



CALIFORNIA COASTAL COMMISSION SEA LEVEL RISE POLICY GUIDANCE

Interpretive Guidelines for Addressing Sea Level Rise in Local Coastal Programs and Coastal Development Permits



Sunset Beach, Photo by Mario Fernandez



Chula Vista, Photo by Lisa Cox



San Francisco, Photo by Mike Baird



Arcata, Photo by Humboldt Baykeeper

Original Guidance unanimously adopted – August 12, 2015

Science Update unanimously adopted – November 7, 2018

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The **original** *California Coastal Commission Sea Level Rise Policy Guidance: Interpretive Guidelines for Addressing Sea Level Rise in Local Coastal Programs and Coastal Development Permits* was unanimously adopted by the California Coastal Commission on August 12, 2015.

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A **Science Update** to the *California Coastal Commission Sea Level Rise Policy Guidance: Interpretive Guidelines for Addressing Sea Level Rise in Local Coastal Programs and Coastal Development Permits* was unanimously adopted by the California Coastal Commission on November 7, 2018.

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SUMMARY OF DOCUMENT REVISIONS

A first draft of this Guidance was released for public review on October 14, 2013. The public comment period was open for 120 days, until February 14, 2014. During that time, the Commission received over 100 comment letters that broke down into over 800 distinct comments. A revised draft was released on May 27, 2015 and presented at the June 2015 Coastal Commission hearing in Newport Beach. Written comments were requested by July 10, 2015, and 28 comment letters were submitted.

On August 12, 2015 the Commission adopted the Recommended Final Draft (dated July 31, 2015 and updated with addenda August 10, 2015) as interpretive guidelines pursuant to Public Resources Code section 30620. The final draft has been posted on the Commission's website and used by the Commission, local governments, project applicants, and other stakeholders since its adoption.

Science-focused updates have now been developed to address evolving science. Acting on direction from Governor Brown, the Ocean Protection Council has released two reports that update our understanding of sea level rise science and best practices for planning for and addressing anticipated impacts. The first of these reports, *Rising Seas in California: An Update on Sea-Level Rise Science*, synthesizes recent evolving research on sea level rise science, and forms the foundation for the second report, the *State of California Sea-Level Rise Guidance: 2018 Update*. The 2018 OPC SLR Guidance provides higher level recommendations for how to plan for and address sea level rise impacts, notably including a set of projections recommended for use in planning, permitting, investment, and other decisions.

In order to reflect the updated best available science, a set of focused updates for the Coastal Commission SLR Policy Guidance have been developed. These include:

- *References to best available science throughout the document, including SLR projection tables, which formerly referenced the 2012 NRC Report, have been updated to reference the 2018 OPC SLR Guidance.*
- *Sections of the Guidance that provided extensive details about the NRC report and/or how to use the information provided within the NRC report (mainly in Chapters 3, 5, and 6 and Appendices A and B) have been removed. In their place, summaries of the Rising Seas science report (2017) and the 2018 OPC SLR Guidance have been added (Chapters 3, 5, and 6, and Appendices A, B, and G).*
- *Some updates have been made to tables of resources meant to assist interested parties in addressing sea level rise (e.g., SLR mapping and modeling tools, grant funding sources, and agency and other stakeholder guidance). However, these tables have not been exhaustively updated, and additional resources may be available.*

On November 7, 2018, the Commission unanimously adopted the Draft Science Update to the Coastal Commission Sea Level Rise Policy Guidance.

