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# Port of Stockton Antioch Dunes Restoration Project

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# INTRODUCTION TO THE RESTORATION PROJECT

## History of Antioch Dunes

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Approximately 140,000 years ago, the dunes along the southern shore of the lower San Joaquin River near Antioch, California, were formed by deposits of glacial sands carried down the San Joaquin River from the Sierra Nevada mountains to the east. The shape of the dunes—which grew up to 120 feet tall and stretched over 2 miles along the bank of the river—was formed through winds and tides.

In the early 1900s, the San Francisco Earthquake and subsequent fires destroyed San Francisco. The dunes played a critical role in rebuilding the city. Large amounts of sand were stripped from the dunes and used in brick manufacturing to restore San Francisco following the devastating 1906 earthquake. Mining of the sand and other development nearly wiped out the dunes and the associated dune habitat.

The timeline on the next page details other key points in the history of the Antioch Dunes.

## Creation of the Refuge

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In 1980, USFWS created the 55-acre Refuge. The Refuge is part of the San Francisco National Wildlife Refuge complex and is the first and only national

wildlife refuge in the United States created specifically for the preservation of plants and insects—the Antioch Dunes evening primrose, Contra Costa wallflower, and Lange’s metalmark butterfly. The butterflies require coastal dune habitat and rely on the specific plant communities in which the evening primrose and wallflower also thrive. Another plant species that thrives in dune habitat, naked stemmed buckwheat, is the primary food source for the butterflies.

***The Refuge is home to the last remaining populations of three endangered species: Antioch Dunes evening primrose, Contra Costa wallflower, and Lange’s metalmark butterfly***

## The Restoration Project

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When the Port learned of the need for sand to reestablish dune habitat at the Refuge, the Port took the lead on an innovative interagency collaboration to provide the sandy material from the Channel maintenance dredging. This was the first time the Port and USFWS partnered to restore habitat for endangered species through beneficial reuse of dredged material.

# THE HISTORY OF ANTIOCH DUNES

## 140,000 years ago

The dunes were formed by deposits of glacial sands that were carried downriver from the Sierra Nevadas. Over thousands of years, ocean winds and bay tides slowly shaped the dunes that grew to 120 feet in height and stretched for two miles along the southern bank of the San Joaquin River.

## 1900s

The San Francisco Earthquake and subsequent fires occurred in 1906 and the Antioch sand dunes played a critical role in rebuilding the city. Sand was taken from the dunes to mass produce bricks as San Francisco recovered from the devastating destruction. The Great Western Power Company – later acquired by PG&E – built a transmission line across the dunes.

## 1950s

The City of Antioch bought land from the Stamm family and built a sewage treatment plant in the dunes.

## 1980s

The 55-acre Antioch Dunes National Wildlife Refuge was established and the first acquisition ever was made by the U.S. Fish and Wildlife Service specifically for the protection of plants and insects.

## 1990s

PG&E donated 7,000 cubic yards of riverine sand to recreate new dunes and habitat for the endangered species. Native plants, including the primrose, wallflower and buckwheat were planted on the new dunes. Service personnel and volunteers counted 2,342 Lange's during the population peak count in 1999, the highest count on record.

## 1800s

The Los Meganos Land Grant, later named Antioch, was awarded to Jose Noriega and settlers were encouraged to take up residence on the land grant. A brick factory was built in town and later a dairy, piggery, sheep fold and store were established at the dunes. A shipyard and vineyard were also located at the dunes.

## 1930s

The western portion of the sand dunes as well as the vineyard was acquired by the Stamm family who proceeded to mine sand from the property for almost half a century. Various beaches, dance pavilions, wharfs and recreational cottages attracted visitors to the shore of the San Joaquin River – making Antioch Beach very popular. Lange's Metalmark Butterfly was discovered and the first specimens of Antioch Dunes evening primrose were collected.

## 1970s

Lange's Metalmark Butterfly was placed on the Federal Endangered Species List, along with the wallflower and primrose. The Antioch Dunes were designated as a "critical habitat."

