

COASTAL CONSERVANCY

Staff Recommendation
December 6, 2018

COASTAL DUNE VULNERABILITY AND ADAPTATION ASSESSMENT PHASE II

Project No. 18-036-01
Project Manager: Su Corbaley

RECOMMENDED ACTION: Authorization to disburse up to \$430,750 to the Friends of the Dunes to conduct Phase II of a coastal dune vulnerability and adaptation assessment along 32 miles of coastline in Humboldt County to test adaptation strategies at demonstration sites, develop an empirical model of dune response to sea level rise, and develop recommendations for adaptation strategies in the project area.

LOCATION: Between Trinidad Head and Centerville Beach, Humboldt County

PROGRAM CATEGORY: Climate Change

EXHIBITS

1. [Project Location](#)
 2. [Map of Project Area and Components](#)
 3. [Extracts Pages from Preliminary Reports](#)
 4. [Photos of Pre and Post Dune Restoration](#)
 5. [Project Letters](#)
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RESOLUTION AND FINDINGS:

Staff recommends that the State Coastal Conservancy adopt the following resolution pursuant to Sections 31111 and 31113 *et seq.* of the Public Resources Code:

“The State Coastal Conservancy hereby authorizes the disbursement of up to two hundred thirty thousand seven hundred and fifty dollars (\$230,750) received from the California Ocean Protection Council and an additional disbursement of up to two hundred thousand dollars (\$200,000) of Conservancy funds, for a total disbursement not to exceed four hundred thirty thousand seven hundred and fifty dollars (\$430,750) to Friends of the Dunes to conduct Phase II of a coastal dune vulnerability and adaptation assessment along 32 miles of coastline from Trinidad Head south to Centerville Beach in Humboldt County.

This authorization is subject to the following conditions:

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1. Prior to the disbursement of any funds, Friends of the Dunes shall submit for review and approval by the Executive Officer a work program, schedule, budget, and the names of any contractors to be used for the project, and shall provide evidence that all permits and approvals necessary for the project have been issued.
2. Conservancy funding shall be acknowledged in all project-related documentation, such as reports, notices, or other relevant publications, as approved by the Executive Officer of the Conservancy.
3. Prior to the establishment of a new adaptation site, Friends of the Dunes and Conservancy staff shall complete site specific Tribal consultation with the Bear River Band of Rhonerville Rancheria, Blue Lake Rancheria, and Wiyot Tribe.
4. Friends of the Dunes and its contractors shall follow the following Inadvertent Archaeological Discovery protocol: If archaeological resources are encountered during construction activities, all onsite work shall cease in the immediate area and within a 50-foot buffer of the discovery location. A qualified archaeologist will be retained to evaluate and assess the significance of the discovery, and develop and implement an avoidance or mitigation plan, as appropriate. For discoveries known or likely to be associated with Native American heritage and select historic period sites, the Tribal Historic Preservation Officers (THPOs) for the Bear River Band of Rhonerville Rancheria, Blue Lake Rancheria, and Wiyot Tribe are to be contacted immediately to evaluate the discovery and, in consultation with the project proponent and consulting archaeologist, develop a treatment plan in any instance where significant impacts cannot be avoided. Prehistoric materials may include, but are not limited to, obsidian or chert flakes, tools, locally darkened midden soils, groundstone artifacts, shellfish or faunal remains, and human burials. Historic archaeological discoveries may include, but are not limited to, 19th century building foundations; structural remains; or concentrations of artifacts made of glass, ceramic, metal or other materials found in buried pits, old wells or privies. Should known or suspected Native American skeletal remains or burials be inadvertently discovered, the provisions of Section 7050.5 of the California Health & Safety Code and Section 5097.98 of the Public Resources Code shall apply.”