How to Use this Document

This document is:	This document is <u>NOT</u> :
Guidance	Regulations
<p><i>This Guidance is advisory and not a regulatory document or legal standard of review for the actions that the Commission or local governments may take under the Coastal Act. Such actions are subject to the applicable requirements of the Coastal Act, the federal Coastal Zone Management Act, certified Local Coastal Programs, and other applicable laws and regulations as applied in the context of the evidence in the record for that action.</i></p>	
Dynamic	Static
<p><i>This Guidance will be updated periodically to address new sea level rise science, information, and approaches regarding sea level rise adaptation, and new legal precedent. The Commission will also continue working on sea level rise through other projects and in a collaborative manner, as outlined in Chapter 9: Next Steps.</i></p>	
Multi-purpose for multiple audiences	Meant to be read cover-to-cover
<p><i>This Guidance is a comprehensive, multi-purpose resource and it is intended to be useful for many audiences. As such, it includes a high level of detail on many subjects. However, chapters were written as stand-alone documents to provide usable tools for readers.</i></p>	
A menu of options	A checklist
<p><i>Since this document is intended for use statewide, it is not specific to a particular geographic location or development intensity (e.g., urban or rural locations). Therefore, not all of the content will be applicable to all users, and readers should view the content as a menu of options to use only if relevant, rather than a checklist of required actions.</i></p>	

Reading Tips

- Look carefully at the Table of Contents and identify sections of interest.
- Do not expect all of the content to apply to your particular situation. As a statewide document, a wide variety of information is included to address the concerns of various users.
- Navigate to your desired level of detail: The *Executive Summary* provides a basic summary of the content; the body of the document provides a detailed discussion; and the *Appendices* provide more scientific and technical detail and a variety of useful resources.

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Commonly Used Acronyms and Agency Names

Terms:

CCT – California Coastal Trail

CDP – Coastal Development Permit

CoSMoS – Coastal Storm Modeling System

ENSO – El Niño Southern Oscillation

ESHA – Environmentally Sensitive Habitat Area

GHG – Greenhouse gas

IPCC – Intergovernmental Panel on Climate Change

LCP – Local Coastal Program

LUP – Land Use Plan

NRC Report – National Research Council Report “*Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future*”

PDO – Pacific Decadal Oscillation

SLR – Sea level rise

TNC – The Nature Conservancy

Agency Names:

BCDC – San Francisco Bay Conservation and Development Commission

BOEM – Bureau of Ocean Energy Management

BSEE – Bureau of Safety and Environmental Enforcement

Cal OES – California Governor’s Office of Emergency Services

Caltrans – California Department of Transportation

CCC/Commission – California Coastal Commission

CDFW – California Department of Fish and Wildlife

CNRA – California Natural Resources Agency

CO-CAT – Coast and Oceans Climate Action Team

Conservancy – California State Coastal Conservancy

EPA – Environmental Protection Agency

FEMA – Federal Emergency Management Agency

NERR – National Estuarine Research Reserve

NMS – National Marine Sanctuary

NOAA – National Oceanic and Atmospheric Administration

NPS – National Park Service

OPC – California Ocean Protection Council

OPR – California Governor’s Office of Planning and Research

State Lands – California State Lands Commission

State Parks – California Department of Parks and Recreation

SWRCB – State Water Resources Control Board

USACE – United States Army Corps of Engineers

USFWS – United States Fish and Wildlife Service

USGS – United States Geological Survey



Executive Summary

Climate change is upon us, affecting almost every facet of California’s natural and built environment. Increasing global temperatures are causing significant effects at global, regional, and local scales. In the past century, average global temperature has increased by about 0.8°C (1.4°F), and average global sea level has increased by 7 to 8 in (17 to 21 cm) (IPCC 2013). Sea level at the San Francisco tide gauge has risen 8 in (20 cm) over the past century, and recent reports developed by the California Ocean Protection Council (OPC) (in conjunction with the OPC Science Advisory Team) project that by the year 2100, sea levels may rise by approximately 2.4 to 6.9 feet, with the potential for rapid ice loss to result in an extreme scenario of 10.2 feet of sea level rise (Griggs *et al.*, 2017; OPC 2018). While the California coast regularly experiences erosion, flooding, and significant storm events, sea level rise will exacerbate these natural forces, leading to significant social, environmental, and economic impacts. The [third National Climate Assessment](#) notes that there is strong evidence showing that the cost of doing nothing to prepare for the impacts of sea level rise exceeds the costs associated with adapting to them by about 4 to 10 times (Moser *et al.* 2014). Therefore, it is critically important that California plan and prepare for the impacts of sea level rise to ensure a resilient California coast for present and future generations.

