

3. CRITICAL AREAS OF EROSION

This section provides an analysis of critical areas of erosion within the southern Monterey Bay littoral cell. In order to delineate these areas, two criteria are adopted that are used to prioritize erosion responses; risk of erosion and consequences of erosion.

3.1 RISK AND CONSEQUENCES OF EROSION

The risk of erosion is based on the risk analysis developed by PWA and Griggs (2004). This method establishes our first level of risk assessment over a planning horizon of 50 years:

- what facility is at risk?
- what is the probability that it will be impacted by erosion?

PWA and Griggs (2004) defined three risk categories to Monterey Regional Water Pollution Control Agency (MRWPCA) facilities between Marina and Wharf II. These risk categories were determined by assuming that current long-term historic erosion rates would continue over the next 50 years. For this assessment of critical areas of erosion, the historic erosion rate results of Thornton et al. (2006) are used (Table 3) with an increment to the erosion rate added for potential increases due to future sea-level rise (Section 2.4). The risk categories are:

- **Low risk** - facilities with a low probability of being impacted by erosion over the next 50 years.
- **Moderate risk** - facilities not likely to be affected by chronic erosion over the next 50 years, but potentially susceptible to short-term storm event erosion within the planning horizon.
- **High risk** - facilities that are located seaward of the shoreline position anticipated in 50 years or presently vulnerable to short-term event-based erosion.

Future erosion rates could be lower if sand mining at Marina ceases (Section 2.5.4). In this case, moderate and high risk facilities would have a larger buffer zone of protection, and management action could be delayed beyond the time lines recommended in this Coastal RSM Plan. Conversely, erosion rates may increase if future sea-level rise accelerates over the predicted estimates (Section 2.4), and management may need to be more immediate.

All the facilities identified as at high or moderate risk of erosion were then assessed as to their future value. This assessment is based on the SMBCEW (2006c) evaluation of the economic (potential loss of facility), environmental (potential loss of habitat), and safety and human health (potential loss of life) consequences of loss of the facility. The facilities are designated as high consequence, moderate consequence, or low consequence.

3.2 SITE SHORT-LIST

The locations of high to moderate risk and high consequence critical areas of erosion are shown in Figure 19, summarized in Table 10, and described in detail in Section 3.3. They are also available as GIS data files in CSMWs GIS database.

Figure 19. Location of Critical Areas of Erosion



Table 10. Critical Areas of Erosion

Location	Summary of Facility	Erosion Rate (ft/year)	Risk of Erosion	Consequences of Erosion
Sanctuary Beach Resort near Reservation Road	Vacation complex approximately 120 feet from the bluff top	~5.5	High (compromised in approximately 20 years)	High economic
Tioga Avenue and Highway 1 at Sand City	Bluff top road, storage facility, Highway 1 and proposed hotel developments	~3.5	High (seaward end of Tioga Avenue eroding)	High environmental safety economic
Seaside Pump Station at Bay Avenue	Raw wastewater pump station approximately 100 feet from the bluff top	~3.0	High (compromised in approximately 30 years)	High economic environmental human health
Monterey Interceptor between Seaside Pump Station and Wharf II	Raw wastewater pipeline approximately 115 to 175 feet from the bluff top or buried mid-beach	~1.0-3.0	High to moderate (some dune portions compromised in approximately 40 years; beach sections exposed in winter)	High economic environmental human health
Monterey Beach Resort, Highway 1 and Resort Access Road	Hotel on Del Monte Beach, hotel access road and Highway 1	~1.5	High (erosion already compromising fronting seawall)	High economic safety
Ocean Harbor House Condominiums and Del Monte Beach Subdivision	Condominium complex on the bluff top	~1.0-1.5	High (erosion compromising fronting riprap)	High economic safety
Monterey La Playa Town Homes at La Playa Street	Homes, one of which is 30 feet from the bluff top	~1.0	High to moderate (some homes compromised in approximately 30-50 years)	High economic

