widespread demand for private insurance resulting from a series of catastrophic flood losses early in the twentieth century. In addition to covering flood losses, one of NFIP's objectives is to encourage communities to adopt floodplain management and land use policies that ultimately reduce their flood risks and the financial impacts on NFIP when disaster strikes. *See* 42 U.S.C. § 4022(b) (West 2015); 44 C.F.R. § 59.2 (West 2015).

151 Wharton Risk Management & Decision Process Center, *Managing Large-Scale Risks In A New Era Of Catastrophes*, at 21 (2008).

152 *Challenges Facing the National Flood Insurance Program: Hearing Before S. Comm. Banking, Housing, and Urban Affairs*, 109th Cong. 1 (2005) (statement of William O. Jenkins Jr., Director, Homeland Security and Justice Issues, U.S. Gov't Accountability Office). In 2010, NFIP was running a deficit of nearly $19 billion. *Id*.

153 *Id*.; U.S. Gov't Accountability Office, GAO-09-12, Flood Insurance: FEMA's Rate-Setting Process Warrants Attention (2008).

Federal disaster relief also distorts risk signals to coastal property owners, thereby encouraging them to remain in hazardous areas. FEMA's Hazard Mitigation Assistance (HMA) grant programs seek to reduce risk to life and property pre-natural disaster, to implement long-term hazard mitigation measures post-disaster, and to reduce the number and size of National Flood Insurance Program claims.[154] However, HMA grant funds typically go toward structural projects, such as floodwalls, levees, building retrofits, and elevation projects. While property acquisition and structure removal or relocation are eligible activities under the HMA programs, they have not been widely used.[155] As of early 2014, only 28 acquisition projects had been funded in California over the history of the HMA programs.[156]

In addition, the hazard mitigation planning undertaken as part of these FEMA programs is not sufficiently integrated into other local planning processes.[157] This may be due in part to the fact that local hazard mitigation planning is typically the responsibility of emergency managers and civic engineers, whose training, expertise and responsibilities often do not relate to long-term land use development. Without input from local planners, integrating hazard mitigation efforts into land use planning becomes more challenging. However, by including an assessment of the land use policies for reducing hazard risks from sea level rise in Hazard Mitigation Plans,[158] local hazard mitigation planning could be strengthened. In addition, incorporating Hazard Mitigation Plans directly into the safety or land use elements of a jurisdiction's general plan and into local zoning ordinances will help to steer development away from hazard-prone areas. Senator Jackson recently proposed legislation that would require the inclusion of climate change impacts and hazard mitigation in the safety elements of general plans.[159] This effort should be supported.

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California's post-disaster coastal redevelopment policies also indirectly promote shoreline armoring. If a structure is destroyed by a natural disaster, Coastal Act Section 30610 allows it to be rebuilt without a coastal development permit, provided that it is sited in the *same location on the property* as the destroyed structure and that it is not more than 10% larger than the destroyed structure.[160] Perversely, if the property owner attempts to site the replacement structure further back from an eroding bluff or higher above the flood elevation than the destroyed structure, the replacement will not be exempt and the owner will need a coastal development permit. Thus, the property owner is incentivized to rebuild in a more vulnerable spot in order to avoid permitting delays and expenses. In addition, by allowing for rebuilding without a coastal development permit, there is no opportunity to analyze the vulnerability of the replacement structure or to alter the design of the replacement structure to reduce the future need for armoring.

154 *See* 42 U.S.C. § 5170, 5174; *see also* Am. Planning Ass'n, Hazard Mitigation: Integrating Best Practices into Planning, at 16-17 (2010). The program is problematic because it focuses on replacing exactly what a community has before the hazard with no consideration of future exposures. For more information on FEMA HMA grant programs, see FEMA, Mitigation Assistance Unified Guidance (Jul. 2013) [hereinafter FEMA Mitigation Assistance Guidance] available at http://www.fema.gov/media-library-data/15463cb34a2267a900b-de4774c3f42e4/FINAL_Guidance_081213_508.pdf

155 FEMA, *Mitigation Assistance Guidance, supra* note 154; *see also* FEMA Hazard Mitigation Program Summary Dataset (2014) *available at* http://catalog.data.gov/dataset/fema-hazard-mitigation-program-summary.

156 *See id*.

157 Studies have repeatedly shown that land use approaches to hazard mitigation are underutilized. *See, e.g.*, Mark D. Spalding et al., *Coastal Ecosystems: A Critical Element of Risk Reduction*. 7 Conservation Letters 293, 293-301 (May 2014); Filippo Ferrario et al., *The Effectiveness of Coral Reefs for Coastal Hazard Risk Reduction and Adaptation*, Nature Commc'ns, Vol. 5, at 1–9 (May 2014).

158 Hazard Mitigation Plans are typically prepared in order for communities to qualify for reduced premiums under NFIP.

159 S.B. 379, 2015-16 Leg., Reg. Sess. (Cal. 2015).

160 Cal. Pub. Res. Code § 30610(g)(1) (emphasis added).

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Another challenge facing coastal managers trying to appropriately site coastal development is distorted insurance incentives. Insurance has a potentially important role to play in influencing the decision making of coastal property owners.[161] In theory, if insurance is properly priced to reflect the natural hazard risks associated with living in the coastal zone, it should send a price signal that would deter additional investment in high-hazard areas. However, there is substantial evidence that natural hazard and property insurance products[162] often do not convey risk signals to property owners.[163] One explanation for this failure is that, in many states, the government itself plays a role in distorting the price signaling capability of the insurance market: state insurance commissions typically regulate the price of policies that may be sold in the State and work to achieve a primary policy goal of keeping policies affordable rather than of strategically avoiding or mitigating losses. Indeed, in California, the Department of Insurance has the authority to limit property insurance premiums and has played a role in keeping premiums low.[164]