Staff further recommends that the Conservancy adopt the following findings:

“Based on the accompanying staff report and attached exhibits, the State Coastal Conservancy hereby finds that:

1. The proposed authorization is consistent with Chapter 3 of Division 21 of the Public Resources Code, regarding preparing for impacts from climate change.
2. The proposed project is consistent with the current Conservancy Project Selection Criteria and Guidelines.
3. Friends of the Dunes is a nonprofit organization organized under section 501(c)(3) of the U.S. Internal Revenue Code, and whose purposes are consistent with Division 21 of the Public Resources Code.”

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PROJECT SUMMARY

Staff recommends the Conservancy authorize the disbursement of up to \$430,750 to the Friends of the Dunes to conduct Phase II of the Coastal Dune Vulnerability and Adaptation Assessment, an effort begun in 2015 with a grant from the Conservancy, to assess vulnerabilities to sea level rise (SLR) along the 32-mile shoreline of the Eureka littoral cell (ELC) in Humboldt County (Exhibit 1). The project continues and expands the research initiated during Phase I to: 1) document historic changes in shoreline position and beach-dune morphology along the littoral cell; 2) monitor and measure annual and seasonal changes in beach-dune morphology and vegetation to determine sediment budget, transport pathways, and the role of vegetation in foredune morphodynamics; 3) develop an empirical model of dune response to SLR; 4) conduct a SLR vulnerability analysis along the entire study area; 5) test adaptation strategies at demonstration sites; 6) develop recommendations for adaptation strategies along the ELC; and 7) relay findings and results to planners, policy-makers and the public.

The ELC is composed of barrier dune systems that separate Humboldt Bay and the estuaries of the Mad, Little and Eel Rivers from the Pacific Ocean (Exhibit 2). This is the longest barrier dune system in California and includes some of the best remaining native, naturally functioning dune systems on the west coast of the United States. The dunes protect not only estuarine systems, but also neighboring communities and critical infrastructure. In addition, these dune systems provide habitat for threatened and endangered plant and animal species and contain important archeological sites. The resilience of the barrier system is at risk from the ongoing impacts of accelerated SLR, inter-seismic subsidence, recent changes in sediment supply from rivers and from bay dredging activities, and deterioration in natural dune processes resulting from the establishment of invasive European beachgrass (*Ammophila arenaria*).

The behavior of coastal barrier dune systems, like those of Humboldt County, determines the resiliency of their associated shorelines to SLR. Yet little is understood about how these systems function and how they might respond to climate change. To date, much of the research focus on response to SLR in West Coast dune systems has been related to flood resistance or overtopping of the foredune during high tides and storm events based on foredune height, with little consideration given to the larger picture of how dune morphodynamics and sediment budgets are maintained under predicted climate forces on natural littoral processes and ongoing interseismic subsidence. Monitoring of sediment movement and foredune morphology at the scale of the littoral cell is needed to better understand sediment dynamics. This monitoring will allow researchers to identify areas of vulnerability due to factors such as sediment deficiency or subsidence. The Coastal Dune Vulnerability and Adaptation Assessment (Assessment) will improve understanding of coastal dunes and beaches along the ELC, identify areas that are vulnerable to sea level rise, and provide potential responses to address those vulnerable areas.

The overarching goal of the Assessment, which was split into two phases due to availability of funds, is to increase Humboldt County's capacity to develop resiliency measures to prepare for SLR and increased storminess through existing planning and regulatory structures. To accomplish this, the Assessment involves monitoring regional shoreline dynamics with two main research objectives. The first is to increase understanding of littoral cell sediment dynamics and sand supply as it relates to beach-dune barrier evolution. Some of the research conducted during Phase I of the Assessment, discussed below, has identified long-term shoreline trends and erosional hotspots within the ELC; these may be affected by sediment management practices,