## Today

Two disjunct parcels (the Stamm and Sardis Units) contain sand dunes that vary from 0–50 feet high and make up the refuge. Due to the sensitivity of the habitat and the endangered species, the refuge is not open to unsupervised use by the public. However, refuge staff and local educators conduct on-site environmental education efforts through monthly guided tours and special events. Volunteers regularly assist refuge staff with habitat restoration projects and endangered species surveys.

The Port of Stockton, in partnership with the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers are working collaboratively to aid in the restoration of the dunes and delicate ecosystem. Each fall the Delta is dredged to keep the shipping channel clear and the dredged material is rebuilding the dunes.

## The Port of Stockton

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The Port's facilities, located on 2,000 acres in the Delta, are equipped to handle various types of cargo. The Port is committed to protecting the environment and maximizing environmental benefits in carrying out all its activities, including dredging.

Annual maintenance dredging of the Channel is conducted by USACE in partnership with the Port to allow safe travel of large cargo ships between the San Francisco Bay area and the Port. The Port is responsible for securing dredged material placement sites for the effort. Prior to initiation of the Restoration Project, the Port used an existing placement site at a nearby location on Sherman Island to place annual maintenance dredging material.

## Interagency Collaboration for Innovative Restoration

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The Restoration Project required a strong partnership between the Port, USACE, USFWS, National Marine Fisheries Service (NMFS), and the Central Valley Regional Water Quality Control Board (CVRWQCB). Based on prior established trust and understanding among the project partners and regulatory agencies, all the involved parties saw the benefits of the project and worked in an efficient manner to achieve their common goals.

Until recently, it was difficult to receive agency approval for projects proposing to beneficially reuse dredged material, even for projects such as land-side levee stabilization and road construction projects where the dredged material would be capped by

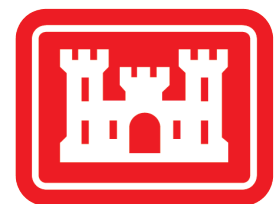
asphalt or concrete, let alone for restoration of sensitive habitat containing endangered species.

Over the course of a decade, the Port conducted research at its placements sites in various locations throughout the Delta and ultimately determined that placement of sediment dredged from the Channel had no adverse impacts to the soil, groundwater, or surface water. The Port's research showed that the groundwater quality underlying the placement sites was improved as compared to the surrounding areas. However, even with this data in hand, several more years of regulatory agency negotiation by the Port were required. Ultimately, negotiations were successful, resulting in a project with clear benefits for all the agencies involved.

The Port provided dredged material at no cost to the Refuge while meeting its responsibility of providing a location for Channel dredged material. In addition to saving money by avoiding fees ordinarily associated with placing material at nearby Sherman Island, the Port also met one of its primary environmental initiatives: finding environmentally beneficial reuses for the dredged material and continuing to be faithful environmental stewards.

USACE is responsible for ensuring that the Channel is maintained to its authorized depth of 35 feet. Their role in the project was to coordinate with the dredging contractor to prepare the site and supply the material by way of a pipeline.

USFWS was able to find a free, ongoing source of suitable local sand for the long-anticipated project to restore dune habitat at the Refuge. Before this interagency partnership was implemented, the USFWS-led Restoration Project had stalled due to prohibitive material handling costs for the large volumes of sand required.



**US Army Corps  
of Engineers®**

# GOALS AND OBJECTIVES

The purpose of the Restoration Project was to create both environmental and economic benefits by combining the annual Channel maintenance dredging effort with restoration of dune habitat that provides sanctuary to numerous endangered species. The two primary project objectives were:

1. Restoration of dune habitat for protection of endangered species
2. Safe, efficient, cost-effective placement of dredged material at a new placement site for the Port

## Reestablishment of Dune Habitat for Protection of Endangered Species

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The first objective of the Restoration Project is to provide clean sand from the annual maintenance dredging effort to restore dune habitat for the endangered Lange’s metalmark butterfly, Antioch Dunes evening primrose, and Contra Costa wallflower. The Refuge supports the last remaining populations of these three endangered species.

