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American Shore and Beach Preservation Association
Attn.: Awards Committee (Awards@asbpa.org)

Dear Committee Members:

We (Orville T. Magoon and Robert L. Wiegel) would like to nominate for the **2009 ASBPA Coastal Project Award** the five major beach efforts in Orange County, California - Surfside-Sunset, Bolsa Chica, Huntington Cliffs, Huntington Beach, West Newport Beach. These collectively span a coastal reach about twelve miles long, and have proven long-term success for beach enhancement and as mitigation for an effect of coastal subsidence that has resulted from the removal of hydrocarbons and water from underground reservoirs.

Large "periodic" beach nourishments have been made about every five years since 1964 at the feeder-beach, Surfside-Sunset Beach. Placement of sediment, and construction of eight groins at West Newport Beach is also a part of the overall project. This erosion control project was authorized by the U.S. Congress in 1962. This was based in part by a beach erosion study of the Orange County coast made by the Corps of Engineers in cooperation with the Orange County Board of Supervisors, and submitted to the U.S. Congress in 1940. One of the findings in this report was in Paragraph 71, "In his report submitting field data and observations to the Board (sic Beach Erosion Board), the district engineer concludes that the diminution of supply of river sand by the construction of flood-control works will necessitate protective measures to prevent denudation of the beaches." The erosion control project has mitigated this problem as well as the effect of coastal subsidence mentioned above.

The nominees should probably be the U.S. Army Corps of Engineers, Los Angeles District (Commander) and the County of Orange Public Facilities and Resources Department.

An aerial photo looking toward the SE at Surfside-Sunset Beach, probably in the late 1940's, is in Figure 1. A recent aerial photo of the same region is in Figure 2; this is looking toward the NE from offshore. Before (10 Oct. 1934) and after (12 Nov. 1998) aerial photos of West Newport Beach, looking southeasterly towards the Newport Pier are in Figure 3. The locations of the beach sub-reaches are shown in Figure 4, together with the TIN Model Beach

Profile transect locations. A plot of cumulative volume of the beach nourishment, 1963-1997, Anaheim Bay to Santa Ana River Mouth, is in Figure 5.

The beaches are extensively used. For example, annual beach attendance in Huntington City and State Beaches was estimated by King and Symes (2004) to be in excess of ten million. An estimate was made in 1991 of 2.75 million visitors to Bolsa Chica State Beach by David Prior, Lifeguard Supervisor, California Dept. of Parks and Recreation, Orange County (in Pratte, 1991, p. 3). They are easily accessible via the Pacific Coast Highway, which is parallel to most of the coast here. Public parking is available at Bolsa Chica State Beach, Huntington Cliffs, Huntington City Beach, and Huntington State Beach. These beaches are within Los Angeles Megacity (Ewing, 2008), and help mitigate one or more of the problems associated with a growing coastal megacity.

"The U.S. Congress authorized an erosion control project in 1962, recognizing the impacts of flood works, coastal harbors, and other factors in causing beach erosion along the northern Orange County, California shoreline" (Shak and Ryan, 1997). This project was formulated as part of an extensive study made by the U.S. Army Corps of Engineers, Los Angeles District, in the early 1960's: Beach Erosion Control Report on Cooperative Study of Orange County, California, Appendix V, Phase 2, March 1, 1962. The first placement of beach nourishment sediment at Surfside-Sunset as part of this project was in 1964 (Stage 1), and the most recent was in the Spring of 2009 (Stage 12). The cumulative volume placed through Stage 11 (2002) was 16,422,000 cubic yards, and through Stage 12 (2009) was 17,922,000 cubic yards. A study of beach profile surveys made during the 1963-1997 interval shows an average increase in beach width of 4.1 ft/year and a corresponding shorezone unit volume increase of 4.7 cy/ft/year (Gadd, Leidersdorf, Hearon, Shak and Ryan, 2007). The nominators agree with a statement by Gadd. Leidersdorf, et al. that: " the nourishment programs have exerted a substantial positive impact on the beaches of the Huntington Beach Littoral (sic Sediment) Sub-cell."

The nominators add:
The southern California coast from the Los Angeles Harbor south to Huntington Cliffs experienced significant subsidence due to the large scale removal of oil, gas, and water from underground reservoirs. These resources were extracted for regional and national use and subsidence was manifested as a recession of the shoreline and offshore as increased water depth. Measurements have shown that the nominated project has mitigated the shoreline retreat and that, after four decades of beach nourishment, beaches in the Huntington Beach Littoral Sediment Sub-cell are substantially wider than at the start. An important lesson that can be learned from the success of this long-term beach nourishment project is that one effect of relative mean sea level rise (eustatic sea level rise or land subsidence) can be mitigated. If

a beach is valuable, and beach-quality sediment is available, an economic solution to beach recession can be to nourish (replenish) the beach.

