APPENDIX D

Marine Cultural Resources Technical Report for RTI Infrastructure, Inc.'s Grover Beach Subsea Cables Project

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MARINE CULTURAL RESOURCES REPORT

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LIST OF ABBREVIATIONS AND ACRONYMS

AUV	autonomous underwater vehicle
BOEM	Bureau of Ocean Energy Management
B.P.	before present
CEQA	California Environmental Quality Act
CRHR	California Register of Historical Resources
CSLC	California State Lands Commission
km	Kilometer
LMH	landing manhole
MHW	mean high-water mark
NAGPRA	Native American Graves Protection and Repatriation Act
NAHC	Native American Heritage Commission
nm	nautical mile
NRHP	National Register of Historic Places
OCS	outer continental shelf
OGB	ocean ground bed
Project	Grover Beach Subsea Cables Project
PRC	Public Resources Code
ROV	remotely operated vehicle
RTI	RTI Infrastructure, Inc.
TCP	traditional cultural property

Introduction

The proposed RTI Infrastructure, Inc. Grover Beach Subsea Cables Project (Project) would require work in both terrestrial (land) and marine (ocean) areas in Grover Beach, San Luis Obispo County. This Project would install four fiber optic cables carrying telecommunication data to connect the United States with Singapore, Hong Kong, Guam, and Australia (Figure 1).

The Grover Beach portion of the Project would be implemented in four phases—one phase for each of the four cable systems. The first phase of work will include installation of all terrestrial infrastructure to receive up to four fiber optic cables and bring the very first fiber optic cable from Singapore to Grover Beach. Phase 2 would connect California to Guam. Phase 3 would connect California to either Asia or Australia (not yet determined which would be installed first), and Phase 4 would connect Asia or Australia to California (not yet determined which would be installed first).

This report focuses on the marine Project components and discusses regulatory issues associated with the California landing and addresses only state and local components. The prehistoric and historic maritime activities in central California provide the context for review and analysis of the Project. A separate cultural resources report has been prepared for the terrestrial Project components.

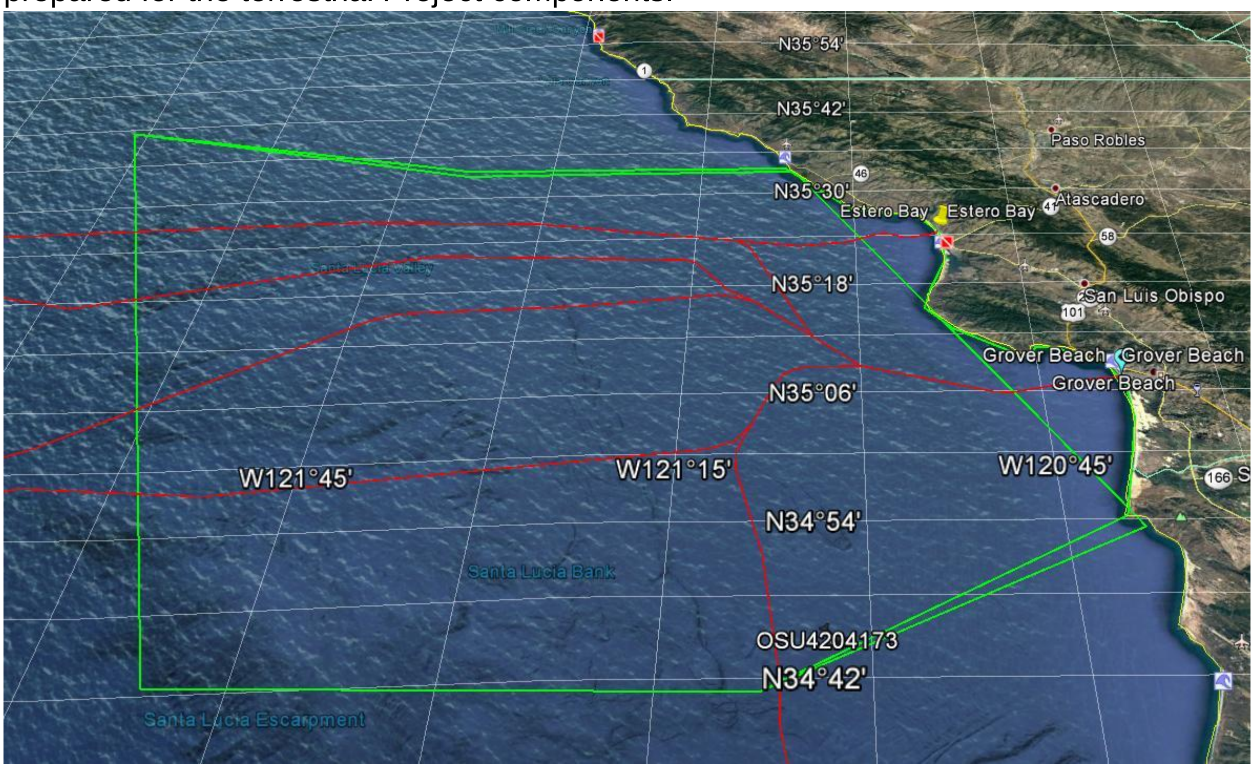

Figure 1. Project Location (cables shown in red)

Summary of Marine Project Components

The following marine Project components would be needed to install up to four fiber optic cables and their related structures from the LMH to offshore in the outer limits of the Outer Continental Shelf (OCS) (approximately 68.4 miles offshore and approximately 5,904 feet deep[1]) as seen in Figure 2:

- **Landing Pipes.** As explained earlier in the terrestrial Project components, up to four landing pipes (approximately 5 to 6 inches in diameter) with a total of length of 3,600 linear feet would be buried offshore at least 35 feet deep under the beach and the ocean floor by using the HDD construction methods. These landing pipes would be a total of 4,600 linear feet starting from the LMH and ending offshore approximately 33 feet below the ocean water so fiber optic cables could be pulled through them and brought into the LMH to connect with the cables coming from the CLS.
- **Fiber Optic Cables.** Since the OCS is approximately 68.4 miles offshore and 5,904 feet deep, each fiber optic cable would be placed directly on the ocean floor where the water is deeper than 5,904 feet. Where the water is less than 5,904 feet deep, these fiber optic cables would be installed by plowing or by post-lay burial method (depending on ocean floor characteristics). The cable-lay ship (with the help of a work vessel and divers) would bring the fiber optic cable to the end of the landing pipe out at about 3,600 linear feet offshore (33 feet deep below the ocean water). Then, the fiber optic cable would be pulled through its own individual landing pipe (constructed in Phase 1) to the LMH.
- **Ocean Ground Beds (OGBs).** The OGBs would be installed onshore or offshore for each subsea fiber optic cable to ground it since electrical signals would be traveling through these fiber optic cables. The OGB would be needed for cathodic protection to control corrosion and to provide a ground for the electricity that would power the marine cable amplifiers.

  If installed onshore, the OGBs would be within approximately 100 feet of the LMH. If installed offshore, the OGBs would be placed beginning at approximately 50 feet beyond the end of each landing pipe, installed along the fiber optic cable, and buried.

Marine Cultural Resource Categories

Three broad categories of marine cultural resources are considered in this report, all of which are currently submerged, and may be encountered during marine installation of the Project: (1) historic period shipwrecks and unidentified debris; (2) prehistoric period

[1] U.S. federal jurisdiction extends to the edge of the OCS under the Outer Continental Shelf Lands Act.

watercraft; and (3) prehistoric archaeological resources, both as *in situ* site deposits and isolated artifacts.

Prehistoric Period Watercraft

Native Americans used watercraft for transportation and fishing, in addition to offshore hunting of otters, seals, and sea lions. During the approximately 13,000 years of Native American navigation through the study area, some native vessels may have been inundated, stranded, or capsized. Given the fragile nature of these craft, in terms of construction methods and perishable materials, it is unlikely that evidence of such vessels would be preserved in the nearshore environment.

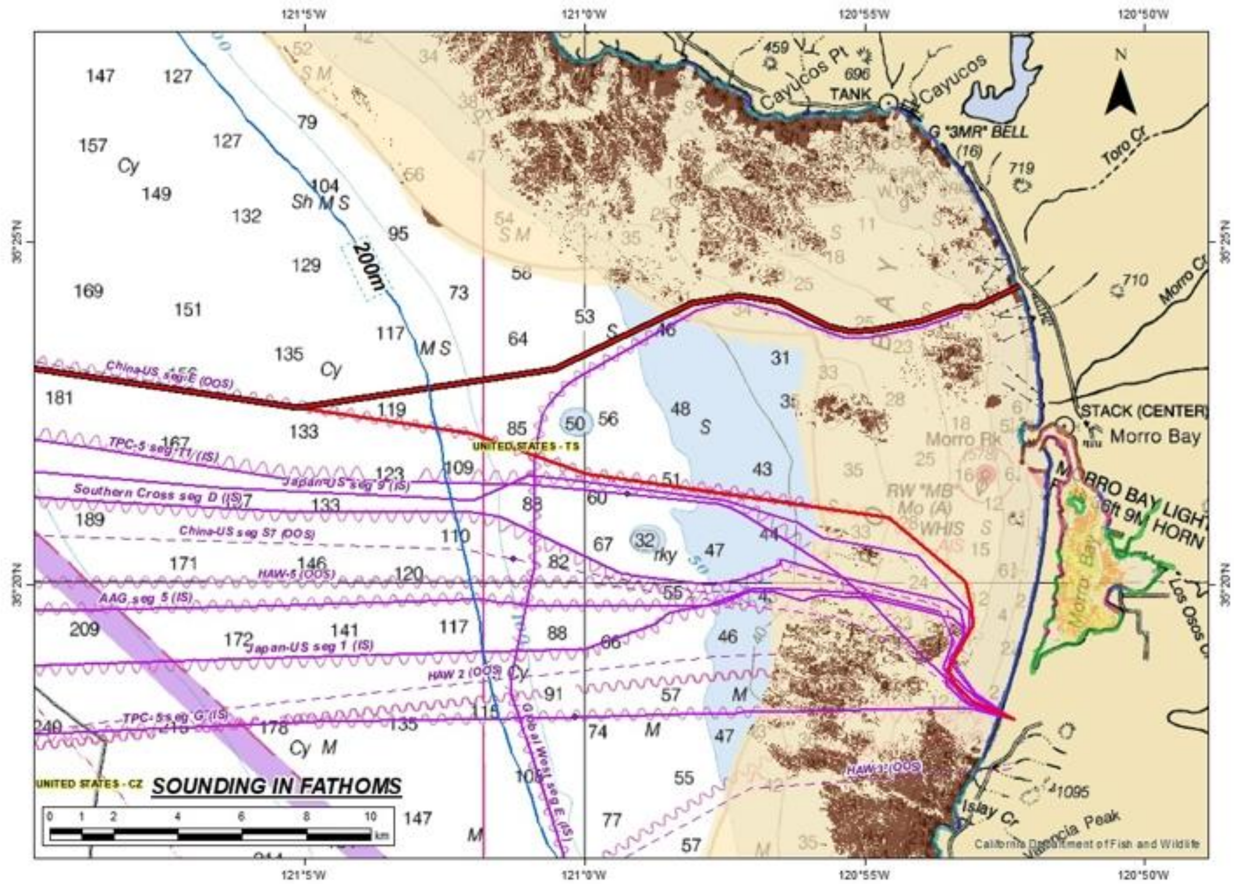

Figure 2. Grover Beach Landing Site Survey Corridor (NOAA Chart No. 18700)

Prehistoric Archaeological Resources

Prehistoric archaeological resources include places that Native Americans lived, performed activities, altered the environment, and created art before they sustained contact with Europeans. Prehistoric resources contain features left behind by these activities as well as artifacts and subsistence remains. They also may contain human remains in the form of burials, cairns, or cremations. Although originally deposited on a non-marine landscape (dry land), changes in sea level have resulted in such resources currently being submerged. Such sites may date from the terminus of the Pleistocene through Holocene periods. These sites and isolated artifacts may be buried at varying depths, depending on their age and the depositional history of the location in which each is found.

Historic Watercraft

Historic-period shipwrecks consist of the remains of watercraft that were used as early as the 16th century to traverse the waters of the study area and unidentified debris. Many of the shipwrecks in this area occur near shoreline rocks, coves, historic landings, anchorages, wharves, and lighthouses; but shipwrecks also occurred in deeper waters offshore. These historic-period watercraft came to rest on the ocean floor due to marine casualties such as capsizing, foundering, stranding, explosion, fire, and collision during their travel on the Pacific Ocean. Currently, their remains may be partially or wholly obscured by sediments and in rocky strata along the ocean floor.

Debris may include flotsam (scattered debris due to the process of wrecking), jetsam (items such as cargo or other equipment purposely jettisoned or accidentally lost from traveling vessels), and items deposited on the seafloor through salvage of vessels or their cargoes and past economic activities such as fishing or marine exploration.

Regulatory Background

Federal Regulations

Federal protections for scientifically significant cultural resources primarily derive from the **National Historic Preservation Act (NHPA) of 1966** as amended. If a project involves a federal property, federal permit, or federal funding, it may be considered a federal undertaking and is required to comply with Section 106 of the NHPA (36 Code of Federal Regulations Part 800). This regulation sets forth the responsibilities that federal agencies must meet in regard to cultural resources. Federal agencies must conduct the necessary studies and consultations to identify cultural resources that may be affected by an undertaking, evaluate those cultural resources to determine whether they are eligible for listing in the National Register of Historic Places (NRHP), assess the potential of the undertaking to affect NRHP-eligible resources, and take action to resolve any adverse effects that may result from the undertaking. The NRHP eligibility criteria are very similar to those for the California Register of Historical Resources (CRHR) (see below).