There is a concern that as rising seas and increasing storms exacerbate coastal property damage, insurers may no longer be able to provide property insurance in California at a price that the state Insurance Department would approve.[165] Insurers' inability to charge prices that reflect actual risk could lead insurers to stop offering their products in the state, which would likely lead to increased state involvement and further distortion of the true cost of living in hazardous areas. This situation has occurred in many hurricane-prone states, where state involvement in wind insurance coverage has exposed states to significant financial risks in the event of a disaster and eliminated the potential of private insurance policies to communicate the risks of the hazard to property owners.[166] Significant state involvement in the natural hazard insurance arena has also occurred in California, indicating the state's willingness and ability to become involved in insurance market pricing. For example, in response to insurers trying to reduce their earthquake exposure by restricting the sale of new homeowners' policies, the state stepped in and created the California Earthquake Authority to stabilize the market by offering earthquake insurance that the companies could sell in lieu of their own.[167] This type of increased involvement by the state—together with federal insurance and disaster relief policies—creates perverse incentives for continued residence and development in hazardous areas. Taken as a whole, these policies

161 Under the current system of federal flood insurance, states do not provide flood reinsurance, but they do have significant involvement in the system by providing additional sources of relief from flood damage. States also provide other insurance products, such as homeowner's insurance, which often does not accurately reflect natural hazard risks. Bagstad et al. provide an interesting discussion of the various sources of subsidy for coastal development given by the states. Kenneth J. Bagstad et al., *Taxes, Subsidies, and Insurance and Drivers of United States' Coastal Development*, 63 Ecological Econ. 285 (2007).

162 Because NFIP coverage only extends to water damage caused by storms, homeowners must also purchase a general property insurance package covering all other damages.

163 *See, e.g.*, Howard Kunreuther & Erwann Michel-Kerjan, *Managing Catastrophes through Insurance: Challenges and Opportunities for Reducing Future Risks*, Risk Management and Decision Processes Center, The Wharton School, University of Pennsylvania (Working Paper # 2009-11-30, 2009), *available at* http://opim.wharton.upenn.edu/risk/library/WP20091130_HK,EMK_ReducingFutureRisks.pdf.

164 Cal. Ins. Code § 1861.01 et seq. In California, insurance markets are regulated by the California Department of Insurance. Public advocates can participate in the administrative process that leads to insurance rate setting, driving down insurance rates. California Department of Insurance, *Information Sheet: Proposition 103 Intervenor Process*, http://www.insurance.ca.gov/01-consumers/150-other-prog/01-intervenor/info.cfm (last visited Jan. 15, 2015).

165 State limitations on premiums may have the effect of driving insurers out of the market because they are unable to transfer enough of their risk through the purchase of reinsurance. Kunreuther & Michel-Kerjan, *supra* note 163.

166 Many hurricane-prone states provide direct insurance or risk-pooling for hurricane events, known as wind insurance pools. The most significant example of state involvement in insurance markets is the Florida Hurricane Catastrophe Program. 2009 Fla. Stat. § 215.555; *see also* Office of Insurance Regulation, *Overview of the Florida Hurricane Catastrophe Fund*, http://www.floir.com/FHCF.aspx (last visited Feb. 15, 2015). For more details on this program, see Florida Office of Program & Policy Analysis and Government Accountability, *State Board of Administration of Florida: Florida Hurricane Catastrophe Fund*, http://www.oppaga.state.fl.us/profiles/4042/ (last visited Feb. 15, 2015).

167 In California, companies who offer homeowners policies must also offer earthquake coverage. However, only 12% of California homeowners have purchased the plans because the premiums are quite expensive. In response to this, California has tried to get federal guarantees for the California Earthquake Authority, which would allow the Authority to reduce its premiums and increase the number of people who buy coverage. While the goal of increasing community resiliency by increased earthquake coverage is laudable, lowering premiums by spreading risks to the general tax base would further distort the risks of living in hazardous areas. For more information on the California Earthquake Authority, see Cal. Ins. Code § 10089.5 et seq.; *see also* Cal. Earthquake Authority, http://www.earthquakeauthority.com.

fail to encourage relocation of structures out of harm's way and other non-armoring solutions to coastal hazards.

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Finally, public financing to support nature-based and other non-armoring solutions to coastal hazards has been inadequate. As noted above, most publicly-funded efforts have focused on structural responses such as armoring, and many state agencies, such as Caltrans, continue to default to armoring to protect infrastructure. However, it is not clear that maintaining the status quo in coastal adaptation by temporarily fortifying eroding shorelines is cost-effective: California seawalls range from $6,200 to $10,000 per foot—up to $56 million per mile—with significant annual maintenance costs.[168] While non-armoring alternatives such as relocation of infrastructure out of vulnerable and eroding areas will also require significant public investment, state and local governments must consider the wisdom of expending taxpayer dollars on temporarily protecting infrastructure with armoring as opposed to pursuing more sustainable long-term solutions. The next section provides a list of the types of adaptation efforts that will require funding support and the possible opportunities to increase funding for non-armoring adaptation solutions.

D. C A A A E A A A D A D A E E E E B C B A

Coastal armoring has been a standard response to coastal hazards threats for some state-owned lands and property.[169] This is in part because coastal roadways and other coastal infrastructure were installed largely without sea level rise in mind and will need to be either relocated or protected. For example, Caltrans "has traditionally based infrastructure plans and designs on historical rates (rather than projected rates) of coastal erosion."[170] In areas such as Ventura County where Caltrans has already faced challenges to the geologic stability of roadways, coastal armoring has been the standard response.[171] The current and potential magnitude of the problem is immense: there are over 4,600 miles of roadways within one-quarter mile of the coast, including several major highways (e.g., Highway 101, Highway 1, Route 92) and bridges that are under Caltrans' authority.

