10.0 GEOLOGY, SOILS, AND PALEONTOLOGICAL RESOURCES

10.1 Regulatory Setting

PWP Volume 1 Chapter 4, "Consistency with Local Coastal Plans and the Coastal Act" includes a detailed discussion of federal, state, and regional and local plans, policies, regulations, and laws, along with PWP consistency, related to Local Coastal Plans and the Coastal Act that are applicable to geology, soils, and paleontological resources.

10.2 Environmental Setting

10.2.1 Seismic Hazards

The PWP planning area is located along the coast of the Pacific Ocean, within the Santa Maria Basin/San Luis Range domain, which extends approximately from San Luis Obispo southward to the Santa Ynez Mountains. This domain forms a structural and geomorphic transition between the Coast Ranges and Transverse Ranges Geomorphic Provinces.

There are no Alquist-Priolo Earthquake Fault Zones in the PWP planning area (California Geological Survey [CGS] 2017). The closest "active" faults (i.e., faults with evidence of displacement during the last 11,700 years [Holocene time]) are outside of the PWP planning area, approximately 10 miles west and north of the North Beach Campground Facility Improvements Project. These faults consist of the Hosgri Fault Zone (off-shore) and Los Osos Fault Zone, respectively (Jennings and Bryant 2010). Faults classified by CGS as "active" are the most likely to result in strong seismic ground shaking.

The Wilmar Avenue (Santa Maria River) Fault is located along the southern boundary of the San Luis Range (roughly parallel to Highway 101), approximately 0.35 miles northeast of the proposed North Beach Campground Facility Improvements Project (see Figure 10-1a). The Oceano Dunes Fault runs through the north end of the Pismo Dunes Natural Preserve and the South County Coastal Planning Area in a northwest/southeast direction, roughly parallel to the western end of Arroyo Grande Creek, approximately 0.65 miles south of the Pier Avenue Entrance and Lifeguard Towers Project (Jennings and Bryant 2010) (see Figures 10-1a and 10-1b). Both of these faults have shown evidence of movement within the last 700,000 years, which means they are considered "potentially active," and therefore are less likely to result in strong seismic ground shaking.

The intensity of ground shaking depends on the distance from the earthquake epicenter to the site, the magnitude of the earthquake, and site soil conditions. Peak horizontal ground acceleration (PGA), which is a measure of the projected intensity of ground shaking from seismic events, can be estimated by probabilistic method using a computer model. The CGS Probabilistic Seismic Hazards Assessment Model (CGS 2008) indicates there is a 1-in-10 probability that an earthquake within 50 years would result in PGAs ranging from approximately 0.264*g* (where *g* is a percentage of gravity) at the North Beach Campground Facility Improvements Project site, to approximately 0.267*g* at the proposed Oso Flaco Improvement Project, to approximately 0.276*g* at the remaining improvement project sites. This indicates that a similar moderate level of seismic shaking would be anticipated throughout the PWP planning area at all of the PWP and Small Development Project and sites. However, following the 2003 earthquake in San Simeon (50 miles to the north), Oceano experienced significant damage to houses, road surfaces, and underground utilities, which was not anticipated given the distance from the earthquake epicenter.

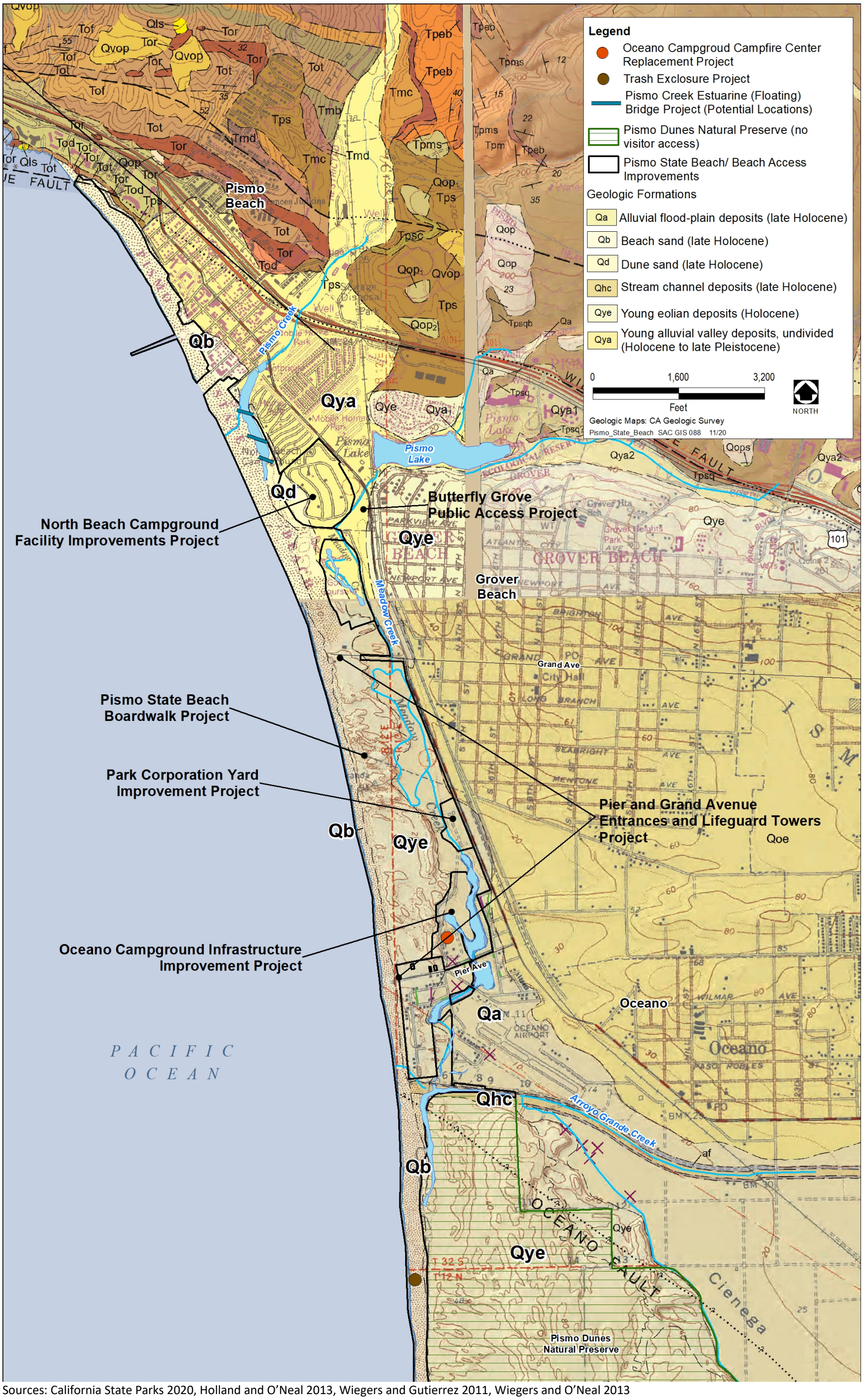
Subsequent investigations (Holzer et al. 2004) determined that damage in Oceano occurred as a result of site amplification, where the strength of the shaking increases abnormally in areas where the seismic-wave velocity of shallow geologic layers is low. As a result, earthquake shaking is felt more strongly than in surrounding areas without similar geologic conditions.