The California Coastal Act is one of the state’s primary coastal management laws for addressing land use, public access and recreation, and the protection of coast and ocean resources in the coastal zone. It is also the primary coastal hazards law governing development along the coast. Using the Coastal Act, the Coastal Commission and local governments have more than four decades of experience managing coastal development, including addressing the challenges presented by coastal hazards like storms, flooding, and erosion as well as responses to these hazards such as armoring. However, sea level rise and the changing climate present management challenges of a new magnitude, with the potential to significantly threaten many coastal resources, including shoreline development, coastal beach access and recreation, habitats, agricultural lands, cultural resources, and scenic resources, all of which are subject to specific protections and regulations in the Coastal Act. Therefore, effective implementation of the Coastal Act and the protection of California’s coast must address global sea level rise and the greater management challenges it will bring.

This document focuses specifically on how to apply the Coastal Act to the challenges presented by sea level rise through Local Coastal Program (LCP) certifications and updates and Coastal Development Permit (CDP) decisions. It organizes current science, technical, and other information and practices into a single resource to facilitate implementation of the Coastal Act by coastal managers at the state and local level. While the document is intended to guide LCP planning and development decisions to ensure effective coastal management actions, it is advisory and does not alter or supersede existing legal requirements, such as the policies of the Coastal Act and certified LCPs. However, one of the Commission’s priority goals is to coordinate with local governments to complete and update LCPs in a manner that adequately addresses sea level rise and reflects the recommendations in this Guidance.

This Guidance document is also part of a larger statewide strategy to respond to climate change that includes both emissions reductions and adaption planning to address the impacts of a changing climate. In 2008, Governor Schwarzenegger issued an Executive Order (S-13-08) directing state agencies to consider sea level rise as part of planning projects and to support the

preparation of the National Research Council report on sea level rise. Additionally, on April 29, 2015, Governor Brown issued an Executive Order (B-30-15) to establish a new greenhouse gas emission reduction target and called for further action on adaptation. This Guidance is also being coordinated with many statewide initiatives to address climate change and sea level rise, including the 2014 [Safeguarding California](#) plan (an update to the 2009 [California Adaptation Strategy](#); CNRA 2009, 2014), the ongoing update to the [General Plan Guidelines](#) (Cal OPR 2015), the 2013 update to the California Governor’s Office of Emergency Services’ (Cal OES) [State Hazard Mitigation Plan](#), and others.¹ Commission staff has also been and will continue to participate in multi-agency partnerships, including the Coast and Ocean Workgroup of the multi-state agency Climate Action Team and the *State Coastal Leadership Group on Sea-Level Rise*. For more detail on these efforts, see the [Introduction](#).

PRINCIPLES FOR ADDRESSING SEA LEVEL RISE IN THE COASTAL ZONE

This Guidance is rooted in certain fundamental guiding principles, many of which derive directly from the requirements of the Coastal Act. These Principles broadly lay out the common ideas and a framework by which sea level rise planning and permitting actions can be assessed, and as such represent the goals to which actions should aspire. Individual actions and outcomes may vary based on a variety of factors, including applicable policies and location- or project-specific factors that may affect feasibility. The Guiding Principles are summarized below and discussed in greater detail in Chapter 2.

Use Science to Guide Decisions [Coastal Act Sections 30006.5; 30335.5]

1. Acknowledge and address sea level rise as necessary in planning and permitting decisions.
2. Use the best available science to determine locally relevant and context-specific sea level rise projections for all stages of planning, project design, and permitting reviews.
3. Recognize scientific uncertainty by using scenario planning and adaptive management techniques.
4. Use a precautionary approach by planning and providing adaptive capacity for the higher end of the range of possible sea level rise.
5. Design adaptation strategies according to local conditions and existing development patterns, in accordance with the Coastal Act.

Minimize Coastal Hazards through Planning and Development Standards [Coastal Act Sections 30253, 30235; 30001, 30001.5]

6. Avoid significant coastal hazard risks to new development where feasible.
7. Minimize hazard risks to new development over the life of authorized structures.

¹ See the Governor’s Office of Planning and Research’s webpage for the [California Climate Change Document](#), which includes a matrix of additional efforts.