Another likely reason that armoring remains the default protection response is that the Coastal Commission and other permitting agencies often fail to adequately consider the impact of coastal armoring on the public trust when reviewing armoring applications.[172] Because the state's tidelands and submerged waters are part of the public trust, if coastal armoring damages the underlying ecosystem or impedes or eliminates coastal access or recreational opportunities, the installation and ongoing maintenance of the armoring could constitute a public trust violation.[173] However, the Coastal Commission and the State Lands Commission have not exercised their public trust authority and responsibilities

168 Cal. Dep't of Boating and Waterways, *The Economic Costs of Sea-Level Rise to California Beach Communities* (2011) at 45, *available at* http://www.dbw.ca.gov/PDF/Reports/CalifSeaLevelRise.pdf. These costs estimates do include permitting and mitigation fees, which can reach into the millions of dollars. *See, e.g.*, Coastal Comm'n Ocean Harbor House Staff Report, *supra* note 130.

169 *See, e.g., State Lands Armoring Report, supra* note 66, at 1.

170 *See* Hanak & Moreno, *supra* note 53, at 21.

171 *Id*.

172 In South Carolina, where the state similarly holds lands below the high tide line in public trust, the South Carolina Supreme Court noted that "no citizen has an inherent right to take possession of or alter these lands. Accordingly, the public's interest must be the lodestar which guides our legal analysis in regards to the State's tidelands." *Kiawah Dev. Partners, II v. S. Carolina Dep't of Health & Envtl. Control*, 766 S.E.2d 707 (S.C. 2014). This reasoning applies in California as well.

173 *See* Cal. Const. art. X, § 4; Cal. Pub. Res. Code § 30001.5(c); *see also* Melissa K. Scanlan, *Shifting Sands: A Meta-Theory for Public Access and Private Property Along the Coast*, 65 S.C. L. Rev. 295, 362 (2013); Aminzadeh, *supra* note 6, at 540 ("The public trust doctrine informs and bolsters the Coastal Commission's mandate to preserve and protect public trust rights, including the protection of the environment, natural resources, and open space."); Cal. Pub. Res. Code § 6009.1 (laying out the State Lands Commission's fiduciary duties to protect and defend public trust lands against any actions which may cause their loss).

to limit shoreline armoring or to preserve open space as a buffer to accommodate rising sea levels or storm surges.[174] For example, the State Lands Commission's current approach for determining the location of the mean high tide line—and thus the extent of the public trust lands—is based on historic (rather than projected) measurements.[175] This approach is problematic for several reasons, including the following: it can lead to miscalculation of the extent of public trust property; it can result in an underestimation of how far development or public infrastructure must be set back to avoid anticipated erosion or inundation; and it may impair the State Lands Commission's ability to regulate armoring structures on public trust lands, because the historic mean high tide line will likely be seaward of the actual mean high tide line.

The next section proposes recommendations to address these concerns.

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As detailed in the analysis above, California's policy, legal, and regulatory framework for making decisions about armoring has placed the Coastal Commission and its stakeholders into a reactive, permit-by-permit regulatory posture, rather than in a proactive and strategic one. This reactive approach leads to inconsistency in policy application across the state and unpredictability for all involved, including Coastal Commission staff, commissioners, other state and local agencies, permit applicants, and the public. The following sets of recommendations are intended to facilitate a more strategic and proactive approach to manage armoring.

EC E DA #1:

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The Coastal Commission can remain true to the Coastal Act's policies safeguarding environmentally sensitive habitat areas and public access by recognizing that existing structures have limited lifetimes. The Coastal Commission and local governments can also, where feasible, using forward planning mechanisms (such as Transfer of Development Rights systems, rolling easements, and moveable structure design approaches) to avoid protecting structures in perpetuity and allowing existing and future development to become essentially permanent. However, meaningful sea level rise adaptation policies that protect public access and coastal habitats will be achievable only if the Coastal Commission concurrently enforces the law. The following sub-recommendations and action items are designed to avoid a future in which armoring is the automatic response to sea level rise and storms.

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- While the political feasibility of such an effort in California is questionable, several other states, including traditionally less environmentally progressive states, have recognized the harms caused by armoring and adopted prohibitions on shoreline protective devices. For example, North and South Carolina prohibit any type of permanent erosion control structures.[176] Oregon has also prohibited coastal armoring for property developed after Jan. 1, 1977.[177] Even if total prohibition

174 Aminzadeh, *supra* note 6, at 542; Wolf, *supra* note 86, at 173.

175 *Lechuza Villas West v. California Coastal Comm'n*, 60 Cal. App. 4th 218, 237 (1997) (noting that the State Lands Commission has typically determined mean high tide lines by averaging high tides over the previous 18.6 year period).

176 North Carolina law provides that: "Permanent erosion control structures may cause significant adverse impacts on the value and enjoyment of adjacent properties or public access to and use of the ocean beach, and, therefore, are prohibited. Such structures include bulkheads, seawalls, revetments, jetties, groins and breakwaters." 15A N.C. Admin Code 7H.0308 (West 2015). South Carolina has also banned seawalls. *See* South Carolina Beachfront Management Act, S.C. Code Ann. § 48-39-250 (West 2015).

177 *See* Or. Admin. R. 736-020-0010 (West 2015).

is not feasible, California should begin to lay the groundwork for legislation restricting shoreline armoring structures.

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- Resolving this statutory conflict can include either: a) changing "shall" to "may" in Section 30235 so that the provision reads "[Armoring structures] and other such construction that alters natural shoreline processes *may* be permitted when required to serve coastal-dependent uses or to protect existing structures . . ."[178] or b) adding conditions in Section 30235 which must be met in order for an armoring permit to be approved.[179] In the absence of these legislative changes, the Coastal Commission could rely on the conflict-resolving provision in Section 30007.5 to deny armoring permits.[180] In addition, Section 30235 language that armoring structures "be permitted when required to . . . protect . . . public beaches in danger from erosion" should be deleted since armoring structures actually exacerbate the erosion of public beaches.