3.3 HIGH TO MODERATE RISK AND HIGH CONSEQUENCE AREAS

3.3.1 Sanctuary Beach Resort near Reservation Road

Site

The Sanctuary Beach Resort is located on a 17-acre site between Dunes Road and the coastal bluff fronted by 550 feet of shoreline (Figure 20). The development includes 112 vacation units, a 72-unit hotel, a conference center, retail facilities, a large restaurant, a health club, a recreational building, two tennis courts, a pool, playground and nearly 500 parking spaces. The resort was constructed in the mid 1990s on land formerly owned by the Monterey Sand Company. Because the dunes had been mined for sand for about 45 years (Table 4), the site lies at a lower elevation than adjacent dunes to the north and south. The resort contains buildings and paving on 6.5 acres, landscaping on four acres, and restored dune habitat on 6.5 acres. A boardwalk provides beach access across the southern portion of the dunes. The seaward-facing wall and buildings of the Sanctuary Beach Resort complex are set back approximately 120 feet from the top of the bluff (Figure 20).

Figure 20. Sanctuary Beach Resort



Risk

The bluff at this location has eroded approximately 4.5 ft/year over the past 20-30 years (Table 4), and with relative sea-level rise is estimated to erode at approximately 5.5 ft/year over the next 50 years. The erosion rate has increased over the past 20 years (Table 3), which may be the result

of increased extraction of beach sand from the mine located only one mile north of the resort. Future dune erosion of 5.5 ft/year would mean that the Sanctuary Beach Resort would be compromised in approximately 20 years time and is therefore designated as a facility at high risk of erosion.

Consequences

The loss of this facility would have high economic consequences to the region as it is a popular tourist destination. The loss of the dunes on this site would also impact endangered western snowy plover, and the black legless lizard (Section 4.2).

The Sanctuary Beach Resort currently raises funds from a restoration fee (currently \$15 per night) to protect endangered species and habitat on its property. The resort has already invested in mitigating threats by installing a 'lizard crossing' beneath the main entry road.

Figure 20 also shows the location of a number of Marina Coast Water District (MCWD) facilities. The facilities include infrastructure and offices on a 12-acre site along 400 feet of shoreline. The seaward fence of the site is at the dune cliff edge in places. Buildings and infrastructure are set back 70-90 feet from the fence. Using an erosion rate of 5.5 ft/year the on-site facilities would be under threat of erosion in 10 to 15 years time. Hence, the MCWD site is at high risk of erosion. Indeed, wells on the beach at the end of Reservation Road that used to supply water to a small desalination plant were compromised by coastal erosion and are no longer operational. Although the MCWD site is at high risk of erosion, there are plans to abandon and remove the facility over the next few years, and hence, there are only low future consequences.

3.3.2 Sand City and Tioga Avenue West of Highway 1

Site

From 1927 to around 1990 the parcel of dunes west of Highway 1 and for about 0.8 miles north of Tioga Avenue was the location of sand mining operations (Section 2.5.3), which left the site in an environmentally degraded condition. In order to boost the economy, Sand City has, since the 1970s, sought to provide for commercially viable resort and recreational development on designated portions of its coastline. In the early 1980s, the certified Sand City Local Coastal Program (LCP) (Section 8.3.1) designated the former sand mine dune location for visitor-serving commercial uses, with a density not to exceed 650 units. In 1996, the City of Sand City entered into a Memorandum of Understanding with Regional and State Park agencies (the Coastal Commission was not party to the agreement) to permit visitor-serving and residential uses at two specific areas north of Tioga Avenue, which are still designated as such in the LCP.

Currently, remnants of a cement mixing facility are located immediately north of Tioga Avenue in Sand City. The facility is now used for temporary storage of construction equipment (Figure

21). Un-engineered structures are holding the shoreline seaward of its natural position creating a peninsula effect (Figure 6) and in the process they block lateral public access (creating safety hazards), prevent natural shoreline retreat, and beach area is lost both for recreation and as a habitat. Also, portions of Highway 1 curve seaward towards the dunes at Sand City. This section of the highway is approximately 400 feet from the dune edge and will ultimately be threatened by coastal erosion.

Figure 21. Storage Facility at the end of Tioga Avenue



Risk

The future erosion rate of the unprotected dunes adjacent to the Sand City site is estimated to be approximately 3.5 ft/year. Continued loss of beach in front of the structures at Sand City will lead to further undermining, erosion, and eventually total failure. The existing storage facility and part of Tioga Avenue which provides access to the facility and the beach would be lost. The Tioga Avenue/Sand City complex is designated as a facility at high risk of erosion.