8. Minimize coastal hazard risks and resource impacts when making redevelopment decisions.
9. Account for the social and economic needs of the people of the state; assure priority for coastal-dependent and coastal-related development over other development.
10. Ensure that property owners understand and assume the risks, and mitigate the coastal resource impacts, of new development in hazardous areas.

Maximize Protection of Public Access, Recreation, and Sensitive Coastal Resources [Coastal Act Chapter 3 policies]

11. Provide for maximum protection of coastal resources in all coastal planning and regulatory decisions.
12. Maximize natural shoreline values and processes; avoid expansion and minimize the perpetuation of shoreline armoring.
13. Recognize that sea level rise will cause the public trust boundary to move inland. Protect public trust lands and resources, including as sea level rises. New shoreline protective devices should not result in the loss of public trust lands.
14. Address other potential coastal resource impacts (wetlands, habitat, agriculture, scenic, *etc.*) from hazard management decisions, consistent with the Coastal Act.
15. Address the cumulative impacts and regional contexts of planning and permitting decisions.
16. Require mitigation of unavoidable coastal resource impacts related to permitting and shoreline management decisions.
17. Consider best available information on resource valuation when mitigating coastal resource impacts.

Maximize Agency Coordination and Public Participation [Coastal Act Chapter 5 policies; Sections 30006; 30320; 30339; 30500; 30503; 30711]

18. Coordinate planning and regulatory decision making with other appropriate local, state, and federal agencies; support research and monitoring efforts.
19. Consider conducting vulnerability assessments and adaptation planning at the regional level.
20. Provide for maximum public participation in planning and regulatory processes.

BEST AVAILABLE SCIENCE AND CONSEQUENCES OF SEA LEVEL RISE

The Coastal Act directs the Coastal Commission and local governments to use the best available science in coastal land use planning and development. This Guidance recommends using the best available science on sea level rise projections to inform planning decisions and project design. The State of California has long supported the preparation and provision of scientific information on climate change and sea level rise to help guide appropriate and resilient planning, permitting, investment, and other decisions. For example, the State recently released [California's Fourth Climate Change Assessment](#) to advance actionable science that serves the needs of state and local-level decision-makers. Specific to sea level rise, the State also supported the preparation of the 2012 National Research Council's Report, [Sea-Level Rise for the Coasts of California, Oregon and Washington: Past, Present, and Future](#), as well as the 2017 [Rising Seas in California: An Update on Sea-Level Rise Science](#) (OPC Science Report) and the [State of California Sea-Level Rise Guidance: 2018 Update](#) (2018 OPC SLR Guidance). The 2018 OPC SLR Guidance contains a set of projections for 12 tide gauges throughout California, and the Coastal Commission recommends using these projections and related information as best available science on sea level rise in California (see [Table 1](#) for the projections at the San Francisco tide gauge, and [Appendix G](#) for projections for other tide gauges). The Coastal Commission will re-examine best available science periodically and as needed with the release of new information.

In addition to sea level rise projections, the 2012 NRC report, the 2017 OPC Science Report, and the 2018 OPC SLR Guidance provide information on the impacts of sea level rise in California². According to these reports, sea level rise will cause flooding and inundation, increased coastal erosion, changes in sediment supply and movement, and saltwater intrusion to varying degrees along the California coast. These effects in turn could have a significant impact on the coastal economy and could put important coastal resources and coastal development at risk, including ports, marine terminals, commercial fishing infrastructure, public access, recreation, wetlands and other coastal habitats, water quality, biological productivity in coastal waters, coastal agriculture, and archaeological and paleontological resources.

² Note that while the Coastal Commission now recognizes the 2018 OPC SLR Guidance as best available science on sea level rise projections, the 2012 NRC Report and other related studies still contain valuable information, and references to these documents and studies throughout this guidance remain relevant and applicable.