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- This could be achieved by a legislative amendment or a regulatory amendment that clearly defines what is meant by "existing development." Either of these options would help provide consistency and lessen the chance that the Coastal Commission's armoring decisions will be characterized as arbitrary and capricious. This definition clarification should state that in the absence of an existing LCP defining it otherwise, "existing" means coastal development pre-Coastal Act. The definition could also include a fairness exception honoring permit conditions on properties built post-Coastal Act.

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- Local governments and the Coastal Commission could provide a time period (e.g., 48 hours) in which a structure must be threatened in order to meet the regulatory definition of emergency. Coastal Commission regulations provide that an emergency as defined in the Coastal Act, means "a sudden unexpected occurrence demanding immediate action to prevent or mitigate loss or damage to life, health, property or essential public services."[181] Adding a specific "imminence requirement" would help to distinguish between a true emergency—for example, when a property owner needs to install sandbags or riprap during the middle of a storm in order to avoid immediate

178 *See* Cal. Pub. Res. Code § 30235.

179 Section 30235 currently provides that the structure must be designed to eliminate or mitigate adverse impacts on local shoreline sand supply. Additional conditions could include, for example, requiring that armoring will only be approved if it will not impair public access, use, or enjoyment of coastal resources.

180 As noted above, Section 30235 conflicts with other sections of the Coastal Act protecting coastal resources, beach access and use, and scenic views, and such conflicts are to be resolved in a manner most protective of coastal resources. *See* Cal. Pub. Res. Code §§ 30200; 30211; 30251; 30007.5. However, because there is some precedent that specific policies govern over more general ones, a court may find that the specific policy governing armoring in Section 30235 controls over the more general policies of Sections 30211 and 30251. *See, e.g., Bolsa Chica Land Trust v. Superior Ct.*, 71 Cal.App.4th 493, 515 (1999) (noting that specific language is controlling over a general policy where both the specific and general provisions apply). While the analysis in *Bolsa Chica* is distinguishable from this case because the court relied on Coastal Commission guidelines regarding classifying land as a wetland or an environmentally sensitive habitat area, the Coastal Commission may be hesitant to rely on the conflict-resolving provision without a legislative change in Section 30235 from "shall" to "may." This legislative change would give the Coastal Commission *clear* discretion to interpret Section 30235 in light of other provisions in the Coastal Act and to apply the conflict-resolving provision in Section 30007.5.

181 Cal. Code Regs. tit. 14, § 13009.

damage to her property—and a simple failure to plan on the part of the property owner who seeks an emergency permit in November, for example, on the grounds that there is no time to analyze alternatives before an anticipated El Niño winter.[182]

- Limit the type of emergency structure that is allowed to temporary solutions or structures, such as sandbags. This would help incentivize those who may be actively seeking to avoid the armoring permitting process.
- Require the removal of emergency armoring within a fixed time (e.g., require removal at the end of the rainy season) prior to consideration of any permanent protection. Limiting the type or duration of emergency structure are attractive solutions because they would not require a legislative fix; the Commission could implement these restrictions on its own.
- Conduct statewide or regional vulnerability assessments to help identify highly vulnerable areas, anticipate episodic bluff erosion events, and encourage strategic shoreline planning in those areas. This will help jurisdictions calculate appropriate setbacks and preempt emergency permits. This effort could be tied into the current regional coastal sediment planning efforts around the State.

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- Encourage the Coastal Commission to require analysis and mitigation of armoring impacts to neighboring properties and public beaches in permit applications and emergency permit applications. One potential vehicle for expansion of the impacts analysis is through the environmental impact analysis required as part of an application for a coastal development permit: under CEQA and the Coastal Act, the Coastal Commission is required to assess the potential impacts of any project on the environment.[183] This obligation requires analysis of impacts not only to the project site, but also of any impacts to neighboring areas.
- Amend CEQA or Public Resource Code provisions on GHADs to ensure that armoring projects that are not true emergencies (e.g., the Broad Beach armoring project) are not exempted from environmental review.
- Consider requiring managed retreat to be part of the "alternatives analysis" in coastal development permit applications. Pursuant to the Coastal Commission's obligations under CEQA, coastal development permit applications must describe the proposed project and either alternatives to the project and mitigation measures or a statement that the project will have no significant effect.[184] Absent significant overriding conditions, the Coastal Commission may not approve a proposed project if there are feasible alternatives or mitigation measures that would avoid or lessen the significant effects that the project may have on the environment.[185] Thus, the

182 However, even if an "imminence" or "reasonably foreseeable" requirement is passed, the Coastal Commission may often still defer to permit applicants' hired geologists with respect to the need for armoring. The Coastal Commission is "subject to pressure to give emergency approvals for revetments in cases where, it is argued, there is insufficient time to analyze alternatives or to design and build a more appropriate shoreline protective device before the next big winter storms, or where funding would be lost if approvals are not given." Lester, *supra* note 121, at 150. This is due in part because the Coastal Commission wants to ensure that homes and homeowners are protected and in part because litigation losses that may arise from prohibiting emergency structures come out of the Coastal Commission's budget. Thus, other backstop requirements, such as armoring type restrictions or armoring duration restrictions, will be critical to dealing with the proliferation of emergency structures.

183 The Coastal Act states that development should not be located where it will have "significant adverse effects, either individually or cumulatively, on coastal resources" before issuing a coastal development permit. Cal. Pub. Res. Code § 30250(a).

184 *See* Cal. Code Regs. tit. 14, §§ 15271(c); 15252(a); *see also Citizens for Non-Toxic Pest Control v. Dep't of Food & Agriculture*, 187 Cal. App. 3d 1575, 1585-6 (1986).