The ***Outer Continental Shelf Lands Act of 1953*** provides that the subsoil and seabed of the OCS are subject to United States jurisdiction and triggers other laws, including NHPA. The ***Antiquities Act of 1906***, enacted to protect cultural resources on lands owned or controlled by the federal government, has successfully been used to protect important cultural resources on the OCS in national marine monuments and other federal marine protected areas but has not yet been applied on the OCS outside of such areas (BOEM 2013:31–32).

The ***Native American Graves Protection and Repatriation Act (NAGPRA) of 1990*** was enacted for the protection and repatriation of the remains of Native Americans and associated grave objects. The act applies to tribal and federal lands, defining *federal lands* as any land other than tribal lands that are controlled or owned by the U.S. government. Although no case has yet been recorded of the application of NAGPRA in a marine context in the study area, it appears reasonable that NAGPRA would apply to the remains of Native Americans and associated objects on the OCS when discovered during intentional excavation and as a result of inadvertent discoveries (BOEM 2013:47–48). It is the opinion of the authors that NAGPRA would provide the authority to protect Native American remains and associated grave objects on the OCS (BOEM 2013:49).

Submerged cultural resources within the waters of the State of California and federal waters from the 3-nm State limit to the OCS margin may be within the jurisdiction of the U.S. Army Corps of Engineers, Los Angeles District (Section 404, Clean Water Act, Nationwide 12 Authorization) and the Bureau of Ocean Energy Management (BOEM). It is the policy of the U.S. Army Corps of Engineers and BOEM to consult with the appropriate State Historic Preservation Officer regarding all federally permitted offshore activities.

State Regulations

California Environmental Quality Act (CEQA) (Public Resources Code [PRC] Section 21000 et seq.). Historical, archaeological, and paleontological resources are afforded consideration and protection by CEQA (PRC Section 21083.2). CEQA Guidelines define significant cultural resources under two regulatory designations: historical resources and unique archaeological resources (14 California Code of Regulations [CCR] Section 15064.5).

A *historical resource* is defined as a “resource listed in, or determined to be eligible by the State Historical Resources Commission, for listing in the California Register of Historical Resources”; or “a resource listed in a local register of historical resources or identified as significant in a historical resource survey meeting the requirements of Section 5024.1(g) of the Public Resources Code”; or “any object, building, structure, site, area, place, record, or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California, provided the agency’s determination is supported by substantial evidence in light of the whole record" (14 CCR Section 15064.5[a][1]–[3]). Although traditional cultural properties (TCPs) and cultural landscapes are not directly called out in the state definitions of historical resources, TCPs are places and cultural landscapes are areas, and places and areas are included as types of historical resources. Historical resources that are automatically listed in the CRHR include California historical resources listed in or formally determined eligible for the NRHP and California Registered Historical Landmarks from No. 770 onward (PRC Section 5024.1[d]). Locally listed resources are entitled to a presumption of significance unless a preponderance of evidence in the record indicates otherwise.

Under CEQA, a resource generally is considered *historically significant* if it meets the criteria for listing in the CRHR. A resource must meet at least one of the following four criteria (PRC Section 5024.1; 14 CCR Section 15064.5[a][3]) for eligibility:

A. It is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States.

B. It is associated with the lives of persons important to local, California, or national history.

C. It embodies the distinctive characteristics of type, period, region, or method of construction, or represents the work of a master or possesses high artistic values.

D. It has yielded or has the potential to yield information important to the prehistory or history of the local area, California, or nation.

Historical resources also must possess integrity of location, design, setting, materials, workmanship, feeling, and association (14 CCR 4852[c]).

An archaeological artifact, object, or site can meet CEQA's definition of a *unique archaeological resource*, even if it does not qualify as a historical resource (14 CCR 15064.5[c] [3]). An archaeological artifact, object, or site is considered a unique archaeological resource if "it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria (PRC Section 21083.2[g]):

- Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.

- Has a special and particular quality such as being the oldest of its type or the best available example of its type.

- Is directly associated with a scientifically recognized important prehistoric or historic event or person."

Under California law, *cultural resources* are defined as buildings, sites, structures, or objects, each of which may have historical, architectural, archaeological, cultural, and/or scientific importance. All resources nominated for listing in the CRHR must have integrity; the authenticity of a historical resource's physical identity is evidenced by the survival of characteristics that existed during the resource's period of significance. Therefore, resources must retain enough of their historical character or appearance to convey the reasons for their significance. Integrity is evaluated with regard to the retention of location, design, setting, materials, workmanship, feeling, and association. It also must be judged with reference to the particular criteria under which a resource is proposed for nomination (PRC Section 5024.1).

CEQA Guidelines, CCR Title 14, Section 15064.5. When an initial study identifies the existence of, or the probable likelihood of, Native American human remains within a project area, a lead agency is directed to work with the appropriate Native Americans as identified by the Native American Heritage Commission (NAHC). The applicant may develop an agreement for treating or disposing of, with appropriate dignity, the human remains and any items associated with Native American burials with the appropriate Native Americans identified as the Most Likely Descendant by NAHC.

PRC Section 5097.5 states that no person shall willingly or knowingly excavate, remove, or otherwise destroy a vertebrate paleontological site or paleontological feature without the express permission of the overseeing public land agency. PRC Section 30244 further states that any development that would adversely affect paleontological resources shall require reasonable mitigation. These regulations apply to projects located on land owned by or under the jurisdiction of the state or a city, county, district, or other public agency.

PRC Section 5097.9 et seq. (1982) establishes that both public agencies and private entities using, occupying, or operating on state property under public permit shall not interfere with the free expression or exercise of Native American religion and shall not cause severe or irreparable damage to Native American sacred sites. This section also creates the NAHC, charged with identifying and cataloging places of special religious or social significance to Native Americans, identifying and cataloging known graves and cemeteries on private lands, and performing other duties regarding the preservation and accessibility of sacred sites and burials.

The ***California Coastal Act of 1976*** establishes policies pertaining to cultural resources investigations conducted for impact analysis pursuant to CEQA, NEPA, and NHPA Sections 106 and 110. The act provides that "[w]here development would adversely impact archeological or paleontological resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required" (PRC Section

30244). Anyone who proposes any development in the coastal zone must secure a **Coastal Development Permit** from the **California Coastal Commission**.

The ***Abandoned Shipwreck Act*** (enacted by Congress in 1987) transferred ownership of submerged historic shipwrecks embedded in the bottomlands of a state's waters to the state. Under this law, submerged historic shipwrecks occurring within 3 nm of a state's shoreline are owned by that state. The act provides authority for states to protect and manage submerged, abandoned shipwrecks through state law (BOEM 2014:42).

Local Regulations

San Luis Obispo County

San Luis Obispo County provides for the discovery and protection or investigation of cultural resources as mandated by CEQA in the San Luis Obispo Archaeological Resource Program Guidelines (October 2009) and applicable county ordinances.

City of Grover Beach

The City of Grover Beach and California State Parks require protection of archaeological and historical resources to the greatest extent feasible. Management of archaeological and historical resources is addressed by the City of Grover Beach Coastal Program Section 3.0 Archaeological Resources Component that briefly outlines Coastal Act Policy Section 30244 (www.grover.or/DocumentCenter/Home/View/1808, page 44).

Environmental Setting

The Project area is located at and offshore of Pismo State Beach Park, south of the Oceano Dunes Natural Preserve in the City of Grover Beach. The cable landing site is situated along the San Luis Obispo County coast. The study area for marine cultural resources consists of the proposed cable routes shown in Figures 1 and 2, and a 10-nm buffer around each route, beginning at the mean high-water mark (MHW) out to the edge of OCS at a water depth of approximately 5,904 feet (1,800 meters, or 984 fathoms). The broad-scale buffer zone allows for inaccuracies inherent in the reported locations of historic shipwrecks. There is some overlap in the buffers around each route. The boundary for the marine archaeological record search is shown in Figure 1. The study are includes marine areas within California's jurisdiction that extend 3 nm (4.8 kilometers [km]) from MHW, as well as marine areas under federal jurisdiction that extend beyond the 3-nm State jurisdiction on the OCS where the submarine cables will be buried to the extent feasible.

The prehistoric and historic maritime activities in Central California provide the context for review and analysis of the Project.

Paleogeography

Marine deposition, coastal sedimentation, and resulting landforms on the coast of Central California have been dominated throughout the Pleistocene by the combined effects of climatic and tectonic patterns (Bradley and Griggs, 1976; Dupre et al. 1980 in MMS 1987:36). The early and middle Pleistocene were times of folding and major tectonic activity in California. The late Pleistocene, by contrast, was dominated by erosional and depositional events related to sea level fluctuations responding to glacial and interglacial stages.

During the Pleistocene periods of lower sea stands, westerly flowing fluvial systems likely incised the exposed continental margin, depositing sediments in floodplain, deltaic, and terraced marine environments. Sediments were reworked into beach and shallow marine deposits, which were reworked again during subsequent transgression. Wave-cut platforms or abrasion platforms developed along the coast as the result of wave abrasion during ancient still stands (MMS 1990:II-54). With a change in sea level, platforms may be submerged or raised. Raised platforms are marine terraces. Pleistocene marine terraces occur discontinuously along much of the coast of the study area. The late Pleistocene/Wisconsin sediments (30,000 to 18,000 Before Present [B.P.]) are probably preserved on the present-day continental slopes only below 120 meters (394 feet, 66 fathoms) or as early fill in some of the submarine canyons, slope gullies or deep shelf river channels (MMS 1987:38).

The most recent regression affecting the study area started during the onset of the Wisconsin glaciations, approximately from 30,000 to 35,000 B.P. About 30,000 B.P., sea level dropped from a level near or slightly below the present sea level. Between 21,000 and 18,000 B.P., sea level dropped to a level about 120 to 130 meters (394 to 427 feet, 66 to 72 fathoms) below the present level, exposing Late Pleistocene deposits (Curray 1965; Bloom, 1977; Bloom et al. 1974 in MMS 1990:II-69). Holocene stratigraphy of the OCS in the study area represents deposits resulting from the eustatic sea level rise, known as the Flandrian Transgression, which began about 18,000 years B.P. in response to climate change. From the onset of the Holocene transgression to about 10,000 to 7,500 years B.P., a rapid inundation of the OCS occurred. The rate of sea level rise has since slowed and has been stable or fluctuating slightly during the past 3,000 years (Kulm et al. 1968 in MMS 1990:II-54). Holocene sediments deposited on the OCS vary in thickness and consist mostly of unconsolidated sand, silt, clay, and gravels (Wagner et al. 1972 in MMS 1990:II-54). Surficial sediment distribution on the central California shelf can generally be divided into a nearshore sand and mid- to outer-shelf silt and mud in depths of 60 to 80 meters (197 to 263 feet, 33 to 44 fathoms). Sources of overlying sediments in the study area can be attributed to river outflows of suspended sediments. The OCS in the study area has been controlled by four major cycles of shoreline advance and retreat. During glacial periods, the shoreline retreated to near the edge of the modern OCS. During interglacial periods, the shoreline advanced to near modern levels. These changes in sea level occurred rapidly relative to geologic time and resulted in formation of the broad, gently sloping, sediment-veneered, wave-cut platform that makes up the modern OCS. The OCS ranges from 2.7 nm (5 km) off Point Estero to about 10.8 nm (20 kilometers) off Grover City/Pismo Beach and 11 nm (20.4 km) wide southward at Point Sal. The maximum late Pleistocene low stand is found at a depth of about 120 meters (394 feet, 66 fathoms).

As the Flandrian Transgression pushed the shore easterly, valleys incised during the glacial low stand began to back-fill with fluvial sediments, which in turn were covered with marine post-Wisconsin deposits as sea level was reaching its present level. The shelf between Point Estero to Point San Luis is mainly exposed Franciscan bedrock, a hard, erosion-resistant rock with several post-Wisconsin terraces and sea cliffs cut into it (Wagner 1974 in MMS 1987:49). A wedge of post-Wisconsin sediment is found seaward of the outcrop that is thought to be about 10 to 20 meters (33 to 66 feet) thick. The shelf between Point San Luis to Point Sal ranges from 9 to 11 nm (17 to 20.4 km) wide and is dominated by a lens of post-Wisconsin sediments to a maximum thickness of 40 meters (131 feet). Outcrops are rare in the area between Point San Luis and Point Sal. The underlying bedrock is thought to be folded and truncated Miocene and Pliocene beds (MMS 1987:49).

Geology and Oceanography

Geology and oceanography in the Project area are summarized in BOEM (2013:13).

The western coastal region of California in which the Project is located is composed of four geomorphic provinces (the Klamath Mountains, the northwest-trending Coast Ranges, the west trending Transverse Ranges, and the northwest treading Peninsular Ranges. The Project area is in the southern part of the Coast Ranges Geomorphic Province. The province is characterized by parallel, linear mountain ranges trending obliquely to the coastline, thus forming a series of rocky headlands and broad sandy bays. The prominent San Luis and Santa Lucia Mountain Ranges extend across the area to the south and to the east and north, respectively. The ranges are separated by the Los Osos and San Luis Valleys.

The OCS between Point Estero and Point Conception, where the Grover Beach Project area is located, is oriented north-south. The continental shelf meets the continental slope at a change of gradient marked between 125 and 200 m of depth. The continental shelf in the study area from Cape San Martin to Morro Bay is described as narrow, averaging less than 10 km in width (MMS 1990:II-62). McCulloch et al. (in MMS 1990:II-62) describes this portion of the shelf as not exhibiting a well-developed shelf surface and, therefore no well-developed shelf/slope break in topography. The width of the shelf between Point Estero and Point San Luis ranges from 3 to 7. 4 miles (5 to 12 km) and broadens to 12.4 miles (20 km) off Pismo Beach. It is generally flat and featureless, with slopes west-southwesterly at less than 1 percent. The present shelf break is found at a depth of about 394 feet (120 meters) which is at or near the maximum late Pleistocene low stand.