Table 1. Sea Level Rise Projections for the San Francisco Tide Gauge³ (OPC 2018)

Projected Sea Level Rise (in feet): <i>San Francisco</i>			
	Probabilistic Projections (in feet) (based on Kopp et al. 2014)		H++ Scenario (Sweet et al. 2017)
	Low Risk Aversion	Medium-High Risk Aversion	Extreme Risk Aversion
	<i>Upper limit of "likely range" (~17% probability SLR exceeds...)</i>	<i>1-in-200 chance (0.5% probability SLR exceeds...)</i>	<i>Single scenario (no associated probability)</i>
2030	0.5	0.8	1.0
2040	0.8	1.3	1.8
2050	1.1	1.9	2.7
2060	1.5	2.6	3.9
2070	1.9	3.5	5.2
2080	2.4	4.5	6.6
2090	2.9	5.6	8.3
2100	3.4	6.9	10.2
2110*	3.5	7.3	11.9
2120	4.1	8.6	14.2
2130	4.6	10.0	16.6
2140	5.2	11.4	19.1
2150	5.8	13.0	21.9

**Most of the available climate model experiments do not extend beyond 2100. The resulting reduction in model availability causes a small dip in projections between 2100 and 2110, as well as a shift in uncertainty estimates (see Kopp et al., 2014). Use of 2110 projections should be done with caution and acknowledgement of increased uncertainty around these projections.*

³ Probabilistic projections for the height of sea level rise and the H++ scenario are presented. The H++ projection is a single scenario and does not have an associated likelihood of occurrence. Projections are with respect to a baseline year of 2000 (or more specifically, the average relative sea level over 1991-2009). Table is adapted from the 2018 OPC SLR Guidance to present only the three scenarios OPC recommends evaluating. Additionally, while the OPC tables include low emissions scenarios, only high emissions scenarios, which represent RCP 8.5, are included here because global greenhouse gas emissions are currently tracking along this trajectory. The Coastal Commission will continue to update best available science as necessary, including if emissions trajectories change.

ADDRESSING SEA LEVEL RISE IN LOCAL COASTAL PROGRAMS

This document provides a step-by-step process for addressing sea level rise and adaptation planning in new and updated Local Coastal Programs. These Steps, summarized below in text and in [Figure 1](#), can be tailored to fit the needs of individual communities and to address the specific coastal resource and development issues of a community, such as dealing with bluff erosion or providing for effective redevelopment, urban infill, and concentration of development in already developed areas. Ideally, Commission and local government staff will establish regular coordination and work together in the early steps of any LCP planning process. For a detailed explanation of these LCP planning Steps, see [Chapter 5](#). Communities in areas where sea level rise vulnerability assessment work is already underway can start later in the process, at Step 4, or other relevant Step(s).

- Step 1. Determine a range of sea level rise projections relevant to LCP planning area/segment** using best-available science, which is currently the 2018 OPC SLR Guidance.
- Step 2. Identify potential physical sea level rise impacts in the LCP planning area/segment**, including inundation, storm flooding, wave impacts, erosion, and/or saltwater intrusion into freshwater resources.
- Step 3. Assess potential risks from sea level rise to coastal resources and development in the LCP planning area/segment**, including those resources addressed in Chapter 3 of the Coastal Act.
- Step 4. Identify adaptation measures and LCP policy options** to include in the new or updated LCP, including both general policies and ordinances that apply to all development exposed to sea level rise, and more targeted policies and land use changes to address specific risks in particular portions of the planning area.
- Step 5. Draft updated or new LCP for certification with California Coastal Commission**, including the Land Use Plan and Implementing Ordinances.
- Step 6. Implement the LCP and monitor and re-evaluate strategies as needed** to address new circumstances relevant to the area.

