US Army Corps
of Engineers®
New York District

FINAL

Integrated Hurricane Sandy General Reevaluation Report and Environmental Impact Statement

Atlantic Coast of New York

East Rockaway Inlet to Rockaway Inlet and Jamaica Bay

Appendix D

Environmental Compliance

Attachment D5
Coastal Zone Management Program
Federal Consistency Determination

December 2018

East Rockaway Inlet to Rockaway Inlet and Jamaica Bay Reformulation Study

Final General Reevaluation Report and Environmental Impact Statement

New York (and New York City Local Waterfront Development Plan) Coastal Zone Management Program Federal Consistency Determination

As required under the Federal Coastal Zone Management Act, the USACE, New York District reviewed the Recommended Plan in relation to the applicable policies of the New York State Coastal Zone Management Program. A number of questions under Part C of the New York State Coastal Management Program (NYS CMP) Federal Consistency Assessment Form (New York State Department of State (NYSDOS), Division of Coastal Resources (DCR), 2003b) were answered in the affirmative; therefore, as stated under Part D, number two, it is necessary to analyze the Project in more detail with respect to its consistency with the *State Coastal Policies* (NYSDOS DCR, 2003c) of the NYS CMP, as well as New York City's *The New Waterfront Revitalization Program* (WRP) (New York City Department of City Planning, Consistency Assessment Form 2016). Following is a list of the State and city policies in question and a brief statement of how the Project is consistent with each of these policies. Policies that are not listed were answered in the negative with respect to this Project as proposed. New York State Department of State concurred with the Federal Consistency Determination on December 6, 2018, in coordination with the New York City Department of City Planning (Appendix I—Pertinent Correspondence).

1 DEVELOPMENT POLICIES

1.1 Policy 1

Restore, revitalize, and redevelop deteriorated and underutilized waterfront areas for commercial, industrial, cultural, recreational, and other compatible uses. (Question 1c)

The Project will restore deteriorated waterfront areas along the Atlantic shorefront and along the Jamaica Bay / Back Bay on Rockaway peninsula. The Project will protect the environment and human development around Jamaica Bay, as well as coastal resources of Kings, Queens, and Nassau counties, which will enhance existing and anticipated recreational uses in the future, namely the use of Rockaway Beach and the recently improved Rockaway Boardwalk. The Project will renourish the beachfront and improve existing groins, as well as offer flood protection to residents and enhance natural resources along the Jamaica Bay perimeter, to further reduce the type of damage to all waterfront areas (natural and residential areas), that occurred during Hurricane Sandy. Accordingly, the Project is consistent and compatible with the character of the area, will not adversely affect adjacent and upland views, will not cause further deterioration of the shoreline, and will reduce the extent of adverse impacts to the economic base of the community from potential future coastal storms similar to Hurricane Sandy.

1.2 Policy 2

Facilitate the siting of water-dependent uses and facilities on or adjacent to coastal waters. (Questions 1b and 3a)

The Project includes flood and erosion protection structures that will physically alter land along the shoreline and under coastal waters, and requires siting of water-dependent uses and facilities along the Atlantic Ocean shorefront and along the Jamaica Bay / Back Bay shoreline on the Rockaway peninsula. The Project will not preempt the reasonably foreseeable development of water-dependent uses. The Project is designed to add to the public use and enjoyment of the water's edge, as well as reducing the extent of damage to coastal resources that occurred during Hurricane Sandy. The guidelines for site choices listed under this policy apply to this Project as follows:

1. Competition for space: The Project will provide increased protection to water-dependent activities as well as to existing and reasonably foreseeable development or redevelopment located inland of the Atlantic Shoreline. There is no competing use for within the shoreline.
2. In-place facilities and services: Existing in-place facilities and service will be sufficient to support this Project.
3. Access to navigational channels: Shipping, fishing, and boating activities are not planned for the Project site. The Project will not prevent access to existing navigation channels
4. Compatibility with adjacent uses and protection of other coastal resources: The Project is compatible with adjacent properties and will enhance the surrounding community and environmental quality of Rockaway by protecting coastal resources from damaging coastal storms similar to Hurricane Sandy.
5. Preference to underutilized sites: Not applicable to the Project. However, the Project protects underutilized sites from coastal storm damage.
6. Providing for expansion: The Project does not prevent current or reasonably foreseeable future water-dependent uses. The CSRMUs are designed to provide 50-years of coastal storm protection with a minimal footprint such that long-term space needs and future demand for land are not limited.

2 FISH AND WILDLIFE POLICIES

2.1 Policy 7

Significant coastal fish and wildlife habitats will be protected, preserved, and where practical, restored so as to maintain their viability as habitats. (Question 2c)

The Project will affect and be located in the NYSDEC-designated Critical Environmental Area. The Project involves dredging and excavation, physical alteration of shore area through beach renourishment and construction of flood protection and environmental enhancement features and structures The Project will protect coastal habitat and reduce damage from coastal storms similar to Hurricane Sandy, which is in direct accord with this policy, as well as the direction of *The New*

Waterfront Revitalization Program regarding Special Natural Waterfront Areas (SWNA); the western portion of the Rockaway peninsula is a proposed SNWA as of October 30, 2013. Accordingly, the Project will increase the quality and quantity of the physical, biological, and chemical parameters along the Atlantic shorefronts of the Rockaway Peninsula and Jamaica Bay Back Bay shoreline.

This policy requires that a narrative for each significant habitat be provided to aid in consistency determination. As stated above, the Project area has been identified by NYSDEC as a CEA and by NYC as a proposed SWNA. Following is a narrative for the Project site, noting the five required items.

(1) The Project is located in Kings and Queens Counties, and will provide protection to coastal areas in these counties as well as southwestern Nassau County.

(2) The Jamaica Bay Ecological Restoration and Research Team reports (Tanacredi *et al*, 2002) observed many different types of vegetative, fish, bird, and other wildlife species. These species are discussed in the Revised Draft Integrated General Reevaluation Report and Environmental Impact Statement (GRR/EIS).

(3) Physical, biological, and chemical parameters that will be improved and/or increased by the Project include protection of coastal habitat and associated wildlife and habitat and erosion control.

(4) Dredging would be an activity to impact offshore coastal habitat, while beachfront renourishment, groins, and seawalls will require filling along the coastline and may impact nearshore benthic, fish and bird habitat. However, all work will utilize best management practices to limit impacts to offshore benthic and fish communities.

(5) The quantitative basis used to rate the habitat is provided in the GRR/EIS.

Fill placement along the Atlantic shoreline in the project area will create wider beaches and dunes to minimize breaching and overwashing and consequent damage to habitats and communities on the barrier island. There will be no change in existing tidal exchange patterns, only a continuation of the non-storm induced conditions. A comprehensive assessment of potential project impacts to threatened and endangered species and habitats was conducted and is presented in the GRR/EIS prepared for the project.

The proposed activities would be undertaken in a manner consistent with this policy.

2.2 Policy 8

Protect fish and wildlife resources in the coastal area from the introduction of hazardous wastes and other pollutants which bio-accumulate in the food chain or which cause significant sublethal or lethal effect on those resources.

The material that may be obtained from the offshore borrow areas, consists primarily of clean, coarse-grained sand. The material has been dredged in the past, and prior sampling of this material has indicated that the material is suitable for use as downdrift beach nourishment material. The material that would be dredged and used for beach nourishment on the down drift beaches would not contain hazardous wastes or other pollutants that would bioaccumulate in the food chain or cause significant sublethal or lethal effects on those resources. Sediment re-suspension is likely to cause temporary increases in turbidity; however, these increases would be limited in duration and

spatial extent and are not expected to significantly affect fish or aquatic wildlife in the project areas.

The proposed activities would not adversely affect fish and wildlife resources and would be undertaken in a manner consistent with this policy.

3 FLOODING AND EROSION HAZARDS POLICIES

3.1 Policy 11

Buildings and other structures will be sited in the coastal area so as to minimize damage to property and the endangering of human lives caused by flooding and erosion. (Questions 1a, 1b, and 2b)

The Project will result in physical changes to the Atlantic shorefront and the Back Bay of Jamaica Bay, Rockaway. The Project is also located in a federally-designated flood hazard area. However, the Project is designed to protect coastal resources in these areas through a layered approach consisting of a combination of seawalls, groins, floodwalls, bulkheads, nature-based non-structural features and beach renourishment. Sand obtained from the offshore borrow area would be pumped to the beach areas to restore the natural protective features of the barrier island. The nourishment of beaches and dunes with appropriate material is an allowable activity pursuant to the coastal erosion hazard area regulations contained in 6 NYCRR Part 505 (see also Policy 35), and is a non-structural erosion control measure preferred over structural measures by the State in its tidal wetlands, erosion hazards, and coastal management program statutes and regulations (see Policies 17, 35, and 44). Restoring the natural protective characteristics of the barrier island (resulting in the protection of the barrier island itself, the bay-system and the mainland of Long Island) would be consistent with and further promote Policy 12, which is to minimize damage to natural resources and property by protecting the naturally occurring protective characteristics and the associated physical processes. Therefore, the Project will minimize damage to property and reduce the risk to human lives caused by flooding and erosion from coastal storms similar to Hurricane Sandy.

3.2 Policy 12

Activities or development in the coastal area will be undertaken so as to minimize damage to natural resources and property from flooding and erosion by protecting natural protective features including beaches, dunes, barrier islands and bluffs. (Question 1b and 2b)

The Project will require physical alteration of onshore and offshore coastal area; is located in flood and erosion hazard areas; and will affect beaches, dunes, and barrier islands. However, the coastal resources this policy is intended to protect will be protected by the Project, which will reduce damage to these coastal resources from coastal storms similar to Hurricane Sandy.

Therefore, the project will be undertaken in a manner consistent with this policy.