185 Cal. Pub. Res. Code § 21080.5(d)(2)(A); Cal. Code Regs. tit. 14, §§ 15021(a)(2);15092(b).

alternatives section of a coastal development permit application may be used as a vehicle to highlight managed retreat as a feasible alternative. Local governments could also specify in their LCPs that applications for armoring must include a comprehensive analysis of alternatives to a shoreline protection structure, including evaluating the relocation or partial removal of the threatened structure.[186]

[illegible]

- Support development of an online permit application system that enables public tracking of armoring proposals and locations (both for emergency actions and regular coastal development permits).
- The legislature should increase the Coastal Commission's enforcement authority to remedy Coastal Act armoring violations.[187] This could include increased authority to levy fines or the ability to deny a new permit unless the permitee remedies ongoing permit violations.
- Explore strategies for education and outreach with the State Lands Commission, including on issues of mean high tide line determinations, implementation of the public trust doctrine, and conditions of approval in State Lands Commission leases or permits.
- Identify opportunities for citizen suits challenging state permitting agencies and local governments when their permitting decisions violate the Coastal Act, CEQA, and other laws. For example,
  - Enforce the public trust doctrine and identify fact patterns particularly well-suited to application of the public trust doctrine, applying arguments similar to those advanced in *Mono Lake* and *Milner*.[188]
  - Pursue common law nuisance remedies to prevent or remove coastal armoring that adversely impacts or compromises public access, destroys beaches, or otherwise encroaches on the public's land.[189]
  - Enforce the Coastal Act's conflict-resolving provision," which requires that "conflicts be resolved in a manner which on balance is the most protective of significant coastal resources" and could limit structural armoring when a less environmentally damaging alternative exists.[190]

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In order to protect the coastline from detrimental effects of armoring—and ensure that the full environmental costs of armoring are borne by the permittee where the Coastal Commission has no discretion to prohibit armoring—the Coastal Commission should:

- Develop consistent, transparent and standard methodologies to calculate and assess each type of impact mitigation fee for all coastal armoring projects. The methodologies need to be transparent and straightforward enough to be applied consistently by agency staff, stakeholders, and permit applicants alike.
- Because valuation of ecological services

186 *See, e.g.*, Lester, *supra* note 121, at 140-41 (citing the Santa Cruz County Local Coastal Program).

187 The Coastal Commission should prioritize those violations affecting coastal access, environmentally sensitive habitat areas, or the public trust.

188 *Nat'l Audubon Soc'y v. Superior Court*, 658 P.2d 709, 718-19 (Cal. 1983); *U.S. v. Milner*, 583 F.3d 1174 (9th Cir. 2009).

189 As noted above in Section V, local governments have the right to legislatively declare that a seawall is a public nuisance that may be removed without compensation because it encroaches on public land. *Scott v. City of Del Mar*, 58 Cal. App. 4th 1296, 1305-06 (1997).

190 Cal. Pub. Res. Code § 30007.5.

impacts is so difficult, consider using a restoration fee as a proxy. This would entail developing a standardized approach similar to the biological mitigation ratio tables used in some jurisdictions to protect species and their habitat.[191] For example, the Commission or local governments could rate beaches according to the ecological services they provide and then require that the restoration provided by the permittee conforms to a pre-determined ratio. If the habitat is very rare then the restoration costs may be quite high, forcing coastal property owners to internalize the true costs of their armoring's impacts.

- The Coastal Commission should consider hiring a staff economist to help support any economic valuation work done in-house, by the applicant, or by a consultant.
- Develop and implement programs that more effectively use mitigation fees and actually recapture lost coastal resource value. Such an approach could include using mitigation banks to facilitate selection and prioritization of mitigation projects restoring other impaired shorelines, preserving shorelines of significant ecological value, or enhancing or creating other public access sites. Investigate the legal feasibility of mitigation banking on a regional basis, or regional scale mitigation efforts (akin to multiple jurisdiction Habitat Conservation Planning).
- As an alternative to mitigation fees, require actual, physical mitigation of impacts (e.g., use protection and restoration) rather than in-lieu fees.
- Explore the legal feasibility of establishing a minimum mitigation fee per sq. ft. of coastal armoring.

191 *See, e.g.*, San Diego, Cal., Biological Mitigation Ordinance, Table of Mitigation Ratios, Att. M, *available at* http://www.sdcounty.ca.gov/pds/mscp/bmo.html; *see also id*. § 86.607.

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The following actions would help facilitate sea level rise updates in LCPs and reduce reliance on coastal armoring as an emergency response. However, local governments need additional funding to implement these measures. Appendix A provides further detail on potential funding sources for adaptation efforts.

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- Develop and advance model language for LCPs that clearly describes adaptation strategies.[192]
- Consider requiring local governments to incorporate sea level rise policies into LCPs as part of the state's efforts to address climate change and adaptation. Move toward mandatory, rather than advisory, periodic reviews of LCPs.[193] Alternatively, consider legislative action to require local jurisdictions to update their LCPs more frequently and to develop and adopt more progressive policies (e.g., by setting and enforcing deadlines by which uncertified areas must submit LCPs with sea level rise policies for certification). Legislative action could also allow the Coastal Commission to use a local government's application for a major LCP amendment to trigger a requirement to include sea level rise policies.

192 UCLA's Emmett Institute on Climate Change and the Environment is currently working on developing this model language.

193 The state has required planning updates like this in other contexts; for example, state law requires that the housing elements of general plans be updated at certain intervals – typically every four to eight years – to promote compliance with housing goals. *See* Cal. Gov't. Code § 65588.

- Identify and prioritize locations where sea level rise poses the greatest risks to property and coastal access and create a "road map" for assisting governments in those areas with outreach, funding, etc., and consider mandating LCP certifications or updates for areas at greatest risk of episodic erosion events.
- Develop educational materials showing where state agencies and local governments can lawfully advance shoreline armoring management approaches that better protect public access and natural resources while respecting the rights of land owners. Legal uncertainties have made decision-makers overly cautious in their responses to sea level rise. Desired legal analysis would outline a local government's and the Coastal Commission's authorities and responsibilities under the Coastal Act, the Public Trust Doctrine, CEQA, and Takings case law to help inform them of their affirmative duties, discretionary authority, and legal risks.
- Ensure local governments have access to planning and implementation funds.