Wagner (1974, in MMS 1987) indicates that the shelf consists of hard, erosion-resistant rock, with several post-Wisconsin terraces and sea cliffs cut into it. A wedge of post-Wisconsin sediment is found seaward of the area of outcrop.

Prehistoric Setting

Prehistoric Occupation of the Marine Study Area

At the height of the Wisconsin glaciation (approximately 18,000 to 24,000 years B.P.), the sea level was as much as 120 meters (394 feet, 66 fathoms) below its present altitude (Milliman & Emory 1968). At that time, the California shoreline was near the edge of the OCS, approximately 6 nm offshore of the present shoreline (uncorrected for local offshore deposition or uplift rates) within the study area.

Recent Geographic Information System studies summarized in BOEM (2013:21) indicate that the sea level rose an average of 6.3 millimeters per year, or 6.3 meters every 1,000 years, over the 19,000-year period since the Last Glacial Maximum. This rate was not constant, but varied over time. Sea level continues to rise incrementally along the California coast.

Human populations have occupied the California coast for at least the past 13,000 years and enjoyed the products of the littoral zone for much of that time. The littoral zone includes the nearshore intertidal area where many edible resources, including shellfish, can be harvested. Sea level 11,000 years B.P. was at about 46 meters (151 feet, 25 fathoms) below the present level. It is reasonable to assume that prehistoric occupation sites where debris from villages and campsites accumulated as far out as what is now the OCS, were abandoned as they were inundated by the rising sea level during the Holocene transgression (Nardin et al. 1981; Bloom 1977). As sea levels rose after the Last Glacial Maximum, prehistoric people moved their sites farther inland to stay above shifting shorelines and to access shifting resource areas (BOEM 2013:21).

If the preference for site locations remained the same over time, even as the sea level rose, we would expect to find inundated prehistoric period archaeological sites offshore in places where former streams once came together to flow into larger streams and rivers, and where they entered the ocean as they crossed bluffs and beaches (Stright

1988). Former estuaries, bay mouth bars, tombolos (a bar of sand or shingle joining an island to the mainland), and backshore beaches as well as nearby bluffs also would be sensitive locations for offshore prehistoric archaeological sites.

Prehistoric archaeological sites are formed from the accumulation of layers of soil and debris from daily activities that have been deposited over time. Typically, the longer the period of occupation and the larger the group of people, the greater the accumulation of debris. Archaeological sites at or near the shoreline most often are characterized by concentrations of whole and fragmentary seashells, while archaeological sites that are more distant from the shoreline most often lack such concentrations of shell and include the debris from the exploitation of inland habitats. Such debris may include stone tools and the remains of animals that were hunted, butchered, and cooked, as well as tools for grinding nuts and seeds. Archaeological sites on the OCS may be composed of a series of deposits that document the sea level rise and resulting change in the relative distance of the site from the sea. As the sea level rose, sites that once were used for exploitation of terrestrial resources may have become bases for exploitation of intertidal resources before being abandoned as the sites became inundated. As stated in BOEM (2013:23), the order of site occupations recorded in such layered archaeological sites can reveal the sequences of environmental changes associated with rising sea levels and the resulting changes in human behavior and resource preferences.

Not all prehistoric sites would have been well preserved. Prehistoric sites on the paleolandscape of the Pacific OCS would have been subjected to the erosive effects of water as rising sea levels advanced the shoreline of the Pacific Ocean to the east. Inman (1983) suggests that erosion would be widespread and sites may not have been preserved except in exceptional circumstances, where conditions on the landscape, such as clusters of plants and trees or rocky overhangs, would have protected such deposits from erosion. Such conditions might be expected in the ecological and geomorphic contexts associated with lagoons and terraces. Snethkamp et al. (1990 III:106-108); Bickel 1978, 1988) suggest that the same classes of physiographic locations with a high potential for site preservation on land may have offered the highest potential for preservation during and following the process of inundation.

Site preservation depended on at least three factors: the degree of protection of site deposits by overlying sedimentation prior to inundation, the duration of exposure to increased forces of erosion associated with time spent in the intertidal zone during the transgression, and the intensity of wave energy. As is true of sites on dry land, rapid burial of sites prior to inundation would have created the best conditions for preservation during inundation. An example of rapid burial on dry land occurs when a river overflows its banks and leaves behind a thick layer of sediment and debris on the surrounding landscape. The burial of sites on the OCS most likely occurred in river floodplains and terraces. Prehistoric sites that were not rapidly buried, but which remained on or near the surface of the Pacific OCS, most likely were washed away (BOEM 2013:25). The erosive effects of the Pacific's wave actions on buried archaeological sites would have been reduced through time, as the sea level continued to rise and the depth of the water increased.

The subtidal zone includes all of the seafloor below the normal reach of high wave energy and offers a more stable environment conducive to the preservation of inundated sites, especially if they had been buried beneath sediments prior to inundation (Snethkamp et al. 1990 III:105 in MMS 1990; BOEM 2013:26). All of the OCS within the study area is located within the subtidal zone and, as sea level rose, the intertidal zone migrated landward and left behind a layer of sand in the subtidal zone.

BOEM (2013:54, Figure 16) depicts shoreline contours in the study area that were present on the exposed Pacific OCS coastal landscape during the time since the Last Glacial Maximum. Contours depicted include 12,000 B.P., 13,000 B.P., 14,000 B.P., 16,000 B.P., and 18,000 B.P. shorelines west of the study area. It is also possible that inundated prehistoric sites on the Pacific OCS that may have been preserved along the margins of paleochannels or intervening buried landforms were buried under a substantial layer of sediment and are deep enough to remain unaffected by the proposed Project. However, the depth of such protective sedimentation compared with the depth of anticipated Project-related ground disturbance has not yet been analyzed.

In summary, the study area has the potential for as yet undiscovered prehistoric archaeological deposits. Zones within the study area of moderate to high potential for such deposits are highly localized, and identification of these localities would require a sophisticated analysis of the pre-submergence landscape within the study area, and modeling of subsequent conditions of submergence and rate of deposition throughout the marine transgression.

Native American Settlement and Occupation

Human occupation of the California coast spans at least the last 13,000 years, although some have claimed a much greater antiquity for this habitation (e.g., Carter 1957; Moriarty and Minshall 1972); however, these claims are met with skepticism by many (BOEM 2013:83).

The earliest evidence for habitation of the central California coast may have been obscured by environmental factors (BOEM 2013:83). The earliest identified California coastal sites are located on the Northern Channel Islands offshore of southern California and date to between 13,000 and 12,000 B.P. (Erlandson et al. 2007a, b; Arnold et al. 2004; Erlandson 1997 in BOEM 2013:83). The oldest site is located at Arlington Springs, Santa Rosa Island (CA-SRI-173) and represents the earliest human remains encountered on the Pacific coast, contemporaneous with Clovis (Erlandson et al. 2007b and Arnold et al. 2004 in BOEM 2013:83). The large number of marine/littoral sites dating to between 12,000 and 10,000 B.P. offers some of the best evidence for early persistent use of marine resources in the Americas (Rick et al. 2001 and Arnold et al. 2004 in BOEM 2013:83). Ascribed to the Paleoindian Tradition, the assemblages consist of abundant flaked stone tools and a distinct lithic technology (BOEM 2013:83).

Conflicting hypotheses on the origin of the Paleocoastal peoples (e.g., independent settling of coast, descending from inland Paleoindian peoples) have been suggested by Morrato (1984) and Davis et al. (1969), but data from the earliest Channel Island sites (Arlington Springs [CA-SRI-173]), Daisy Cave [CA-SMI-261]) with components dating to between 13,000 and 11,000 B.P. suggest that Paleocoastal peoples did not descend from inland Paleoindian peoples but arrived on the coast independently (Rick et al. 2001 and Erlandson 1997, 2007b in BOEM 2013:83). The paucity of sites contemporaneous to the Santa Rosa Island and San Miguel Island sites may reflect the site destruction processes of rising eustatic sea levels along the mainland coast. In addition to the many early Channel Island sites, large numbers of sites dating to between 10,000 and 8,000 B.P. are present along the entire California mainland coast, although the majority are located in southern California.

The onshore segment of the fiber optic cable landings at Grover City are within the territory historically occupied by the Obispeno Chumash, the northernmost of the Chumash-speaking peoples of California (Heizer 1978; Landberg 1965; Greenwood 1972).[2]

Archaeological evidence has revealed that the ancestors of the Obispeño settled in San Luis Obispo County over 9,500 years ago. The Obispeño area from San Simeon Creek to Avila Bay contains at least 2,500 archaeological sites that span many years of occupation by the Chumash and their ancestors. Following an annual cycle of hunting, fishing, fowling, and harvesting, the Chumash peoples adapted to changing environmental and social conditions and grew into a large, complex society that persists today.

At the time of Spanish contact, the area inshore of the proposed offshore cable corridors was occupied by speakers of the Obispeño dialect of the Chumash language. The Chumash were a group of hunter-gatherer-fishers who attained an extraordinary level of social complexity given their means of subsistence. The Obispeño Chumash occupied the northern limits of the Chumash occupation sphere, beginning near the Nipomo area and extending northward as far as San Simeon and beyond.

[2] 0rr (1967) indicates evidence of hunting on Santa Rosa Island possibly as early as 15,820 B.P.; however, Moratto (1984) and Taylor (1985) indicate a date of 11,000 B.P. based on the majority of current evidence.

In the world of the Chumash, the long years of prehistory have been divided into several periods that have been sub-divided into chronologically-successive phases (King 1981). The earliest aboriginal settlement in the area historically occupied by the Chumash is a poorly known period between 12,000 and 9500 B.P. A Paleo-period fluted point from this era was found in the coastal area east of Point Conception.

Much of the long history of the Chumash and their ancestors has been based on general patterns of social, technological, and subsistence changes observable in the archaeological record and has been separated into three major periods: Early, Middle, and Late (King 1981).

The Early Period (11,000 to 3000 B.P.) is the first period in California with sites that represent remains of permanent settlements with associated cemeteries. The earliest site in San Luis Obispo County (CA-SLO-2) is found at Diablo Canyon, with radiocarbon dates to between 9900 and 9300 B.P. (Greenwood 1972). The important Lodge Hill site in Cambria also has a substantial Early Period component that has been radio-carbon dated to 8000 B.P. It shows extensive use of local raw materials and coastal marine food resources.

While a number of sites along the San Luis Obispo County coast are known to exist prior to 8000 B.P., very few have been discovered between 8000 and 5500 B.P. The rare occurrence of archaeological sites in this 2,500-year period may be due to the Altithermal, a very dry, warm period in California history when populations may have decreased or been clustered near permanent water sources. After 5500 B.P., many sites were again occupied. Coastal sites in this later part of the Early Period are known from Diablo Canyon, the Morro Bay sand spit, Toro Creek, Cayucos, Cambria, San Simeon Creek, and elsewhere.

Early Period sites often contain milling stones and manos, which indicate extensive use of seed plants in addition to intensive harvesting of shellfish. A basic array of rectangular shell bead ornaments also occurs throughout the Early Period. Village life was well organized, with use of formal cemeteries and specialized resource sites.

Artifacts and food remains recovered from these early contexts indicate that people living along the coast fished with bone hooks, sometimes using boats or rafts, and occasionally taking sea mammals and large fish. Deer and other bones, stone points, and knives indicate that hunting was important. Residential sites often contain milling stones and manos used to process small seeds. During much of the Early Period, society was organized as egalitarian, so that anyone could attain positions of power and wealth. Political power was largely dependent on the acquisition of wealth and ritual power. During the later phases of the Early Period, Olivella barrel beads were the dominant type of bead used throughout Chumash territory. Olivella barrel beads require additional grinding of the base and often the spire to reduce the size of the bead, which increases the manufacturing costs of this type of bead (King 1990). This increased cost per bead is suggested to indicate that these beads were used in economic contexts.

The increasingly standardized size of the Olivella barrel beads and clam disc beads throughout the Early Period also suggest that both were used in changing and developing economic exchange systems. Early settlements often were small hamlets defensively situated on elevated landforms. Throughout the Early Period, while most villages contained 30 to 60 people, some settlements increased in size to several hundred.

The end of the Early Period and beginning of the Middle Period occurs between 3000 and 2600 B.P. and is marked by changes in ornaments and other artifacts, which indicate the development of hereditary control of political and economic power. Cemeteries in this period indicate a separation of "church and state," between chiefs and priests or religious leaders. Toward the end of the Early Period, milling stones decreased in frequency as mortars and pestles became more common. Subsistence patterns appear to shift from small seeds to larger nuts, particularly the acorn and islay as well as fruits. Storage of these foods also increased. Social and marriage networks were established to regulate these food stores and to even out fluctuations of the acorn harvest in different regions. Also during the Middle Period, the importance of fishing from boats increased, and fish became a more important food resource. Village locations during this period tended to be less defensive, as villages became integrated into larger political units to promote inter-village and inter-regional trade.

Although the Early Period economic system used clam disc/cylinder beads and Olivella barrel beads, both types of beads became rare in the Middle Period—indicating a major change in the utility of economic systems during this time. During the Middle Period, political control systems, not economic systems, were adequate to regulate the Chumash society. The most common beads were Olivella saucers (discs) that were used in necklaces during political exchanges between village chiefs and other high-status members of the society. The villages during the Middle Period grew larger in size and number. Toward the end of the Middle Period, there was a shift from the use of large points to small projectile points, and bows and arrows became common throughout California after about 500 to 700 A.D.

The Middle Period of Chumash prehistory spans the centuries between 2500 B.P. and 1150 A.D. During this time, Chumash society shifted into a very organized state with hereditary rights to political and religious power. Artifact types changed in the Middle Period, and shell ornaments became more diverse. An important economic adaptation, the use of acorns, is indicated by the decline in milling stones and the increased use of mortars and pestles. Population size increased and trade networks became well established in the Middle Period. Some cemeteries show evidence of warfare.