Liquefaction is a phenomenon where saturated sands lose their strength during an earthquake and become fluid-like and mobile. Factors determining liquefaction potential are soil type, level and duration of ground motions, and depth to groundwater. Liquefaction is most likely to occur in low-lying areas where the substrate consists of poorly consolidated to unconsolidated water-saturated sediments, recent Holocene-age sediments, or deposits of artificial fill. As a result of liquefaction, the ground may undergo large permanent displacements that can damage underground utilities and well-built surface structures. The type of displacement that is of greatest concern associated with liquefaction is lateral spreading, because it involves the displacement of large blocks of ground downhill along gentle slopes or towards stream channels. The shallow geologic units beneath Oceano are very susceptible to liquefaction (Holzer et al. 2004). These units include young sand dunes and clean sandy artificial fill that was used to bury and convert marshes into developable building lots. Most of the damage in Oceano from the 2003 San Simeon earthquake was caused by liquefaction.

There are no mapped landslides or landslide hazard zones either within or adjacent to the PWP planning area (Holland and O'Neal 2013, Wiegers and Gutierrez 2011, CGS 2020). The elevations at the proposed improvement project sites range from approximately 0 to 25 feet (above mean sea level). There are steep slopes within the Oceano Dunes SVRA, as the wind continually moves and reshapes the sand into dunes. The tops of the dunes along the eastern side of the SVRA are approximately 190–200 feet above mean sea level. However, the sand dunes do not represent a landslide hazard.