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### ANTIOCH DUNES EVENING PRIMROSE

A short-lived perennial plant with large white flowers. The primrose was federally listed as endangered in 1978. Its naturally occurring population is confined to the Refuge.



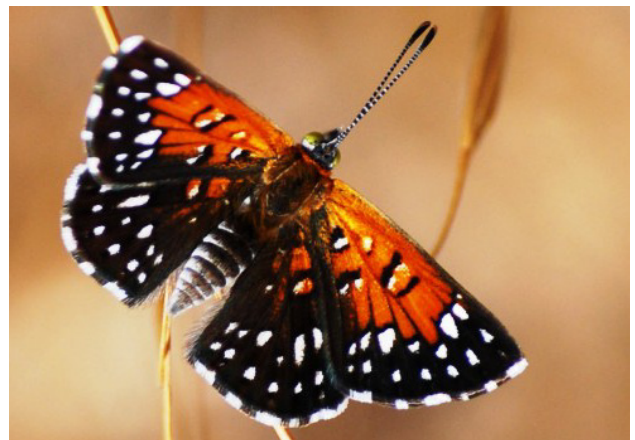
### CONTRA COSTA WALLFLOWER

A yellow flowered herbaceous plant that is a biennial or short-lived perennial. Like the primrose, the wallflower was listed as endangered in 1978.



### LANGE’S METALMARK BUTTERFLY

This quarter-sized, burnt orange and black and white butterfly was one of the first insects to be listed as endangered under the Endangered Species Act in 1976. The Refuge is the only known home to the butterfly.



## A New Placement Site for the Port of Stockton

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The second objective of the Restoration Project is to keep the Channel open and free of shoaling by providing placement sites along the Channel for dredged material. The Port's customers with large, ocean-faring cargo ships rely on the improved speed and safety provided by maintenance of the Channel. Dredging is critical to sustaining infrastructure at the Port, and safe, efficient, cost-effective dredged material placement sites enable ongoing maintenance dredging.

The Port, as the local sponsor for USACE's annual maintenance dredging effort, is responsible for providing dredged material placement sites in strategic locations.

USFWS is allowing the Port to use its property for a dredged material placement site in return for the use of the clean sand dredged from the Channel in locations near the Refuge.

This unique project creates both environmental and economic benefits by combining the annual Channel maintenance dredging effort with local habitat restoration.

***“We are truly committed to being good environmental stewards and focus our programs on continued education and community projects, as well as proactive improvements and protection of our waterways and air quality.”***

*—Port Director Richard Aschieris*



# DISCUSSION

## Background

The Restoration Project is the first significant beneficial reuse of Channel dredged material for ecosystem restoration in this region. It is anticipated that the success of this project will also result in future opportunities for beneficial reuse of dredged sediment toward environmental enhancement.

The Restoration Project’s primary beneficiaries are:

- The species and habitats of the Antioch Dunes
- Area air quality
- The public
- The cooperating agencies

The primary beneficiary is the riverine or Aeolian dune habitat. This habitat, originally formed during glaciation periods, was once widespread in this portion of the Delta. However, it is now a tiny fraction of its former size. This ecosystem provides a

refuge for two endangered plants and one endangered insect, as well as a diversity of native plant and animal species.

The project also resulted in a regional air quality benefit. Prior to the Restoration Project, USFWS planned to haul sand by trucks to the Refuge. This method would have significant short-term air quality impacts associated with the trucking activities. By directly placing sandy dredged material at the Refuge, the air emissions associated with trucking were eliminated.

In addition to its public benefits, the Restoration Project also increased public awareness of the environmental stewardship projects undertaken by governmental agencies. The public’s understanding of and relationship to surrounding ecosystems is constantly evolving. Government projects that have



positive environmental outcomes directly enable future public and private actions likely to produce similar environmental benefits. The Refuge holds a significant place in the public mind and is uniquely visible due to its heavily commercialized surroundings.