The Late Period (1150 to 1790 A.D.) is marked by the differentiation of new bead types, indicating that new economic subsystems again were necessary to regulate the growing Chumash society. This later economic system switched to Olivella callus beads (cup, lip, and cylinder beads) and produced a greater volume of money and invested more energy per bead in the economic system than the Early Period populations. During the 800 years the Late Period economic system operated, shell beads became larger—using less grinding time and thus cheaper to produce—and became more numerous. This healthy trend in economic systems is commonly known as inflation.

Large trade centers were established, and all aspects of Chumash society rapidly grew. Many small sites also were established during this period as a response to the growth of an economic system that supported more specialists and intensive exploitation of many different resources. Ritual objects were seldom owned by individuals but rather were controlled by institutions. Chiefs and many other important political and social positions were inherited along "royal" family lines. Social and political organizations encompassed most of the Chumash nation from Malibu to the northern edge of San Luis Obispo County.

Economic changes continued within the Chumash world. Bead jewelry indicates that there were divisions in wealth between family lines. Money was invented and extensively used as an indication of political as well as economic power. The long process of localized adaptation evident throughout Chumash prehistory became even more established. With the arrival of the Spanish, especially after 1769 A.D., rapid changes altered Chumash political and economic achievements as well as reducing the size of the population. By the end of the Mission era, the Chumash continued to live on their ancestral lands, but their former cultural achievements were largely changed forever.

By 1805, all native people in San Luis Obispo County and beyond had been baptized and their villages abandoned. In the course of only 30 years from the first Spanish expedition in 1769, the traditional way of life had forever been changed for the Chumash people. Once moved to the missions or returned to the various outposts, native people adopted a new way of life, using domestic plants and animals and working to support the Franciscan missions. Those surviving the Spanish period adapted to the ranchos of the Mexican and American periods and later integrated into modern society after the turn of the century.

During prehistory, the area surrounding the San Luis and Morro Bay areas were rich in wild food resources. This abundance of resources is believed to be the reason for the high number and large size of sites per mile relative to neighboring locations, especially to the north and east inland. This high frequency of prehistoric sites makes these areas extremely important in regard to interpreting prehistoric cultures. The likelihood of encountering large substantial prehistoric sites increases as one nears bays and estuaries. Conversely, most of the sites located in the nearby foothills, away from the resources of the bay, are small ephemeral sites, often used for special purpose activities.

Archaeological studies continue to contribute to our knowledge of past cultural patterns and add considerably to our store of information on ancient environments and climatic conditions. Information generated by the systematic surface surveys and subsurface testing of archaeological deposits contributes a significant element to the scientific history of California and to the history of San Luis Obispo County.

Archaeological sites also are an integral part of the modern day Native American community. Their history is contained in the sites, and most contemporary Chumash believe that cultural resources are best left in their natural state. When unavoidable adverse impacts are proposed, most Native Americans strongly support the best sensitive scientific study that will benefit their culture and the general community. Today, many Chumash people are involved in protecting their native heritage and practicing traditional beliefs in the same territory as their ancestors have for over 9,000 years.

A more complete discussion of the Obispeno Chumash may be found in the terrestrial cultural resources section of the Mitigated Negative Declaration.

Historic Setting

Historic Exploration, Settlement, and Commerce

Juan Rodriguez Cabrillo, a Portuguese pilot and navigator, commanded an expedition to explore the California coast north of Cedros Island in Baja California. With the hope of locating the fabled northwest passage, the “Strait of Annan,” and determining whether Asia could be reached by following the Pacific Coast north, he departed Navidad near Acapulco in June of 1542 in the *San Salvador* and the *Victoria* (Bancroft 1886:1). Cabrillo’s was the first European expedition to explore along the California coast. Cabrillo died during the voyage, and his remains are believed to be buried on one of the Channel Islands, possibly San Miguel Island (Moriarty and Keistman 1973; Hole and Heizer 1973). When Cabrillo died, Bartolome Ferrer assumed command of the expedition and led it as far north as the southern Oregon border.

Other explorers followed the Cabrillo expedition, including Pedro de Unameno, who opened the Acapulco-Manila trade route between the Philippines and Mexico in 1565, allowing Spain to realize Columbus' dream of a new trade route with the Indies. The Manila galleon trade lasted until 1815 (Schurz 1939). Another expedition led by

Sebastian Vizcaino in 1602 produced fairly accurate charts of the coast and harbors of southern and central California.

Sir Francis Drake, during his circumnavigation of the world by sea in 1579, is believed to have landed on the west coast of North America. Drakes Bay near Point Reyes is considered as the likely landing spot.

The development by Spain of the Manila galleons in 1565, which transported Chinese porcelain, silk, ivory, spices, and other exotic goods from Asia to Spanish settlements in Mexico, resulted in the inclusion of the West Coast into global trade (BOEM 2013:188). The Manila galleons sailed annually from the Philippines bound for Acapulco. The sailing masters steered the galleons as near to 30 degrees north latitude as possible, often needing to travel farther north to find favorable winds. After the long trip across the Pacific, the ships turned south upon seeing the first indications of land and thus avoiding the uncharted hazards of the California coast (MMS 1987). If all went well, the first land seen by the sailors would be the tip of the Baja peninsula. The ship then sailed to Acapulco. Many galleons never made it to safe harbor in Acapulco. Some of these included the *Capitana* (unknown location, circa 1600); *Nuestro de Senora Aguda* (Catalina Island, circa 1641); and *Francisco Xavier* (Columbia River, Oregon, circa 1707). Galleons also fell prey to pirates such as the *Sir Francis Drake* and *Thomas Cavendish* (Santa Ana, off the tip of Baja, 1587), and *George Compton* (San Sebastian, aground on Catalina Island, 1754) (Schurz 1939; Bancroft 1886; Meighan and Heizer 1952).

When Spain finally colonized California, all Spanish ships sailing along the California coast, including the Manila galleons, were required to stop at Monterey. Schurz (1939) states that more than 30 Manila galleons were lost over the 250 years of trade. A few were wrecked on the westward passage, and others shortly after leaving Manila. At least a dozen galleons remain unaccounted for.

Spanish (1769–1818) and Mexican Colonial Period (1818–1848)

The years of the Spanish-Mexican dominance in California saw increasing numbers of vessels arriving on the California coast. These engaged in the sea otter fur trade, smuggling, and legal trade of China's goods in exchange for California’s abundant hides and tallow from the vast herds of cattle kept at various private ranchos (Ogden 1923, 1941).

In 1812, the Russian-American Fur Company was established near Fort Ross and flourished for 20 years (MMS 1990:98). The sea otter trade, existing roughly from 1784 to 1848 although declining markedly after 1830, and the hide and tallow trade of the 1830s and 1840s were the major international commercial activities that brought ships to California until the Gold Rush of 1849. Although certain Spanish and later Mexican citizens were authorized to conduct business on behalf of the government, most commerce consisted of smuggling by Yankee ships from East Coast ports. Spanish and later Mexican authorities made trading, except through specified ports, either outright illegal or imposed exceedingly high tariffs to protect their economic interests.

To the inhabitants of colonial locations like California, participating in these smuggling ventures was the only way to acquire some common conveniences and luxury goods. Smugglers in the otter trade would buy as many skins as possible in California and then sail to China and trade them for goods that brought high prices in New England or Europe. Otter furs initially were supplied by Native Americans working for the missions. Later, Aleut Islanders from Alaska working for the Russians competed for this lucrative trade.

The hide and tallow trade consisted of buying cattle hides from the ranchos in California and shipping them to New England's expanding industrial base for the production of leather goods for domestic use and export. Most of the hide and tallow trade took place in southern California. The Mexican-American War of 1846 and the Gold Rush of 1849 permanently changed the character of California shipping (MMS 1987:82). Clipper ships and side-wheel steamers soon eclipsed the outdated sailing brigs, and what had in Hispanic times been a sparsely populated coast with a livestock-raising economic base supplemented by some fur trading was transformed into a thriving, densely populated, American state with a diverse economy.

American Period (after 1848)

With the discovery of gold in California in 1848, the primacy of San Francisco as the principal port on the West Coast was confirmed, as thousands of vessels made their way to San Francisco as part of the Gold Rush. The Pacific depended on ships bringing raw and manufactured goods, immigrants, and capital until the completion of the transcontinental railroad in 1869 offered an alternative method of transportation for commerce (Delgado 1990:8). California waters soon were alive with clipper ships and side-wheel steamers. Lumber, bricks, food, machinery, and labor were provided by vessels because San Francisco and the rest of California had only scarce agricultural and industrial output. Soon, however, reciprocal trade burgeoned with the establishment of lumber mills, farms, factories, and ranches.

Schooners were developed as vessels used for short hauls that could maneuver in the close quarters required at smaller landings. Generally having two masts, schooners were faster, easier to handle, needed smaller crews, could be made of wood, and were less expensive to operate than other sailing ships (Lindstrom 2013). The schooners were shorter, wider, had shallower hull depths (draft), and generally weighed less than 200 tons. Lindstrom (2013) indicates that, from 1860 to 1884, about 70 percent of vessels built were sail-powered only; and after 1884, most vessels had steam engines or were converted to steam power. Steam allowed the boats to travel even without wind and allowed vessels to move up rivers. In addition, steam schooners still had sails in case the engine or boiler failed. As can be attested to by the number of shipwrecks reported in the study area, loss of vessels through stranding, grounding, or other damage was common. Steam schooners became prevalent by 1897. Far fewer losses of steam-powered schooners are listed than the earlier schooners.

Coastal trade in California continued to grow with the expansion of mining, agriculture, fishing, and manufacturing. California's flourishing economy, coupled with the natural physical barrier of the mountains of the Sierra Nevada to terrestrial commerce, resulted in coastal growth at an unparalleled rate (Caughey 1970 in MMS 1987:82). Rapid industrial growth and the advent of rapid technological development in the shipping industry in the latter half of the 19th century resulted in increasingly larger wood, iron, and steel ships. Southbound sidewheel steamers carried gold shipments from the gold fields.

Spanish ships bringing grain from Chile were common during the last half of the 19th century. In the last quarter of the 19th century, lumber schooners were bringing lumber and railroad ties from the north, while huge British iron barks were bringing rails and heavy machinery round the horn (Caughey 1970 in MMS 1987:82).

With the development of agriculture in California, barks could carry grain out instead of sailing "in ballast" (without any cargo). Steamships and schooners were being built on the West Coast, and steel-hulled ships were being built on the East Coast and elsewhere. The increasing need for coal brought in British ships from Newcastle, which later were used along with San Francisco ferryboats as fishing barges up and down the coast. Other ships were converted into cargo barges for use in the coastal trade. A large percentage of these ships sank along the California coast and constitute a significant element of the cultural resources that may be found in the study area. From the latter quarter of the 19th century, the Japanese dominated the California fishing industry with vessels of traditional Japanese design. During the first quarter of the 20th century, the Japanese fishing communities gradually were supplanted by Portuguese and Italian fishermen and finally were displaced altogether when World War II brought about Japanese-American relocation (BLM 1979:IV–115).

Coastal growth resulted in ships of all kinds from all over the world bringing in a variety of goods and distributing California products to ports worldwide (MMS 1987:82). The latter half of the 19th century saw rapid industrial growth and the advent of rapid technological development within the shipping industry. By the end of the 19th century, steamships were replacing sailing vessels as the primary mode of transportation, and the Pacific Coast of the United States became prominent in shipbuilding. By World War I, the diesel engine and the oil-burning steam turbine had replaced sail for all but bulk cargoes. As steam replaced sail, the internal combustion engine became popular. California became the American gateway to the Pacific world; and virtually every type of ship, large and small, was seen in California waters.

The U.S. Navy fleet pertains to all vessels built for or used by the U.S. Navy during World War I or World War II that were decommissioned and converted for pleasure, fishing, transport, survey, or other uses that were lost offshore of northern California. While not apparent by their use at their time of loss, some may have battle stars or other historic associations that may require further research to determine their significance and eligibility for listing in the NRHP. Vessels built or commissioned by the U.S. Navy have not been identified by current research in the study area.

Historic Sea Routes and Shipwreck Distribution

Coastal and overseas routes in use north of Point Conception originally followed the southbound longshore California current, the North Pacific current (sometimes called the North Pacific Drift, a slow warm water current that flows west to east between 30 and 50 degrees of latitude), and the Japanese west- to east-flowing Kuroshio or Japanese current. While traversing coastal waters without stops, motorized ship traffic travels within the established shipping lanes. Sailing vessels, however, must constantly tack and jibe in order to make headway up the coast because of the prevailing northwesterly wind pattern. Sailing ships running down the coast usually will not tack or jibe because they are running before the wind. These routes are compiled from descriptions in the historic record and idealized depictions taken from route charts published by various shipping lines (MMS 1987:85).

Numerous vessels have been reported lost in the study region. A large number of vessels whose coordinates remain unknown were lost en route along the California coast. BOEM generally has confined archaeological search to the areas considered most sensitive (i.e., waters less than or equal to 120 meters deep (394 feet, 66 fathoms) and areas of potentially high shipwreck density as determined by historical data. The planned cable routes cross through these documented areas that are sensitive for the occurrence of shipwrecks and known historic shipping lanes. Although most shipwrecks in the study are may be anticipated to be located nearshore, any of these vessels may be located within or near the deeper water portion of the study area. The distribution of shipwrecks is influenced by environmental factors (e.g., wind; current; weather; and nearshore hazards such as sandbars, rocks and reef areas), it is influenced even more by vessel traffic patterns.

Branching of shipping lanes to reach local ports varies with the point of origin, destination and the direction and force of winds that changes with the seasons. In addition ships often take shortcuts to reduce running time outside of the established shipping lanes. Although historic shipping lanes can be plotted, they are not always adhered to, and vessel losses may occur within the lanes or shoreward. The density of losses increases with the occurrence of natural hazards such as rocky shoals, headlands, reefs, as well as in the vicinity of ports-of-call.