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- Require integration of local hazard mitigation planning with land-use planning in coastal communities. For example, as has been recently proposed in the California legislature, hazard mitigation plans could be required as part of the safety element of each jurisdiction's general plan. The LCP would then be required to be horizontally consistent with the hazard mitigation plan.[194]
- Develop criteria for identifying areas where property acquisition would advance goals regarding risk reduction, environmental conservation, and economic objectives simultaneously. Integrate these criteria into local and state hazard mitigation planning and local coastal planning, and support pilot projects that show how use of such criteria can work effectively.
- Pursue FEMA's hazard mitigation assistance grant funding to support property acquisition and structure removal or relocation as an alternative to armoring.[195]

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- Support policies that require sea level rise to be factored in when calculating erosion rates and setbacks.[196] One such possible method for calculating setbacks is the probabilistic method, which correlates future erosion rates with the increased frequency of wave impacts.[197]
- Support the Coastal Commission's engagement of new staff and independent experts to ensure it has access to best available science when reviewing engineering reports and erosion estimates in coastal development permit applications.

194 S.B. 379, 2015-16 Leg., Reg. Sess. (Cal. 2015). California's approaches to managing the risks of wildfire (e.g., risk reduction and insurance) and earthquakes (California Earthquake Authority) can also provide lessons learned for managing the risks of coastal hazards related to sea level rise. In 2012, the California Legislature passed S.B. 1241 (Kehoe), which requires city and county General Plan Safety Elements to be updated to incorporate additional wildfire hazard considerations for lands within high fire hazard severity zones. S.B. 1241, 2011-12 Leg., Reg. Sess. (Cal. 2012).

195 Although acquisition, demolition and relocation are all fundable activities under the Hazard Mitigation Assistance programs, habitat or ecosystem restoration is not. In order to fully achieve "triple bottom line" returns (risk reduction, natural resource enhancement, and economic cost reduction), target parcels would need to be restored to natural habitat. Additional work would need to be done to pair HMA funding with restoration funding. *See* FEMA, *Mitigation Assistance Guidance, supra* note 154.

196 The Coastal Commission suggests that local governments require that sea level rise be considered when devising bluff-top setback policies; however, permit applicants should be required to incorporate sea level rise considerations into bluff-top calculations. *See, e.g.*, LCP Update Guide, *supra* note 133, at 8-7; *see also* Cal. Coastal Comm'n Draft Sea-Level Rise Policy Guidance, *supra* note 149, at 52-53.

197 *See* Johnsson, *supra* note 133, at 1.

- Advocate for a forward-looking mean high tide line determination at the State Lands Commission that accounts for future projections of sea level rise and require periodic reassessments of mean high tide lines; this will promote science-based setbacks and better protect public trust lands. Consider using the movement of the mean high tide line as a trigger for removal of armoring structures or for additional mitigation for armoring impacts.

EC ˜\˜\E˜\DA ˜\#3:

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As discussed in recommendation #4 below, the Coastal Commission and some local governments have begun to require that property owners assume some of the risk of development in vulnerable areas by including express assumption-of-risk provisions, no future seawall conditions, and structure removal triggers if structures are threatened by sea level rise or storms. Improved mitigation fee calculation, discussed in Recommendation #1G above, would also help to send an economic signal to property owners regarding the true cost of developing in hazardous areas. In addition, insurance policies have the potential to play an important role in influencing responsible and resilient coastal development. Efforts to improve federal and state insurance and disaster relief policies to foster sea level rise adaptation include:

- Amend state and federal hazard mitigation and insurance policies to guide new development away from vulnerable coastal areas.
- Research feasibility of changes in state insurance regulations that would require property coverage to be limited in cases where rebuilding after hazard events would interfere with access to the public beach. In these cases, insurance could potentially be structured to provide for accommodation of sea level rise and restoration of natural coastal infrastructure.
- Amend federal post-disaster relief and insurance policies to allow for the rebuilding of an *improved* structure or rebuilding/relocation of the damaged structure on a different part of the property or an entirely different parcel. This includes the potential for using transferable development rights and retiring development rights on the affected property in exchange for receiving FEMA funds.
- Amend Coastal Act post-disaster redevelopment policies in Section 30610 to either: 1) require a coastal development permit to rebuild any structure destroyed by a natural disaster so that the Coastal Commission can analyze the stability of the replacement structure or require alteration of the design of the replacement structure to reduce the need for future armoring, or 2) extend the current coastal development permit exemption to property owners who wish to rebuild the destroyed structure in a less vulnerable location on the property.

EC ˜\E˜\DA ˜\#4:

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In order to adapt to climate change and increasing storms without hardening large swaths of the coastline, the Coastal Commission, State Land Commission, and state and local governments must do more to pursue managed retreat and other non-armoring responses to sea level rise. In addition to prior recommendations to emphasize public trust obligations through education, outreach, and litigation, the following efforts explore mechanisms and strategies to facilitate retreat.