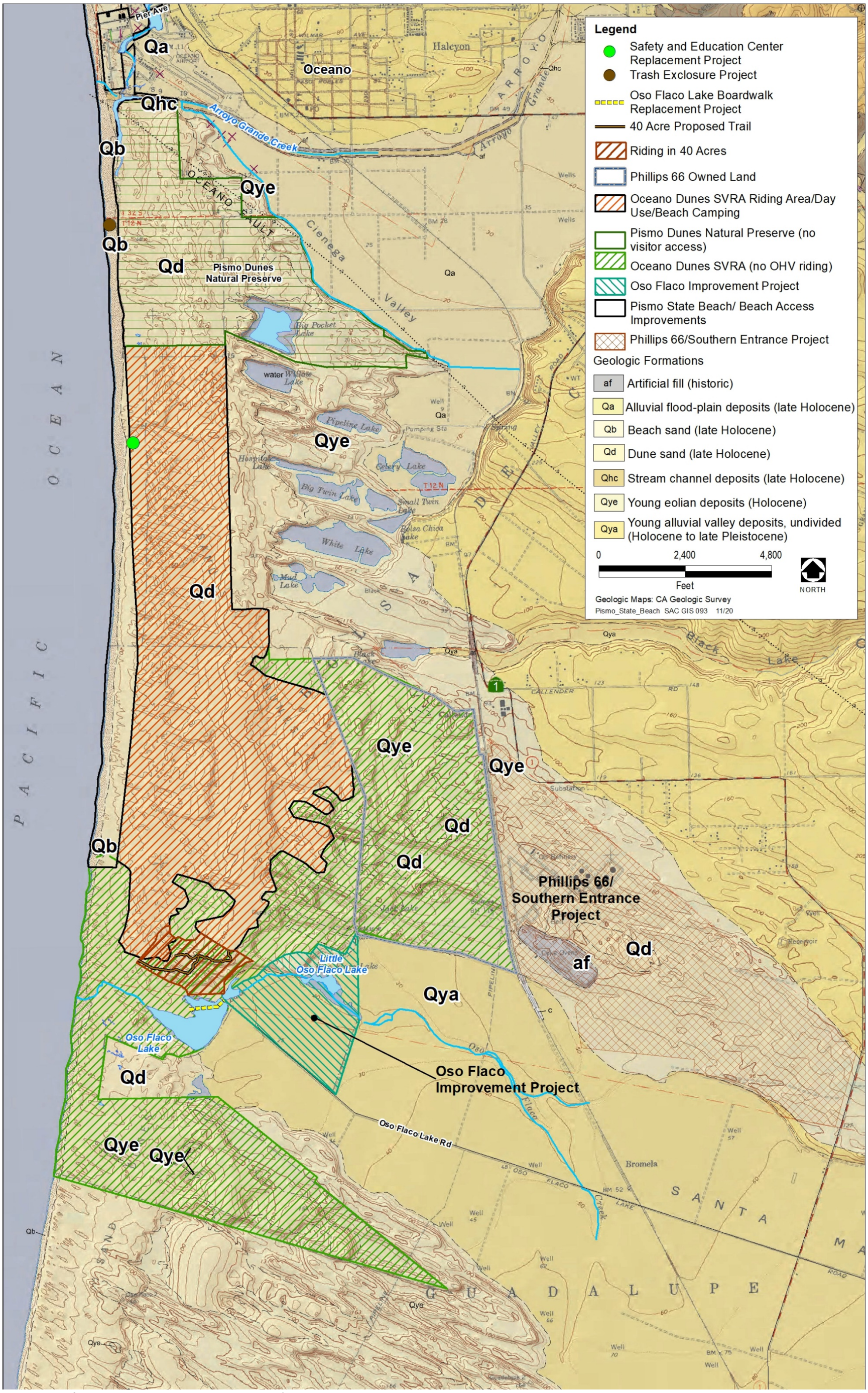
10.2.2 Erosion Hazards

The Oceano Dunes SVRA and Pismo State Beach lie within the northern portion of the Guadalupe-Nipomo Dune Complex, which extends approximately 18 miles along the shore and 31 miles inland. This dune complex formed as a result of an abundant sand supply and effective onshore winds (Orme and Tchakerian 1986). The amount of sand and finer material carried onshore to the dunes that lie between Arroyo Grande Creek (just south of Grand Avenue in Pismo State Beach) and the Santa Maria River has been estimated at between 125,000 and 400,000 cubic yards per year (Bowen and Inman 1966, Mulligan 1985). Oceano Dunes SVRA and Pismo State Beach are located within the more recent dune deposits, estimated to be approximately 3,000 years old. The Nipomo Mesa, which is located downwind of Oceano Dunes SVRA, consists of older dune deposits (6,000 to 25,000 years old) and is much higher in elevation (approximately 250 feet above mean sea level) than the shoreline, although some dunes within Oceano Dunes SVRA can reach approximately 200 feet in height (Orme and Tchakerian 1986). The difference in elevation between the older and newer dune systems is the result of changes in sea level over time.



Sources: California State Parks 2020, Holland and O'Neal 2013, Wiegers and Gutierrez 2011, Wiegers and O'Neal 2013

Figure 10-1a. Geologic Formations in the Northern Half of the PWP Planning Area



Sources: California State Parks 2020, Holland and O'Neal 2013

Figure 10-1b. Geologic Formations in the Southern Half of the PWP Planning Area

CGS estimates, based on a review of sequential aerial photography, that the rate of dune advancement within Oceano Dunes SVRA ranges from 6 to 18 feet per year along dune slip faces (the side of the dune in away from the wind) in open sand areas and 1 to 7 feet per year along slip faces west of vegetated dune areas (CGS 2007). The slow movement of sand dunes over time is a naturally occurring process, but can disturb resources and infrastructure in and near the beach and dunes. For example, wind-blown sand is a nuisance to businesses and residences on Grand Avenue (in Grover Beach) and Pier Avenue and Strand Way (in Oceano).

Wind-blown sand also encroaches upon Park infrastructure and vegetation, and the District actively protects these and other resources from encroaching sand dunes (e.g., Oceano Dunes SVRA CDP 4-82-300-A5). From approximately March to July of each year, the District installs approximately 1,700 linear of four-foot-high, orange-colored wind fencing directly upwind of Grand Avenue in Grover Beach and Pier Avenue and Strand Way in Oceano. The District installs this fencing to control natural sand drift from the beach onto public roads, parking areas, and other structures such as residences that front the southern portion of Pismo Beach. Although the District does not install this fencing explicitly for the purposes of preventing track-out of sand onto paved, public roadways, it nonetheless captures a large amount of sand that would otherwise be blown up the sand ramps that provide access to Pismo State Beach and Oceano Dunes SVRA. Without this fencing, this sand would deposit on public roadways and be prone to movement from vehicles and wind.

10.2.3 Other Geologic Hazards

Native sand, along with recent, unconsolidated alluvial material, represent an unstable base upon which to construct building and road foundations, because these soils have a low foundation bearing load strength, and these soils can shift, both of which can result in damage to building foundations and roads. The west side of the Pismo Creek Estuarine (Floating) Bridge Project site, Oceano Campground Infrastructure Improvement Project site, Oceano Campground Campfire Center Replacement Project, Pier and Grand Avenue Entrances and Lifeguard Towers Project sites, Pismo State Beach Boardwalk Project site, Trash Enclosure Project site, and Safety and Education Center Replacement Project sites are located in soil classified as Dune land (i.e., sand dunes). Soil at the Park Corporation Yard Improvement Project Site is classified as Oceano sand, Psamments (i.e., loamy fine sand), and Fluvents (i.e., alluvial soils where development is prevented by repeated deposition of sediment in periodic floods). Soil at the Butterfly Grove Public Access Project site is classified as Oceano sand, and soil at the Phillips 66/Southern Entrance Project site is classified as Oceano sand and Dune land (Natural Resources Conservation Service [NRCS] 2020). As described above, these soils are also subject to liquefaction and lateral spreading hazards.

Expansive soils shrink and swell as a result of moisture change. Over time, these volume changes can damage building foundations, underground utilities, and other subsurface facilities and infrastructure, if the facilities and infrastructure are not designed and constructed appropriately to resist damage caused by changing soil conditions. Placing buildings or constructing infrastructure on or in expansive soils can result in structural failure. Soil at the North Beach Campground Facility Improvements Project site, and the eastern sides of the Pismo Creek Estuarine (Floating) Bridge Project site, consists of Marimel sandy clay loam and Marimel silty clay loam, both of which have a moderate shrink-swell potential (NRCS 2020).

10.2.4 Paleontological Resources

10.2.4.1 Geologic Formations

The PWP planning area (and the Oceano area as a whole) sits atop an approximately 780-foot-thick sequence of gently westward-dipping unconsolidated sediment (Holzer et al. 2004). The uppermost sediment consists of a complexly interbedded sequence of Holocene dune sand, shallow marine or estuarine deposits, and fluvial sediments of Meadow and Arroyo Grande Creeks that rests on early Holocene/late Pleistocene marine and estuarine sediments. The thickness of the Holocene dune and fluvial sediment sequences is generally less than 32 feet. These sediments overlie approximately 328 feet of beds that are equivalent to the lower-Pleistocene Paso Robles Formation and 460 feet of upper-Pliocene Careaga Sand, which is of primarily marine origin. These sediments in turn rest on sedimentary bedrock: the lower- to upper-Pliocene Pismo Sandstone.

Based on a review of geologic mapping prepared by Wiegers and Gutierrez (2011) and Holland and O'Neal (2013), there are a variety of surficial deposits in the PWP planning area, all of which are relatively young (in geologic terms). The location of the PWP planning area and Development and Small Projects in relationship to the mapped geologic formations are shown on Figures 10-1a and 10-1b.