Coastal and overseas routes in the Santa Maria Basin were established by the Spanish (MMS 1987:84). While motorized vessels can readily maintain travel within these shipping lanes, sailing vessels must constantly tack and jib in order to make headway of the coast due to prevailing northwesterly wind patterns. Sailing ships running down coast usually don't have to tack and jib because they running before the wind (MMS 1987:84). The sea lanes established historically are still in use today and appear on modern navigational charts. Transit to local ports branch off from the established sea lanes that increases traffic and collisions as does seasonal fog of varying densities.

The nine Manila galleons reported lost offshore of the California coast could be located anywhere in the Pacific; however, given the southerly destination of Mexican ports and probable use of the North Pacific current, they may be encountered within the proposed cable routes in the study area.

Marine Cultural Resources

As noted earlier, three broad categories of marine cultural resources are considered in this report, all of which currently are submerged and may be encountered during the marine installation of the Project: (1) historic period shipwrecks and unidentified debris; (2) prehistoric period watercraft; and (3) prehistoric archaeological resources, both *in situ* site deposits and isolated artifacts. No downed aircraft are listed in the California State Lands Commission (CSLC) or BOEM databases for the study area (Figure 1).

Historic Period Shipwrecks and Unidentified Debris

Historic period shipwrecks consist of the remains of watercraft that were used as early as the 16th century in the study area to traverse Pacific waters and unidentified debris. While the majority of shipwrecks reported in the study area occurred near natural hazards (e.g., rocky shoals, headlands, and reefs; and in the vicinity of coves, historic landings, anchorages, wharves, and lighthouses) or other ports of call, they also may have occurred in deeper waters such as those associated with historically established shipping lanes. Ports of call are accessed from the coastal shipping lane.

These historic watercraft most often came to rest on the ocean floor due to numerous causes such as equipment failure, inclement weather, and associated marine casualties such as capsizing, foundering, stranding, explosion, fire, and collision during their travels on the Pacific Ocean. They also may be present due to purposeful scuttling. Their *in-situ* remains may be partially or wholly obscured by sediments and in rocky strata along the ocean floor in the study area.

As noted earlier, debris may include flotsam, jetsam, and items deposited on the seafloor through salvage of vessels or their cargoes and past economic activities such as fishing or marine exploration.

Prehistoric Period Watercraft

The historic and prehistoric period watercraft came to rest after they were abandoned during travel across bodies of water, and they currently may be partially or wholly obscured by sediments of the ocean floor.

Native Americans used watercraft during their approximately 13,000 years of navigation through the study area for transportation and for fishing and hunting offshore for otters, seals, and sea lions. Three different kinds of watercraft were used: (1) the tule balsa canoe (*tomol 'ishtapan*) was used on both the esteros and the ocean; (2) dug-out canoes (*'ah̲ipe'nesh*) hewn from a single log of willow, cottonwood, or poplar, were used on the esteros or in the smooth waters of a cove; and (3) the plank canoe (*tomol*) made largely from driftwood was used on the ocean (Hudson et al. 1987:27–36). The *tomol* was less common in San Luis Obispo County than in Santa Barbara County although its use in Cayucas to the north has been cited (Hudson et al. 1978:36).

It is known that some native vessels may have been inundated, stranded, or capsized in the esteros and ocean. Given the fragile nature of these craft, in terms of construction methods and perishable materials, it is unlikely that evidence of such vessels would be preserved in the nearshore environment.

Prehistoric Archaeological Resources

The prehistoric period archaeological sites and isolated artifacts were deposited during occupation of what is now ocean floor, but what was dry land at the time of their deposition. These sites and isolated artifacts may be buried at varying depths depending on their age and the depositional history of the location in which each is found.

Prehistoric archaeological resources include places that Native Americans lived; performed activities; altered the environment; and created material culture such as tools, art, and subsistence remains prior to contact with Europeans. Additionally, they may contain human remains in the form of burials, cairns, or cremations. Although originally deposited on a non-marine landscape, changes in sea level have resulted in such resources currently being submerged. Such sites may date from the terminus of the Pleistocene through Holocene periods.

Such sites may be situated on relict submerged landforms either mantled with unconsolidated sediments or exposed on bedrock outcrops. Underwater prehistoric sites also may represent remains deposited subsequent to the Holocene Transgression that are situated on the seafloor or within unconsolidated recent sediments. The latter remains primarily are isolated artifacts deposited as a result of random loss (e. g., cliff erosion, fishing, and ceremonial activities).

Preservation of intact prehistoric resources along the California coast is considered unlikely due to the high energy nature of the shoreline environment. Preservation of such submerged sites may potentially occur, however, in association with protected environments (i.e., buried under alluvium or estuary silt, mud. or peat prior to inundation; or where the erosive force of the sea may have been lessened by an intervening landform such as reefs or rocky headlands). Although the former conditions occur in the study area, to date no i*n-situ* remains of intact prehistoric habitation sites have been reported in or near the study area. The probability of submerged prehistoric sites occurring in the study area, except where burial under deltaic sediments or within esteros has produced a more protective environment, therefore, is considered low.

There is a somewhat greater probability for the occurrence of isolated bottom-founded artifacts in the study area. Isolated artifacts have been documented in depths of less than I00 feet (30 meters) in the western Santa Barbara Channel and southward to San Diego (Hudson 1976). The closest artifact location to the study area is reported at Avila Beach (Port San Luis), south of the study area.

Local Maritime History

City of Grover Beach–Pismo Beach

The City of Grover Beach is a coastal city in San Luis Obispo County. The city's western boundary is Pismo Beach State Park and the Pacific Ocean, and its northern boundary is Pismo Beach with Highway 1 running parallel.

The area was claimed by Jose Ortega, who had a Mexican land grant in 1842. The 8,838-acre Ortega Land Grant was claimed by Isaac Sparks in 1867. Sparks named the area El Pizmo Rancho. *Pizmo* is the Chumash word for tar, which was gathered from tar springs in Price Canyon near Pismo Beach. The Pismo clam was named for the long, wide beach where they were once found in numerous quantities.

Sparks sold half of the acreage to John Michael Price, the founder of Pismo Beach in 1887. Price sold 1,149.11 acres of the Pismo rancho to D. W. Grover, a lumberman from Santa Cruz, and his associate George Gates for $22,982.20 in gold. They named the area the Town of Grover and Hunting Beach, hoping that the Southern Pacific Railroad would extend its range from where it ended at San Miguel past the town of Grover.

D .W. Grover laid out streets in a grid pattern, naming them for popular beaches of the time, with land set aside for a train depot, a hotel and a city park hoping to foster commercial growth (www.grover.or/index.aspx?NID-121). Grand Avenue was laid out at that time to stretch from Arroyo Grande to the Pacific seashore.

Grover hired the Carnall-Hopins Company of San Francisco to take care of land sales in an auction in August 1887. D. W. Grover and two of his friends registered the paperwork for their land endeavor corporation, calling it the Southern Land and Colonization Company of San Luis Obispo, California. Although D. W. Grover tried to make Grover City a train depot in the 1890s, the Southern Pacific Railroad decided to construct their depot in the unincorporated town of Oceano. The town of Grover became a city in 1959. It became Grover Beach in 1992.

While there are no indications in the literature that Grover Beach had any major maritime interests, the need for a shipping wharf other than John Hartford's at Port San Luis was recognized. In 1881, a wharf was built by the Merherin Brothers at Pismo Beach for shipping crops and asphaltum by boat. The ocean end of the 1,400-foot-long wharf stood in 18 feet of water at low tide, which allowed access for boats shipping goods to and from San Francisco.

The wharf created competition for shipping with the Pacific Coast Steamship Company. With completion of the Pacific Coast Railway to Arroyo Grande in 1882, the wharf served to create a rate war with the Pacific Coast Steamship Company. Despite damage to the pier in 1884 by a storm that washed out 250 feet of the wharf and a fire in 1885, Price subdivided his Rancho El Pismo adjacent to the wharf in 1887; and a townsite map was filed under the name of Town of El Pismo.

The creation of an economically successful wharf near Grover Beach increases the potential of the study area for the occurrence of shipwrecks and debris offshore.

Impact Analysis

The impact analysis for marine cultural resources discusses methods and significance thresholds, and identifies impacts and mitigation measures.

Methods

Research methods were limited to an archival and records search to inventory marine cultural resources. All marine cultural resources cited consisted of shipwrecks. No downed aircraft or prehistoric archaeological sites and isolated artifacts were listed. The inventory completed for the study area covers the four potential routes plus a 10-nm buffer. No remote sensing survey of the ocean floor for shipwrecks and other debris or predictive modeling for prehistoric archaeological resources has yet been completed for the marine portion of the study area. Sources consulted included cultural resource inventories (shipwreck and downed aircraft listings) provided by the CSLC, BOEM Pacific OCS Region (BOEM 2013; BLM 1979 [Stickel & Marshack]), the Minerals Management Service (MMS 1990 [Gearhart et al.]), and the National Oceanic and Atmospheric Administration (NOAA) Automated Wreck and Obstruction Information System (AWOIS) database (1988). The NRHP, California Historical Landmarks, California Inventory of Historical Resources, and local archives also were consulted.

Other sources consulted include the U.S. Army Corps of Engineers, Los Angeles and San Francisco Districts; National Maritime Museum in San Francisco; Los Angeles Maritime Museum; Commerce Department files at the National Archives in Washington D.C. and San Bruno; Regional Records Centers at Laguna Nigel and San Bruno; The Huntington Library in San Marino; the published volumes of Lloyds of London Ships Registry 1850–1980 and 1885–1950; the U.S. Department of Commerce Merchant Vessels of the United States 1867–1933; the U.S. Coast Guard Merchant Vessels of the United States 1933–1982 and U.S. Coast Guard Supplements 1982–1988 located at the University of California Library at the University of California at Santa Barbara and Long Beach Library; and at the State Library and State Archives and Records Office.

Results

Submerged Prehistoric Resources (Offshore)

The records search yielded no maritime finds of prehistoric origin within the study area for the proposed cable routes. All known underwater prehistoric resources on file appear to be located in Oregon and southern California waters. It should be recognized, however, that the potential exists for remains of prehistoric and historic sites, artifacts, and Native American water craft to be present offshore, although there is a lower potential for their preservation *in-situ*.

Submerged Historic Resources (Offshore)

Submerged historic cultural resources include historic period shipwrecks and debris. No evidence of downed aircraft was found in the archival search for the study area.

The locations of historic period shipwrecks are characterized by inaccuracies in reported location. Many, if not most, vessels reported as lost in the study area have not been accurately located or assessed for their eligibility for listing in the CRHR. Therefore, the potential for the Project to affect these shipwrecks cannot be accurately assessed. However, given the large number of shipwrecks reported within or near the study area, it is likely that one or more may be found by site-specific remote sensing surveys for each of the four routes.

The 10-nm buffer included in the study area records search reflects the most conservative interpretation of the potential accuracy of a shipwreck's location reported

(Figure 1). The CSLC, BOEM, NOAA AWOIS, and in-house shipwreck databases were checked for listings within the study area.

Although the majority of shipwrecks of known approximate location (i.e., accurate from within 1 to 10 miles) are situated close to shore, numerous shipwrecks are reported that may fall within or near the cable routes as they pass through offshore waters to the 3-nm State limit and beyond to U.S. territorial waters. In order to further verify locations of the vessels reported lost within the study area, original sources were reviewed and information such as "at", "near", and "off" a land reference that had been removed from State Lands shipwreck listings were added back into the data..

Shipwrecks tend to concentrate along approaches to historic harbors and landings. Shipwrecks also are concentrated along the shoreline, especially along treacherous points of land because of dense fog or other sea conditions. These factors indicate that the highest density of shipwrecks are expected to occur close to shore, given the number of anchorage, wharves and landings in the study area. Shipwrecks also may occur anywhere within State waters and high priority should be given to collecting additional side-scan sonar and magnetometer data from Project routes in this area.

Fewer shipwrecks may be expected to occur in extremely deep waters outside of the normal lanes of traffic. Shipwrecks in deep water generally are thought to be the result of marine casualties but also may include those abandoned due to purposeful scuttling. One or more shipwrecks may be documented by site-specific remote sensing surveys using both side-scan sonar and magnetometer. The presence or absence of the older, more fragile shipwreck localities can be determined only by magnetometer survey. Without magnetometer survey, such resources may go undetected and may be disturbed, damaged, or destroyed during the pre-lay grapnel run or during cable installation and burial. In the case of historic wooden shipwrecks, disturbance of any portion of the shipwreck or overlying substrate would facilitate a more rapid decomposition through physical, chemical, and biological processes and a loss of information on a site or sites significant in the history of California.

Shipwrecks were mapped in relation to the cable routes based on their reported coordinates or other relevant information. Centered on the Grover Beach cable origin, the study area includes the waters offshore of Cambira, Cayucas State Beach, Morro Beach Strand, Atascadero Beach, Morro Bay, Spooners Cave, Montaña del Ora State Park, Point Buchon, Diablo Canyon/Pecho, Point San Luis, Port of San Luis and Avila Beach in San Luis Obispo Bay, Shell Beach, Pismo Beach, Grover City, Oceano, Santa Maria, Mussel Point, and Point Sal. The limits of the study area are shown in Figure 1. Roughly plotted, the study area includes all shipwrecks reported lost between 34º 42' to 35º 36' north latitude and -120º 48' to -122º 05 west longitude. Sixty-seven shipwrecks have been reported lost within the study area (Table 1 [at the end of the report]). In addition to these shipwrecks, 24 shipwrecks are reported as off the California coast, California coast, and Pacific Ocean (Table 2 [at the end of the report]). Any of these shipwrecks could occur within the study area.