- In future LCP amendments, local governments should carefully tailor provisions regarding nonconforming structures in hazardous coastal locations to ensure their timely removal. Efforts to reduce the need for armoring could include: conditioning coastal development permits to require a nonconforming structure to be relocated if it becomes endangered;[198] requiring new residential or commercial development to be retired at the end of its designated economic life; or reducing the amortization period for nonconforming structures located within identified coastal hazard areas.[199]
- Research the possibility of implementing a statute similar to the Coastal Barrier Resources Act—a federal statute that limits federal funding for private development and public infrastructure in vulnerable or ecologically valuable coastal areas—to create reserves in which no seawalls are allowed.[200]
- Due to the increasing pressure to armor, the Coastal Commission needs to be consistent in attaching "no future seawall" conditions to permits for new development. This includes continuing to limit and enforce what a property owner can do to alter existing development without the improvements being characterized as "new development" or otherwise requiring a new permit.[201]
- Support LCP policies that:
  - Require property owners to assume the risks of developing in hazardous locations and assume responsibility for modifying, relocating or removing development if it is threatened in the future; and
  - Require identification of "retreat plans" in coastal development permit applications, such as plans or provisions explaining how a structure can be relocated and/or removed when a triggering event occurs (e.g., sea level reaches a certain elevation, inundation of the property occurs one or more instances over a specific time period).
- Identify places to concentrate planning and/or advocacy efforts, including developing local/regional/statewide priorities for investing in managed retreat. In particular, develop a list of projects/examples where good results have been achieved with respect to removal of seawalls and managed retreat (e.g., public land where managed retreat is possible or underway, such as Surfer's Point in Ventura and Sloat Blvd in San Francisco). Use such examples as pilots to show that managed retreat "works" and develop a resource guide to show how it is technically and economically feasible.
- Compile needed data and statistics on the economic characteristics of coastal properties (e.g., how much coastal properties contribute to the local tax base differentially and are affected in the market by coastal armoring) to highlight impacts to tax bases and to

198 The Coastal Commission staff has recently begun to recommend such conditions to facilitate retreat. *See* Cal. Coastal Comm'n, Staff Report W10a (App. No. A-3-SNC-98-114) (Monterey Bay Shores Resort) Special Condition 9, at 23-28 (Apr. 2014), *available at* http://documents.coastal.ca.gov/reports/2014/4/W10a-4-2014.pdf. Similarly, the City of Solana Beach has passed relatively strict redevelopment conditions and is requiring permittees to sign encroachment/removal agreements. *See* Letter from Eric Stevens, Coastal Commission Planner, to David Ott, City Manager of City of Solana Beach, re: the Certification of the City of Solana Beach LCP Land Use Plan Amendment (Apr. 22, 2014), *available at* http://www.ci.solana-beach.ca.us/vertical/sites/%7B840804C2-F869-4904-9AE3-720581350CE7%7D/uploads/SOL-MAJ-1-13_LUPA_Certification_Letter.pdf.

199 Zoning ordinances may provide for the termination of a nonconforming use without compensation if it provides a reasonable amortization period. *Metromedia, Inc. v. City of San Diego*, 26 Cal. 3d 848, 882 (1980), *void on other grounds*, 453 U.S. 490 (1981). The reasonableness of the amortization period depends on many factors, including the depreciated value of the structure to be removed, its remaining useful life, and the harm to the public if the structure is left standing. *City of Salinas v. Ryan Outdoor Advertising Inc.*, 189 Cal. App. 3d 416, 424 (1987).

200 Coastal Barrier Resources Act, 16 U.S.C. §§ 3501 - 3510 (Westlaw 2015) (The Act was originally passed in 1982 to prohibit federal funding to insure or protect undeveloped, vulnerable, and privately-owned land.) Such legislation should include a clear provision indicating that it overrides Section 30235 of the Coastal Act.

201 The complexity of how these issues present and interact is illustrated by the recent Bannasch permit. *See* Cal. Coastal Comm'n, Staff Report TH14a (App. No. 6-13-0948) (June 2014) (outlining the Coastal Commission's findings for approval of the Bannasch permit), *available at* http://documents.coastal.ca.gov/reports/2014/6/Th14a-6-2014.pdf.

encourage local governments to pursue managed retreat strategies.

- Research opportunities for transferable development rights (TDRs), including between local jurisdictions, as part of a managed retreat strategy and develop possible case studies.
- Research state laws regarding the rights and responsibilities of municipalities and whether local jurisdictions can: a) allow development but refuse to provide services based on vulnerability, or b) charge increased rates to those properties due to risk (including increased rates in repetitive flood loss areas) in order to facilitate managed retreat or development limitations.
- Other land use planning and regulatory approaches to reduce the need for armoring include:
  - New or expanded overlay zones designating coastal hazard areas with stricter development, setback and rebuilding ordinances and resilient design requirements;
  - Streamlined permitting for living shorelines or "soft" coastal protection projects, such as dune or wetlands conservation or restoration;
  - Acquisition and buyout programs; and
  - Conservation easements and rolling conservation easements requiring the removal of structures that encroach on public lands.
- Support development of a suite of criteria for identifying strategies and locations that maximize overall resilience.[202]

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Underpinning all of these recommendations is the need for further analysis and monitoring of the impacts of armoring structures and their removal. This includes determining the location, extent, and permitting status of armoring along the coast, how much beach has been lost from armoring, and what the impacts to the shoreline will be if California continues its current rate of shoreline hardening. Further analysis is also needed to understand how long it takes a beach to rebuild once an armoring structure has been removed.

Finally, developing and advancing local and state financing mechanisms to support non-structural coastal adaptation will be critical to reducing the number of seawalls and revetments along the coast. Potential options for establishing local funding opportunities include special assessment districts, service fees, infrastructure financing districts, regulatory and benefit or privilege fees, and transferable development rights. Potential options for state funding opportunities include determining whether and which types of adaptation projects are eligible for AB 32 cap-and-trade revenue funding and pursuing funding opportunities for projects from state agencies that have received Proposition 1 funding – the $7.5 billion bond for water infrastructure and ecosystem improvements approved in November 2014.[203] This strategy should include engaging in the development of state criteria to be used for Proposition 1 funding disbursement. Appendix A provides more details on potential funding sources.

202 For an example of evaluation criteria (e.g., effectiveness, resiliency, certainty of success, environmental, safety/access) used to evaluate alternatives (i.e., mitigation measures) so that alternatives can be compared systematically, see ESA PWA, *Evaluation of Erosion Mitigation Alternatives for Southern Monterey Bay*, 32 (May 30, 2012), *available at* http://montereybay.noaa.gov/research/techreports/esapwa2012.pdf. The criteria aim to provide a thorough assessment of impacts, costs, and effectiveness.