Consequences

The current land use has a relatively low economic consequence, but a future threat to Highway 1 (approximately 100 years) could have moderate levels of consequence over the 50 year planning horizon. However, there are several proposed development projects at the Sand City site, located along the west side of Highway 1, north of Tioga Avenue, which would increase the economic consequence of erosion. The Sterling Center is a proposed resort on eight acres immediately north of Tioga Avenue. This proposed development would consist of a 136-unit hotel with restaurant,

conference and retail space, and parking garage. North of the Sterling Center is a plot of land owned by the Sand City Redevelopment Agency, on which they are pursuing development of a 16-acre resort complex including 155 vacation condominium units, an 80-unit hotel, three restaurants, conference and meeting facilities, a spa and health/wellness center, and parking structures.

In addition, Monterey Peninsula Water Management District (MPWMD) intends to implement a water project at the site to address water resources issues in Sand City. The Sand City Desalination Plant would be constructed on a parcel of land approximately 0.7 miles north of Tioga Avenue and three horizontal directionally drilled wells and three radial wells are proposed seaward of Sand Dunes Drive between Tioga Avenue and Monterey Beach Resort (see also Section 3.3.5). Water would be obtained from the shallow groundwater aquifer. As of October 2007, Sand City had completed and certified the Environmental Impact Report (EIR) in accordance with California Environmental Quality Act (CEQA) requirements, obtained Coastal Development Permit approval and permit amendment from the Coastal Commission, and obtained a U.S. Fish and Wildlife determination that the project construction would not result in a taking of species listed under the Endangered Species Act.

As part of their condition compliance, the City of Sand City submitted an adaptive management plan to address the potential risk to the desalination components that could be subject to shoreline erosion. The plan includes surveying the bluff and shoreline edge at regular intervals to assess the risk to the wells and pipeline infrastructure, as well as monitoring the salinity level of the feed water. At the onset of a ‘risk condition’ (i.e. when the bluff retreats to within five feet or the salinity level exceeds an established threshold), measures will be taken to relocate the wells to an approved location in consultation with the Coastal Commission. Coastal armoring is not contemplated as a means of protecting the project components and would only be considered as a last resort.

Overall, the potential future consequence of erosion at Sand City west of Highway 1 is high due to potential future environmental, safety, and economic factors.

3.3.3 Seaside Pump Station at Bay Avenue

Site

Seaside Pump Station (completed in 1983) is located at the junction of Bay Avenue and Vista del Mar Street. Seaside County Sanitation District’s former wastewater treatment plant was originally located adjacent to Seaside Pump Station. That plant was decommissioned in 1990 when a Regional Treatment Plant was completed north of Marina, and all of the treatment plant tanks and structures were demolished. The bulk of the site was sold to the California Department of Parks and Recreation (CDPR), although MRWPCA retains ownership of the Seaside Pump Station site. The Seaside Pump Station is approximately 100 feet from the base of the low-lying dunes that front the facility (Figure 22).

Figure 22. Seaside Pump Station



Risk

The historic rate of erosion has been approximately 2.5 ft/year, and the future rate is estimated at 3.0 ft/year. The facility could be compromised by erosion in about 30 years. However, the site would be vulnerable to significant wave damage and flooding before that time due to the low elevation of the fronting dunes. The top of the dunes are at approximately 25 ft NAVD compared to the base flood elevation (BFE – maximum elevation of wave runup and overtopping during a 100-year flood event) at this location of 27 ft NAVD (FEMA, 2007). Seaside Pump Station is considered a high erosion risk facility (PWA and Griggs, 2004).

Consequences

Seaside Pump Station pumps all of the raw (untreated) wastewater from the cities of Pacific Grove, Monterey, Del Rey Oaks, Seaside, and Sand City through the regional wastewater system to the MRWPCA Regional Treatment Plant. The pumps are a key component of the system and need to remain in full operation indefinitely, so erosion would have significant economic, environmental, and human health impacts. A breach of this facility would have environmental impacts to the dunes and beaches, and water quality impacts within the MBNMS. Seaside Pump Station is therefore designated as a high consequence facility.