Planning Process for Local Coastal Programs and Other Plans

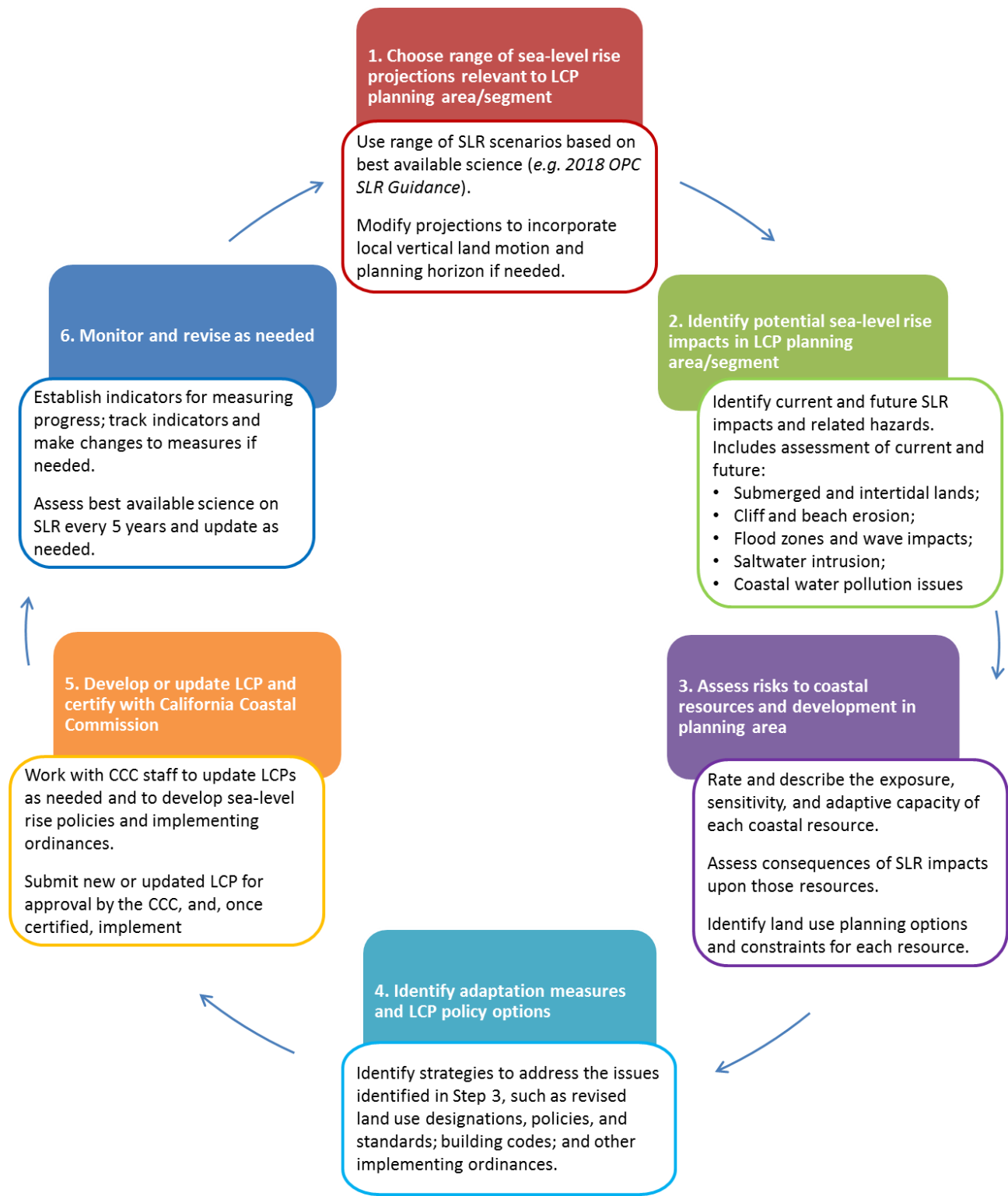


Figure 1. Flowchart for addressing sea level rise in Local Coastal Programs and other plans

ADDRESSING SEA LEVEL RISE IN COASTAL DEVELOPMENT PERMITS

New development within the coastal zone generally requires a Coastal Development Permit (CDP). Many projects reviewed through the CDP application process already examine sea level rise impacts as part of the hazards analysis, though not every CDP application will need to consider sea level rise. In general, sea level rise is only likely to affect those projects that are on low-lying land, on eroding coastal bluffs, are in close proximity to water, or rely upon a shallow aquifer for water supply. This document offers a step-by-step outline, summarized below in text and in [Figure 2](#), for how to conduct such an analysis as a standard part of the CDP application process. The goal of these Steps is to ensure careful attention to minimizing risk to development and avoiding impacts to coastal resources over the life of the project. Early coordination with the Coastal Commission staff is highly recommended, and staff will be available to consult with applicants during this process. Adopting or updating LCPs as recommended in this Guidance should facilitate subsequent review of CDPs. LCPs can identify areas where a closer review of sea level rise concerns is necessary. If kept up to date, they can also provide information for evaluation at the permit stage and specify appropriate mitigation measures for CDPs to incorporate. For a detailed explanation of these steps, see [Chapter 6](#) of this Guidance.