203 Water Quality, Supply, and Infrastructure Improvement Act of 2014, Cal. Water Code, § 79700 et seq. (West 2015) (Proposition 1 was approved by voter initiative in November 2014 and codified in the Cal. Water Code.)

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The science on seawalls is clear. To preserve California's iconic beaches, the legislature and state and local coastal managers need to take immediate and comprehensive action to remedy the ad hoc armoring of the coast. Right now, momentum for "natural" coastal protection options like living shorelines and managed retreat are building as sea level rise adaptation planning ramps up in coastal jurisdictions throughout the state. Planners and lawmakers should capitalize on this opportunity to shape public and private investment decisions in ways that both decrease reliance on armoring and benefit coastal communities. A more sustainable approach to addressing sea level rise and related coastal hazards is critical to California's ability to protect public access, public and private property, and coastal ecosystems now and in the future.

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Advancing appropriate financing methods depends on whether the adaptation activities primarily benefit the general public, or if individuals or specific parcels of property can be identified which either benefit or are in some reasonable way liable or responsible for paying for adaptation measures. A summary list of both kinds of financing measures is provided below. More research is needed to determine how these options might apply to coastal adaptation.

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- **A E A A .** The state general fund is oversubscribed and difficult to secure as a source of public funding. But one potentially promising source of funding could include cap-and-trade revenue from A.B. 32,[204] if the allowable uses for such revenues are met, among which is a reduction in greenhouse gas emissions. Allowable uses are set in statute and can be changed.
- **A E E E A B A B D .** These require majority voter approval and 2/3 legislative vote. For practical reasons, bonds are limited to purposes with strong organized support (e.g. school construction, dams) or that poll well. Voters approved a $7.5 billion bond proposal for water infrastructure and ecosystem improvements in November, 2014.[205] Bonds don't bring a new revenue source, but are paid from the existing revenues of the general fund.
- **CA E E A B A B D .** These require difficult-to-obtain 2/3 voter approval.[206] The bonds are paid from an increase in the local property tax.
- **A CE A E .** A local jurisdiction can impose a fixed dollar tax per parcel, if it can gain approval from 2/3 of the local voters.[207] This is unlike a property tax that is a percentage of assessed value, or an assessment that is related to benefits that accrue directly to the property owners (see below). A $9/year tax has been considered by the San Francisco Bay Restoration Authority, which would require voter approval.
- **A E DE C E A E A C A E .** An example is the 1% personal income tax surcharge on incomes over $1 million for mental health services approved by voters in 2004 as Prop 63.[208] These are very unlikely for coastal adaptation at present, but things could change if crises and disasters occur. Both surcharges could also apply at a county or regional scale.

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- **EE E CE C DE E E .** Landowners can be charged fees for water and sewer service (including relocation), and storm water management, and conceivably systemic work to manage shoreline impacts from sea level rise. The fees must comply with Proposition 218, which imposes certain requirements for why and how such fees may be assessed.[209] A majority landowner vote may be required.
- **E A A D BE E E E .** State and some local agencies can charge fees to pay the costs of a regulatory program, which could arguably include costs to manage environmental and other consequences of

204 Cal. Health & Safety Code, § 38500 et seq.

205 Cal. Water Code, § 79700 et seq.

206 Cal. Const. art. XVI, § 18.

207 *Id*. art. XIIID, § 4.

208 Cal. Rev. & Tax. Code, § 19602 et seq.

209 Cal. Const. art. XIIID, § 6.

climate change.[210] These must comply with Proposition 26[211] and must carefully identify beneficiaries or responsible parties.

- EC A A E E . These can be levied where specific properties are specially benefited or perhaps specially responsible (for example, properties with increased impermeable surface area might have some responsibility for downhill flooding). Approval by a majority of landowners, weighted by the amount each would pay, is required.[212]
- A A D A A A CE A A . Grant money is available through FEMA for property acquisition and structure removal or relocation so long as the owners are willing sellers.[213]
- EDE E E . The state Constitution allows assignment of property tax increment to fund programs for blighted areas.[214] The sixty-year-old redevelopment program ended at the Governor's request due to alleged abuses and state revenue losses. In time, this very powerful financing mechanism could conceivably be redirected to new purposes including shoreline adaptation, if adapting to effects of sea level rise were defined as a kind of redevelopment.
- A C E A C D C . Existing law allows use of some tax increment (property tax revenue generated by the growth of assessed value over a base level) with agreement of all local agencies and property owners involved.[215] This could be applied to coastal adaptation. Though the vote requirement has recently been reduced, it would still likely be difficult to satisfy. However, the requirement is not constitutionally necessary and could be amended by statute.
- A E AB E DE E E , A BA .[216] There are several mechanisms that involve requiring properties seeking development approval to buy development rights or mitigation credits, or conceivably to fund payments to owners of developmentally restricted parcels. Sales of development rights might avoid successful takings claims. Revenue from sales of mitigation credits could fund (or refund, if the work is already done) shoreline adaptation work.
- DE D DE D . A source of funding could be to stop funding unsustainable or counterproductive efforts (such as rebuilding public infrastructure that is repeatedly damaged in storms) and dedicate that funding to more sustainable infrastructure.

210 See Cal. Water Code, § 1525 et seq.

211 Cal. Const. art. XIIIA, § 3.

212 *Id*. art. XIIID, § 4.

213 See discussion *infra* Section VI.

214 Cal. Const. art. XVI, § 16.

215 Cal. Gov't Code, § 53398.50 et seq.

216 See Donald G. Hagman and Dean J. Misczynski, *Windfalls for Wipeouts: Land Value Capture and Compensation* (Amer. Planning Assoc. 1977).