3.3 Policy 13

The construction or reconstruction of erosion protection structures shall be undertaken only if they have a reasonable probability of controlling erosion for at least thirty years as

demonstrated in design and construction standards and/or assured maintenance or replacement programs. (Question 3c)

The Project requires construction of flood and erosion control structures (ex. seawalls, groins, beach renourishment) as well as the construction of nature-based non-structural features. The Atlantic shoreline features are designed to provide 50-years of protection from coastal storms similar to Hurricane Sandy. The Project includes procedures for scheduled maintenance to ensure the shoreline features remain effective over this time frame. Should the magnitude of coastal storms increase above conditions predicted for the next 50 years (see GRR/EIS for sea level change scenarios used to calculate the 50 year projection), USACE, New York District will assess how best to upgrade the shoreline features to provide increased protection from such coastal storm events. Stone structures in the coastal environment, such as the proposed groins, can continue to perform well past their intended design life. It is anticipated that the groins can provide rocky intertidal habitat enhancement and erosion protection past their 50-year service life. It should also be noted that features are adaptable and could be modified in the future to extend their service life.

3.4 Policy 14

Activities and development, including the construction or reconstruction of erosion protection structures, shall be undertaken so that there will be no measurable increase in erosion or flooding at the site of such activities or development, or at other locations. (Question 3c)

The Project requires construction of flood and erosion control structures (seawalls, groins, floodwalls, bulkheads beach renourishment), as well as the construction of nature-based non-structural features. The proposed measures are designed to address wave energy, event-based (i.e., short-term/storm-related) and gradual (long-term) shoreline erosion and impacts of coastal flooding, while not leading to increased erosion of the shoreline outside the project site. The design of these structures accounts for subsequent changes that will occur to littoral transport of sediment to adjacent shorelines; these design elements are described in the GRR/EIS Appendix A1A on the Engineering Modeling for the Atlantic Shorefront (Section 8). Accordingly, as required, construction and operation of the shoreline features will not increase erosion or flooding at the site or at other locations.

The proposed activities are consistent with this policy.

3.5 Policy 15

Mining, excavation or dredging in coastal waters shall not significantly interfere with the natural coastal processes which supply beach materials to land adjacent to such waters and shall be undertaken in a manner which will not cause an increase in erosion of such land. (Question 1h)

The Project will result in dredging from a borrow source located approximately 3-4 miles south of the Rockaway Atlantic shorefront. Dredging near this area for other borrow source material has occurred for several USACE-led beachfront renourishment projects; these prior dredging activities have not reduced the natural regenerative powers of the shoreland. Best management practices will be followed during all dredging activities and the proposed dredging depth in the

borrow areas will not reduce the flow of sediments to adjacent areas. Coastal processes along the shoreline sand placement areas will not be interfered with as only natural sands will be placed; no structures or shoreline hardening is proposed. The natural regenerative powers of the subject project shoreline have decreased such that renourishment, groins, and seawalls are necessary to limit further loss of shoreline sediment due to coastal storms and normal coastal hydrodynamics, and not due to excavation or dredging in coastal waters.

The proposed activities are consistent with this policy.

3.6 Policy 16

Public funds shall only be used for erosion protective structures where necessary to protect human life, and new development which requires a location within or adjacent to an erosion hazard area to be able to function, or existing development; and only where the public benefits outweigh the long term monetary and other costs including the potential for increasing erosion and adverse effects on natural protective features. (Question 3c)

The Project requires construction of flood and erosion control structures (seawalls, groins, floodwalls, bulkheads, and beach renourishment), as well as the construction of natural and nature-based non-structural features. The economic impacts associated with construction and operation of the shoreline features are significantly lower than the cost to repair damages reasonably anticipated to occur from coastal storms similar to Hurricane Sandy. Benefits to the human and natural environments outweigh the expenditures of public funds. Economic models are presented in the GRR/EIS.

The project is consistent with this policy.

3.7 Policy 17

Non-structural measures to minimize damage to natural resources and property from flooding and erosion shall be used whenever possible. (Question 2b)

The Project will affect and will be located in flood and erosion hazard areas. The shoreline features will provide flood and erosion control through beach renourishment, seawalls, floodwalls, bulkheads, groins and natural and nature-based non-structural features. The beach renourishment would be considered a non-structural measure. However, beach renourishment alone is not sufficient to minimize damage to nature resources and property from flooding and erosion that this policy seeks to ensure. The GRR/EIS includes the results of the analysis showing that non-structural measures alone are insufficient. Accordingly, as structural measures (ex. groins, seawall) are likely necessary to minimize damage to these coastal resources from coastal storms similar to Hurricane Sandy, non-structural measures are also included, where feasible, as applicable. The proposed activities are consistent to the maximum extent practicable with this policy.

4 PUBLIC ACCESS POLICIES

4.1 Policy 19

Protect, maintain, and increase the level and types of access to public water-related recreation resources and facilities. (Yes to Question 2h; no to Question 1d)

The Project will affect and will be located adjacent to State, County, and local parks. The CSRMUs will protect these resources from damage caused by coastal storms similar to Hurricane Sandy. The beach areas in the proposed project area support a variety of public recreational activities. A temporary reduction in off-season, public access to the work site during the construction season would occur. Buffer areas approximately 1,000 feet in length will be closed during construction activities for safety reasons. As beach placement activities are completed within each 1,000-foot compartment, the buffer is shifted accordingly. Public use of the beach area would be restored at that time. The shoreline features will reduce damage to the transportation systems, parking areas, and pedestrian walkways that occurred during Hurricane Sandy. Additionally, the Project will prevent a decrease in access to and use of recreational areas (e.g. Rockaway Beach and Jamaica Bay) due to flooding that would continue if the Project is not implemented.

The proposed activities would be undertaken in a manner consistent with this policy.

4.2 Policy 20

Access to the publicly-owned foreshore and to lands immediately adjacent to the foreshore or the water's edge that are publicly-owned shall be provided and it shall be provided in a manner compatible with adjoining uses. (Questions 1b and 2h; no to Question 1d)

The lands and waters adjacent to and at the sites of the proposed activities are publicly owned and accessible underwater lands and parklands that support a variety of public uses are present in the area (see also Policies 18 and 19). Based on the Policy 19 analysis above, the proposed activities would be undertaken in a manner consistent with and would advance this policy.

5 RECREATION POLICIES

5.1 Policy 21

Water-dependent and water-enhanced recreation will be encouraged and facilitated, and will be given priority over non-water-related used along the coast. (Question 3a)

The majority of lands and waters within the project area are publicly owned and currently support a variety of public water dependent uses such as fishing, boating and beaching. The project will protect and enhance these uses in the long term, with only staggered short term loss of use during construction, as described under Policy 19. The proposed project is consistent with and will advance this policy.

5.2 Policy 22

Development, when located adjacent to the shore, will provide for water-related recreation, whenever such use is compatible with reasonably anticipated demand for such

activities, and is compatible with the primary purpose of the development. (Questions 1a and 3a)

The project is not "development" per se, but is a coastal storm risk management measure. Water related recreation is a primary land use in the project area and will remain as such. The project will protect and enhance these water dependent recreational uses in the long term, with only staggered short term loss of use during construction, as described under Policy 19. The project will not restrict passive water- related recreational uses or diminish scenic views of the coastal shoreline. The beachfront renourishment along the Atlantic shoreline provides greater area for recreational activities. Additionally, the groins and seawall reduce damage to coastal resources (e.g. Jamaica Bay) caused by coastal storms similar to Hurricane Sandy. The proposed project is consistent with and will advance this policy.

6 HISTORIC AND SCENIC RESOURCES POLICIES

6.1 Policy 23

Protect, enhance and restore structures, districts, areas or sites that are of significance in the history, architecture, archaeology or culture of the state, its communities, or the nation. (Question 2i)

The Project will affect and be located adjacent to National and NYC historic resources. However, the Project will have a beneficial impact on these resources by protecting them from damage caused by coastal storms similar to Hurricane Sandy. USACE has closely coordinated the project design with the NY SHPO and Federally-recognized Native American Tribes (a record of coordination is provided in the GRR/EIS).

The project will protect cultural resources and is consistent with this policy.

7 WATER AND AIR RESOURCES POLICIES

7.1 Policy 30

Municipal, industrial, and commercial discharge of pollutants, including but not limited to, toxic and hazardous substances, into coastal waters will conform to state and national water quality standards. (Question 3d)

Although identified as a potentially relevant policy on the FCAF checklist, this policy is not directly applicable to the project as no pollutants will be discharged. The project is likely to result in sediment re-suspension and associated increases in turbidity during dredging in the borrow areas and during sand placement along the shoreline. These turbidity increases will be temporary and will not result in a violation of this policy.

7.2 Policy 35

Dredging and filling in coastal waters and disposal of dredged material will be undertaken in a manner that meets existing State permit requirements, and protects significant fish and wildlife habitats, scenic resources, natural protective features, important agricultural lands, and wetlands. (Questions 1b, 1h, and 1i)

No scenic resources or agricultural lands are located near the proposed project area; therefore, no such resources or lands will be affected by the proposed activities.

The proposed dredging of clean, relatively coarse-grained accumulated sand offshore borrow area approximately ¾ mile to three miles offshore, will not adversely affect significant coastal fish and wildlife habitats (see Policy 7), natural protective characteristics (see Policies 12, 14, 15, 17, and 18), or wetlands (see Policy 44).

The proposed dredging activities would take place in waters greater than 6 feet deep, and are therefore not required to meet the regulatory standards contained in the State's tidal wetlands land use regulations in 6 NYCRR Part 661. However, the use of the dredged material for beach nourishment in the areas adjacent to the Atlantic Ocean tidal wetland littoral zone would require a tidal wetlands permit (see Policy 44). The sand placement area is within state designated significant fish and wildlife habitats. The State tidal wetlands regulations in 6 NYCRR Part 661 indicate that the use of the dredge material for beach nourishment in an area adjacent to tidal wetlands is a generally compatible use; however, such a use is dependent on several character and resource values and the effects such nourishment and its associated dredged materials might have on intertidal wetlands and adjacent areas. The material to be dredged and used to nourish the beaches is compatible with the material currently on the beaches. The nourishment of beaches and dunes where necessary and appropriate is an activity that may be authorized pursuant to the coastal erosion hazard area regulations in 6 NYCRR Part 505 (see also Policy 12).

The project will be implemented in such a manner as to avoid adverse impacts to these habitats during construction to the extent practicable. Long term benefits to significant fish and wildlife habitats are anticipated as the placement of the beach fill would lead to larger and wider beach areas that could be used for breeding and nesting by shorebirds.