3.3.4 Monterey Interceptor between Seaside Pump Station and Wharf II

The Monterey Interceptor pipeline can be divided into three segments each with a different set of erosion concerns; Seaside Pump Station to Monterey Beach Resort, Monterey Beach Resort to Tide Avenue, and Tide Avenue to Wharf II (Figure 7).

Site

The Monterey Interceptor between Seaside Pump Station and Monterey Beach Resort is buried in dunes, approximately 100 to 175 feet from the dune bluff. Between Monterey Beach Resort and Tide Avenue the pipeline is not under imminent threat of erosion damage (PWA and Griggs, 2004). However, the pipeline could be vulnerable to erosion damage during a large storm event towards the end of the 50-year planning horizon. From Tide Avenue to Monterey Pump Station, the pipeline is located a minimum of 115 feet from the shoreline. Between Monterey Pump Station and Wharf II, the Monterey Interceptor was originally buried beneath the back beach, but due to erosion is now at mid-beach.

Risk

Based on approximate future erosion rates of between 1.5 and 3.0 ft/year, the shoreline between Seaside Pump Station and Monterey Beach Resort would be expected to erode 75-150 feet over the next 50 years, and parts of the pipeline between these two locations may be compromised over the next 40 years. The erosion could uncover the pipe and/or manholes and make them vulnerable to damage. Hence, the Monterey Interceptor between Seaside Pump Station and Monterey Beach Resort is a facility at high risk of erosion (PWA and Griggs, 2004).

Between Monterey Beach Resort and Monterey Pump Station, the future erosion rate is estimated at approximately 1.5 ft/year, and therefore the pipeline would be at low risk of chronic erosion over the next 50 years. However, given the accuracy of the base map (+/- 16 feet) used to define the position of the pipeline in the dunes here (PWA and Griggs, 2004), it is designated as a moderate risk facility with the potential for storm damage towards the end of the 50-year planning horizon (PWA and Griggs, 2004).

Between Monterey Pump Station and Wharf II the shoreline is estimated to erode at an average rate of approximately 1.0 ft/year and the beach has been observed to scour during storms (Dingler and Reiss, 2002). Manhole covers are now sometimes exposed at low tide during the winter and are vulnerable to damage. At this location, the Monterey Interceptor pipeline is under imminent threat of erosion damage and is at high risk of erosion (PWA and Griggs, 2004).

Consequences

The Monterey Interceptor carries all of the raw (untreated) wastewater from the cities of Pacific Grove and Monterey. This flow is pumped through Monterey and Seaside Pump Stations to the MRWPCA Regional Treatment Plant. The exposure of the pipeline could ultimately be a threat to marine resources if erosion caused a spill to occur. The pipeline is a vital facility that needs to

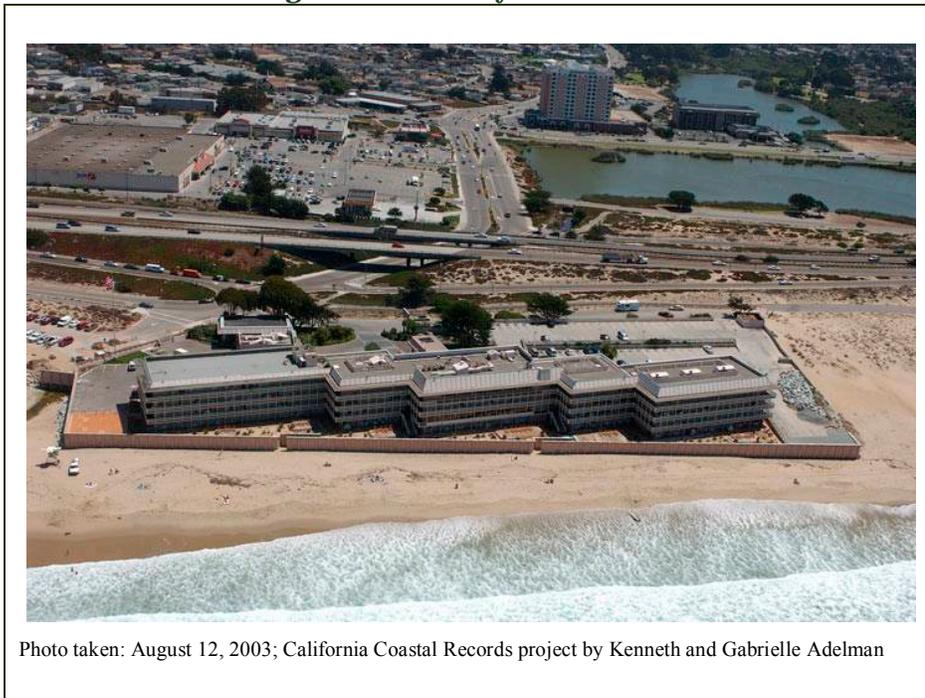
remain fully operational indefinitely, and the consequences of erosion would be significant economic, environmental, and human health impacts. A breach to this facility would have environmental impacts to the dunes and beaches, and water quality impacts within the MBNMS. The Monterey Interceptor between Seaside Pump Station and Wharf II is therefore a high consequence facility.