A combination of the change in the supply of sand to the beach just "downdrift" of the Anaheim Bay entrance "arrowhead" jetties, the encroachment on the beach by the building of beachhouses in the Surfside-Sunset area, and subsidence as a result of withdrawal of hydrocarbons and water from underground reservoirs, resulted in recession/ erosion of the beach beginning at the base of the southeast jetty. The first source of sediment for this project was from dredging for navigation requirements at the U.S. Navy Seal Beach Naval Weapons Station (NWS) in Anaheim Bay. Subsequent sources were other navigation projects and dredging from offshore "dredge pits" (also called "offshore borrow pits"). The "feeder beach" was Surfside-Sunset, just southeast of the Anaheim Bay entrance jetties. The local wave climate in this region is complex, and is affected by several of the "Channel Islands" on the California Continental Borderland. Sand is transported alongshore by wave action either to the southeast or northwest, depending on the wave conditions. The net movement of littoral sand transport is toward the southeast. Owing to this, the sand has been transported and distributed along Bolsa Chica State Beach, Huntington Cliffs, and Huntington Beach, to the mouth of the Santa Ana River, as planned. Some sections of beach are backed by low steep bluffs (seacliffs) of mesas. Sand has also been placed on West Newport Beach, obtained from dredging the Santa Ana River beach and by "backpassing" from Balboa Peninsula (Beach). As part of the project, eight groins were built between 1968 and 1973 in this section.

The quantities of sand and dates of placement are given in Table 1 and Table 2 below.

Table 1. Beach Nourishment Placements at Surfside-Sunset (USACE, Los Angeles District, Dec. 2002; Shak and Ryan, 1997; Gadd, Leidersdorf, Herron, Shak and Ryan, 2007; Ryan, 2009)

June 1964. dredge volume, 4,000,000 cubic yards; cumulative volume 4,000,000 cubic yards (Stage 1, dredged from Anaheim Bay)
May 1971, 2,260,000 cy; cum. vol. 6,260,000 cy (Stage 4A, dredged from Anaheim Bay)
June 1979, 1,644,000 cy; cum. vol. 7,904,000 cy (Stage 7, from offshore borrow areas)
May 1983, 400,000 cy; cum. vol. 8,304,000 cy (deepening NWS Channel)
April 1984, 1,500,000 cy; cum. vol. 9,804,000 cy (Stage 8, offshore borrow areas and Anaheim Bay)
April 1984, 783,000 cy; cum. vol. 10,587,000 cy (Seal Beach NWS)
March 1989, 180,000 cy; cum. vol. 10,767,000 cy (deepening NWS Channel)
June 1990, 1,300,000 cy; cum. vol. 12,067,000 cy (Stage 9, offshore

borrow areas)
Sept. 1990, 522,000 cy; cum. vol. 12,589,000 cy (Stage 9, offshore borrow areas)
Nov. 1996 to July 1997, 1,600,000 cy; cum. vol. 14,189,000 cy (Stage 10, offshore borrow areas)
2002, 2,233,000 cy; cum. vol. 16,422,000 cy (Stage 11)
June - July 2009, 1,000,000 cy; cum. vol. 17,422,000 cy (Stage 12, offshore borrow area)
July 2009, 250,000 cy, cum. vol. 17,672,000 cy (Stage 12, offshore borrow area)
July 2009, 250,000 cy, cum. vol. 17,922,000 cy (Stage 12, offshore borrow area)

Table 2. Beach Nourishment of West Newport Beach

1965;	124,000 cy,	from Balboa Peninsula
1966;	60,000 cy,	from Balboa Peninsula
1967;	150,000 cy,	from Balboa Peninsula
1968;	435,000 cy,	from Balboa Peninsula
1968;	246,000 cy,	from Santa Ana River, Stage 2
1969;	750,000 cy,	from Santa Ana River, Stage 2
1970,	124,000 cy,	from Santa Ana River, Stage 3
1973,	350,000 cy,	from Santa Ana River, Stage 4b and 5
1992;	1,300,000 cy,	from Santa Ana River,
2009;	100,000 cy,	from beach near Santa Ana River mouth, "backpass" using scraper, Stage 12

[Notes. 1) In the 1992 placement of 1,300,000 cubic yards, the material was obtained from the Santa Ana River and placed offshore in a "narrow mound; a mix of silt and mud (17%), sand (80%), and some cobble-size angular rock" (USACE, LAD, Dec. 2002). 2) For the 2009 project, sand was moved by scrapper from the river mouth to 56th St. jetty reach, to the reach between the 46th St. and 28th St. jetties]

Surveys were made on numerous occasions along a series of beach profiles, Figure 4. They included condition surveys, pre- and post construction surveys, CCSTWS (Coast of California Storm and Tidal Wave Study) surveys, NOS (National Ocean Survey), Santa Ana River Mainstem (SAR) project surveys; with varying spatial coverage, resolution and duration (Shak and Ryan, 1997); USACE, LAD, Dec. 2002; Gadd, Leidersdorf, et al., 2007). The survey data were used to construct Triangulated Irregular Network (TIN) models (also referred to as digital terrain models, DTM). The time history of sediment placement quantities (gross, and also gross less estimated 20% volume of fines which would not have remained on the beach, or shoreward of the "statistical depth of closure," are in the USACE, Los Angeles District report (2002); and in Gadd, Leidersdorf, et al. (2007). [**Note.** The concept of "statistical depth of closure" was refined for use in this study.] Also given are the shorezone volumes, defined as "the volume of sediment lying between the back beach and an offshore boundary representing the

seaward limit of statistically significant profile data. This includes the subaerial volume of the beach. The nourishment volume (less 20% fines) displays close agreement with the shorezone volume, indicating that the nourishment has remained in (and provided benefit to the shorezone; see Figure 5. As mentioned previously, it was found that during 1963-1997 there was an average increase in beach width of 4.1 ft/year and a corresponding shorezone unit volume increase of 4.7 cy/ft/year.