In addition, all required permits, such as a NYSDEC Tidal Wetlands Permit, Section 401 Water Quality Certificate, and Clean Water Act Section 404 analysis will be acquired and all permit conditions will be complied with. Consultation and coordination with State and Federal resource agencies (US Fish &Wildlife Service, NOAA Fisheries, National Park Service and State Natural Resource agencies) will be conducted and species specific seasonal restrictions and mitigation measures will be put in place. The proposed activities will be conducted in a manner consistent with this policy.

7.3 Policy 38

The quality and quantity of surface water and groundwater supplies will be conserved and protected, particularly where such waters constitute the primary or sole source of water supply. (Questions 1a and 3d)

Temporary increases in turbidity may occur during dredging and sand placement activities; however, these will be limited to construction periods and will be limited in spatial extent and duration. Best management practices will be implemented to minimize impacts. The Project will require State water quality permits or certifications. However, the Project will not encounter bedrock aquifers or surface water drinking water resources. Therefore, the Project will have no impact on surface water or groundwater supplies.

7.4 Policy 41

Land use or development in the coastal area will not cause national or state air quality standards to be violated. (Questions 1a and 3e)

The Project will require a large physical change to sites within the coastal area which will require the preparation of an EIS. These alterations are necessary for the construction of CSRMUs that will reduce damage to coastal resources caused by coastal storms similar to Hurricane Sandy. Construction of the Project will exceed the *de minimis* Air Quality Thresholds for nitrogen oxides (NOx), for which a full mitigation plan, per General Conformity Rule (GCR) of the Clean Air Act (CAA) is designed to reduce those thresholds back down to zero, as currently presented for authorization in the GRR/EIS.

7.5 Policy 43

Land use or development in the coastal area must not cause the generation of significant amounts of acid rain precursors: nitrates and sulfates. (Questions 1a and 3e)

The Project will require a large physical change to sites within the coastal area which will require the preparation of an EIS. These alterations are necessary for the construction of CSRMUs that will reduce damage to coastal resources caused by coastal storms similar to Hurricane Sandy. Construction of the Project will exceed the *de minimis* Air Quality Thresholds for nitrogen oxides (NOx), for which a full mitigation plan, per General Conformity Rule (GCR) of the Clean Air Act (CAA) is designed to reduce those thresholds back down to zero, as currently presented for authorization in the GRR/EIS.

8 WETLANDS POLICY

8.1 Policy 44

Preserve and protect tidal and freshwater wetlands and preserve the benefits derived from these areas. (Questions 1b and 2a)

As demonstrated above in the Policy 35 analysis, the proposed beach nourishment activities would take place in an area adjacent to the Atlantic Ocean littoral zone and an intertidal wetland area. The proposed beach nourishment activity is a generally compatible use according to the tidal wetlands land use regulations in 6 NYCRR Part 661. The beach nourishment activities will result in physical changes to the intertidal area that will adversely affect some invertebrates at the site of the beach nourishment activities for approximately 3 months while the projects are being undertaken (see Policy 35 analysis). However, these adverse effects would not be significant, would be temporary, and would not result in significant adverse effects nor significantly impair the benefits derived from the tidal wetland areas. The GRR/EIS provides detailed analyses of impacts to fish and wildlife habitat, and any mitigation that is required to compensate for significant (permanent, extensive, long term) losses. The proposed activities would be undertaken in a manner consistent with this policy.

9 NEW YORK CITY LOCAL WATERFRONT DEVELOPMENT PLAN

Policy 1.2

Encourage non-industrial development with uses and design features that enliven the waterfront and attract the public.

Restoration of the beach should enhance the recreational experience for beach goers and attract the public.

The proposed project is consistent with this policy.

Policy 2.2

Encourage a compatible relationship between working waterfront uses, upland development and natural resources within the Ecologically Sensitive Maritime and Industrial Area.

The *high frequency flooding risk reduction features* (HFFRRFs) on the bayside of the Rockaway peninsula utilize varying measures in order to be compatible between existing uses and conditions. For example, in areas that have active marinas or docks, either the alignment is pulled back behind the interactive waterfront uses, or a compatible bulkhead is proposed. In natural areas, a nature-based feature is proposed which incorporates tidal wetlands that slope up to an upland berm and integrate varying appropriate types of vegetation in order to help stabilize the features, provide habitat, and help attenuate wave actions. Rock sills are proposed at the toe of the wetlands in order to establish the necessary quiescent environment for wetland development and to attenuate wave action to protect the berm and upland habitat and the communities/infrastructure behind them.

The proposed project is consistent with this policy.

Policy 2.5

Incorporate consideration of climate change and sea level rise into the planning and design of waterfront industrial development and infrastructure, pursuant to WRP Policy 6.2.

Existing and future projected sea level rise was incorporated into the design for both the shorefront and bayside features. Please see attached worksheet and graphs pursuant to Policy 6.2 (attachment 2). Adaptive strategies (and the cost to adapt) has also been considered in the event that sea levels rise faster than the intermediate projection upon which the design is based.

The proposed project is consistent with this policy.

Policy 3.1

Support and encourage in-water recreational activities in suitable locations.

Beach restoration on the Atlantic Shorefront supports and encourages recreational uses of the beach. On the bayside, existing kayak launches, fishing spots, etc. have been noted and incorporated into the design of in-water NNBFs so that recreational activities are not negatively impacted. Fishing may improve due to the establishment of new foraging habitat, i.e. wetlands.

The proposed project is consistent with this policy.

Policy 4

Protect and restore the quality and function of ecological systems within the New York City coastal area.

Five areas of habitat restoration/enhancement are proposed as part of the Recommended Plan for Jamaica Bay, which will protect and restore the quality and function of ecological systems.

The design of the HFFRRFs has been refined to minimize impact to sensitive shoreline habitats, and primarily occur in mapped upland ruderal or urban habitats. Within these degraded habitats, the condition will primarily be restored as a temporary impact.

The project would have direct adverse impacts on native habitats that include beach and unvegetated shoreline, freshwater wetland, intertidal wetland, mudflats, subtidal bottom, and maritime forest. Specifically, as detailed in Section 6.5 Habitat Impacts and Mitigation Requirements of the Integrated General Reevaluation Report/Environmental Impact Statement (Integrated Report), the project will result in 14.1 acres of temporary impacts and 5.5 acres of permanent impacts to these habitats (See Section 6.5, Table 6-14 of the Integrated Report). Specific to federal and state regulated waters and wetlands, the project will temporarily impact 14.1 acres and permanently impact 3.7 acres (Table 6-13 of the Integrated Report). Temporary impacts assume that habitat will be replaced on-site and in-kind. The majority of temporary impacts to federal and state regulated waters and wetlands will occur in open water habitats (i.e., subtidal bottom, mudflat), or beach and unvegetated shorelines where subsequent planting will not be required and the time to full restoration of ecological services will be relatively quick compared to habitats that require development of native plant community.

To account for permanent impacts, *natural and nature-based features* (NNBFs) associated with the HFFRRFs will result in the restoration and/or creation of 7.6 acres of intertidal wetlands, enhancement to 0.5 acres of intertidal wetlands, and restoration of 1.3 acres of maritime forest (See Section 6.5, Table 6-15 of the Integrated Report). Overall, the Recommended Plan that includes NNBFs will attenuate waves, stabilize shorelines, and facilitate the restoration or enhancement of native shoreline habitats. As such, the long-term benefit realized by this plan will likely exceed the NNBF acreage noted above. For example, shore slopes behind the rock sill structures will be regraded to reduce risk of erosion further and create suitable elevation gradients and substrates for future establishment of tidal marsh plants. As such, the total restoration of intertidal marsh habitats will likely exceed the proposed planting area of 7.6 acres. The graded habitat behind the structure will also be designed to allow the shoreward migration of various habitats with rising sea levels, thereby extending the life of these important ecological systems. Finally, the rock sills will provide opportunities for shellfish habitat creation and will provide habitat complexity to near shore open water habitats (that is currently absent in project areas) which will support a diversity of both aquatic and terrestrial wildlife (discussed below), as well as improve near shore water quality.

A functional habitat assessment model for wetlands, EPW, also was used to characterize the functional impacts and benefits within intertidal wetlands associated with each HFFRRF. The assessment results estimate current resource value loss, and the potential increase in resource value through implementation of NNBFs. A summary of the analysis and the numerical results of the EPW functional assessment is provided in Section 6, Tables 6-12 and 6-13 of the Integrated Report. The project will result in the loss of 8.6 FCUs across the five functions. However, the

NNBFs will result in the gain of 34.5 FCUs across the five functions. Similar to the metric evaluation, the EPW functional assessment shows significant gains to the shoreline ecosystem through the incorporation of NNBFs.

The proposed project is consistent with this policy.

Policy 4.1

Protect and restore the ecological quality and component habitats and resources within the Special Natural Waterfront Areas.

Five areas and a gain of 34.5 functional habitat units, or a net gain of 3.9 acres of habitat, are proposed as part of the Recommended Plan, which will protect and restore the quality and function of ecological systems.

The proposed project is consistent with this policy.

Policy 4.3

Protect designated Significant Coastal Fish and Wildlife Habitats.

See NYSDOS Policy 7. Jamaica Bay up to the high tide line is a designated Significant Coastal Fish and Wildlife Habitat by Department of State. The project will result in a net gain of 3.9 acres of habitat, however, due to the degraded condition of much of the existing habitat which will be enhanced, this should result in a gain of 34.5 functional habitat units. Furthermore, the designs include erosion control features which should protect against future erosion of the shoreline which has been rapidly eroding.

The proposed project is consistent with this policy.

Policy 4.4

Identify, remediate and restore ecological functions within Recognized Ecological Complexes.

There are five areas proposed as part of the Recommended Plan where an opportunity to restore ecological functions has been identified, in conjunction with improving the natural resiliency to frequent coastal storms that these coastal ecosystems provide. (See Attachment A: Project Description) for more information on the proposed restoration.

The proposed project is consistent with this policy.

Policy 4.5

Protect and restore tidal and freshwater wetlands.

A total of 7.6 acres of tidal wetland restoration is proposed as part of this project. See above description for Policy 4 for more detail.

The proposed project is consistent with this policy.

Policy 4.6

In addition to wetlands, seek opportunities to create a mosaic of habitats with high ecological value and function that provide environmental and societal benefits. Restoration should strive to incorporate multiple habitat characteristics to achieve the greatest ecological benefit at a single location.