3.3.5 Monterey Beach Resort, Highway 1 and Resort Access Road

Site

The 196-room Monterey Beach Resort hotel was constructed on north Del Monte Beach in 1968 and consists of five four-story buildings, a restaurant, meeting rooms, a pool, and parking structures (Figures 5 and 23). It was originally constructed with surrounding seawalls and a large beach area fronting the hotel. This part of Del Monte Beach was a major attraction of the hotel. Since the hotel was built, shoreline erosion has occurred up coast and down coast, and the hotel has become a headland.

Figure 23. Monterey Beach Resort



Risk

Here future erosion rates are estimated to be approximately 1.5 ft/year. When the existing seawall was built in 1968, beach elevations in front of the hotel were over three feet higher than today. Erosion has lowered the beach elevations such that during high tides there is now no beach access

in front of the hotel. The existing seawall is not embedded deep enough into the sand to withstand further beach erosion. This structure was partially breached during the severe El Niño winter of 1983 when large waves coincident with very high tides surged through the stairwell opening in the wall, broke through the joints in the wall causing loss of fill behind. In 2004, much of the south wing wall of the seawall failed with collapse of the fill behind the wall. Emergency riprap was brought in to fill this void (Figures 5 and 23). Because of the erosion problem the hotel has received approval from the Coastal Commission to build a new seawall. The seawall has not yet (June 2008) been constructed. It would comprise a 600-foot long driven sheet-pile metal seawall with a footprint of 1,000 square feet immediately adjacent to the existing seawall. The permitted project would also involve removal of the existing end walls and replacement with driven sheet-pile walls.

In addition to the Resort, the access road on Sand Dunes Drive and the offramp to Highway 1 are within the 50-year erosion zone. The Monterey Beach Resort and the road infrastructure are designated as facilities at high risk of erosion.