The following Holocene-age surficial deposits are mapped in the PWP planning area:

- Artificial Fill (Phillips 66/Southern Entrance Project). Recent, historic-age soil materials imported from other locations.
- Stream Channel Deposits (northern edge of Pismo Dunes Natural Preserve). Unconsolidated sand, gravel and cobbles in active stream channels.
- Alluvial Floodplain Deposits (along the southern portion of Meadow Creek—includes the Park Corporation Yard Improvement Project and Oceano Campground Infrastructure Improvement Project, and Oceano Campground Campfire Center Replacement Project). These are active and recently active floodplain deposits, composed of unconsolidated sandy, silty, and clay-bearing alluvium.
- Beach Sand (along the Pacific Ocean, portions of Pismo State Beach and Oceano Dunes SVRA; includes the Pismo Creek Estuarine (Floating) Bridge Project, Pier and Grand Avenue Entrances and Lifeguard Towers Project, the Pismo State Beach Boardwalk Project, and Trash Enclosure Project). Unconsolidated beach deposits consisting mostly of fine- to medium-grained well-sorted sand.
- Dune Sand (portions of Pismo State Beach, Safety and Education Center Replacement Project, Oceano Dunes SVRA, 40 Acre Riding Trail, western end of the Oso Flaco Lake Boardwalk Replacement Project, and Phillips 66/Southern Entrance Project). Unconsolidated, well-sorted white to brown windblown sand. Forms active dunes behind modern beaches.
- Young Eolian Deposits (Pismo Dunes Natural Preserve, Phillips 66/Southern Entrance Project, southern portion of Oceano Dunes SVRA). Vegetated stationary sand dune deposits displaying dune morphology. Well-sorted white to brown windblown sand.

The North Beach Campground Facility Project, Butterfly Grove Public Access Project, Oso Flaco Improvement Project, and the eastern end of the Oso Flaco Lake Boardwalk Replacement Project sites are mapped as Young Alluvial Valley Deposits, undivided, of Holocene to late-Pleistocene age. These deposits are composed of unconsolidated sand, silt, and clay-bearing alluvium deposited on floodplains and along valley floors.

10.2.4.2 Paleontological Sensitivity Assessment

The potential paleontological sensitivity of a project area can be assessed by identifying the paleontological importance of rock units that are exposed there. A paleontologically sensitive rock formation is one that is rated high for potential paleontological productivity (i.e., the recorded abundance and types of fossil specimens, and the number of previously recorded fossil sites) and is known to have produced unique, scientifically important fossils. Exposures of a specific rock formation at any given project site are most likely to yield fossil remains representing particular species or quantities similar to those previously recorded from the rock formation in other locations. Therefore, the paleontological sensitivity determination of a rock formation is based primarily on the types and numbers of fossils that have been previously recorded from that rock unit.

In its standard guidelines for assessment and mitigation of adverse impacts on paleontological resources, the Society of Vertebrate Paleontology (SVP 2010) established four categories of sensitivity for paleontological resources: high, low, no, and undetermined. Areas where fossils have been previously found are considered to have a high sensitivity and a high potential to produce fossils. Areas that are not sedimentary in origin and that have not been known to produce fossils in the past typically are considered to have low sensitivity. Areas consisting of high-grade metamorphic rocks (e.g., gneisses and schists) and plutonic igneous rocks (e.g., granites and diorites) are considered to have no sensitivity. Areas that have not had any previous paleontological resource surveys or fossil finds are considered to be of undetermined sensitivity until surveys are performed. After reconnaissance surveys, a qualified paleontologist can determine whether the area of undetermined sensitivity should be categorized as having high, low, or no sensitivity. In keeping with the SVP significance criteria, all vertebrate fossils are generally categorized as being of potentially significant scientific value.

Table 10-1 presents the results of the paleontological sensitivity assessment for the PWP planning area based on a review of geologic maps, a literature review, and a records search performed at the University of California, Berkeley Museum of Paleontology (UCMP) on November 10, 2020. No fossil localities have been recorded within the PWP planning area (UCMP 2020).

Table 10-1. Paleontological Sensitivity Assessment

Formation Name and Map Unit Abbreviation	Age	Fossils	Paleontological Sensitivity Rating
Artificial Fill (af)	Holocene	Holocene deposits contain only the remains of extant, modern taxa (if any resources are present), which are not considered "unique" paleontological resources.	Not Sensitive
Stream Channel Deposits (Qhc)	Holocene	Holocene deposits contain only the remains of extant, modern taxa (if any resources are present), which are not considered "unique" paleontological resources.	Not Sensitive
Alluvial Floodplain Deposits (Qa)	Holocene	Holocene deposits contain only the remains of extant, modern taxa (if any resources are present), which are not considered "unique" paleontological resources.	Not Sensitive
Beach Sand (Qb)	Holocene	Holocene deposits contain only the remains of extant, modern taxa (if any resources are present), which are not considered "unique" paleontological resources.	Not Sensitive
Dune Sand (Qd)	Holocene	Holocene deposits contain only the remains of extant, modern taxa (if any resources are present), which are not considered "unique" paleontological resources.	Not Sensitive
Young Eolian Deposits (Qye)	Holocene	Holocene deposits contain only the remains of extant, modern taxa (if any resources are present), which are not considered "unique" paleontological resources.	Not Sensitive
Young Alluvial Valley Deposits (Qya)	Holocene to late Pleistocene	Only three recorded vertebrate localities have yielded Pleistocene-age fossils from San Luis Obispo County—two are from the Plio-Pleistocene age Paso Robles Formation in Camp Roberts, and one is from the Pleistocene-age Quaternary Nonmarine Terrace Deposits in San Miguel. Both of these formations are older than the Young Alluvial Valley Deposits found within the PWP planning area, and all three fossil localities are approximately 43 miles north of the PWP planning area.	Low

Sources: Holland O'Neal 2013, Jennings 1958, Wiegers and Gutierrez 2011, U.C. Berkeley Museum of Paleontology 2020

10.3 Project Impacts

10.3.1 Thresholds of Significance

Based on Appendix G of the CEQA Guidelines, implementation of the PWP would result in a potentially significant impact related to geology and soils if it would:

a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

   i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? (Refer to California Geological Survey Special Publication 42.)

   ii) Strong seismic ground shaking?

   iii) Seismic-related ground failure, including liquefaction?

   iv) Landslides?

b) Result in substantial soil erosion or the loss of topsoil?