The NNBF designs do incorporate a mosaic of habitats. Please see Project Description for more information.

The proposed project is consistent with this policy.

Policy 4.7

Protect vulnerable plant, fish and wildlife species, and rare ecological communities. Design and develop land and water uses to maximize their integration or compatibility with the identified ecological community.

Wetland and maritime forest habitats are rare and vulnerable ecological communities in Jamaica Bay. As part of the Recommended Plan, the Corps proposes restoring and enhancing existing wetland and maritime forest habitats. The feature types for the *high frequency flooding risk reduction features* were chosen based on the ability of various measures to integrate in a compatible fashion with the existing habitat and waterfront uses/conditions.

The proposed project is consistent with this policy.

Policy 4.8

Maintain and protect living aquatic resources.

By using nature-based features, where feasible, the project will maintain and protect living aquatic resources.

The proposed project is consistent with this policy.

Policy 5

Protect and improve water quality in the New York City coastal area.

Currently, stormwater runoff enters the Bay untreated in many areas via sheetflow and outfalls into the Bay. By adding wetlands where stormwater runoff can be directed to, the water quality of the Bay should improve. This is due to wetland's ability to filter nutrients and pollutants and improve water quality.

The proposed project is consistent with this policy.

Policy 5.1

Manage direct or indirect discharges to waterbodies.

As described above, indirect discharges to Jamaica Bay include stormwater runoff and direct discharges exist at outfalls. This project will help to manage these discharges by including interior drainage upgrades (see Project Description for more information). These upgrades will capture

runoff that currently sheetflows into the bay and will direct that flow to the existing or new outfalls. Where there is sufficient space behind the proposed berms, floodwalls or bulkheads the runoff will be captured in vegetated swales. Where space is limited, the stormwater will be collected in pipe drains near the toe of the structure. At this time the new outfalls are not anticipated to connect directly to the existing drainage system. They are expected to discharge the sheetflow captured in the swales, toe drainage and stormwater that backs out of the existing drainage system during high tides. During the design phase opportunities to interconnect the systems to improve overall performance will be investigated. The existing outfalls will be repaired as needed and new flap gates to prevent backflow will be added. Standard construction stormwater BMPs would be implemented to protect water quality of surrounding water resources.

The proposed project is consistent with this policy.

Policy 5.2

Protect the quality of New York City's waters by managing activities that generate nonpoint source pollution.

The project will reduce the frequency and extant of flooding from storm tides and stormwater runoff, which wash nonpoint pollution back into the bay. Stormwater runoff, which is usually laden with contaminants in an urban paved environment, have the potential in some areas to be directed into the wetlands which the project is constructing, in order to filter runoff and improve water quality. Standard construction stormwater BMPs would be implemented to protect water quality of surrounding water resources.

The proposed project is consistent with this policy.

Policy 5.5

Protect and improve water quality through cost-effective grey-infrastructure and in-water ecological strategies.

The project floodwalls, berms and bulkheads will reduce the frequency and extant of flooding from storm tides and reduce the amount of contaminants washed back into the bay. This will contribute to protecting and improving water quality. In-water ecological strategies for improving water quality include wetlands, which this project is proposing.

The proposed project is consistent with this policy.

Policy 6

Minimize loss of life, structures, infrastructure, and natural resources caused by flooding and erosion, and increase resilience to future conditions created by climate change.

The project is designed to manage the risk of coastal erosion and flooding for the study area sea level rise due to future climate conditions was addressed in the project design.

The project is consistent with this policy.

Policy 6.1

Minimize losses from flooding and erosion by employing non-structural and structural management measures appropriate to the site, the use of the property to be protected, and the surrounding area.

Structural management measures are proposed as part of this project and are chosen in order to apply appropriate measures to the varying site conditions, the use of the properties and the surrounding areas. Where there is limited space or sensitive habitat, smaller footprint features like floodwalls and/or a smaller footprint hybrid berm are proposed. Where natural shorelines exist and bathymetry is appropriate, nature-based features for minimizing losses from flooding and erosion are proposed. Section 5 of the main General Reevaluation Report explains the rationale behind the selection of the Atlantic Shorefront design. The screening criteria for the HFFRRFs included that they 1) had to be incrementally justified by coastal storm risk management benefits which exceeded the costs, 2) are designed to complement a potential future storm surge barrier which is being further studied under the New York and New Jersey Harbor and Tributaries Study, and 3) they had to be standalone features which could withstand larger storms that would overtop them and would function as intended even if the storm surge barrier never gets built. The formulation, evaluation and screening of the HFFRRFs is discussed in detail in Section 5 of the main report.

With respect to constructing and maintaining a beach for the Atlantic Ocean Shorefront, USACE considered various alternatives. These alternatives are referred to as the erosion control alternatives (see Section 7.2 of Appendix A1). Plan formulation of the erosion control alternatives focused on identifying the most cost effective solution to maintaining a wide beach and dune over the 50-year planning horizon. All alternatives include the initial construction of a beach such that a wide beach is present at the onset of the 50 year project life and all alternatives include periodic renourishment such that the initial constructed beach is maintained. The design of the groins and locations of the groins was based on sediment transport modeling and analyses of modeling results (showing both normal day-to-day conditions and storm conditions) to assess the alternatives' performance over the lifetime of the project. A summary of the overall life-cycle cost estimate for each alternative was then evaluated. The recommended plan is the alternative that had the lowest annualized costs over the 50-year project life and the lowest beach renourishment costs over the project life. The recommended plan does not include groins in Belle Harbor and Neponsit, but please note that the released plan is part of the Feasibility Study. Additional analysis will be completed during the Pre-Construction, Engineering and Design (PED) phase which is currently ongoing. Refinement of the groin design and groin placement and spacing will be improved upon such that erosion control is further refined. The proposed project is consistent with this policy.

Policy 6.2

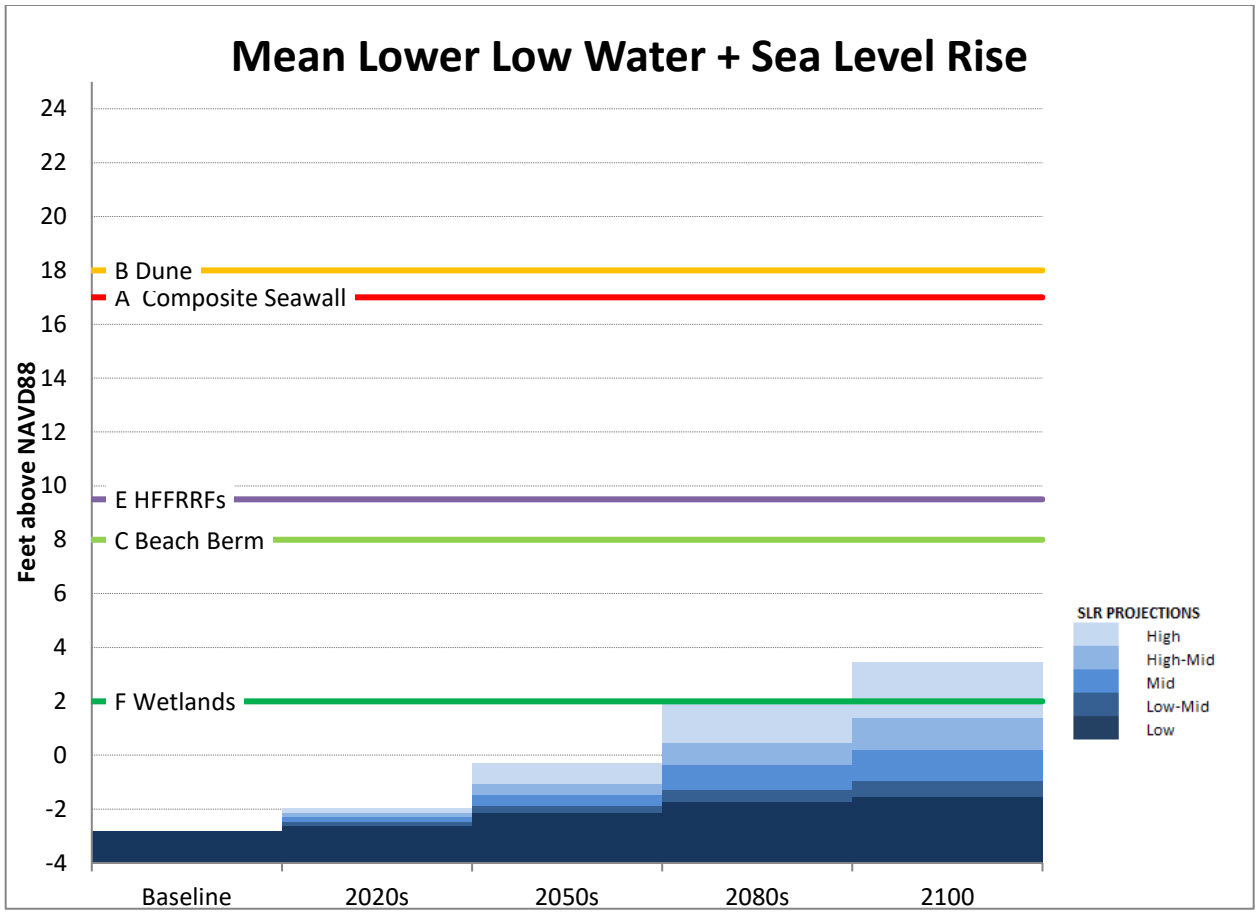
Integrate consideration of the latest New York City projections of climate change and sea level rise (as published in New York City Panel on Climate Change 2015 Report, Chapter 2: Sea Level Rise and Coastal Storms) into the planning and design of projects in the city's Coastal Zone.