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such as annual dredging by the Corps of Engineers (COE). The second objective is to refine the implementation of biogeomorphic restoration (the study of interactions between organisms, in this case plants, and the development of landforms) as an adaptation strategy to increase the resilience of foredunes in the region. Recent foredune vulnerability research in the Pacific Northwest has emphasized the protective function of continuous, steep, narrow foredunes stabilized by invasive European beachgrass (*Ammophila arenaria*), whereas the function of broader, more dynamic, native foredunes has been largely unexplored. Researchers involved in the Assessment hypothesize that native vegetation allows more aeolian sediment to pass from the backshore to, and over, the foredune, which may result in increased sand storage volume above the high-water limit. In turn, these more dynamic foredunes may have enhanced resilience to ongoing and future erosion and SLR owing to enhanced aeolian dynamics required for dune recovery and a greater ‘buffering capacity’ against erosive events. This is an innovative perspective which, if proven correct, will provide crucial information to coastal communities in similar settings.

In June 2015, the Conservancy awarded a Climate Ready Program grant to the Friends of the Dunes for the first phase of the Assessment. Phase I was designed to cover the first two years of dune monitoring and data collection and analysis, with the goal of reporting preliminary results on potential areas of coastline vulnerability and on early demonstration adaptation site results. Public outreach and education, a key component, was also included in Phase I. Using additional funding from Bureau of Land Management (BLM) and a small augment from the Coastal Conservancy in year two, Phase I was expanded to cover three years of data collection. As a result, the research team was able to complete three years of annual and seasonal geomorphology monitoring at 73 cross-shore transects located along the ELC, establish vegetation adaptation demonstration sites - one each on the North Spit of Humboldt Bay and south of the Eel River - to test two vegetation adaptation strategies, and to develop a native dune grass propagation site on BLM property on the South Spit (Exhibit 2). Using imagery dating back to 1939, the team completed an analysis of historic shoreline change over the entire littoral cell and calculated rates of erosion/accretion. The team also presented information about the Assessment to the public through outreach and educational forums.

Phase I was completed in October 2018. Preliminary results of the first two years of shoreline transect monitoring, the historical shoreline analysis, and a preliminary analysis of the Lanphere Dunes adaptation demonstration site results were reported in early 2018; an example from each report is presented in Exhibit 3. The shoreline transect monitoring preliminary report will be updated with third year monitoring data by the end of 2018. Public outreach and education accomplishments during Phase I included two public listening and information exchange forums over two years, biannual guided public walks at study locations, and ongoing quarterly reports on the status of the research.

The analysis of the historic shoreline change completed in Phase I indicates that there are long-term and continuing erosional hotspots at several locations along the ELC, likely resulting from a deficit in sediment supply. This has prompted concerns over the ongoing COE dredging program that removes approximately 1 million m³ of sand-sized sediment annually to a deep-water disposal site.

Phase II of the Assessment will occur over three years and will build on the three years of research conducted during Phase I. As discussed below in the “Project Financing” and “Project History” sections, the California Ocean Protection Council (OPC) has awarded \$243,750 to the

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Conservancy. These funds, together with the proposed Conservancy authorization for Phase II, will enable the research team to: complete the last two years of annual and seasonal geomorphology monitoring of the 73 transects; carry out additional monitoring of two demonstration adaptation sites and establish and monitor a third adaptation site to study biogeomorphic response to various native planting regimes; complete a vulnerability assessment for the littoral cell; revise the sediment budget for the littoral cell to recommend changes to Army Corps of Engineers (ACOE) dredge management practices; complete a model of climate-driven scenarios of dune barrier response to sea level rise; and assist the County of Humboldt to develop adaptation strategies for areas vulnerable to SLR and climate change. To remove the beachgrass at the new adaptation site, a controlled burn will be carried out by California Department of Forestry and Fire Protection, followed by an application of a dilute solution of the herbicide imazapyr (not Round Up) to control post-burn resprouts. The herbicide will be applied through targeted hand-spraying of resprouts using 4-gallon back-pack sprayers.