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994, as updated), creating direct or indirect substantial risks to life or property?

e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

10.3.1.1 Paleontological Resources

Based on Appendix G of the CEQA Guidelines, implementation of the PWP would result in a potentially significant impact on paleontological resources if it would directly or indirectly destroy a unique paleontological resource or site. A “unique paleontological resource or site” is one that is considered significant under the following professional paleontological standards.

An individual vertebrate fossil specimen may be considered unique or significant if it is identifiable and well preserved, and it meets one of the following criteria:

- a type specimen (i.e., the individual from which a species or subspecies has been described);
- a member of a rare species;

- a species that is part of a diverse assemblage (i.e., a site where more than one fossil has been discovered) wherein other species are also identifiable, and important information regarding life history of individuals can be drawn;
- a skeletal element different from, or a specimen more complete than, those now available for its species; or
- a complete specimen (i.e., all or substantially all of the entire skeleton is present).

The value or importance of different fossil groups varies, depending on the age and depositional environment of the rock unit that contains the fossils, their rarity, the extent to which they have already been identified and documented, and the ability to recover similar materials under more controlled conditions (such as for a research project). Marine invertebrates generally are common, the fossil record is well developed and well documented, and they would generally not be considered a unique.

10.3.2 Issues Not Discussed Further in This EIR

Surface Fault Rupture—There are no Alquist-Priolo Fault Zones mapped either within or immediately adjacent to the PWP planning area. Therefore, no impact related to surface fault rupture would occur. This issue is not discussed further in this draft EIR.

Landslides — There are no mapped landslides or landslide hazard zones either within or adjacent to the PWP planning area, and all of the proposed improvement project sites are located on flat terrain. There are no steep slopes either within or adjacent to the PWP planning area that could represent a landslide hazard. Therefore no impact related to landslide hazards would occur. This issue is not discussed further in this draft EIR.

Soil Suitability for Septic Systems — Septic systems are not used on state lands within the PWP planning area. Wastewater treatment is provided either via underground pipelines connected to existing sewage treatment plants within local municipalities, or by vault toilets. Therefore, no impact related to soil suitability for septic systems would occur. This issue is not discussed further in this draft EIR.

10.3.3 Impacts and Mitigation

10.3.3.1 Impacts from PWP Implementation

All buildings would be designed and constructed according to applicable building codes, including the CBC, which are designed to reduce risks from seismic and geologic hazards to the maximum extent practicable during the operational life of the structures. Ongoing operation of park management programs and plans involves structural maintenance and upkeep. New construction only includes facilities that are consistent with existing facilities and do not expand the existing footprint above 10% and for which grading is generally minor. Therefore, implementation of the PWP would result in **less-than-significant impacts** related to seismic and geologic hazards.

Operation and maintenance activities associated with the PWP may include grading of areas larger than 50 cubic yards (the standard amount typically considered routine maintenance in the coastal zone). Grading of amounts larger than 50 cubic yards is subject to all resource management guidelines, and would be conducted in full compliance with all applicable permits such as the National Pollutant Discharge Elimination System

(NPDES) permits issued by the State Water Resources Control Board. OHV riding in the Oceano Dunes SVRA Riding Area would continue. The dunes are active and dynamic, influenced by prevailing ocean winds and seasonal spring winds shaping the dunes. The Dune land soil type is highly susceptible to wind erosion (NRCS 2020). The OHMVR Division would continue to actively protect Park infrastructure and vegetation from encroaching sand dunes through implementation of a variety of measures such as Oceano Dunes SVRA CDP 4-82-300-A5, and installation of linear wind fencing from approximately March to July of each year upwind of Grand Avenue in Grover Beach and Pier Avenue and Strand Way in Oceano. State Parks also implements a Soil Conservation Plan for the Oceano Dunes SVRA (California State Parks 2010). The Soil Conservation Standard and Guidelines (California State Parks 2008) require that OHV recreation facilities be managed for sustainable long-term prescribed use including the minimization of negative effects such as soil loss, erosion, and sedimentation. OHV facilities are further mandated by PRC Sections 5090.2, 5090.35, and 5090.53, which emphasize that OHV use should be managed for sustained long-term use and that the protection of public safety, the appropriate utilization of lands, and the conservation of land resources are of the highest propriety in the management of SVRAs. The California Coastal Act also requires development to reduce potential impacts from geologic and soil conditions. The OHV Best Management Practices (BMPs) Manual gives guidance on selecting, implementing, and maintaining BMPs for OHV-type facilities and construction activities (California State Parks 2007). The manual provides details on BMPs for erosion control (e.g., blankets, mulches, hydroseeding techniques), scour control (e.g., check dams and armoring as in upland swales and ditches), dust control, sediment traps, and waste management. Furthermore, ground disturbance of areas larger than 1 acre requires a Stormwater Pollution Prevention Plan with associated BMPs specifically designed to prevent erosion. State Parks also implements a Stormwater Management Plan (SWMP) for Pismo State Beach and the Oceano Dunes SVRA consistent with the requirements of the NPDES permits issued by the State Water Resources Control Board. Therefore, implementation of the PWP would result in **less-than-significant impacts** related to erosion hazards.

As presented in Table 10-1 and shown in Figure 10-1, most of the PWP planning area is underlain by Holocene-age rock formations, which do not contain unique paleontological resources. The Young Alluvial Valley Deposits contain a small percentage of recent Pleistocene-age materials; however, a records search at the UCMP (2020) indicates there are no recorded fossil localities from within the PWP planning area, and the nearest recorded vertebrate fossil localities from Pleistocene-age formations are approximately 43 miles to the north. Because the Young Alluvial Valley Deposits are considered to be of low paleontological sensitivity and because ongoing maintenance and operational activities associated with implementation of the PWP involve only a limited amount of minor grading for facilities that are consistent with existing facilities and do not expand the existing footprint above 10%, implementation of the PWP would result in **less-than-significant impacts** related to destruction of unique paleontological resources.