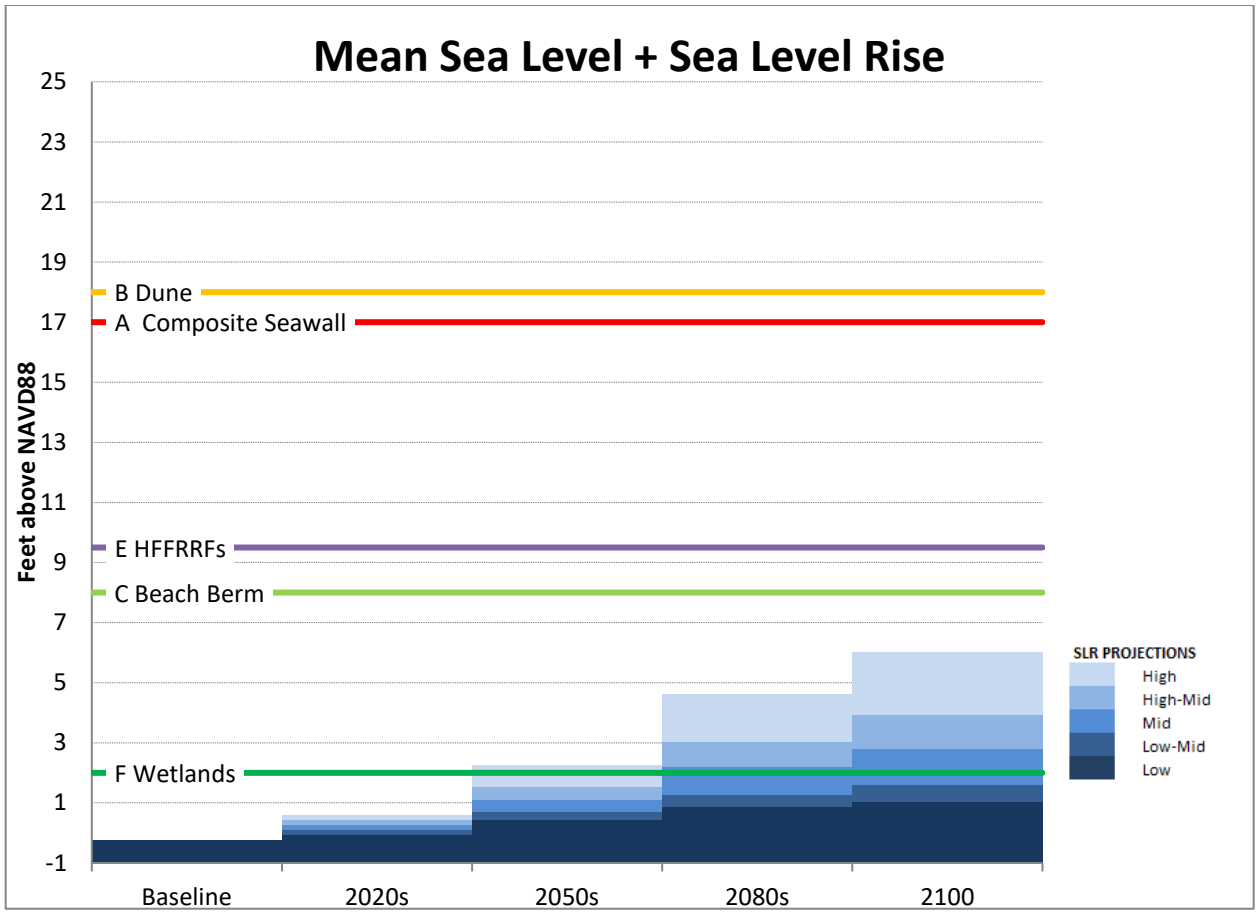
As stated in Policy 6, sea level rise due to future climate conditions was addressed in the proposed design. Hydraulic and hydrology modeling were conducted to review the interaction

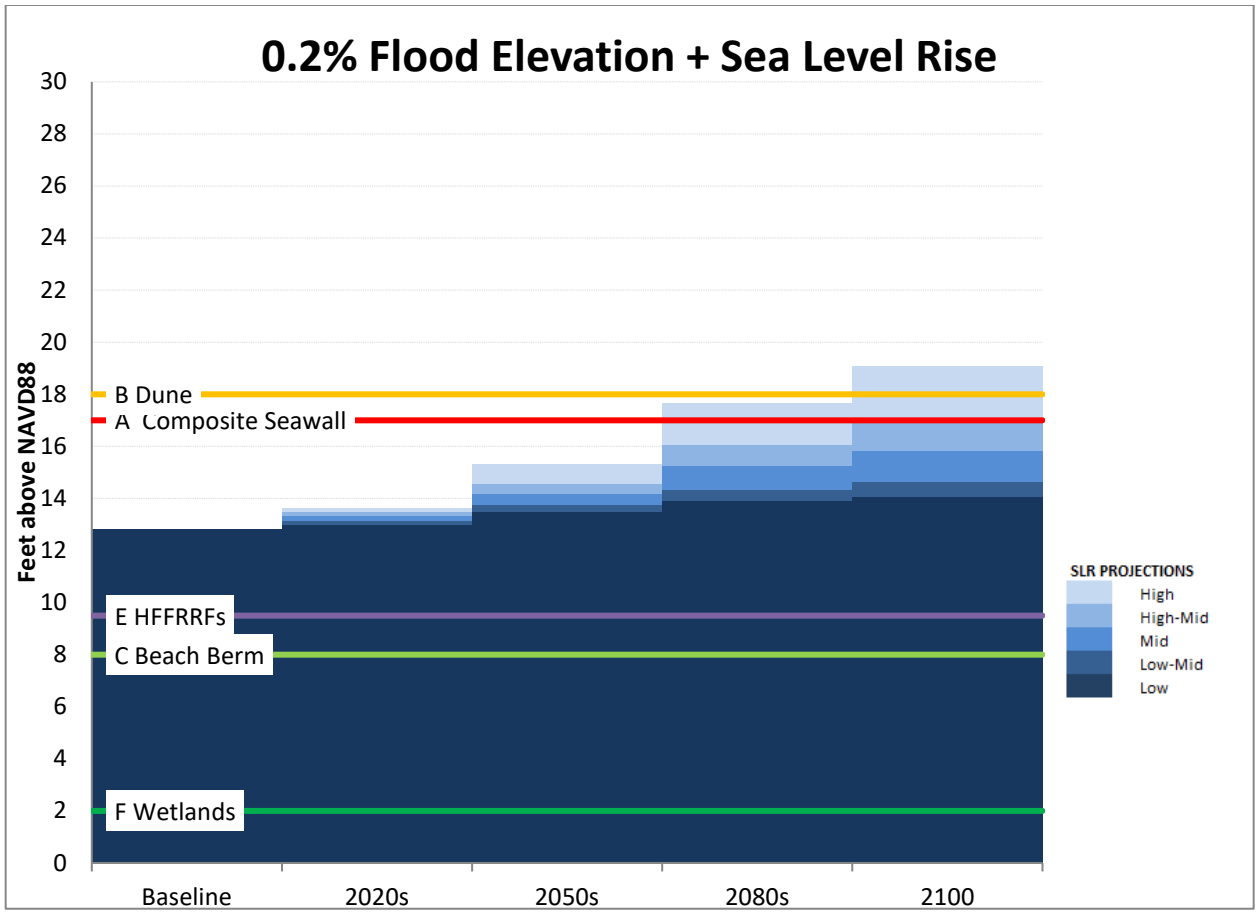
of typical and storm tidal conditions and included the effects of sea level rise. The sea level rise (SLR) projection for the study area site was estimated by using the USACE Sea Level Change Curve Calculator (version 2015.46). This Sea Level Change Curve Calculator is based on the most recent sea level curves published from the National Research Council (NRC) and Inter-Governmental Panel on Climate Change (IPCC). Adaptive measures for how the project features could be adapted if sea levels rise at a faster rate than the intermediate curves predict have been considered. The below graphs (from the attached Policy 6.2 worksheet, sub-attachment a) shows the various features (and their respective top elevations) as they compare with various sea level rise trends.

The groins and wetlands (both at +2 feet NAVD88 elevations, though you can only see wetlands on the below graphs), are compatible with being near the water level. Wetlands by definition are partially wet some or all of the time and as sea levels rise, given the proper sediment supply and available upland space, can even naturally accrete and migrate to adapt to rising water levels. Under the high sea level rise scenario, the groins would no longer be as effective and adding more or larger rocks to them would be an appropriate adaptive management strategy to maintain their full intended usefulness.

The project is intended to last 50 years from 2018-2068. Around the end of the project life is when the high sea level rise predictions would begin to decrease the effectiveness of the other coastal storm risk management features, such as the dune and composite seawall. Potential adaptive features, such as adding 1 foot to the seawall, are discussed in the Integrated Report. For the Jamaica Bay reach, the high frequency features are expected to be overtopped, with increasing frequency with sea level rise. The proposed storm surge barrier currently under consideration in the NYNJHAT study would provide an additional adaptive feature to the Bayside plan as the barrier could be operated more frequently if sea levels rise more rapidly than the intermediate curve projections. There is also a possibility that HFFRRF features could be retrofitted to a higher top elevation to adapt to future conditions. The nature-based features included in the design are expected to accrete naturally with sea level rise and are more inherently adaptable by nature. If sediment deficits in the Bay inhibit natural accretion, these could be artificially adapted by adding new sediment to raise their elevations. Adaptive capacity of the project is discussed further in both the main report (Section 6) and in the Engineering Appendices A1 and A2. Therefore, the project is consistent with this policy.


Mean Lower Low Water + Sea Level Rise
Feet above NAVD88
24
22
20
18
16
14
12
10
8
6
4
2
0
-2
-4
B Dune
A Composite Seawall
E HFFRRFs
C Beach Berm
F Wetlands
Baseline
2020s
2050s
2080s
2100
SLR PROJECTIONS
High
High-Mid
Mid
Low-Mid
Low


Mean Sea Level + Sea Level Rise
Feet above NAVD88
25
23
21
19
17
15
13
11
9
7
5
3
1
-1
B Dune
A Composite Seawall
E HFFRRFs
C Beach Berm
F Wetlands
Baseline
2020s
2050s
2080s
2100
SLR PROJECTIONS
High
High-Mid
Mid
Low-Mid
Low



Policy 6.3

Direct public funding for flood prevention or erosion control measures to those locations where the investment will yield significant public benefit.

This project is publically funded for coastal storm risk management and the overall project yields significant public benefit of 50.2 million dollars in net National Economic Development benefits.

The proposed project is consistent with this policy.

POLICY 8 PROVIDE PUBLIC ACCESS TO, FROM, AND ALONG NEW YORK CITY'S COASTAL WATERS

Public access for the entire beach side of the project will be provided at a minimum of every ¼ mile, but generally smaller distances between public access points are available. See the Public Access Plan (Appendix F) for more information.