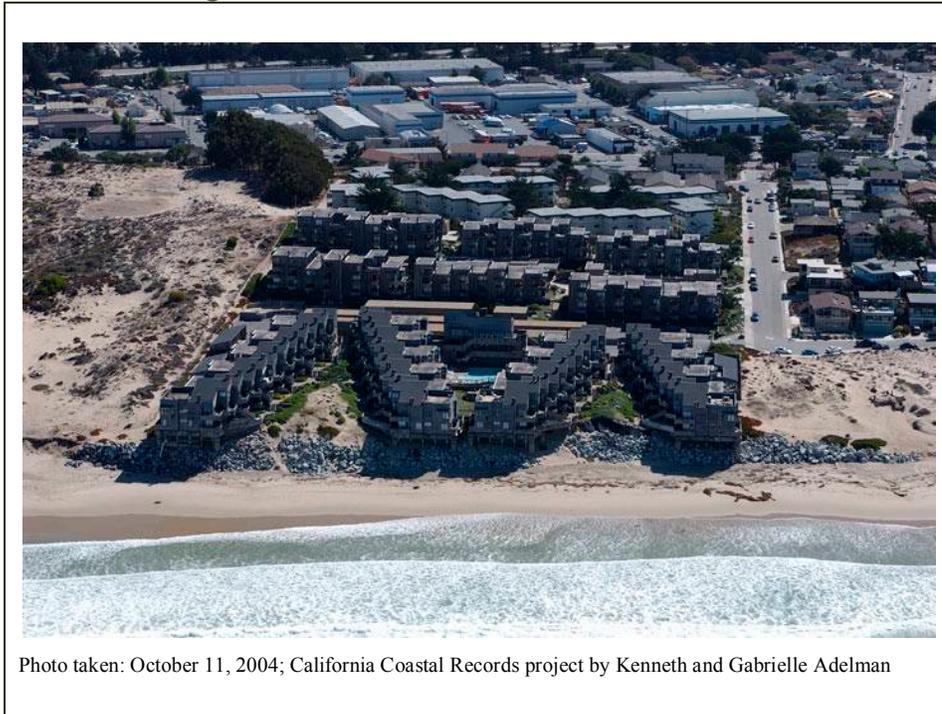
Consequences

The hotel continues to be a popular tourist destination and loss of this facility would have high economic consequences. In addition, the presence of the seawall has led to loss of the fronting beach for recreational purposes and at high tide there is a public safety issue as lateral access along the beach is compromised. Monterey Beach Resort, access road, and Highway 1 access ramps are designated as high consequence facilities.

3.3.6 Ocean Harbor House Condominiums/Del Monte Beach Subdivision

Site

Beginning in 1968 the first eight buildings (Ocean House) of an apartment complex were constructed on the dunes on Surf Way in Monterey. An additional six buildings (Harbor House) were constructed further landward in 1974. At the time of construction, the City of Monterey allowed the front buildings to overhang the utility easement running parallel to the bay in return for all land seaward of the easement, which means the City owns all land up to the edge of the front buildings. Collectively, the 172 units, now converted to condominiums, are called Ocean Harbor House (Figures 5 and 24).

Figure 24. Ocean Harbor House Condominiums

Since its construction, Ocean Harbor House has had a history of erosion problems. Following the 1982-83 El Niño, erosion of the dunes had approached to within 14 feet of the shallow pilings supporting the complex (the bases of the pilings were at an elevation ten feet above MLLW). Emergency riprap (600 feet of rock over 20 feet high) was placed on Del Monte Beach to provide protection to the buildings but subsequently had to be removed, following completion of an Environmental Impact Report (EIR) in 1984, because of City of Monterey regulations regarding placement of materials on a public beach. The front pilings were subsequently removed and 50-55 foot deep concrete caissons were then poured along with grade beams to support the front row of condominiums. Despite the deep caissons and grade beams, waves continued to erode the dune face back beyond the two rows of caissons (Figure 5, right panel). Additional emergency riprap was required to protect the condominium units in 2002 and another EIR was completed to assess a number of longer-term alternatives to the riprap. While the preferred alternative was to remove the frontal units, the owners of the condominiums preferred to build a seawall to protect their property. The application was approved by the Monterey City Planning Commission, the Monterey City Council, and the Coastal Commission, with substantial mitigation fees involving nourishing the beach in front of the seawall. The seawall will be within the footprint of the existing building foundations, and will not encroach onto the City of Monterey (Del Monte Beach) property.

There is no infrastructure to the east of the condominiums, whereas to the west, Tide Avenue with 15 homes runs parallel to the shore on the dune top. Tide Avenue is generally greater than 150

feet from the dune edge, although a short stretch appears to be within 50 feet. Landward of Tide Avenue is Del Monte Beach subdivision comprising several apartment buildings and 128 single-family homes, and associated infrastructure. The neighborhood has some problematic storm drain and sewer infrastructure that are targeted for improvements, including abandonment of a sewer main within the open space dune area and the consolidation of storm drain outfalls.

Risk

A new seawall fronting Ocean Harbor House is being engineered to withstand storm wave-attack and is considered a long-term (50-year planning) solution to erosion of the condominiums. However, it is likely that the new seawall will cause the fronting beach to further lower in elevation because the armoring will provide a surface for wave reflection. The seawall will also enhance the peninsula effect at this location, with the dunes to the east and west continuing to erode. Because of the seaward position of Ocean Harbor House and the limited set back of the Tide Avenue community, the condominiums and the Del Monte Beach subdivision are designated as facilities at high risk of erosion.