Of the 68 shipwrecks reported lost in the study area, the most likely to occur in the fiber optic cable corridors generally are thought to be those shipwrecks reported lost offshore rather than “at” a specific geographic location. However, mariners view “at” from a different perspective. While researching shipwreck data for this report, we found that mariners may define “at” as within visual range of a specific geographic location from a location offshore unless other information is available. For example, if the combined vessel’s and observer’s height above sea level is 15 to 25 feet, a distance of 4.5 to 5.9 nm (8.3 to 10.9 km) is visible, assuming clear weather and a calm sea. Shipwrecks, therefore, cannot be excluded from consideration simply based on the location reported as “at” a specific location unless the coordinates have been accurately recorded.

Nine of the reported shipwrecks (*Annie Lysle*, *Challenge*, *Electra*, *Lena*, *Little Dipper*, *Golden Gate*, *Otsego*, an unknown schooner, and an unknown metal hulk) are reported as grounded on rocks or ashorem and are considered unlikely to occur within the planned cable routes except where their estimated coordinates place them at or near the location of cable origin.

One shipwreck, an unnamed wooden Chinese boat that capsized in a squall in 1866 off the coast of San Luis Obispo, has been evaluated as significant (MMS 1987, 1990). Nine shipwrecks (*Annie Lysle*, *Challenge*, *Elg*, *Golden Gate*, *La Cresenta* [*La Cresentia*], *Lena Otsego*, *ROANOKE*, *Santa Cruz*, and *Svea*) including five of those mentioned above, have been evaluated as moderately significant (MMS 1987, 1990). Of these vessels, the *Challenge*, *Golden Gate*, *Lena*, and *Otsego* were subjected to salvage. Salvage usually indicates that the vessel was accessible from shore, grounded on rocks or sand bars, or kept afloat after wrecking. Only one vessel, the *Otsego*, is listed as removed or refloated. None of these vessels have been accurately located (MMS 1987, 1990).

Sixteen shipwrecks have been evaluated as insignificant (*Bridget II*, *Cibola Negra*, *D. M. Renton*, *Donnie Boy*, *Hattie H*., *Jan Lin*, *Liberty*, *Louisa*, *Mello Boy*, *Miss Judy*, *Petrina*, *Santa Lucia*, *Snagerak*, an unknown metal hulk, an unknown pilot boat, and the *Whale*—a former American barkentine converted to a barge (MMS 1987, 1990; Macfarlane N.D.). Two of these vessels have been accurately located (*Patrina* and *Louisa*).

The remaining shipwrecks have never been evaluated, although two (an unknown wreck and the *Vienni Su*) have been accurately located.

The vessels reported lost were found to range in size from 10 to 370 tons, with one additional vessel, a steamship of 2,354 tons. Nineteen shipwrecks had no recorded tonnage. Nine shipwrecks were reported as grounded, on the rocks, or ashore and thus may be excluded from the analysis. One of the vessels lost in the study area is reported as having been removed or refloated. Four of the vessels lost in the study area are reported to have been salvaged, including the vessel reported as removed or refloated. Their coordinates remain in the shipwreck table because cargo or associated machinery may still remain at the loss location. One vessel, an American barkentine of wood construction named *Whale*, was converted to a wood barge prior to its loss.

Eighteen of the 40 shipwrecks were built during World War II. Many small vessels built during World War II were repurposed as pleasure and work boats in the years following the war. Should any of these small vessels be found during any of the marine archaeological surveys recommended herein, they would need to be identified and researched as to whether they were used in the war effort and whether they were issued battle stars. Historically, during World War II and the Korean War, commendations called “battle stars” were issued to U.S. Navy warships for meritorious participation in battle, or for having suffered damage during battle conditions. This information can be found on file at the Maritime Museum in San Francisco and the National Archives and Records Administration at San Francisco and Washington D.C.

The distribution of the types of vessels identified in the study area and their range of built and loss dates is presented in Table 3. The distribution of the types of vessels identified off the California coast and their range of built and loss dates is presented in Table 4.

Table 3. Distribution of Shipwrecks in the Study Area by Rig/Service and Built and Lost Dates

Rig/Service	Number	Built	Lost
American barkentine (wood barge conversion)	1	1925	1925
American steamship (wood), steam screw	1	1906	1922
Chinese boat (wood)	1	Unknown	1866
Gas screw	8	1908–1945	1921–1962
Lighter	1	Unknown	1872
Schooner, lumber	2	1864	1894
Oil screw	38	1912–1972	1936–1977
Unknown, metal hulk of ship	1	Unknown	1850’s
Unknown, pilot boat	1	Unknown	1877

Table 4. Distribution of Shipwrecks off the California Coast by Rig/Service and Built and Lost Dates

Rig/Service	Number	Built	Lost
Barque	2	1874–1902	1896–1925
Clipper	1	1870	1881
Schooner	2	1892	1878–1908
Schooner, steam screw	1	1906	Unknown
Steam screw	1	Unknown	1922
Oil screw	7	1912–1974	1960–1974
Unknown	9	Unknown	1826–1955

Additional research for subsequent remote sensing surveys may provide additional information on the accuracy of the coordinates recorded. The following describes the shipwrecks anticipated to occur within the maximum 10-nm radius of the proposed routes. The MMS (1987, 1990) databases discuss eligibility for listing in the CRHR only in terms of historical significance. Unfortunately, these three levels of significance, insignificant (not eligible for listing in the NRHP), moderate (potentially eligible for listing in the NRHP), and significant (eligible for listing in the NRHP), were not assigned to CSLC or BOEM listings available for the study area.

For the purposes of this environmental document, any property listed in the NRHP also is considered eligible for listing in the CRHR. None of the shipwrecks listed in CSLC or BOEM databases and in the study area has been evaluated for NRHP eligibility.

Summary

In summary, numerous shipwrecks and maritime shoreline resources consisting of historic wharves, landings, coves and anchorages, and historic ports of call are located in the study area between Point Sal in the south and Cayucos in the north. Maritime sites significant to the study area include historic Port Harford (now seen as Port San Luis and Avila Beach), the historic piers at Pismo Beach built by the Meherin Brothers in 1870, the Williams and Riley Pier built in 1870 at Morro Bay, and the Cayucos Pier built by Captain James Cass in 1872. In the era before wharves were built, vessels would anchor offshore along beaches and at river mouths, and lighter in their cargoes and passengers ashore in isolated cow counties such as San Luis Obispo (Patton 1989; Middlecamp 2013).

Although use of the cable landing site at Grover Beach as an historic landing is not documented in the literature, such usage cannot be discounted prior to the 1870s. Major coastal traffic has been documented between the Pismo Beach Pier, Port Harford/Avila Beach, Morro Bay, and Cayucas, which would have brought vessel traffic to the Project vicinity and increases the potential for shipwrecks and other debris to occur offshore the cable landing and corridor locations.

The references consulted as part of the records search for submerged historic period cultural resources provided information on the locations of shipwrecks, unknown wreckage, and debris. As noted earlier, the causes of vessel losses include marine casualties due to equipment failure, inclement weather, fire, explosion, collision, capsizing, wrecking, stranding, and foundering. Stranding generally occurs when a vessel runs aground, becomes caught on a sandbar or reef, is becalmed, runs out of fuel, or has engine trouble—although this term is often misused by mariners to indicate trouble with the engine or ship machinery, rather than with the vessel itself. Vessels that foundered are those that took on water and sank below the surface of the water.

A total of 68 shipwrecks and unknown wreckage or debris locations have been reported in the study area between the 1850s and 1977. All resources that could be placed to within 10 nm of each of the proposed cable routes have been included for consideration and are listed in Table 1 (at the end of the report). An additional 24 shipwrecks are listed as California coast, off the California coast, and the Pacific Ocean.

The accuracy of the coordinates provided for the shipwrecks varies. Neither the accuracy of location nor the significance of the vessels listed by the CSLC database and MMS 1990 or BOEM 2013 have been evaluated. Many of the resources listed contain information that, regardless of the documented coordinates, place the vessels north of the southern most route. This information can neither be verified nor denied based on the information available. Considerably more research will need to be conducted as part of the remote sensing surveys to validate the locations cited. Many shipwreck locations may never be found based on the inaccuracy of coordinates sited or their degraded conditions on or within the ocean sediments.

With additional information, several more shipwrecks could be eliminated from the numbers cited above. Without confirmation of the accuracy of the coordinates cited, they cannot be completely eliminated.

Eligibility for Listing in the California Register of Historical Resources

With reference to their potential eligibility for listing in the NRHP and, by extension, the CRHR, the MMS 1990 reference uses the terms "significant," "probably significant," and "not significant." Alternative terminology, used by the BOEM 2013 reference, includes "probably eligible," "may be eligible," and "not eligible" for inclusion in the NRHP. Unless the resource has been evaluated according to the criteria established for inclusion in the NRHP, these statements of significance and eligibility remain informal suggestions. Based on previous evaluations, all those shipwrecks with a loss of life are generally evaluated as significant. Significance also may be accrued based on the importance of the ship's designer or builder, materials, type of engine or other equipment, association with an early built date, or date of loss. Eleven of the reported shipwrecks have the potential to be eligible for inclusion in the NRHP.

One shipwreck is evaluated as significant (MMS 1987, 1990) and eligible for inclusion in the NRHP:

- Unnamed wooden Chinese boat reported to have capsized in a squall in 1866 off the coast of San Luis Obispo.

Ten shipwrecks are evaluated as moderately significant (MMS 1987, 1990) and may be eligible for inclusion in the NRHP:

- *Annie Lysle*, a 13-ton schooner built in 1875 was reported to have foundered and gone ashore in the same year.
- *Challenge*, a three-masted schooner was lost in 1877 at Morro Bay. The vessel is listed as salvaged.
- *Elg*, a vessel of unknown type/rigging or service, sank in 1938 at Port San Luis/Avila Beach.
- *Golden Gate*, a three-masted schooner built in 1873, parted cables and washed ashore at Morro Bay in 1873 due to lack of wind. The vessel may have gone ashore in the vicinity of the northern channel entrance.
- *La Cresenta* [*La Cresentia*], a steam-powered tanker, was reported missing off Port San Luis in 1935 enroute from Port San Luis to Osaka, Japan.
- *Lena*, a schooner built in 1866, struck rocks and sank in 1866 at Morro Bay.
- *Otsego,* a schooner built in 1872 and stranded ashore in the same year, drifted ashore after parting lines 1,000 yards south of Morro Rock while kedging (i.e., moving a boat by hauling in a hawser attached to a small anchor dropped at some distance). The vessel was reported as salvaged, removed, or refloated.
- *ROANOKE*, A 278- by 40.5-foot, 2,354-ton steel steamship with three decks and two masts, was built in 1882. The ship foundered in 1916 when its cargo shifted, and the ship turned over and sank about 15 miles west of Port Harford (Port San Luis), with 47 lives lost. Some cargo is reported to have been jettisoned.
- *Santa Cruz*, a steam-powered vessel, was wrecked in 1904 at San Luis Reef near Port San Luis.
- *Svea*, a wooden 370-ton American steamship built in 1906, was run down in 1916 by the steel vessel *NEWPORT* 6 miles off of Port San Luis.

None of these vessels have been accurately located (MMS 1987, 1990).

Of the 67 shipwrecks that may fall within the study area, only the 11 cited above are considered eligible or may be eligible for listing in the NRHP without further information. Any resource eligible for listing in the NRHP also is eligible for listing in the CRHR. Sixteen of the 67 vessels listed are considered insignificant and not eligible for listing in the NRHP. The eligibility of the remaining 40 vessels remains undetermined.

The recent (post-1950s) shipwrecks in the BOEM (2013) database have been included as a means of eliminating finds from consideration should they appear in the results of sonar, magnetometer, autonomous underwater vehicle (AUV), or multibeam surveys.

It is considered historically significant that the majority of shipwrecks listed are between 10 and 370 tons, which would have allowed them access to the available pier/wharves in the study area as well as transit from the major ports of call of Port San Luis and Morro Bay to and from San Francisco.

It should be noted that vessels built prior to 1950 should be evaluated for significance to the extent possible, but that effort is not within the range of the present scope of work. Vessels lost after 1950 with an early building date, a specific or unusual design, are associated with significant loss of life, or other historic association also may be evaluated as potentially significant (MMS 1990) and are “probably eligible for listing in the NRHP” (BOEM 2013).

Vessels used after 1950 that were built as part of the World War II effort and converted to pleasure craft, passenger transport, fishing boats, or other service craft may be considered eligible if research showed that they were used in the war effort and that they were issued battle stars.

For the most part, all vessels built after 1950 have been recommended as not eligible for listing in the NRHP (Minerals Management Service [Pierson et al.] 1987). The majority of these vessels are diesel-, gas-, or sail-powered vessels of wood, fiberglass, steel, and more rarely cement construction. As stated above, these vessels were included in the updated BOEM 2013 shipwreck database so that they could be eliminated as potential historic cultural resources during the interpretation of side scan sonar, magnetometer, automated underwater vehicle, and multibeam records. Vessels reported lost in the study area that were built between 1940 and 1945 may be associated with the war effort and may bear battle stars or have other historic associations that have not yet been evaluated.

Of the 24 shipwrecks reported without geographic location other than “California coast,” 5 are evaluated as significant (MMS 1987, 1990) and are eligible for nomination to the NRHP. They include the following:

- *Alice D. Snow*, a clipper built in 1870, was reported lost in 1881. This vessel is reported as removed or refloated.
- *Blossom*, a vessel of unknown rig or service but assumed to be a sailing ship, was reported lost in 1826.
- *Cora*, a vessel of unknown rig or service but assumed to be a sailing ship, was reported lost in 1884.
- *Ella Francis*, a vessel of unknown rig or service but assumed to be a sailing ship, was reported destroyed by a storm in 1866.
- *Forest Monarch*, a vessel of unknown rig or service but assumed to be a sailing ship, was lost in 1859.
- *Senegal*, a vessel of unknown rig or service but assumed to be a sailing ship, was lost in 1893.