The proposed project is consistent with this policy.

Policy 8.1

Preserve, protect, maintain, and enhance physical, visual and recreational access to the waterfront.

Along the Atlantic Shorefront, physical, visual and recreational access is provided for the waterfront. In the bayside Mid-Rockaway site, physical recreational access is not compatible with the successful establishment of wetland vegetation and effective erosion control, which is the intent of the feature. In areas where kayakers or fishing recreation are existing, these uses and access will be maintained. Visual recreational access in the form or bird-watching will be enhanced. The USACE will work with the New York State Department of Environmental Conservation and New York City during the Pre-Construction Engineering and Design (PED) Phase to identify potential compatible public access points on the Bayside, such as upland paths or point access, as long as they do not interfere with the intended function of the project. However, it is possible that additional features will require non-federal funds to implement. This will need to be worked out in the PED Phase.

The Recommended Plan is the result of a Feasibility Study and the design details presented are in line with typical feasibility design plans. The goal of a Feasibility Study is to recommend a feasible plan which meets the objectives laid out during the study and complies with the law and the policies of the USACE. The level of design and analysis performed during the Feasibility Study is geared towards reducing the amount of uncertainty about what the alternative(s) would cost to implement and what the potential impacts of the plan(s) may be in order for decision makers to feel comfortable with approving the Recommended Plan for implementation. Please note that additional design details will be worked out during the next phase—the PED Phase. During the Feasibility Study the focus has been on the evaluation of the various Coastal Storm Risk Management and erosion control alternatives. With the buried composite seawall / dune plus beach berm being the Recommended Plan for the Atlantic Shorefront reach. Detailed design and/or analyses of access points and on and off ramps and ADA compliance has not been included at this stage as that level of design is performed during the PED Phase. Beach access designs will be completed during the PED phase and will need to be completed on a site-specific basis to account for any geometric constraints. Changes in the alignment or section of the horizontal composite seawall may be needed at certain locations to accommodate beach access, but all of this is expected to be worked out during PED in coordination with the non-federal partners, New York State and New York City.

The proposed project is consistent with this policy.

Policy 8.2

Incorporate public access into new public and private development where compatible with proposed land use and coastal location.

The project incorporates public access in the public beach restoration. On the bayside, public access is incompatible with the objectives of the proposed nature-based features and will not be provided, except where existing recreational uses are already there and have been incorporated into the design. The USACE will work with the New York State Department of Environmental Conservation and New York City during the Pre-Construction Engineering and Design (PED) Phase to identify potential compatible public access points on the Bayside, such as upland paths or point access, as long as they do not interfere with the intended function of the project. However, it is possible that additional features will require non-federal funds to implement. This will need to be worked out in the PED Phase.

The proposed project is consistent with this policy.

Policy 8.3

Provide visual access to the waterfront where physically practical.

Visual access is provided where physically practical. The height of the features is dependent on the existing elevations in order to keep a consistent line of protection and avoid inducing flood impacts at any lower sites. In most cases the heights of the features do allow for visual access. During Plans and Specs, the Corps will work with New York City and NYDEC to identify any potentials to enhance visual access along the bayside, which may be included as betterments at the discretion and funding of the non-federal sponsors.

The proposed project is consistent with this policy.

Policy 8.4

Preserve and develop waterfront open space and recreation on publicly owned land at suitable locations.

The Atlantic Shorefront plan would restore and maintain a minimum beach berm width of 60 feet, which would develop waterfront open space and recreation on publicly owned land at suitable locations.

The proposed project is consistent with this policy.

Policy 8.5

Preserve the public interest in and use of lands and waters held in public trust by the State and City.

By restoring eroding beaches in the Rockaways, public interest in using the lands and waters held in public trust by the State, City, and NPS, will be preserved.

The proposed project is consistent with this policy.

Policy 9

Protect scenic resources that contribute to the visual quality of the New York City coastal area.

By restoring the eroding beach resources, the visual quality of the NYC coastal area will be protected. Furthermore, use of natural and nature-based features on the bayside will contribute to the visual quality of the NYC coastal area.

The proposed project is consistent with this policy.

Policy 9.1

Protect and improve visual quality associated with New York City's urban context and the historic and working waterfront.

By restoring the eroding beach resources, the visual quality of the NYC coastal area will be protected and improved. Furthermore, use of natural and nature-based features on the bayside will contribute to the visual quality of the NYC coastal area.

The proposed project is consistent with this policy.

Policy 9.2

Protect and enhance scenic values associated with natural resources.

By restoring the eroding beach resources, the visual quality of the NYC coastal area will be protected and improved. Furthermore, use of natural and nature-based features on the bayside will contribute to the visual quality of the NYC coastal area.

The proposed project is consistent with this policy.

10 POLICY 10

Protect, preserve, and enhance resources significant to the historical, archaeological, architectural, and cultural legacy of the New York City coastal area.

Policy 10.1

Retain and preserve historic resources, and enhance resources significant to the coastal culture of New York City.

The proposed plan would protect existing historic properties, City landmarks and other cultural resources located on or behind the Rockaway barrier island, which would include, but not be limited to, the Far Rockaway Bungalow Historic District, the Far Rockaway Coast Guard Station Historic District, the Gil Hodges Bridge, the Flight 587 Memorial, and Waterfront Tribute Park. The proposed plan would be adjacent to or encroach within the eastern boundary of Jacob Riis Park, which is listed on the National Register of Historic Places. The District is coordinating with the National Park Service to ensure that the placement of sand or the tapering of groins will not have an adverse effect on the property's contributing elements.

The proposed project is consistent with this policy.

Policy 10.2

Protect and preserve archaeological resources and artifacts.

The proposed plan would have an adverse effect on buried cultural resources, primarily buried land surfaces and archaeological sites related to the earliest occupation of the area, located along the project alignment. However, archaeological investigations would be completed in advance of construction to examine the proposed alignment and identify and evaluate archaeological sites and recover significant archaeological information if sites are identified. This work is memorialized in the project's Programmatic Agreement.

The proposed plan would protect potentially significant archaeological information associated with identified historic properties and City landmarks as well as buried land surfaces and archaeological sites associated with the earliest use of the barrier island that are located on the Rockaway peninsula behind the berm.

The proposed project is consistent with this policy.

Sub-Attachment a to Appendix D, Attachment 5 Coastal Zone Management Federal Consistency Determination

New York City Waterfront Revitalization Program – Policy 6.2 Flood Elevation Worksheet

NYC Waterfront Revitalization Program - Policy 6.2 Flood Elevation Workhsheet

COMPLETE INSTRUCTIONS ON HOW TO USE THIS WORKSHEET ARE PROVIDED IN THE "CLIMATE CHANGE ADAPTATION GUIDANCE" DOCUMENT AVAILABLE AT www.nyc.gov/wrp

Enter information about the project and site in highlighted cells in Tabs 1-3. HighTab 4 contains primary results. Tab 5, "Future Flood Level Projections" contains background computations. The remaining tabs contain additional results, to be used as relevant.Non-highlighted cells have been locked.

Background Information	
Project Name	East Rockaway Inlet to Rockaway Inlet and Jamaica Bay Hurricane Sandy Reformulation Study
Location	Atlantic Coast of New York
Type(s)	☐ Residential, Commercial, Community Facility ☐ Parkland, Open Space, and Natural Areas ☑ Tidal Wetland Restoration ☑ Critical Infrastructure or Facility ☐ Industrial Uses ☐ Over-water Structures ☑ Shoreline Structures ☐ Transportation ☐ Wastewater Treatment/Drainage ☑ Coastal Protection
Description	The objective of the Recommended Plan is to manage the risk of coastal flooding from the Atlantic shorefront as well as the frequent flooding from smaller events in Jamaica Bay. The general approach to developing CSRM along Rockaway Beach (between Beach 9th Street and Beach 169th Street, which the east and west tapers are included) was to evaluate erosion control alternatives in combination with a single beach restoration plan to select the most cost effective renourishment approach prior to the evaluation of alternatives for coastal storm risk management. The most cost-effective erosion control alternative is beach restoration with increased erosion control. This constitutes of a beach berm width of 60ft at an elevation of +8ft NAVD88
Planned Completion date	

For technical assistance on using this worksheet, email wrp@planning.nyc.gov, using the message subject "Policy 6.2 Worksheet Error."

Last update: June 7, 2017

Establish current tidal and flood heights.

	FT (NAVD88)	Feet	Datum	Source
MHHW	2.41	**2.41**	**NAVD88**	*Sandy Hook Gage*
1% flood height	9.91	**9.91**	**NAVD88**	*ADCIRC NACCS*
As relevant:				
0.2% flood height	12.80	12.80	**NAVD88**	*ADCIRC NACCS*
MHW	2.08	2.08	**NAVD88**	*Sandy Hook Gage*
MSL	-0.24	-0.24	**NAVD88**	*Sandy Hook Gage*
MLLW	-2.82	-2.82	**NAVD88**	*Sandy Hook Gage*

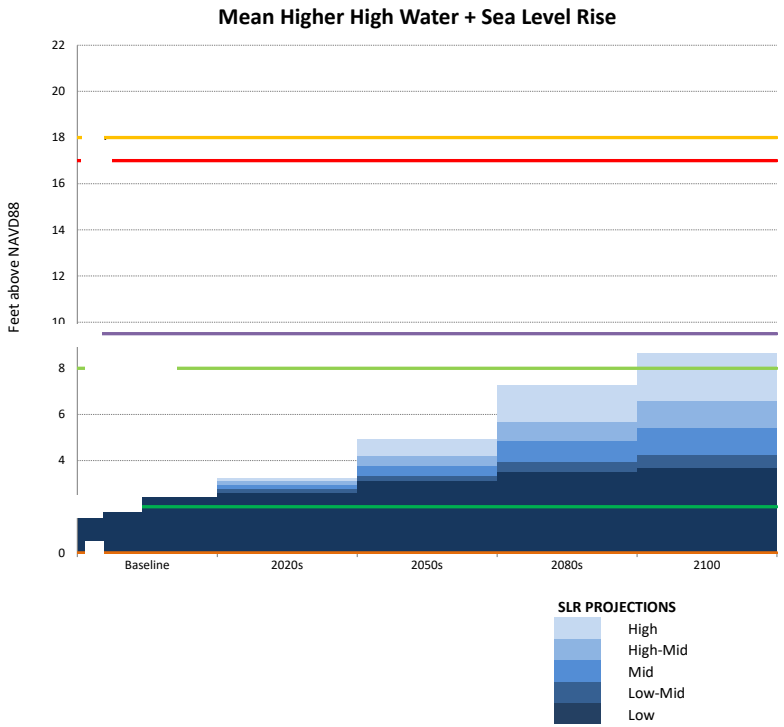
Data will be converted based on the following datums:

