California MLPA Master Plan Science Advisory Team
Draft Background Information Regarding Beach Manipulation Activities in the MLPA South Coast Study Region

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Sandy beaches in the MLPA South Coast Study Region support very high levels of recreation and human use. These coastal areas are managed with a wide variety of approaches and techniques, ranging from modest to intensive activities, on both seasonal and year-round schedules. Widespread management activities for study region beaches include beach nourishment, beach grooming, public safety, breaching of impounded creeks, lagoons and outfalls, construction of winter sand berms to protect structures, contouring of berms, filling of beach pools and removal of wind-blown sand from paved areas and private property. The MLPA Master Plan Science Advisory Team (SAT) is tasked with providing scientific information about how these activities impact the surrounding ecosystem, to help fulfill the goals of the Marine Life Protection Act (MLPA).

A key caveat is that jurisdiction of the MLPA begins at the mean high tide line or the mouth of a coastal river[1] and extends offshore to the state water boundary at three nautical miles. Therefore, attention should be paid most to those activities that 1) are related to MLPA planning (i.e., occurs seaward of the mean high tide line, or directly impacts the environment seaward of the mean high tide line) and 2) for which spatially explicit information exists so that it can be mapped and known as to whether an activity occurs within a potential marine protected area. An initial analysis indicates that beach nourishment activities in California mostly occur seaward of the mean high tide line, and spatial data showing the locations of these activities are available[2].

Beach Nourishment

Beach nourishment (i.e., replenishment) is the term used to describe the introduction of sand onto a beach to supplement a diminished supply of natural sediment, for the purpose of beach restoration, enhancement or maintenance[3]. Beach nourishment is commonly used to combat shoreline retreat, particularly for beaches of high recreational value, and involves sediments from at least one dredge site or a terrestrial source[2]. Beach nourishment takes many forms including the placement of sand in the intertidal and subtidal zones using dump trucks, dredges, pipelines, and barges.

Beach nourishment represents a widespread impact to sandy beach habitats in the study region. For example, approximately 130 million cubic yards of sand was added to southern California beaches between 1940 and 1960[4]. The disturbances created by beach nourishment activities cause immediate ecological damage to the associated sandy beach habitats and biota of receiver sites and to subtidal “borrow” or sand source sites[5]. Documented impacts to

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[1] California Fish and Game Code, Section 2852(c).
[2] Coastal Sediment Management Workgroup (http://dbw.ca.gov/csmw/PDF/TABLE2TASK3CSMW.pdf).
[3] California Department of Boating and Waterways and State Coastal Conservancy. 2002. California Beach Restoration Study. Sacramento, California.
[4] Flick, R. E. 1993. The myth and reality of southern California beaches. Shore and Beach 61(3):3-13.
[5] Peterson, C. H. and M. J. Bishop. 2005. Assessing the environmental impacts of beach nourishment. Bioscience 55(10):887-896.

receiver beaches include near complete mortality of resident intertidal biota, which can lead to lasting reductions in abundance and biomass, significant declines in shorebird use, and alterations to the habitat (i.e., decreased sediment quality and increased intertidal slopes)[6,7]. Subsequent ecological recovery can be protracted, particularly in the face of repeated nourishment or bypassing episodes[8]. Beach nourishment may also potentially damage adjacent marine habitats such as rocky reefs, estuary mouths, surfgrass beds and kelp forests due to an increase in sediment transport and the generation of turbidity plumes.

While offshore deposits of sand in depths up to about 100 feet are generally the nearest source of suitable quality sand, the use of sediments from harbor dredging and flood control projects is often viewed as the most cost-effective means of nourishment. Beaches are also widely used as convenient sites of dredge disposal for various projects such as harbor bypassing, often receiving sediments that are too fine to be competent as beach sand. Due to longshore currents, retention of sand on or near a nourished beach may require the construction of jetties or submerged reefs offshore. To protect water quality and avoid turbidity plumes, the sand used in beach nourishment is often limited to 20% fine sediment[9]. However, for severely eroded beaches, appropriately applied nourishment can restore sandy intertidal habitat for subsequent colonization and use by marine animals and birds.

Other Beach Manipulation Activities

A variety of other beach manipulation activities occur in south coast study region beaches including beach grooming, public safety vehicle traffic, breaching of impounded creek mouths, lagoons and outfalls, construction of winter sand berms to protect structures, contouring berms, filling of high beach pools and removal of wind-blown sand from paved areas and private property. Many of these approaches involve intensive use of heavy equipment including trucks, bulldozers, and grooming machines in the intertidal zones of beaches. These activities primarily take place above the mean high tide line, outside the jurisdiction of the MLPA. However, several activities take place below the mean high tide line. For example, beach grooming does occur below the mean high tide line, particularly outside of grunion season, and sand is often collected below the mean high tide line to construct protective winter berms further up on the beach. These activities have the potential to negatively impact living marine resources associated with the sandy intertidal environment.