In September 2014, the Port worked with USFWS to design and construct an interpretive exhibit at the Refuge to outline the importance of the dune habitat to endangered species, as well as how sand is beneficially reused at the site. The Refuge also has a public interpretive center and trails that illuminate the history and importance of this dune ecosystem.

## Methodology

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### Planning

#### **Interagency Collaboration**

After lengthy collaboration and planning, the Port, USACE, and USFWS first implemented a pilot project to assess the feasibility of placing sandy dredged material at the Refuge in 2013. The pilot project revealed that the concept appeared to be a success, and the three agencies moved forward with planning for the more robust Restoration Project. After the process of characterizing the dredged sediment and evaluating potential impacts on surface water and groundwater from its placement, the Restoration Project became the first significant beneficial reuse of Channel dredged material for ecosystem restoration in the region.

Until recently, significant restrictions prevented most types of beneficial reuse beyond levee repair, levee construction, and road construction where the dredged material would be capped by impervious material. Research conducted by the Port at its other dredged material placement sites was used to show that the dredged material is clean and suitable for reestablishing sensitive habitats, including dune habitat at the Refuge. The studies revealed no adverse impacts to the placement site from dredged material. In fact, water quality was improved in the groundwater underlying and in the immediate

vicinity of the placement site, as compared to the surrounding areas.

Finally, the project has benefits for all of the agencies involved, and allows each to fulfil their goals and objectives. The Port provided a location for the dredged material, at a lower cost than other placement sites, and met one of its primary environmental initiatives: finding environmentally beneficial reuses for the dredged material and continuing to be faithful environmental stewards. USACE achieved authorized maintenance dredge depths in the Channel. USFWS found a free, ongoing source of suitable local sand for the long-anticipated project to restore dune habitat at the Refuge. Before this interagency partnership was implemented, USFWS-led restoration at the site had stalled due to prohibitive material handling costs for the large volumes of sand required.

vicinity of the placement site, as compared to the surrounding areas.

#### **Strong Partnerships**

The success of the Restoration Project depended on strong partnerships between the Port, USACE, USFWS, NMFS, and CVRWQCB. The Port provided leadership and brought the agencies together to work through the issues and obtain necessary approvals, allowing the realization of the common goal of enhancing dune habitat through beneficial reuse of dredged material.

Through building trust and showing the environmental benefits of the Restoration Project, the project was permitted and authorized in an efficient and timely manner. A key component of this project was the speed and cooperation among the agencies and other parties that was required to meet project milestones and allow the permits, finances, preparations, and agreements to be in place at critical times.

***The Antioch Dunes Restoration Project is the first significant beneficial reuse of Channel dredged material for ecosystem restoration in this region***

## Design and Implementation

The Port worked closely with USACE and USFWS to design the dredged material placement site within the Refuge boundaries. Containment berms or levees were constructed on site to hold the dredged sand and allow the dredged material to sufficiently dewater before reuse. The construction of the containment levees had its own challenges.

Working in the Refuge also presented unique environmental challenges not typically faced when establishing a new dredged material placement site. Ordinarily, it is undesirable to establish a placement site in an area that has endangered species, and such a site would be nearly impossible to get approved. The Refuge is the home to three endangered species and therefore is a very sensitive habitat. This required significant coordination between all parties involved to ensure that there were no adverse environmental impacts.

Once the project was permitted, USFWS crews carefully removed any endangered plants—and the naked stemmed buckwheat that is the primary food

source for the butterflies—within the area that was to become the new placement site for the sand, and safely relocated them elsewhere within the Refuge.

Each year, during USACE’s annual maintenance dredging of the Channel, clean sand dredged from sites adjacent to the Refuge is pumped into containment cells located on the Refuge. The amount of sand deposited annually depends on the amount of sedimentation that occurs within the federal channel near the Refuge. Over the past two years, more than 40,000 cubic yards of clean sand have been dredged and reused to create dune habitat at the Refuge.