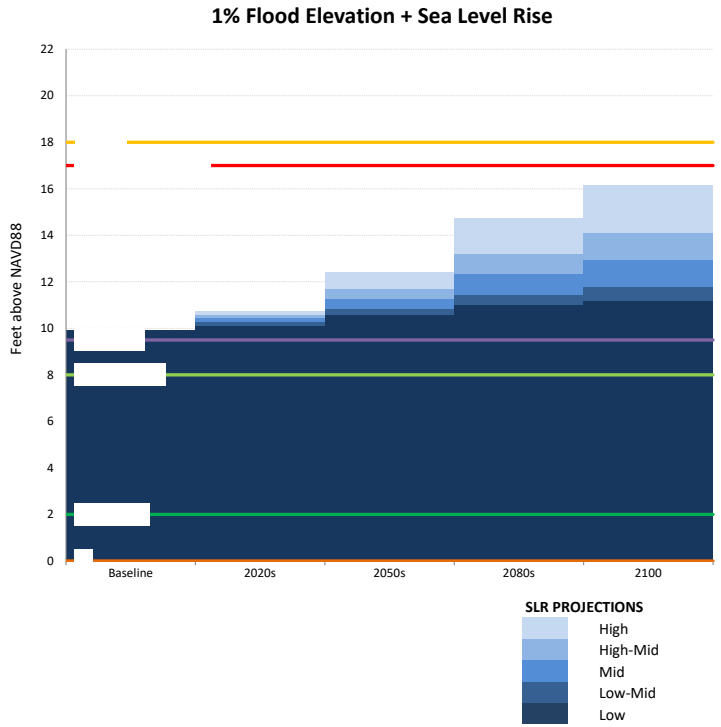
Datum	FT (NAVD88)
NAVD88	*0.00*
NGVD29	*-1.10*
Manhattan Datum	*1.65*
Bronx Datum	*1.51*
Brooklyn Datum (Sewer)	*0.61*
Brooklyn Datum (Highway)	*1.45*
Queens Datum	*1.63*
Richmond Datum	*2.09*
Station	Sandy Hook
MLLW	-2.82

Describe key physical features of the project.

Feature *(enter name)*	Feature Category	Lifespan	Elevation	Units	Datum	Ft	Ft Above NAVD88	Ft Above MHHW	Ft Above 1% flood height	Ft Above 0.2% flood height
A Composite Seawall	☐Vulnerable ☐Critical ☐Potentially Hazardous ☐Other	50	17.0	Feet	NAVD88	*17.0*	*17.0*	*14.6*	*7.1*	*4.2*
Description of Planned Uses and Materials										
B Dune	☐Vulnerable ☐Critical ☐Potentially Hazardous ☑Other	50	18.0	Feet	NAVD88	*18.0*	*18.0*	*15.6*	*8.1*	*5.2*
Description of Planned Uses and Materials										
C Beach Berm	☑Vulnerable ☐Critical ☐Potentially Hazardous ☐Other	50	8.0	Feet	NAVD88	*8.0*	*8.0*	*5.6*	*-1.9*	*-4.8*
Description of Planned Uses and Materials										
D Groins	☐Vulnerable ☐Critical ☐Potentially Hazardous ☑Other	50	2.0	Feet	NAVD88	*2.0*	*2.0*	*-0.4*	*-7.9*	*-10.8*
Description of Planned Uses and Materials										
E HFFRRFs	☐Vulnerable ☐Critical ☐Potentially Hazardous ☑Other	50	9.5	Feet	NAVD88	*9.5*	*9.5*	*7.1*	*-0.4*	*-3.3*
Description of Planned Uses and Materials										
F Wetlands	☐Vulnerable ☐Critical ☐Potentially Hazardous ☑Other	50	2.0	Feet	NAVD88	*2.0*	*2.0*	*-0.4*	*-7.9*	*-10.8*
Description of Planned Uses and Materials. Rocks for the rock sills, limited fill to grade to appropriate elevations and wetland vegetation. These features should be able to accrete naturally with sea level rise and are inherently adaptable when compared with gray infrastructure										
G	☐Vulnerable ☐Critical ☐Potentially Hazardous ☐Other			Feet	NAVD88					
Description of Planned Uses and Materials										
H	☐Vulnerable ☐Critical ☐Potentially Hazardous ☐Other			Feet	NAVD88					
Description of Planned Uses and Materials										

Assess project vulnerability over a range of sea level rise projections.





SLR (ft)

	Low	Low-Mid	Mid	High-Mid	High	
Baseline	0.00	0.00	0.00	0.00	0.00	**2014**
2020s	0.17	0.33	0.50	0.67	0.83	**2020s**
2050s	0.67	0.92	1.33	1.75	2.50	**2050s**
2080s	1.08	1.50	2.42	3.25	4.83	**2080s**
2100	1.25	1.83	3.00	4.17	6.25	**2100**

MHHW+SLR (ft above NAVD88)

	Low	Low-Mid	Mid	High-Mid	High	
Baseline	2.41	2.41	2.41	2.41	2.41	**Baseline**
2020s	2.58	2.74	2.91	3.08	3.24	**2020s**
2050s	3.08	3.33	3.74	4.16	4.91	**2050s**
2080s	3.49	3.91	4.83	5.66	7.24	**2080s**
2100	3.66	4.24	5.41	6.58	8.66	**2100**

1%+SLR (ft above NAVD88)

	Low	Low-Mid	Mid	High-Mid	High	
Baseline	9.91	9.91	9.91	9.91	9.91	**Baseline**
2020s	10.08	10.24	10.41	10.58	10.74	**2020s**
2050s	10.58	10.83	11.24	11.66	12.41	**2050s**
2080s	10.99	11.41	12.33	13.16	14.74	**2080s**
2100	11.16	11.74	12.91	14.08	16.16	**2100**

0.2%+SLR (ft above NAVD88)

	Low	Low-Mid	Mid	High-Mid	High
Baseline	12.80	12.80	12.80	12.80	12.80
2020s	12.97	13.13	13.30	13.47	13.63
2050s	13.47	13.72	14.13	14.55	15.30
2080s	13.88	14.30	15.22	16.05	17.63
2100	14.05	14.63	15.80	16.97	19.05

	0	1
A Composite Seawall	17	17
B Dune	18	18
C Beach Berm	8	8
D Groins	2	2
E HFFRRFs	9.5	9.5
F Wetlands	2	2
G	0	0
H	0	0

SLR (in)

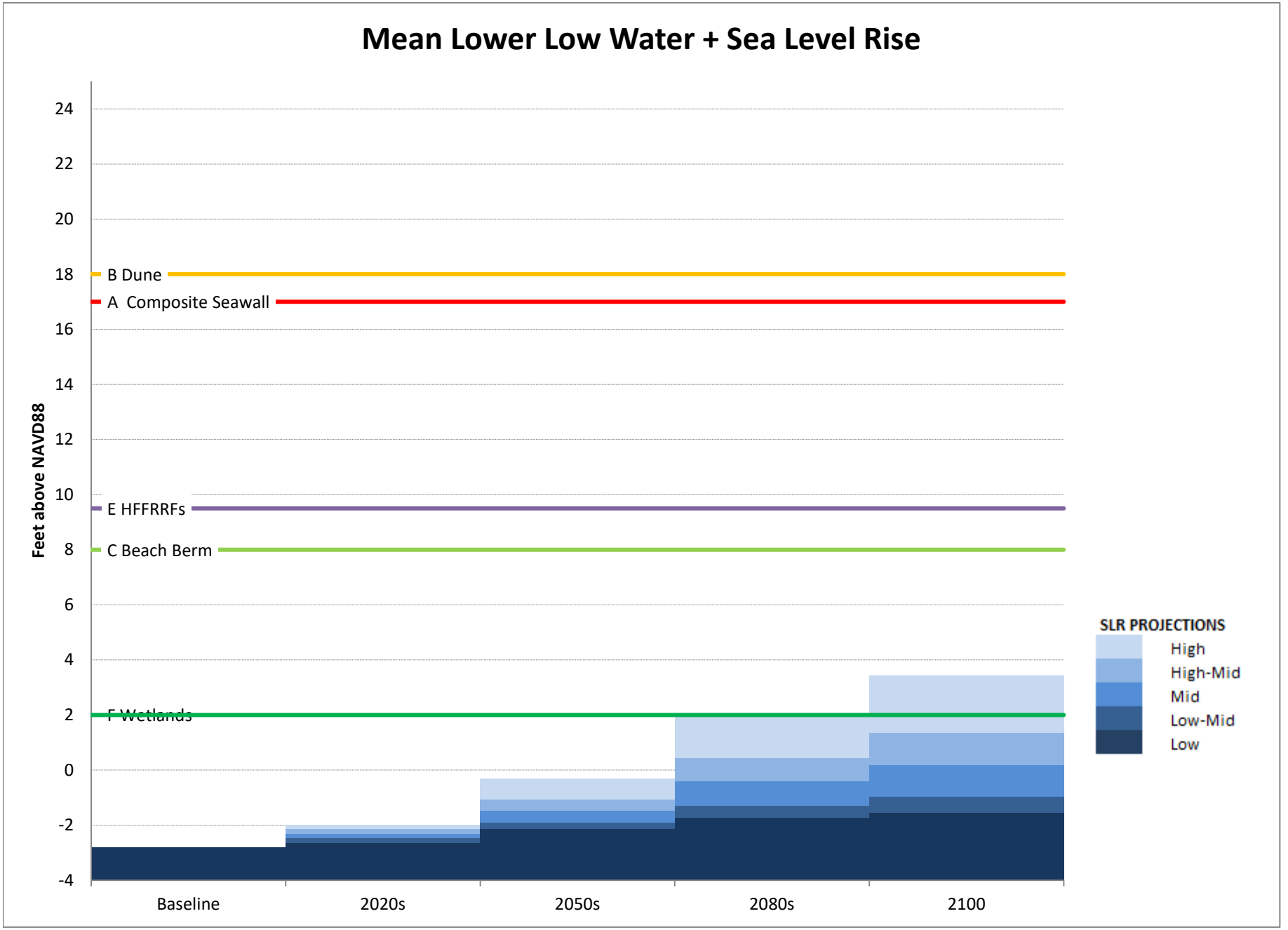
Low	Low-Mid	Mid	High-Mid	High
0	0	0	0	0
2	4	6	8	10
8	11	16	21	30
13	18	29	39	58
15	22	36	50	75