Five vessels are evaluated as moderately significant (MMS 1987, 1990) and may be eligible for nomination to the NRHP. They include:

- *City of Honolulu*, a steam powered vessel lost in 1922.
- *General Hugh L. Scott*, a vessel of unknown rig or service lost in 1941.
- *Pacific*, a schooner reported abandoned in 1878.
- *Steel Chemist*, a vessel of unknown rig or service lost in 1955.
- *Ticonderoga*, a vessel of unknown rig or service lost in 1953.

None of these vessels have been accurately located.

Although not evaluated by MMS in 1987 or 1990, the following vessels were added to the list by Macfarlane (N.D.) and may be eligible for nomination to the NRHP but require additional research to support this finding. They include:

- *Amazon*, a 1,167-ton four-masted barque built in 1902 and burned at sea in 1925.
- *Discovery*, a 450-ton barque built in 1874 and lost in 1896.
- *Eclipse*, a schooner lost in 1908 at the edge of United States territorial waters.
- *The Independence*, a wood vessel of unknown rig or service that burned in 1853.

Significance Thresholds

Under CEQA, lead agencies are to protect and preserve resources with cultural, historic, scientific, or educational value. State CEQA Guidelines Section 15064.5 provides significance criteria for determining a substantial adverse change to the significance of a cultural resource. Appendix G of the State CEQA Guidelines provides additional guidance in determining a project's impact on cultural resources. The information provided in the State CEQA Guidelines has been used to develop the significance criteria for cultural resources for the proposed Project. State CEQA Guidelines also require reasonable mitigation measures for impacts on archaeological resources that result from development on public lands.

A Project activity would result in a significant impact ton a cultural resource if it would:

- Cause a substantial adverse change in the significance of a historical resource as defined in State CEQA Guidelines Section 15064.5 and PRC Section 21083.2.
- Cause a substantial adverse change in the significance of an archaeological resource pursuant to State CEQA Guidelines Section 15064.5 and PRC Section 21083.2.

Until identified cultural resources can be evaluated for their eligibility for nomination to the NRHP and California Historic Places, they must must be considered potentially significant until otherwise eliminated by additional research, avoidance, or a program of data recovery.

Impacts and Mitigation Measures

Impacts on cultural resources are classified as Class I or Class I, as follows:

Class I: Significant impact; cannot be mitigated to a level that is not significant. A Class I impact is a significant adverse effect that cannot be mitigated below a level of significance through the application of feasible mitigation measures. Class I impacts are significant and unavoidable.

Class II: Significant impact; can be mitigated to a level that is not significant. A Class II impact is a significant adverse effect that can be reduced to a less than significant level through the application of feasible mitigation measures.

Impacts

RTI proposes to install four transpacific submarine cables to land at Grover Beach. The Project will be implemented in four phases—one phase for each of the four cable systems at Grover Beach.

The marine segments of the cable systems refer to those segments between mean high water line and the outer limit of the OCS, where seawater depth is approximately 5,904 feet (1,800 meters, or 984 fathoms). They consist of the marine conduit, cables, splice boxes, and cable regenerators. Cables consist of a double-armored design, used in rocky areas or coarse substrates and where protection from fishing gear may be warranted; and a light-weight armored cable, similar to the doubled-armored cable, used where the risk of damage due to substrate conditions or fishing is reduced by burial of the cable in soft-bottom sediments using a seaplow or remotely operated vehicle (ROV). Both cables are less than 2 inches (5 centimeters) in diameter.

The following Project activities have the potential to affect submarine archaeological resources.

Marine Directional Bores. Four marine directional bores would be conducted, one for each of the cable systems, to provide a housing for the fiber-optic conduit. Each directional bore would extend approximately 1.210 meters (4,000 feet) offshore into the Pacific Ocean from the LMH to water depths of 12 meters (40 feet).

Impacts from directional bores are anticipated to result during anchoring activities. A workboat would be anchored to the seafloor via a four-point mooring, with an anchor spread of 328 feet (100 meters). A smaller secondary workboat would set and retrieve anchors. All anchors would be set and retrieved vertically to avoid dragging them across the seafloor.

Ocean Ground Beds. The OGBs would be installed onshore or offshore for each subsea fiber optic cable to ground it since electrical signals would be traveling through these fiber optic cables. Impacts are anticipated to occur during installation of the OGB

If installed onshore, the OGBs would be within approximately 100 feet of the LMH. Each OGB would consist of up to six anodes constructed of cast iron and encased in a magnesium canister 10 inches in diameter and up to 84 inches in length. The anodes would be placed in a line and spaced at 10-foot intervals. The tops of the anodes would be approximately 10 feet below grade. Ground cable would be buried approximately 6 feet below grade and lead from each OGB to the LMH. The OGBs would be located approximately 250 feet landward of the mean high-water mark.

Onshore installation involves drilling holes from the LMH down to the seawater level with a well-drilling machine and then installing the iron anodes in the drilled holes. The copper ground cable would be installed by excavation between the tops of the iron anodes to connect the tops of the anodes to one another and back to the ground cable in the LMH.

Alternatively, the OGBs would be installed in the ocean beginning at the seaward side of the landing pipes. The tubular anodes would be mixed metal oxide rods approximately 11.8 inches in diameter and approximately 4.9 feet in length. Three to five anodes would be connected together in a linear or string fashion to create an anode string assembly. Each anode on the array would be approximately 9.8 feet apart and connected by an insulated copper conductor. The MMO anode string assembly would be installed by diver jet burial in the same operation as the marine cable burial. The offshore anode array system would be placed beginning at approximately 50 feet beyond the end of each landing pipe and installed along the fiber optic cable. The fiber optic cable and the ocean anode string assembly would be tied together and buried as part of the same burial operation.

Pre-Lay Grapnel Run. Impacts may result during the pre-lay grapnel run to clear debris, such as discarded fishing gear, from the seafloor along corridors where the cables are to be buried. A grapnel, typically of the flatfish type, would be dragged along the cable routes prior to cable installation. The grapnel would be attached to a length of chain to ensure contact with the seafloor and towed by the cable ship or a workboat at a speed of about 1.2 miles per hour (about 1 knot or 1.9 km per hour). The arms of the grapnel are design to hook debris laying on the seafloor or shallowly buried to about 0.4 meter (1.3 feet). Any debris hooked would be retrieved by winch, stowed on the vessel, and subsequently be disposed of onshore.

Cable Laying and Plowing. At the end of the bore pipe, the cable would be temporarily laid directly on the seafloor to a water depth of approximately 100 meters (328 feet) until it can be post-lay buried by divers or by an ROV. Cable plowing can be used between water depths of 100 and 926 meters (328 and 3,037 feet). A cable plow is a burial tool consisting of a large sled that is deployed by the main cable ship. Divers assist with loading the cable into the plow’s articulated feed chute and burial shank. As it is towed by the ship, the plow slices a narrow furrow through ocean floor sediments about 1 meter (3.3 feet) wide and mechanically feeds and buries the cable to its desired depth. The plow, supported by two outriggers, would affect a total width of approximately 6.1 meters (20 feet). Together the weight of the soil and the sled serve to fully close and compact the furrow. The plow operates at 0.95 kilometer per hour (0.5 knot or 0.6 mile per hour).

Diver-Assisted Post-Lay Burial. This technique can be used in shallow depths between 10 and 30 meters (33 and 98 feet). Divers using hand jets open a narrow furrow beneath the cable, the cable drops into the furrow as it is opened, and disturbed sediments settle back over the cable. Depending on bottom conditions, the cable would be buried to a depth of 1.0 meter (3.3 feet) where feasible based on localized conditions. Between depths of 30 meters (98 feet) and 100 meters (328 feet), an ROV would be used to bury the cable. Sections of cable not buried would be laid temporarily on the ocean floor by the cable ship, with post-lay burial at a later date.

Remotely Operated Vehicle Post-Lay Burial. Between water depths of 30 meters (98 feet) and 100 meters (328 feet), or where the cable plow cannot achieve the targeted burial depth, an ROV would be used to bury the cable. The post-lay burial of the cable by ROV would disturb the seafloor. The ROV would loosen the seafloor sediments beneath the cable, allowing the cable to settle to the desired depth. The sediments then would settle back over the area, burying the cable. The typical width of disturbance would be 4.6 meters (15 feet). The ROV operates at an average rate of speed, about 0.12 mile per hour (about 0.1 knot or 0.19 km per hour). The ROV moves at a rate of 0.36 mile per hour but may take up to three passes to complete the burial.

Emergency cable repair, retirement, abandonment, or removal of the cable systems are likely to result in impacts similar to installation impacts. If significant impacts are identified, the types of measures proposed to mitigate installation impacts would be equally feasible to mitigate removal impacts to less than significant levels.

Impact CR-1: Project-related ground-disturbing activities have the potential to disturb or destroy previously unknown or inaccurately recorded submerged prehistoric archaeological resources or historic shipwrecks.

As identified in the construction techniques above, marine construction activities have the potential to disturb, disrupt, or degrade extant cultural resources such as inundated prehistoric sites and watercraft and historic shipwrecks on the seafloor or within seafloor sediments from the mean high water line to the outer limit of the OCS—that is, where the seawater depth is approximately 1,000 fathoms (6,000 feet or 1,830 meters). Prehistoric archaeological sites associated with buried late Pleistocene and Holocene paleo-landforms in the study area are unlikely to be disturbed during construction, operation, or repair of the four cables proposed given the anticipated depth of overlying sediments. Such resources, should they be present, would have a significant covering of marine sediments 20 to 30 meters (66 to 98 feet) thick. Subsurface disturbance of a potentially significant or significant shipwreck may result from anchoring activities associated with directional boring through nearshore sediments from the LMH to water depths of 9.2 meters (30 feet); from diver-assisted burial at water depths of 12 to 300 meters (49 to 98 feet); from cable plow, diver ,or ROV-assisted post-lay burial in water depths of 30 to 1,200 meters (98 to 3,937 feet); and from direct surface lay in water depths greater than 1,200 meters (3,937 feet).

In addition, although cable-laying and support vessels would be dynamically positioned rather than requiring anchoring or anchor mooring systems at locations along the proposed cable routes, anchoring may be anticipated to occur for a variety of reasons such as bad weather, repair, or other problems. These unanticipated anchoring activities also have the potential to disturb, disrupt, or degrade extant cultural resources.

Mitigation Measures CR-1a, CR-1b, and CR-c would reduce impacts to a less than significant level (Class II) by requiring identification and avoidance of any potentially significant resources by rerouting the cable.

Mitigation Measures

CR-1a. Conduct a Pre-Construction Offshore Archaeological Resources Survey. Using the results of an acoustic survey (e.g., a CHIRP System survey) for evidence of erosion/incision of natural channels, the nature of internal channel-fill reflectors, and the overall geometry of the seabed, paleochannels and the surrounding areas will be analyzed for their potential to contain intact remains of the past landscape with the potential to contain prehistoric archaeological deposits (e.g., Schmidt et al. 2014). The analysis will include core sampling in various areas, including but not limited to, paleochannels to verify the seismic data analysis. Based on the CHIRP and coring data, a Marine Archaeological Resources Assessment Report shall be produced by a qualified maritime archaeologist and reviewed by the California Coastal Commission or the State Historic Preservation Officer to document effects on potentially historic properties.

CR-1b. Conduct a Pre-Construction Offshore Historic Shipwreck Survey. A qualified maritime archaeologist, in consultation with the lead agency, shall conduct an archaeological survey of the proposed cable routes. The archaeological survey and analysis shall be conducted following CSLC, BOEM, and U.S. Army Corps of Engineers (San Francisco and Sacramento Districts) standard specifications for underwater/ marine remote sensing archaeological surveys (Guidelines for Providing Geological and Geophysical, Hazards, and Archaeological Information pursuant to 30 Code of Federal Regulations Part 585).

The archaeological analysis shall identify and analyze all magnetic and side scan sonar anomalies that occur in each cable corridor, defined by a lateral distance of 0.5 km on each side of the proposed cable route. This analysis shall not be limited to side scan and magnetometer data and may include shallow acoustic (subbottom) data as well as AUV and multibeam data that may have a bearing on identification of anomalies representative of potential historic properties. The analysis shall include evaluation to the extent possible of the potential significance of each anomaly that cannot be avoided within the cable corridor. If sufficient data are not available to identify the anomaly and make a recommendation of potential significance, the resource(s) shall be considered as potentially eligible for listing in the NRHP and CRHR and treated as a historic property. If any cultural resources are discovered as the result of the marine remote sensing archaeological survey, the proposed cable route or installation procedures shall be modified to avoid the potentially historic property. BOEM administratively treats identified submerged potentially historic properties as eligible for inclusion in the NRHP under Criterion D, and requires project proponents to avoid them unless the proponent chooses to conduct additional investigations to confirm or refute their qualifying characteristics. BOEM typically determines a buffer (e.g., 50 meters) from the center point of any given find beyond which the project must be moved, in order to ensure that adverse effects on the potential historic property will be avoided during construction.

CR-1c. Prepare a Cultural Resources Avoidance Plan. Pursuant to Sections 30106 and 30115 of the Coastal Act of 1976, “where developments would adversely impact archaeological…resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required” (PRC Section 30244). An avoidance plan, therefore, shall be developed and implemented to avoid all documented resources from the Marine Archaeological Resources Assessment Report and the Offshore Historic Shipwreck Survey Report, provide for addressing discoveries of as yet unidentified resources encountered during planned marine survey and construction, and provide mitigation monitoring if deemed necessary during construction to ensure compliance.