Beach grooming (i.e., manicuring) refers to removing debris (natural and unnatural) from sandy beaches. Much of the southern California mainland coast (>100 miles) and over 45% of the

[6] Peterson, CH, M.J. Bishop, G.A. Johnson, L.M. D'Anna, and L.M. Manning 2006. Exploiting beach filling as an unaffordable experiment: benthic intertidal impacts propagating upwards to shorebirds. Journal of Experimental Marine Biology and Ecology 338:206-221.
[7] Speybroeck, J., Bonte, D., Courtens, W., Gheskiere, T., Grootaert, P., Maelfait, J-P., Mathys, M., Provoost, P., Sabbe, K., Stienens, E.W.M., Van Lanker, V., Vicx, M., and S. Degraer. 2006. Beach nourishment: an ecologically sound coastal defence alternative? A review. Aquatic Conservation: Marine and Freshwater Ecosystems 16:419-438.
[8] Dolan, R., C. Donoghue and D. Stewart 2006. Long-term impacts of tidal inlet bypassing on the swash zone filter feeder *Emerita talpoida* Oregon Inlet and Pea Island, North Carolina. Shore & Beach 74: 23-27
[9] Clean Water Act, Section 404(b)(1).

beaches are mechanically groomed to remove macrophyte wrack and trash at least seasonally[10]. There are many approaches to grooming, including the use of heavy equipment to remove cobbles, kelp plants, carrion and large woody debris, as well as specialized grooming machines (raking, sifting, smoothing). The disposal of wrack also varies widely among beaches and can include burial in the intertidal or supralittoral zones, removal from beach to land fills or transfer stations, and deposition downcoast.

Beach grooming has major impacts on the associated marine communities of beaches. For example, the removal of beach wrack (primarily giant kelp and surfgrass) by grooming is associated with decreased species richness, abundance, and biomass of intertidal macroinvertebrates and reduced prey resources for shorebirds and fish in southern California[10]. Shorebird abundance and diversity is also reduced on groomed beaches. Similarly, grooming over spawning sites for California grunion destroys eggs and significantly reduces survival of any embryos remaining[11]. During grunion season, many beach managers restrict their grooming to well above high tide[11]. During the off-season, however, grooming can occur below the mean high tide and grooming protocols and equipment differs widely across locations within the study region.

The building of winter berms using intertidal sand involves heavy equipment and occurs routinely on many beaches along the Santa Barbara, Ventura, Los Angeles, Orange and San Diego counties'coasts (i.e., Zuma Beach, Mission Beach, Pacific Beach, etc.), and emergency berm building can occur in numerous other locations. Berm building has negative effects on beach biota, including congeners of clams and crabs that can make up the majority of intertidal biomass on southern California beaches[12].

Vehicle traffic associated with public safety is common in the study region and causes ecological impacts to beach biota. Compaction, crushing, exposure and direct mortality of intertidal animals, including clams, crabs, and more soft bodied forms and grunion eggs, are associated with vehicle use on sandy beaches[13,14].

[10] Dugan, J. E., D. M. Hubbard, M. D. McCrary, and M. O. Pierson. 2003. The response of macrofauna communities and shorebirds to macrophyte wrack subsidies on exposed sandy beaches of southern California. Estuarine, Coastal and Shelf Sciences 58S:25-40.
[11] Martin, K.T. Speer-Blank, R. Pommerening, J. Flannery and K. Carpenter. 2006. Does beach grooming harm grunion eggs? Shore & Beach 74(1):17-22.
[12] Peterson, C.H., Hickerson, D. H.M. and G. G. Johnson. 2000. Short-term consequences of nourishment and bulldozing on the dominant large invertebrates of a sandy beach. Journal of Coastal Research. 16:368-37.
[13] Schlacher, T. A., L.M. C. Thompson, S. J. Walker. 2008. Mortalities caused by off-road vehicles (ORVs) to a key member of sandy beach assemblages, the surf clam, *Donax deltoides*. Hydrobiologia 610:345-350.
[14] Schlacher, T.A. and L. M. C. Thompson. 2007. Exposure of fauna to off-road vehicle (ORV) traffic on sandy beaches. Coastal Management 35:567-583.