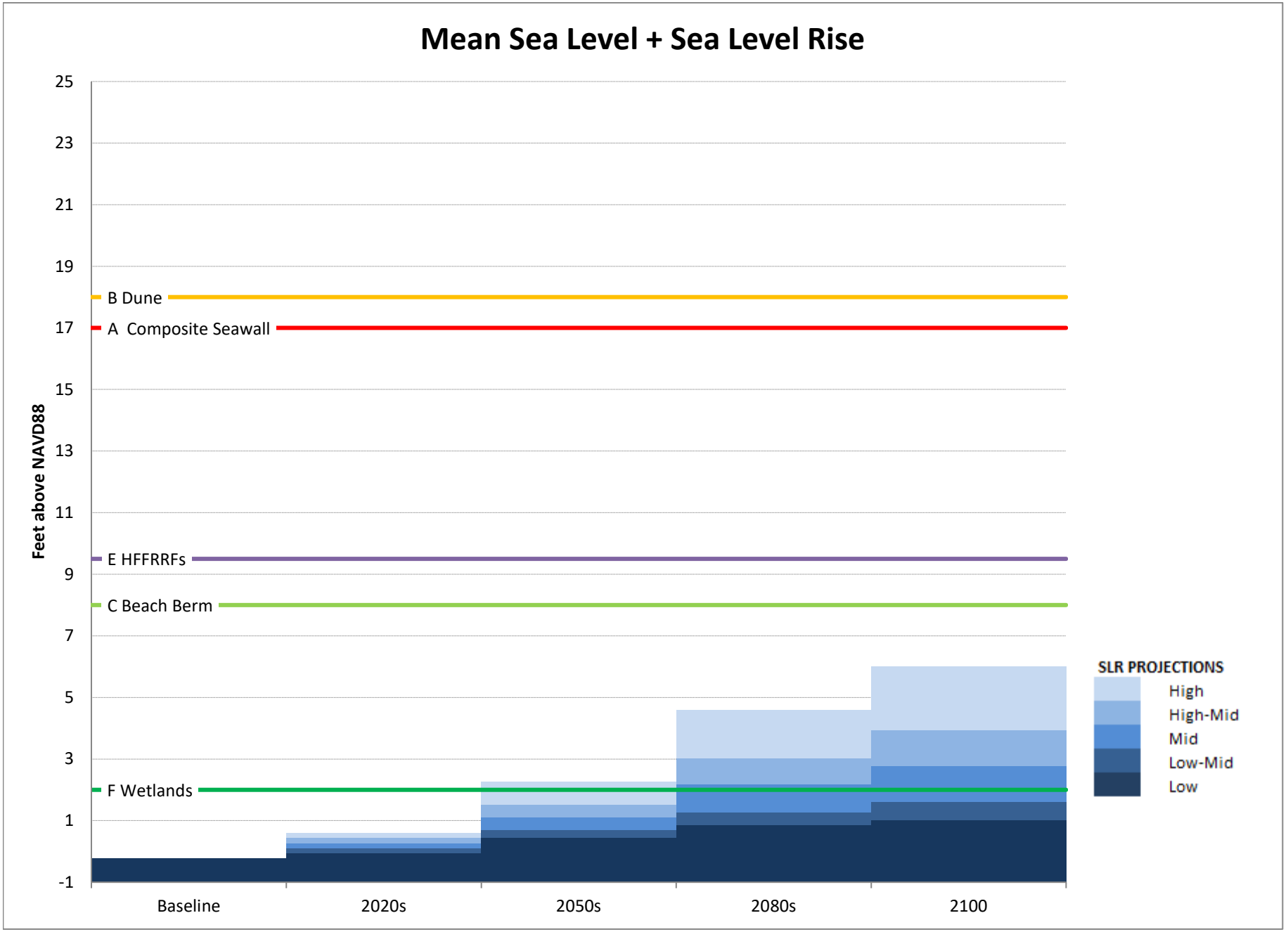
MLLW+SLR (ft above NAVD88)

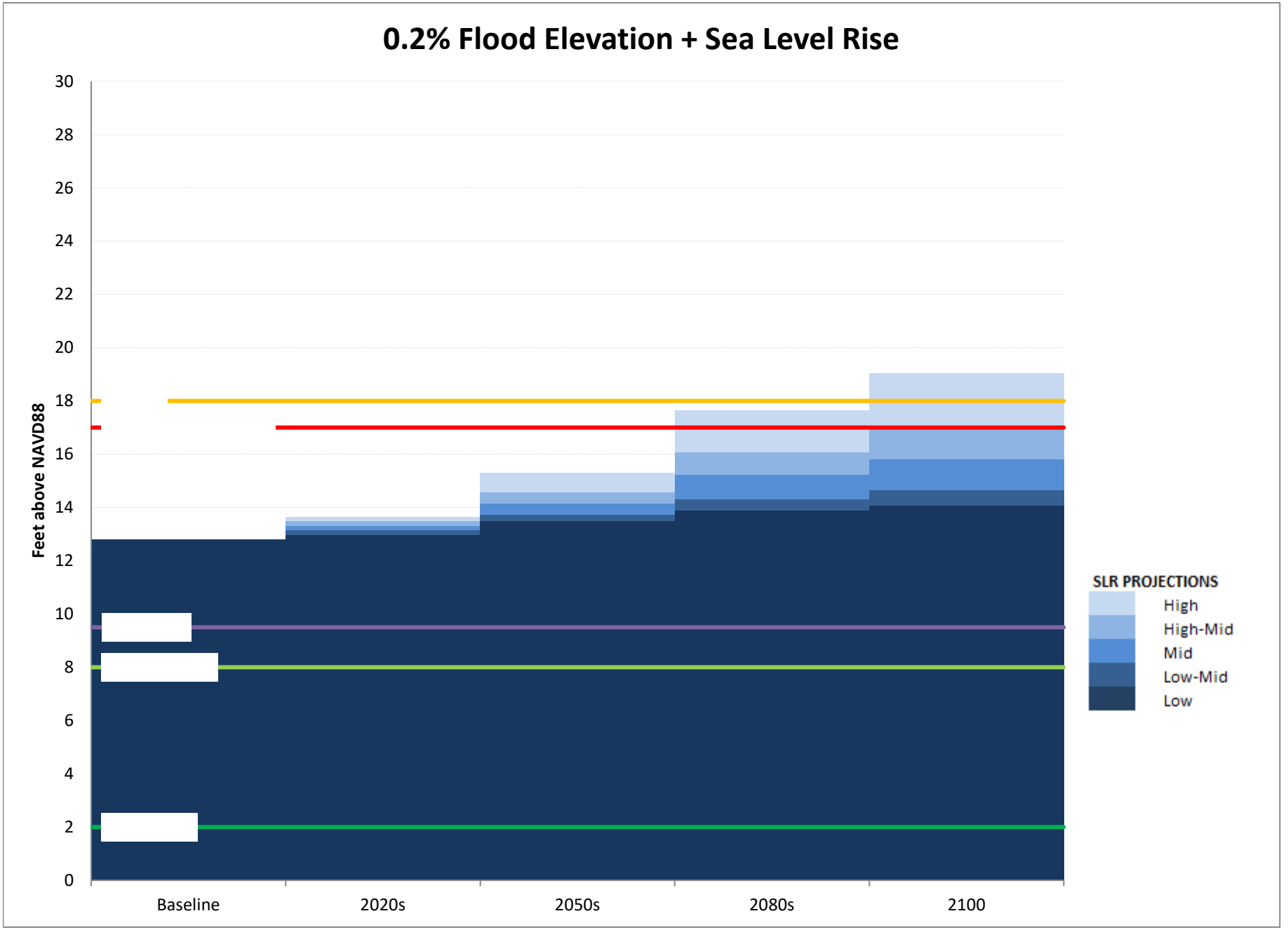
Low	Low-Mid	Mid	High-Mid	High
-2.82	-2.82	-2.82	-2.82	-2.82
-2.65	-2.49	-2.32	-2.15	-1.99
-2.15	-1.90	-1.49	-1.07	-0.32
-1.74	-1.32	-0.40	0.43	2.01
-1.57	-0.99	0.18	1.35	3.43

MSL+SLR (ft above NAVD88)

Low	Low-Mid	Mid	High-Mid	High
-0.24	-0.24	-0.24	-0.24	-0.24
-0.07	0.09	0.26	0.43	0.59
0.43	0.68	1.09	1.51	2.26
0.84	1.26	2.18	3.01	4.59
1.01	1.59	2.76	3.93	6.01


Mean Lower Low Water + Sea Level Rise
Feet above NAVD88
24
22
20
18
16
14
12
10
8
6
4
2
0
-2
-4
B Dune
A Composite Seawall
E HFFRRFs
C Beach Berm
F Wetlands
Baseline
2020s
2050s
2080s
2100
SLR PROJECTIONS
High
High-Mid
Mid
Low-Mid
Low


Mean Sea Level + Sea Level Rise
Feet above NAVD88
25
23
21
19
17
15
13
11
9
7
5
3
1
-1
B Dune
A Composite Seawall
E HFFRRFs
C Beach Berm
F Wetlands
Baseline
2020s
2050s
2080s
2100
SLR PROJECTIONS
High
High-Mid
Mid
Low-Mid
Low


0.2% Flood Elevation + Sea Level Rise
Feet above NAVD88
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
Baseline
2020s
2050s
2080s
2100
SLR PROJECTIONS
High
High-Mid
Mid
Low-Mid
Low