To increase the level of information exchange, Phase II will include participation by land management agencies, local planning departments, regulatory agencies, nonprofits, private landowners, local governance districts, tribal governments, private landowners, and members of the public. Friends of the Dunes will manage a public outreach program, engaging stakeholders to communicate key scientific findings of the studies, expand the regional knowledge base, build decision-making capacity needed to increase resilience, and develop management recommendations to increase adaptive capacity. The public outreach program will present a local perspective on the impacts of SLR and extreme events through public meetings, guided walks, newsletters, and at community events.

Site Description: The Assessment area consists of 32 miles of coastline between Trinidad and Centerville Beach, Humboldt County known as the Eureka Littoral Cell (ELC) (Exhibit 1). It is comprised of barrier dune systems that enclose Humboldt Bay and the estuaries of the Mad, Little and Eel Rivers. North of the Little River the site includes pocket beaches backed by coastal bluffs and sea stacks. From the Little River south the area is essentially a continuous stretch of dunes, interrupted by the mouths of the Mad River, Humboldt Bay and the Eel River estuary. The research focuses on the upper beach and foredunes present along the system. These dune stretches provide protection from the ocean for communities as well as critical infrastructure, notably the Humboldt Bay Municipal Water District pipeline, Manila Community Service District's wastewater treatment ponds, and Highways 101 and 255.

Grantee Qualifications: Friends of the Dunes (FOD) is a nonprofit organization dedicated to conserving the natural diversity of coastal environments through community supported education and stewardship programs. FOD has successfully implemented restoration and outreach projects related to dune and coastal habitats at its property on Humboldt Bay's north spit, in the community of Manila, and throughout Humboldt County. The Conservancy and FOD have collaborated on many projects to protect and enhance the dunes of Humboldt County, including the acquisition of dune properties that comprise the Humboldt Coastal Nature Center in Manila and conducting public outreach and education on dune morphology and restoration, and recreational and conservation opportunities in the dunes throughout Humboldt County. FOD has administered the first phase of the Assessment since 2015, coordinating all aspects of the Assessment with the research team, as well as providing public outreach and education. It will continue in this capacity, working closely with the partner organizations and contractors, to

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complete the second phase of the vulnerability assessment and develop adaptation strategies for Humboldt County.

Project History: For more than 20 years, conservation and resource organizations have been restoring dune habitat in Humboldt County by removing the monoculture of invasive European beach grass and allowing native dune plants to reestablish. The results are both aesthetically pleasing (Exhibit 4) and provide habitat diversity that supports several threatened and endangered species. Despite those benefits, with increased awareness of potential sea level rise and predictions of increased storminess on our coasts, some members of the public have expressed concern that dune stability is being compromised by restoration efforts, which could impact existing infrastructure and development. The Assessment is an effort to address the validity of those concerns.

The idea for this Assessment initially arose out of a few small-scale independent dune restoration efforts at the US Fish and Wildlife Services (USFWS) Lanphere Dunes Unit and a small dune overwash area at the Eel River Estuary Preserve (EREP), the need to understand dune formation along the ELC, and the need to clarify the role/effect dune restoration (ongoing on Humboldt County dunes for more than 20 years) has on dune formation and stability. Before the 2015 Climate Ready Program grant, USFWS staff had been conducting a small-scale monitoring and modeling project to measure seasonal changes at the restored dunes on its property. At EREP, the landowner had attempted to repair the overwash using driftwood to recruit sand. Data was collected, and observations made, but there was no way to know how these isolated results compared to non-experimental sites in the dunes. Thus, the idea of expanding the study to the entire ELC came about.

In November 2014, Friends of the Dunes applied to the Conservancy's Climate Ready Program for a five-year project to develop the Assessment and adaptation strategies. Due to limitations in available funding, Conservancy staff worked with Friends of the Dunes to scale back the effort by splitting the work into phases. In June 2015, the Conservancy awarded a grant to Friends of the Dunes to undertake the first phase of the Assessment, which entailed establishing the transect monitoring program along the dune spits in both Humboldt Bay and the Eel River estuary, analyzing historic coastline accretion and erosion along the ELC, and establishing vegetation management adaptation demonstration sites on the North Spit of Humboldt Bay and south of the Eel River.