Operations and maintenance activities associated with PWP implementation would have no impact on a unique geologic feature (i.e., the dune land associated with the Nipomo Dunes-Point Sal Coastal Area Natural National Landmark or the Guadalupe-Nipomo Dune Complex) because these activities involve only minor construction and grading associated with operations and maintenance of existing programs and facilities. Ongoing OHV riding at the Oceano Dunes SVRA does not destroy or substantially modify the dunes. The dunes constitute an active, not a static, geologic feature; the sand is always present and the dunes

themselves are continually reshaped on a daily basis by strong winds blowing from the Pacific Ocean. OHV riding does not eliminate the sand. Tracks in the sand from OHV riding are eliminated overnight or within 1–2 days from the force of the wind, which constantly redistributes the sand into different patterns regardless of whether OHV riding occurs or not. Furthermore, the OHV riding area includes only approximately 2 miles of the 18-mile-long Guadalupe-Nipomo Dune Complex. Therefore, implementation of the PWP would result in **less-than-significant impacts** related to destruction of a unique geologic feature.

10.3.3.2 Impacts from PWP Development Projects

Impact 10-1 Seismically-Induced Risks to People and Structures from Strong Seismic Ground Shaking and Liquefaction

As discussed in detail in Section 10.2.1, "Seismic Hazards," areas with site amplification conditions similar to those in Oceano, including all of the PWP Development and Small Projects in the PWP planning area, are vulnerable to seismic ground shaking generated by earthquakes. This site amplification may cause shaking from distant earthquakes, which normally would not cause damage, to increase locally to damaging levels. The vulnerability in the PWP planning area is compounded by the widespread distribution of highly liquefiable soils that are expected to re-liquefy when ground shaking is amplified from the next earthquake on regionally active faults, as it was during the 2003 San Simeon earthquake. Holzer et al. (2004) concluded that the experience in Oceano can be expected to repeat in the future because there are several active faults in the region that are capable of generating large earthquakes. In addition, Holzer et al. (2004) concluded that liquefaction and lateral spreading will be more extensive for moderate-size earthquakes that are closer to Oceano than was the 2003 San Simeon earthquake.

However, construction of all project-related buildings that are intended for human habitation is required by law to comply with the requirements of the California Building Standards Code (CBC). The CBC requires that any structure designed for a project site undergo a seismic-design evaluation that assigns the structure to one of six categories, A–F; Category F structures require the most earthquake-resistant design. The CBC philosophy focuses on "collapse prevention," meaning that structures are to be designed to prevent collapse during the maximum level of ground shaking that could reasonably be expected to occur at a site. CBC Chapter 16 specifies exactly how each seismic-design category is to be determined on a site-specific basis, based on site-specific soil characteristics and proximity to potential seismic hazards. Chapter 18 of the CBC regulates the excavation of foundations and retaining walls, as well as the preparation of a preliminary soil report, engineering geologic report, geotechnical report, and supplemental ground-response report. Chapter 18 also regulates the analysis of expansive soils and the determination of depth to the groundwater table. For structures in Seismic Design Category C, Chapter 18 requires analysis of slope instability, liquefaction, and surface rupture attributable to faulting or lateral spreading. For structures in Seismic Design Categories D, E, and F, Chapter 18 requires these same analyses plus an evaluation of lateral pressures on basement and retaining walls, liquefaction and loss of soil strength, and lateral movement or reduction of the foundation's soil-bearing capacity. Chapter 18 also requires that mitigation measures be considered in structural design. Mitigation measures may include stabilizing the ground, selecting appropriate foundation types and depths, selecting appropriate structural systems to accommodate anticipated displacements, or using any combination of these measures. The potential for liquefaction and soil strength loss must be evaluated for site-specific peak-ground-acceleration magnitudes and source characteristics

consistent with the design earthquake ground motions. The peak ground acceleration must be determined in a site-specific study, the contents of which are specified in CBC Chapter 18.

As required by the CBC, site-specific geotechnical reports would be prepared by licensed engineers, and recommendations contained therein to provide for seismic safety (as determined by CBC requirements) would be incorporated into the project design and construction of all buildings. Because the CBC is designed to reduce hazards from seismic ground shaking and liquefaction to the maximum extent practicable, the site-specific projects proposed in the PWP planning area would result in **less-than-significant** impacts related to seismic hazards.

Mitigation Measure: No mitigation is required.

Impact 10-2 Potential for Short-Term Construction-Related Erosion and Loss of Topsoil

Soil at the North Beach Campground Facility Improvements Project site consists of Marimel sandy clay loam and Marimel silty clay loam, which have a low wind and water erosion hazard (NRCS 2020). Soil at the Oso Flaco Improvement Project site consists primarily of Camarillo sandy loam, Camarillo loam, and Mocho loam. The Camarillo sandy loam has a moderately high wind erosion hazard, while the other two soils have a low wind erosion hazard.

The Pismo Creek Estuarine (Floating) Bridge Project site, Oceano Campground Infrastructure Improvement Project site, Oceano Campground Campfire Replacement Project site, Pier and Grand Avenue Entrances and Lifeguard Towers Project sites, Pismo State Beach Boardwalk Project site, Trash Enclosure Project site, Safety and Education Center Replacement Project site, 40 Acre Riding Trail site, and a portion of the Oso Flaco Lake Boardwalk Replacement Project site, are located in soil classified as Dune land (i.e., sand dunes). Soil at the Park Corporation Yard Improvement Project Site is classified as Oceano sand, Psamments (i.e., loamy fine sand), and Fluvents (i.e., alluvial soils where development is prevented by repeated deposition of sediment in periodic floods). Soil at the Butterfly Grove Public Access Project site is classified as Oceano sand, and soil at the Phillips 66/Southern Entrance Project site is classified as Oceano sand and Dune land. All of these soils have a high potential for wind erosion. These soils are highly permeable, and have a low water erosion hazard (as related to rainfall and stormwater runoff) (NRCS 2020). Beach sand, along the edge of the Pacific Ocean, is highly erodable from both wind and wave action.