- Step 1. Establish the projected sea level rise range for the proposed project’s planning horizon** using the best available science, which is currently the 2018 OPC SLR Guidance.
- Step 2. Determine how physical impacts from sea level rise may constrain the project site**, including erosion, structural and geologic stability, flooding, and inundation.
- Step 3. Determine how the project may impact coastal resources, considering the influence of future sea level rise upon the landscape** as well as potential impacts of sea level rise adaptation strategies that may be used over the lifetime of the project.
- Step 4. Identify alternatives to avoid resource impacts and minimize risks** throughout the expected life of the development.
- Step 5. Finalize project design and submit CDP application.**

Planning Process for Coastal Development Permits

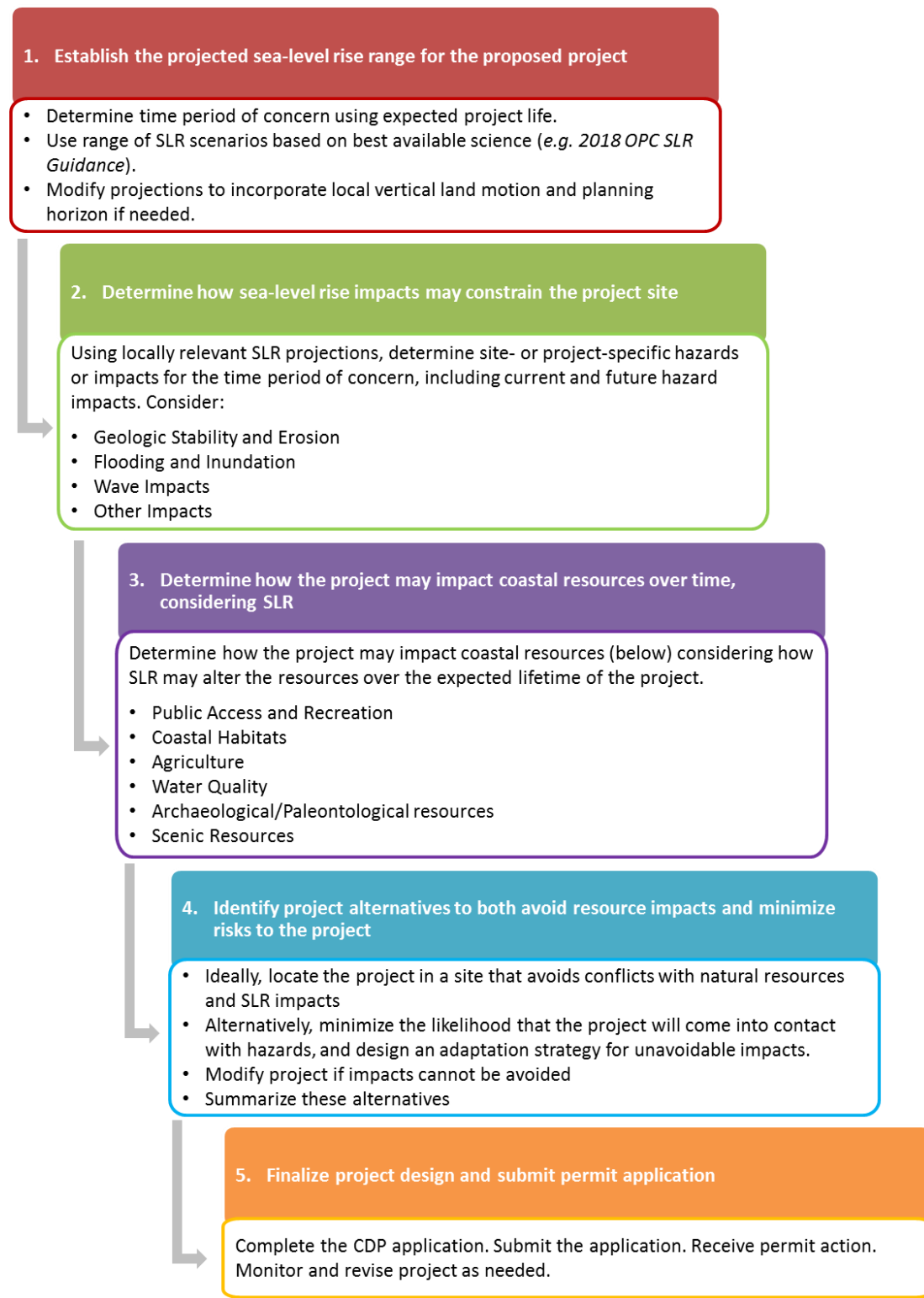


Figure 2. Flowchart for addressing sea level rise in Coastal Development Permits

ADAPTATION STRATEGIES

Steps 1 through 3 of the processes for addressing sea level rise in LCPs and CDPs will help planners and project applicants identify particular vulnerabilities to the planning region and specific project sites. Such vulnerabilities may include impacts to a number of resources identified in the Coastal Act, including development and infrastructure; public access and recreational opportunities; beaches, wetlands, environmentally sensitive habitat areas (ESHA), and other coastal habitats; agricultural resources; water quality; archaeological and paleontological resources; and scenic and visual resources. Planners and project applicants will need to identify, develop, and implement various adaptation strategies designed to protect coastal resources. These strategies should fulfill the hazard minimization and resource impact avoidance policies of the Coastal Act and should account for local conditions. In many cases, strategies will need to be implemented incrementally as conditions change, and planners, project applicants, and partners will need to think creatively and adaptively to ensure that coastal resources and development are protected over time. [Chapter 7](#) of this Guidance summarizes a number of strategies to protect different coastal resources and meet the goals and requirements of the Coastal Act.

ADDITIONAL INFORMATION