With the Conservancy funds for the first phase secured, the research team agreed to seek other funds to complete the study. In 2016 and 2017, the USFWS applied to the NOAA Coastal Resiliency Grants Program and the USC Sea Grant Climate Adaptation Grant Program, respectively. Even though feedback from those agencies was very positive, due to the extremely competitive need for these limited funds, neither application was successful. In August 2018 Conservancy staff applied to the California Ocean Protection Council's (OPC) for Proposition 84 Competitive Grant Program for funds to match Conservancy funds for the second phase of the Assessment. OPC has notified the Conservancy that its application was successful; funds were awarded in October 2018.

PROJECT FINANCING

Coastal Conservancy

\$200,000

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Ocean Protection Council	\$230,750
Project Total	\$430,750

The anticipated source of Conservancy funds for Phase II of the Assessment is an appropriation from Proposition 84, the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006. Proposition 84 authorizes the use of these funds to protect and restore the natural habitat values of coastal waters and lands (Section 75060 of the Public Resources Code). Section 75060(b) of the Public Resources Code specifically allocates funding to the Conservancy for expenditure pursuant to the Conservancy's enabling legislation, Division 21 of the Public Resources Code. The Assessment will protect coastal resources by assisting the local stakeholders and policy-makers in Humboldt County to plan for adapting to the impacts of climate change and the effects to the dune barrier system. As discussed in the section found immediately below, the project is consistent with Chapter 3 of Division 21 of the Public Resources Code.

The California Ocean Protection Council has awarded \$243,750 to the Conservancy for these research activities. Approximately \$230,750 of the grant will support research activities directly pursuant to the proposed authorization, while the remaining \$13,000 would pay for Conservancy staff costs associated with managing the project.

CONSISTENCY WITH CONSERVANCY'S ENABLING LEGISLATION:

The proposed project would be undertaken pursuant to Section 31113 of Chapter 3 of Division 21 of the Public Resources Code, regarding the impacts and potential impacts of climate change on resources within the Conservancy's jurisdiction. Pursuant to Section 31113 (b), the Conservancy is authorized to award grants to nonprofit organizations to undertake projects that reduce greenhouse gas emissions, address extreme weather events, sea level rise, storm surge, beach and bluff erosion, salt water intrusion, flooding, and other coastal hazards that threaten coastal communities, infrastructure, and natural resources. Consistent with this section, the proposed authorization would award a grant to Friends of the Dunes, a nonprofit organization, to undertake the project described in the "Project Summary" section, which maximizes public benefit by reducing coastal hazards due to sea level rise, and conserving biodiversity.

The project would also be undertaken pursuant to Section 31111 of Chapter 3 of Division 21 of the Public Resources Code, which authorizes the Conservancy to fund and undertake plans and feasibility studies, and to award grants to nonprofit organizations for these purposes.

CONSISTENCY WITH CONSERVANCY'S [2018-2022 STRATEGIC PLAN](#) GOAL(S) & OBJECTIVE(S):

Consistent with **Goal 6, Objective 6A**, the proposed assessment will develop plans for the restoration and enhancement of coastal habitats, including coastal wetlands and intertidal areas, dunes, and coastal terraces.

Consistent with **Goal 8, Objective 8A**, the project will conduct a vulnerability assessment and develop adaptation plans to identify specific projects to address sea level rise and other impacts of climate change.