However, the 2008 Soil Conservation Standard and supporting Guidelines are intended to ensure appropriate resource management and maintenance in areas of OHV use (California State Parks 2008). The Soil Conservation Standard states that OHV recreation facilities must be managed for sustainable long-term prescribed use including the minimization of negative effects such as soil loss, erosion, and sedimentation. The 2008 Guidelines provide tools and techniques that may be used to meet the 2008 Standard. In addition, the OHV Best Management Practices (BMPs) Manual gives guidance on selecting, implementing, and maintaining BMPs for OHV-type facilities and construction activities (California State Parks 2007). The manual provides details on BMPs for erosion control (e.g., blankets, mulches, hydroseeding techniques), scour control (e.g., check dams and armoring as in upland swales and ditches), dust control, sediment traps, and waste management. These standards and guidelines would apply to proposed OHV facilities, such as the 40 Acre Riding Trail project and other trails proposed as part of the PWP. Furthermore, ground disturbance of

areas larger than 1 acre requires preparation of a Stormwater Pollution Prevention Plan and implementation of site-specific BMPs specifically designed to prevent erosion. California State Parks' standard construction contracts (California State Parks 2020) require site-specific contractors to implement SWPPPs that include stabilization of construction access points to minimize sediment trackout, and BMPs to control short-term construction and long-term operational erosion. As part of State Parks standard construction contracts, contractors are required to ensure that stormwater and non-stormwater pollution control work (including erosion control) complies with the requirements in the latest version of the California Stormwater Quality Association (CASQA) BMP Handbook. The contractor must also implement a Construction Site Monitoring Program to ensure that all erosion and sediment control requirements are met. Therefore, the site-specific projects proposed in the PWP planning area would result in **less-than-significant** impacts from short-term construction-related erosion hazards.

Mitigation Measure: No mitigation is required.

Impact 10-3 Increase in Geologic Hazards from Unstable/Expansive Soils

As discussed in detail in Section 10.2.3, "Other Geologic Hazards," the Pismo Creek Estuarine (Floating) Bridge Project site, Oceano Campground Infrastructure Improvement Project site, Oceano Campground Campfire Center Replacement Project site, Butterfly Grove Public Access Project site, Pier and Grand Avenue Entrances and Lifeguard Towers Project sites, Park Corporation Yard Improvement Project site, Pismo State Beach Boardwalk Project site, Trash Enclosure Project site, Safety and Education Center Replacement Project site, 40 Acre Riding Trail site, and a portion of the Oso Flaco Lake Boardwalk Replacement Project site, are classified as native sand and/or recent, unconsolidated alluvial material (NRCS 2020). These materials represent an unstable base upon which to construct building and road foundations, because these soils have a low foundation bearing load strength, and these soils can shift, both of which can result in damage to building foundations and roads. As described previously, these soils are also subject to liquefaction and lateral spreading hazards (Holzer et al. 2004).

Soil at the Oso Flaco Improvement Project site has a low shrink-swell (expansion) potential (NRCS 2020). However, due to the shallow depth to groundwater, the young age and unconsolidated nature of the underlying Young Alluvial Valley Deposits, and the presence of active faults in the region, soil at the Oso Flaco Improvement Project site likely is subject to liquefaction.

Soil at the North Beach Campground Facility Improvements Project site consists of Marimel sandy clay loam and Marimel silty clay loam, both of which have a moderate shrink-swell (expansion) potential (NRCS 2020).

However, by law, buildings and other structures must be designed according to the requirements of the CBC, which contains criteria for reducing structural damage from unstable and expansive soils to the maximum extent practicable.

With compliance with the CBC, the site-specific projects proposed in the PWP planning area would result in **less-than-significant** impacts related to unstable and expansive soils.

Mitigation Measure: No mitigation is required.

Impact 10-4 Potential for Damage to or Destruction of Unique Paleontological Resources

A detailed assessment of potential paleontological resources and a sensitivity determination for each rock formation present in the planning area is provided in Table 10-1, and the location of the geologic formations in the PWP planning area are shown in Figures 10-1a and 10-1b. As presented in Table 10-1, Holocene-age rock formations contain only the remains of extant, modern taxa (if any resources are present), which are not considered "unique" paleontological resources under CEQA. Thus, the Holocene-age rock formations (which underlie most of the PWP planning area), are not paleontologically sensitive. Therefore, construction-related earthmoving activities associated with the Pismo Creek Estuarine (Floating) Bridge Project, Pier and Grand Avenue Entrances and Lifeguard Towers Project, Pismo State Beach Boardwalk Project, Park Corporation Yard Improvement Project, Oceano Campground Infrastructure Improvement Project, Oceano Campground Campfire Center Replacement Project, Trash Enclosure Project, Safety and Education Center Replacement Project, 40 Acre Riding Trail, western end of the Oso Flaco Lake Boardwalk Replacement Project, and the Phillips 66/Southern Entrance Project would have **no impact** on unique paleontological resources.

As further discussed in Table 10-1 and shown in Figure 10-1, the North Beach Campground Facility Project, Butterfly Grove Public Access Project, eastern end of the Oso Flaco Lake Boardwalk Replacement Project, and the Oso Flaco Improvement Project sites are mapped as Young Alluvial Valley Deposits, undivided. These deposits are primarily of Holocene age, but some late (youngest) Pleistocene materials may be present. No fossil localities have been recorded within the PWP planning area, and the only recorded vertebrate fossil localities in Pleistoene-age sediments are approximately 43 miles north of the planning area. Furthermore, the Pleistocene sediments at these three recorded localities are older than the sediments in the Young Alluvial Valley Deposits in the PWP planning area. Therefore, the Young Alluvial Valley Deposits are considered to be of low paleontological sensitivity. Thus, construction-related earthmoving activities at the North Beach Campground Facility, Butterfly Grove Public Access, eastern end of the Oso Flaco Lake Boardwalk Replacement, and Oso Flaco Improvement Project sites would have a **less-than-significant impact** on unique paleontological resources.

Mitigation Measure: No mitigation is required.

Impact 10-5 Potential for Destruction of a Unique Geologic Feature

Pismo State Beach and the Oceano Dunes SVRA are situated in the Guadalupe-Nipomo Dune Complex, an 18-mile long coastal dune landscape that occupies approximately 18,000 acres in southwestern SLO County and northwestern Santa Barbara County (USFWS 2012). Several sources identify the Guadalupe-Nipomo Dune Complex as "one of the largest coastal dune landscapes along the west coast of North America" (USFWS 2012). A portion of the dune complex was designated in 1974 as the Nipomo Dunes-Point Sal Coastal Area Natural National Landmark, an area that contains "the largest, relatively undisturbed coastal dune tract in California, and is one of the last remaining tracts of pristine rocky coastline in the South Coast Ranges" (NPS 2020). Though these descriptions vary slightly, they generally identify the Guadalupe-Nipomo Dune Complex as a unique coastal dune landscape with few, if any, parallels in size.