Cumulative Effects

Introduction

Cumulative impacts on cultural resources take into account the impacts of the project in combination with those of other past, present, and reasonably foreseeable projects. The geographic extent of cumulative analysis for cultural resources encompasses a large region due to the interrelated nature of the region's prehistoric, historic, and ethnographic resources. The geographic region for the analysis of cumulative impacts for submerged cultural resources includes the offshore submerged lands beneath the Santa Maria Basin. For purposes of this cumulative analysis, impacts on cultural resources could result at any time throughout the life of the project but are most likely to occur during ground-disturbing activities associated with construction.

This report provides a historical background for the study area and describes the inventory of known cultural resources in the area. The types of resources that are found in the study area are similar to those found within the broader geographic region considered for the cumulative analysis.

The condition of these cultural resources varies considerably, and depends on the types and extent of human and natural factors that may have affected the integrity of individual resources or group of resources. Construction activities offshore can destabilize sediments, thereby increasing erosion at archaeological sites. Many shipwrecks in the offshore environment are buried or partially buried in sediments. The portions of the vessel under sediments are protected from sediment shifting, active biological predation, and chemical processes that degrade exposed portions of the shipwreck. Exposure of even a small portion of a shipwreck to aerobic seafloor conditions can very quickly degrade wood-hulled shipwrecks such as those prevalent in the study area.

Project Contribution to Cumulative Impacts

Direct impacts on marine cultural resources may be avoided through adequate site identification and mandated avoidance as the preferred mitigation. Similar to construction of the proposed Project, should resources be discovered during the construction of current and future projects, they would be subject to legal requirements designed to protect them, thereby reducing the effect of encountering unknown cultural resources. Because of the planning of the marine cable routes to avoid cultural resources that may exist on the sea floor, as well as implementation of Mitigation

Measures CR-1a, CR-1b, and CR-1c, the Project would be unlikely to make a substantial contribution to cumulative impacts on marine cultural resources.

The isolated prehistoric artifacts that have been recovered from the seabed south of the study area by divers and current archaeological research support the assessment that there is the potential to encounter prehistoric archaeological sites during construction of the submerged portion of the cables. The same is true for historic shipwrecks. A number of shipwrecks have been reported within the study area; however, the level of accuracy of these reports is not adequate to determine with certainty that any of the cables will encounter a shipwreck.

Mitigation measures require identification of areas of high potential for specific submerged cultural resources, which would reduce any impact to a less than significant level. No past projects have reported encountering submerged historic shipwrecks or prehistoric archaeological resources in the study area, and currently no other proposed projects have the potential to disturb or destroy such resources. Therefore, the project's contribution to cumulative impacts on marine cultural resources would not be significant.

Summary of Impacts, Mitigation Measures, and Significance Conclusions

Table 5 provides a summary of the impacts identified and associated mitigation measures to reduce or avoid the impact, if warranted. Mitigation measures are required for each significant impact but are not required for impacts that are not significant.

Table 5. Summary of Cultural Resources Conclusions

Impact	Mitigation Measures
CR-1 Project-related seafloor activities have the potential to disturb or destroy previously unknown or inaccurately recorded submerged prehistoric and historic maritime cultural resources	CR-1a. Conduct a Pre-Construction Offshore Archaeological Resources Survey CR-1b. Conduct a Pre-Construction Offshore Historic Shipwreck Survey CR-1c. Prepare a Cultural Resources Avoidance Plan

Site-specific impacts will be identified as a result of the pre-construction offshore archaeological survey. Although impacts may occur as the result of construction of the planned cables, implementation of mitigation measures CR-1a, CR-1b, and CR-1c should reduce impacts to Class II less than significant levels.

References

Arnold, J. E., Michael R. Walsh, and Sandra E. Hollimon. 2004. The Archaeology of California. Journal of Archaeological Research 12(1):1–73.

Bancroft, Hubert Howe. 1886. History of California. Vols. I–VII. Wallace Hebberd, 1963 and 1970, Santa Barbara. [Originally published by The History Company, San Francisco.]

Bean, Lowell John and Dorothea Theodoratus. 1978. Western Pomo and Northeastern Pomo. In: R. F. Heizer, 1978 Handbook of North American Indians: California, Vol. 8, pp. 289–305. Smithsonian Institution, Washington, D.C.

Bickel, Polly. 1978. Changing Sea Levels along the California Coast: Anthropological Implications. *Journal of California Anthropology* Vol. 5, No. 1, pp. 6–20.

_____. 1988. Corrections to Sea Level Article. *Journal of California Archaeology* 5:296–297*.*

Bloom, A. L. 1977. Pleistocene Shorelines: A New Test of Isostasy. *Geological Society of America Bulletin* 78:1477–1494.

Bradley, W. C. and G. B. Griggs. 1976. Form Genesis and Deformation of Central California Wave-Cut Platforms. *Geological Society of America Bulletin* 87:433–449*.*

Bureau of Land Management, U.S. Department of the Interior (BLM). 1979. An Archaeological Literature Review and Sensitivity Zone Mapping of the Southern California Bight, 2 Volumes (G. Stickel and Marshack [eds.]). National Technical Information Service, Department of Commerce, Washington, D.C.

Bureau of Ocean Energy Management, Pacific OCS Region, U.S. Department of the Interior (BOEM). 2013. Inventory and Analysis of Coastal and Submerged Archaeological Site Occurrence on the Pacific Outer Continental Shelf. (OCS Study BOEM 2013–0115.)

Carter, G. F. 1957. Pleistocene Man at San Diego. Johns Hopkins Press, Baltimore, Maryland.

Caughey, J. W. 1970. California: A Remarkable State's Life History. Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

Curray, J. R. 1965. Late Quaternary History, Continental Shelves of the United States. In: The Quaternary of the United States, pp. 723–725. Princeton University Press.

Davis, E. L., C. W. Brott, and David L. Weide. 1969. The Western Lithic Co-Tradition. *San Diego Museum Papers 6.* San Diego, California.

Delgado, James. 1990. To California by Sea: A Maritime History of the California Gold Rush. University of South Carolina Press, Columbia, South Carolina.

Dupre, W. R., H. E. Clifton and R. E. Hunter. 1980. Modern Sedimentary Facies of Open Pacific Coast and Pleistocene Analogs from Monterey Bay, California. In: M. E. Field and others (eds.). Quaternary Depositional Environments of the Pacific Coast. Pacific Coast Paleogeography Symposium 4: Pacific Section, Society of Economic Paleontologists and Mineralogists, Los Angeles, California, pp. 143–156.

Erlandson, J. M. 1997. The Middle Holocene along the California Coast. In: J. M. Erlandson and M. A. Glassow (eds.). Archaeology of the California Coast during the Middle Holocene. Perspectives in California Archaeology, Vol. 4. Institute of Archaeology, University of California, Los Angeles, pp. 1–10.

Erlandson, J. M., M. H. Graham, B. J. Bourque, D. Corbett, J. A. Estes, and R. S. Steneck. 2007a. The Kelp Highway Hypothesis: Marine Ecology, the Coastal Migration Theory, and the Peopling of the Americas. *Journal of Island & Coastal Archaeology* 2:161–174.

Erlandson, J. M., C. Toben, T. L. Jones, and J. F. Porcasi. 2007b. One if by Land, Two if by Sea: Who Were the First Californians? In: T. L. Jones and K. A. Klar (eds.). California Prehistory: Colonization, Culture, and Complexity. Alta Mira Press, pp. 53–62. United Kingdom.

Greenwood, R. S. 1972. 9000 Years of Prehistory at Diablo Canyon, San Luis Obispo County, California. *San Luis Obispo County Archaeological Society Occasional Papers* 7:1–97. San Luis Obispo, California.

Heizer. R. F. 1978. Handbook of North American Indians: California, Vol. 8. Smithsonian Institution, Washington, D.C.

Hudson, D. T. 1976. Marine Archaeology along the Southern California Coast. San Diego Museum of Man, San Diego, California.

Hudson, D. T., J. Timbrook, and M. Rempe. 1987. Tomol: Chumash Watercraft as Described in the Ethnological Notes of John P. Harrington. Ballena Press/Santa Barbara Museum of Natural History, Santa Barbara, California.

King, Chester D. 1981. The Evolution of Chumash Society: A Comparative Study of Artifacts Used in Social System Maintenance in the Santa Barbara Channel Region before A.D. 1804. Ph.D. dissertation, Department of Anthropology, University of California, Davis. University Microfilms, Ann Arbor.

Landberg, Leif C. W. 1965. The Chumash Indians of Southern California. Southwest Museum, Highland Park, Los Angeles, California.

Lloyds of London. 1850–1880. Ships Registry.

_____. 1885–1950. Ships Registry.

Macfarlane, Heather. No Date. Shipwreck File. A Computer Listing of the Names, Description and Registry Numbers of Vessels Reported Lost on the West Coast of the United States: Southern California Area.

McCullogh, D. S., S. H. Clarke, Jr., M. E. Field, and P. A. Utter. 1980. A Summary Report of the Regional Geology, Environmental Geology, OCS Resource Appraisal, Petroleum Potential, and Operational Considerations in the Area of Proposed Lease Sale 73, Offshore California. (U.S. Geological Society Open-File Report 80-2007.) P. 76.

Milliman, J. and K. O. Emery. 1968. Sea Level Changes during the Past 35,000 Years. *Science* 162:1121–1123.

Minerals Management Service, U.S. Department of the Interior (MMS). 1987. Archaeological Resource Study: Morro Bay to Mexican Border (Contract No. 14-12-0001-30272). Prepared by Pierson, Shiller and Slater. Minerals Management Service, Los Angeles, California.

_____. 1989. Archaeology on the Gulf of Mexico Outer Continental Shelf: A Compendium of Studies. Prepared for First Joint Archaeological Congress, Baltimore, Maryland, January 5–9, U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region.

_____. 1990. California, Oregon and Washington Archaeological Resource Study, 5 Volumes. Prepared under MMS Contract 14-35-0001-30439 by Espey Huston & Associates, Inc., Austin, Texas and Dames & Moore. Camarillo, California.

Moratto, M. 1984. California Archaeology. Academic Press, New York.

Moriarty, J. R. and H. Minshall. 1972. A New Pre-Desert Site Discovered near Texas Street. *The Anthropological Journal of Canada* 10(3):10–13.

Moriarty, J. R. and M. Keistman. 1973. Cabrillo's Log 1542–1543, a Voyage of Discovery. In: Dr. James R. Moriarty, III (ed.). Cabrillo Gravestone Seminar, Cabrillo National Monument, San Diego, California.

Nardin, T. R., R. H. Osborne, D. J. Bottjer, and R. C. Scheidemann, Jr. 1981. Holocene Sea-Level Curves for Santa Monica Shelf, California Continental Borderland. *Science* 213:331–333.

National Oceanic and Atmospheric Administration, U.S. Department of Commerce (NOAA). 1988. Automated Wreck and Obstruction Information System. Office of Coast Survey. Silver Spring, Maryland.

Ogden, Adele. 1923. The Californias in Spain's Otter Trade, 1775–1795. *Pacific Historical Review* Vol. 1:447–452.

_____. 1941. The California Sea Otter Trade, 1784–1848. *University of California Publications in History* Vol. 26. Berkeley, California.

Orr, P.C. 1967. Prehistory of Santa Rosa Island. Santa Barbara Museum of Natural History, Santa Barbara, California.

Patton, Mark Hall. 1989. Pismo Pier. *The Tribune News*, Nov. 2.

Rick, T. C., J. M. Erlandson, and R. L. Vellanoweth. 2001. Paleocoastal Marine Fishing on the Pacific Coast of the Americas. Perspectives from Daisy Cave, California. *American Antiquity* 66(4):595–613.

Schurz, W. L. 1939. The Manilla Galleon. E. P. Dutton & Company, Inc., New York.

Schmidt, J. S., K. A. Ryberg, D. A. McCullough, M. Williams, G. Brooks, and R. Larson. 2014. Marine Archaeological Resources Assessment. Virginia Offshore Wind Technology Advancement Project. Prepared for Dominion Resources, Inc. under Contract to Tetra Tech, Inc. by R. Christopher Goodwin & Associates, Inc. Appendix N of Research Activities Plan. 417 pp.

Snavely, P. D., Jr. and N. S. Macleod. 1977. Evolution of Eocene Continental Margin of Western Oregon and Washington. *Geological Society of America Abstracts with Program* 9(7):1183.

Snethkamp, P. G., G. Wessen, A. L. York, J. H. Cleland, S. D. Hoyt, and R. L. Gearhart II. 1990. California, Oregon, and Washington Archaeological Resource Study. Volume III: Prehistory. Prepared under MMS Contract 14-35-0001039438 by Espey, Huston and Associates, Inc., Austin, Texas.

Stickel, Gary and Marshack (eds.). 1979. An Archaeological Literature Review and Sensitivity Zone Mapping of the Southern California Bight, 2 Volumes. National Technical Information Service, Department of Commerce, Washington, D.C.

Stright, Melanie. 1988. Archaeological Sites on the Northern American Continental Shelf. Contribution to The Archaeological Geology of North America, Decade of North American Geology Series. *Geological Society of America*. Normal P. Lasca (ed.).

U.S. Department of Commerce, Coast Guard. 1933–1982. Merchant Vessels of the United States. Government Printing Office, Washington, D.C.

_____. 1982–1988. Supplements. Merchant Vessels of the United States. Government Printing Office, Washington, D.C.

U.S. Department of Commerce, Customs Bureau. 1867–1933. Merchant Vessels of the United States. Government Printing Office, Washington, D.C.

Wagner, H. R. 1924. The Voyage to California of Sebastian Rodrigues Cermeno in 1596. *California Historical Society Quarterly* III(1):3–24.

Wagner, H. C., S. C. Wolf, D. S. McCulloch, E. A. Silver, J. G. Greene and K. G. Blom. 1972. (U.S. Geological Survey Administrative Report.) Prepared and furnished to the U.S. Bureau of Reclamation for the California Undersea Aqueduct Study.