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CONSISTENCY WITH CONSERVANCY'S PROJECT SELECTION CRITERIA & GUIDELINES:

The proposed project is consistent with the Conservancy's Project Selection Criteria and Guidelines, last updated on October 2, 2014, in the following respects:

Required Criteria

1. **Promotion of the Conservancy's statutory programs and purposes:** See the "Consistency with Conservancy's Enabling Legislation" section above.
2. **Consistency with purposes of the funding source:** See the "Project Financing" section above.
3. **Promotion and implementation of state plans and policies:** This project is consistent with the 2014 *Safeguarding California* update to the 2009 *California Climate Adaptation Strategy*, in the Biodiversity and Habitat section, which seeks to "improve understanding of climate risks by...understanding extreme events and disturbance regimes." It is also consistent with the Ocean and Coastal Ecosystems and Resources Section which seeks to "further vulnerability assessments and cost analyses"; "improve management practices for coastal and ocean ecosystem and resources"; "support pilot projects to demonstrate effectiveness of innovative shoreline management techniques"; "continue to support scientific modeling (as essential to project development)" and "improve maps and tools and provide training to incorporate best-available climate science into planning and operation and management decisions for assets at risk from sea-level rise." This project directly seeks to understand and use demonstration sites to develop strategies to prepare for climate-driven impacts on dune habitats.
4. **Support of the public:** This project is widely supported by resource agencies and dune managers, scientists, and elected officials. Project letters are included in Exhibit 5.
5. **Location:** The proposed project is located within the coastal zone of Humboldt County, along 32 miles of coastline between Trinidad and Centerville Beach.
6. **Need:** Matching funds are available from OPC; but are insufficient to complete the study. Without Conservancy funds, the project will have to be scaled back and the critical analysis and modeling efforts would be delayed until other funds become available.
7. **Greater-than-local interest:** The project will serve greater than local need in that the results will be shared across academic and jurisdictional arenas and serve as a model for other areas.
8. **Sea level rise vulnerability:** The entire 32-mile ELC is vulnerable to impacts from SLR. The proposed project will test adaptation strategies that could serve to make this vulnerable area resilient and responsive to change.

Additional Criteria

9. **Urgency:** SLR and the effects of extreme weather events are already evident throughout the west coast United States, threatening critical infrastructure, human communities and wildlife habitat. The severe winter storms of 2016-2017 have caused breaches in the dune barriers and extensive erosion or overtopping of foredunes within the ELC. Authorizing the proposed

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project now will enable Humboldt County to incorporate scientific, scenario-based findings and recommendations into its current planning efforts for SLR response. It will also enable the tested methodologies to be shared sooner with other coastal communities facing similar challenges.

10. **Leverage:** See the “Project Financing” and “Need” sections above.
11. **Innovation:** The project is unique in California as a dune-centered, littoral cell-based endeavor, which incorporates both dune process and vegetation, and tests hypothesis-supported adaptation.
12. **Readiness:** The existing project team is poised and ready to continue the project immediately and without interruption.
13. **Realization of prior Conservancy goals:** See “Project History” above.
14. **Cooperation:** The project is a collaboration of several land managers who, with researchers, are working together to identify the risks on lands they manage and prepare for SLR. Additionally, the project will establish a formal stakeholder group of scientists, policy-makers, land managers, and notably, members of the public, as discussed in the Project Description section, above.
15. **Vulnerability from climate change impacts other than sea level rise:** The Assessment tests the use of native species plantings as an adaptation measure, by establishing native plants in place of invasive species that dominate. Invasive species have been shown to be stressors on natural systems and can exacerbate the effects of climate change. The Assessment could possibly lead to practices that reduce the additive effects of climate change and stressors.
16. **Minimization of greenhouse gas emissions:** The project will use manual labor for the most labor-intensive activities, which are the adaptation sites. This will prevent emissions that would be associated with mechanical methods.

CEQA COMPLIANCE:

The activities under the proposed project are categorically exempt from review under the California Environmental Quality Act (CEQA) pursuant to 14 California Code of Regulations Section 15306, Information Collection, which exempts basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource.

Upon approval of the project, Conservancy staff will file a Notice of Exemption.