The following site-specific improvement projects are located within existing developed areas that would not constitute a unique geologic feature: Pismo Creek Estuarine (Floating) Bridge Project, North Beach Campground Facility Improvements Project, Park Corporation Yard Improvement Project, Oceano Campground Infrastructure Improvement Project, Oceano Campground Campfire Center Replacement Project, and Phillips 66/Southern Entrance Project. Thus there would be **no impact**.

The Butterfly Grove Public Access Project is specifically designed to prevent erosion and overcrowding at this existing natural area composed of a mixed forest and coastal scrub community. This forested area is not a unique geologic feature, and thus there would be **no impact**.

The Oso Flaco Improvement Project site consists primarily of agricultural cropland and a riparian area long Oso Flaco Creek. The Oso Flaco Lake Boardwalk Replacement Project would be located across this small natural lake in an east-west direction. Installation of a new pedestrian-only access trail in the Dune land on the north side of Oso Flaco Creek, and replacement of the existing boardwalk over Oso Flaco Lake, would improve and continue recreational access and would not directly or indirectly destroy the unique geologic feature (i.e., sand dunes north of Oso Flaco Creek or Oso Flaco Lake) as compared to current conditions.

The Pier and Grand Avenue Entrances and Lifeguard Towers Project and Safety and Education Center Replacement Project involve replacement of existing facilities in the same locations. The proposed replacement facilities would substantially enhance the viewshed and scenic quality for visitors to the dunes. Because these projects involve replacement in the same locations, construction would not directly or indirectly destroy the unique geologic feature (i.e., sand dunes) as compared to current conditions.

The Pismo State Beach Boardwalk Project is designed to improve recreational access for pedestrians to the dune landscape. Installation of the boardwalk involves a narrow wooden linear platform, which would not directly or indirectly destroy the unique geologic feature (i.e., sand dunes) as compared to current conditions. Similarly, the additional 40 Acre Riding Trail at the southern end of the Oceano Dunes SVRA Riding Area would allow OHV riding on a designated trail, similar to the other trails throughout the State Parks' OHV system, and therefore would not directly or indirectly destroy the unique geologic feature (i.e., sand dunes) as compared to current conditions. The Trash Enclosure Project is too small to adversely affect the dune complex as a unique geologic feature.

For the reasons stated above, the Pier and Grand Avenue Entrances and Lifeguard Towers Project, Pismo State Beach Boardwalk Project, 40 Acre Riding Trail Project, Safety and Education Center Replacement Project, Trash Enclosure Project, Oso Flaco Lake Boardwalk Replacement Project, and the Oso Flaco Improvement Project would all have **less-than-significant impacts** related to destruction of a unique geologic feature.

Mitigation Measure: No mitigation is required.

10.4 Cumulative Effects

10.4.1 Seismic Effects

The project region is seismically active. Thus, the projects considered in this cumulative analysis, as well as the PWP, could experience damage from seismic

hazards such as strong seismic ground shaking or liquefaction. However, each project considered in this cumulative analysis, along with the PWP, must individually meet the requirements of the CBC, which are specifically intended to reduce damage from seismic events to the maximum extent practicable. In addition to compliance with the CBC, private developers and local City and County agency projects must implement the requirements of local City and County building codes, ordinances, and policies (e.g., grading and erosion control plans), all of which are specifically designed to reduce damage from seismic hazards. Finally, the potential for damage from seismic hazards is site-specific, and thus there is no additive effect. Therefore, there would be **no cumulative** effect due to seismic ground shaking.

10.4.2 Soil Erosion

Please see the cumulative impact analysis in Chapter 13, "Hydrology and Water Quality."

10.4.3 Unstable or Expansive Soils

Portions of the project region include areas with a high soil shrink-swell potential. Furthermore, new construction that occurs in the San Luis Range could occur in areas of steep slopes where landslides may represent a hazard. Much of the project region is also subject to liquefaction hazards. Depending on the location of the projects considered in this cumulative analysis, damage from these hazards could occur. The PWP planning area is not located in an area where steep slopes are present, and based on a review of NRCS (2020) soil survey data the PWP planning area is not subject to hazards from a high shrink-swell potential. With regards to liquefaction, the projects considered in this cumulative analysis, along with the PWP, are required to comply with the CBC, which requires specific design and construction methods that are specifically intended to reduce liquefaction hazards. In addition to compliance with the CBC, private developers and local City and County agency projects must implement the requirements of local City and County building codes, ordinances, and policies, which are specifically designed to reduce damage hazards from construction in areas subject to liquefaction. Furthermore, the potential for damage is site-specific, and thus there is no additive effect. Therefore, there would be **no cumulative** impact due to unstable or expansive soils.

10.4.4 Paleontological Resources

Fossil discoveries resulting from excavation and earth-moving activities associated with development are occurring with increasing frequency throughout the state. The value or importance of different fossil groups varies depending on the age and depositional environment of the rock unit that contains the fossils, their rarity, the extent to which they have already been identified and documented, and the ability to recover similar materials under more controlled conditions (such as for a research project). Unique, scientifically-important fossil discoveries are relatively rare, and the likelihood of encountering them is site-specific and is based on the specific geologic rock formations that are present at any given project site. These geologic formations vary from location to location.

The project region includes Pleistocene-age rock formations such as the Paso Robles, and Miocene-age rock formations such as the Temblor, Monterey, Caliente, and Santa Margarita (among others), which have yielded a variety of vertebrate and invertebrate fossils, and thus are known to be paleontologically sensitive. Therefore, earthmoving activities associated with the projects considered in this cumulative analysis—if located in these formations—could damage or destroy unique paleontological resources. Therefore, some of the projects considered in this cumulative analysis could result in a significant

cumulative impact. However, earthmoving activities associated with the PWP would occur in rock formations of no or low palynologically sensitivity. Therefore, the PWP would result in a **less-than-significant** cumulative impact from damage or destruction of unique paleontological resources.

10.4.5 Unique Geologic Features

Several of the projects considered in this cumulative analysis would occur in the Guadalupe-Nipomo Dune Complex, which is a unique geologic feature (i.e., a unique coastal dune landscape). However, these projects would either be located underground, or they have been specifically designed, as with the PWP, such that they would not adversely affect the visual or recreational features associated with the Guadalupe-Nipomo Dune Complex that result in its designation as a unique geologic feature. Therefore, the PWP would result in a **less-than-significant** cumulative impact from destruction of a unique geologic feature.