It is expected that this project will continue into the foreseeable future, or until the goal of restoring the Refuge site to its original condition is realized. Dredged material could be available indefinitely, as maintenance dredging occurs in several nearby channel locations each year. The site is now a thriving component of the Channel’s maintenance dredging program.



## Award Criteria

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### Benefits to Environmental Quality

The Restoration Project is an opportunity for extremely rare habitats to be restored and populations of three endangered species to thrive.

***The Refuge is showing signs of success***  
*The butterfly population, as small as 40 individuals in 2006, has recently grown to 78*

### Port Involvement

As a project sponsor, the Port led innovative interagency collaboration with USACE, USFWS, NMFS, and CVRWQCB. The Port provided leadership and brought the agencies together to work through the issues and obtain necessary approvals, allowing the realization of the common goal of enhancing dune habitat through beneficial reuse of dredged material.

Leading up to the project, the Port conducted a decade of extensive research at its placement sites throughout the Delta to show that placement of dredged material had no adverse environmental impacts. The Port also led several years of regulatory agency negotiations for approval of the dredged material beneficial reuse project.

### Creative Solutions

The Restoration Project is the first significant beneficial reuse of Channel dredged material for ecosystem restoration in this region. The Restoration Project was also the first time the Port and USFWS partnered to restore habitat for endangered species through beneficial reuse of dredged material.

USFWS is able to rebuild the dunes at the Refuge with free sand provided by the Port and USACE. This will enable completion of the dunes restoration faster, cheaper, and with fewer environmental impacts.

### Project Results to Date

More than 40,000 cubic yards of sandy dredged material have been placed on the site and used by USFWS to begin to re-establish the extremely rare dune habitat since 2014. The Restoration Project is already showing signs of success—the butterfly population, once as small as 40 individuals, has recently grown to 78 individuals.

### Cost Effectiveness

The Port was able to save money by avoiding fees ordinarily associated with placing dredged material at nearby Sherman Island. The project further benefits the economy by maintaining an open route for efficient movement of goods. Although dredging likely would have occurred without the Restoration Project, the project decreased the overall costs of keeping the Channel open, allowing the money saved to be spent elsewhere. The project also results in increased local economic benefit through increased tourism at the Refuge due to the high regional profile and interest in the project.

### Transferability to the Port Industry

This ambitious project to restore habitat for three endangered species is the largest dune habitat restoration project that has been conducted by USFWS. Success of this project will likely increase future opportunities for reuse of dredged material for other environmental enhancement projects at the Port of Stockton and beyond.

The beneficial reuse of dredged material from the Channel at the Refuge will provide critical information on which to build future beneficial reuse projects. The lessons learned will provide guidance for further restoration projects at the Refuge, as well as other locations, and will help to establish a precedent for similar projects in the future.



## CONCLUSION

The Restoration Project is a modern effort to pay back the Antioch Dunes' historic sacrifice, and the endangered species in that habitat are already showing improvement. The project has been a resounding success, based on numerous metrics.

Most importantly, the Restoration Project offers an opportunity for extremely rare habitats to be restored and populations of three endangered species to thrive. Additionally, providing sand to the Refuge reduces dredging-related costs for the Port and provides a beneficial reuse of the dredged material.

The Port can provide clean sand to the Refuge until the Refuge's needs are met, due to the annual maintenance dredging of the Channel conducted by USACE in locations near the Refuge.

Outreach and education has been conducted for the Restoration Project, and articles about it have been published in the *Contra Costa Times*, *Bay Nature*, local blogs, and industry publications. The Port donated a sign that was posted at the Refuge, describing the project to the public, and coordinated with USFWS to design and construct a larger interpretive exhibit. Educational tours at the Refuge have reached additional public audiences.

Increased public awareness of the environmental stewardship projects undertaken by governmental agencies contributes to the public's understanding of local ecosystems, and can enable future public and private actions to produce similar environmental benefits.