In addition to providing a summary of best available science on sea level rise, step-by-step approaches for addressing sea level rise in LCPs and CDPs, and a discussion of numerous adaptation strategies, the Guidance includes the following supplemental information:

- A brief discussion of the legal context of adaptation
- Next steps for Commission staff in coordination with other relevant partners and research institutions, based on objectives and actions from the Commission adopted [California Coastal Commission Strategic Plan 2013-2018](#) (2013a)
- Additional research needs directed toward research institutions at academic, state, federal, and local levels to help communities understand and prepare for sea level rise
- Detailed information on the drivers of sea level rise and sea level rise projections
- A step-by-step methodology for assessing local hazard conditions based on regional sea level rise projections, which is applicable to both LCPs and CDPs
- Lists of useful resources and references, including examples of sea level rise adaptation documents from other state agencies
- Key Coastal Act policies relevant to sea level rise and coastal hazards

CONTEXT OF THIS DOCUMENT

This Guidance is part of a larger body of work on climate change by State agencies, regional collaborations, local leadership, academic research, and other organizations. Many of these efforts are included as resources in [Appendix C](#). Users of the document should take advantage of these existing resources, collaborate with others, and share best practices as much as possible.

Finally, this document is intended to function as interpretive guidance for effective implementation of the Coastal Act and LCPs in light of sea level rise. It is not a regulatory document and does not contain any new regulations. Further, it does not amend or supersede existing legal authorities or the standard of review for Local Coastal Programs and coastal development permit decisions pursuant to the Coastal Act. Those actions are subject to the applicable requirements of the Coastal Act, the Coastal Zone Management Act, certified LCPs, and other applicable laws and regulations as applied in the context of the evidence in the records for those actions. The Commission is adopting this Guidance as interpretive guidelines pursuant to its authority under Public Resources Code Sections 30620.