Consequences

The condominiums and properties along Tide Avenue are privately owned and the consequences of their loss would be economically damaging and hazardous to safety, especially to individual owners. There is no lateral access along the beach in front of the condominiums at high tide now and the frequency of access loss will increase in the future. Coastal Commission conditions of approval are being designed to provide lateral access around the back of the most seaward condominiums. The loss of access roads can also have impacts to public safety for emergency services. Ocean Harbor House condominiums, Tide Avenue and Del Monte Beach subdivision are designated as high consequence facilities.

3.3.7 Monterey La Playa Town Homes at La Playa Street

Site

The La Playa town homes are located in the dunes at the end of La Playa Street in Monterey, and were originally constructed as apartments in 1964. The development was later converted to condominiums (Figure 25).

Figure 25. Monterey La Playa Town Homes



Photo taken: October 28, 2005; California Coastal Records project by Kenneth and Gabrielle Adelman

Risk

The westernmost condominium sits only 30 feet from the dune edge and is protected by a small pile of riprap, with most of the remaining complex over 50 feet from the shoreline. Long-term erosion rates are likely to be greater than 1.0 ft/year, and therefore structures towards the western end of the complex are at high risk of erosion over the next 50 years. In addition, the structures could be vulnerable to wave damage and flooding due to the low elevation of the fronting dunes, compared to the base flood elevation (BFE – maximum elevation of wave runup and overtopping during a 100-year flood event) at this location of 22-26 ft NAVD (FEMA, 2007).

Consequences

The town homes are privately owned and the consequences of their loss would be economically damaging to individual owners. Lateral access along the beach in front of the westernmost condominiums would also be lost and the beach would be hazardous at high tide. The La Playa town homes are considered to be high consequence facilities.

3.4 LOW RISK AND/OR LOW CONSEQUENCE AREAS

Numerous facilities along the southern Monterey Bay shoreline have either a low risk of erosion or a low consequence factor, and are not discussed further in this Coastal RSM Plan. It is recommended however that these facilities be considered for set back or relocation opportunistically as maintenance or other funds become available. These facilities are:

- Moss Landing spit community including the research facilities of MBARI
- Monterey Dunes Colony

- Ocean outfall pipeline near Marina sand mine
- Marina Coast Water District facilities near Reservation Road
- Fort Ord storm water and sewer outfalls
- Fort Ord monitoring and injection wells
- Bay Avenue storm water outfall
- Roberts Lake/Laguna Grande outfall
- Sand Dunes Drive
- Monterey Pump Station
- Del Monte Lake outfall
- Lake El Estero Pump Station and outfall
- Catellus East property near Wharf II.

3.5 CRITICAL AREAS OF EROSION SHORT-LIST

In summary, the following lengths of beach are short-listed as high-risk and high-consequence critical areas of erosion, for three main reasons:

1. Areas where the facility is located beneath the beach and is under threat over the next 50 years from exposure due to beach lowering as the shoreline profile migrates landward. These critical erosion areas include:
 - Monterey Interceptor between Monterey Pump Station and Wharf II.

2. Areas where the facility is located on the dune top and is under threat over the next 50 years through continued erosion of the dune face. These critical erosion areas include:
 - Sanctuary Beach Resort
 - Seaside Pump Station
 - Monterey Interceptor between Seaside Pump Station and Monterey Beach Resort.
 - Monterey La Playa town homes at La Playa Street

3. Areas where armoring of the facility exists causing reduction of local supply of sediment to the beach, causing passive erosion and increasing the potential for undermining the armoring once the sea walls are impacted by waves as well as retreat of the beach on either side of the hard structure. These critical erosion areas include:
 - Tioga Avenue at Sand City
 - Monterey Beach Resort
 - Ocean Harbor House condominiums.

The sections of the Monterey Interceptor from Monterey Beach Resort to Tide Avenue, and from Tide Avenue to Monterey Pump Station are at moderate risk of erosion, with high consequences.