Historical Notes. 1) A widely used formula for the relationship between the alongshore component of wave energy and the littoral transport of sand along a beach was developed by the USACE, Los Angeles District during studies in San Pedro Bay and Santa Monica Bays (e.g, Eaton, 1951; Wiegel and Saville, Jr., 1996). This formula was probably based on the "average work factor" in a Scripps Institution of Oceanography (SIO, 1947) report to the USACE Los Angeles District Office. In this report is the statement "...in the transport of sand by wave action it appears that wave work rather than wave height is the significant parameter." An equation for the time rate of work (wave power) was developed in terms of significant wave height, associated significant wave period, and the frequency distribution of these terms in the summation H^2Ts per unit length of beach. This formula is commonly known as the SPM formula (Shore Protection Manual)). An early use of the SPM formula was for the beach beginning at the Anaheim Bay south jetty (Caldwell, 1956) (the beach that is being nominated herein). 2) One of the earliest uses of wave refraction diagrams was for the San Pedro Bay region. Many diagrams are in the USACE, Los Angeles District, 1962 report. (An earlier wave refraction diagram is in the M.S. thesis of Herbert C. Gee (1938); as part of his hydraulic model study of Cabrillo Beach, CA, a manmade beach at the base of the San Pedro breakwater, on the ocean side. The thesis was done under the supervision of Professor Morrough P. O'Brien, Univ. of California, Berkeley, CA.)

Sincerely yours

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List of Figures

Figure 1. Aerial Photo, looking SE over Surfside-Sunset Beach, probably in the late 1940's. (From USACE, Los Angeles District, 1986)

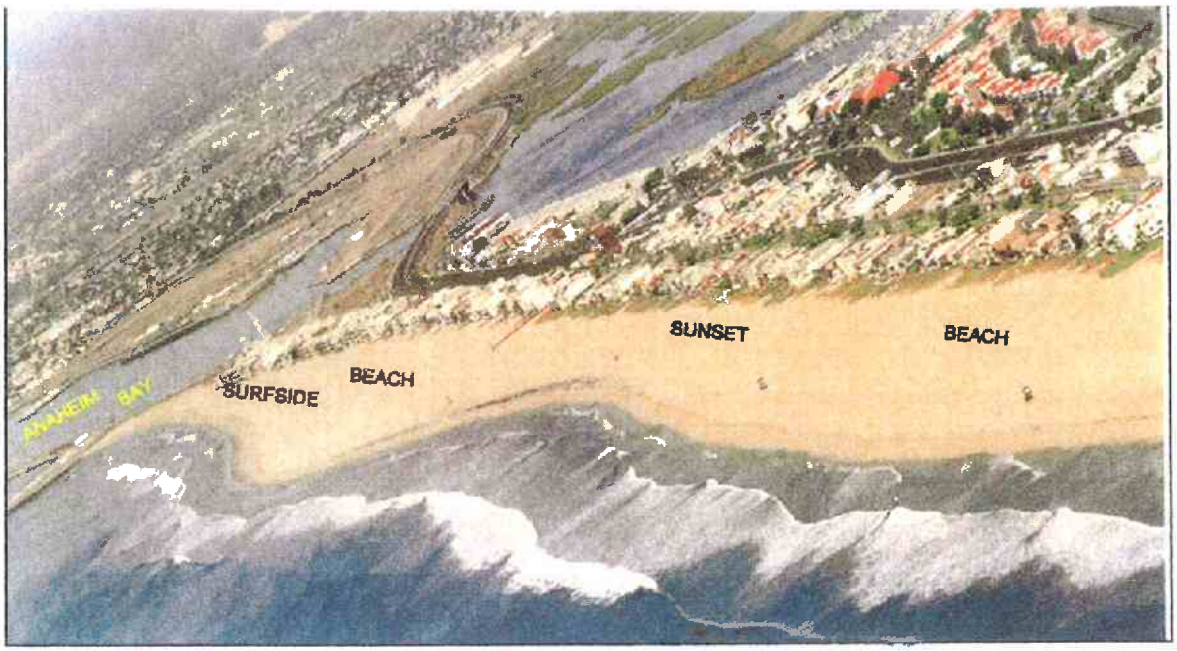

PHOTO TAKEN ON NOVEMBER 12, 1998

Sources: UCLA Department of Geology, Spence Collection
Noble Consultants Inc.

Figure 2. Aerial Photo of Surfside-Sunset Area, looking NE from Offshore. (From USACE, Los Angeles District, Dec. 2002)

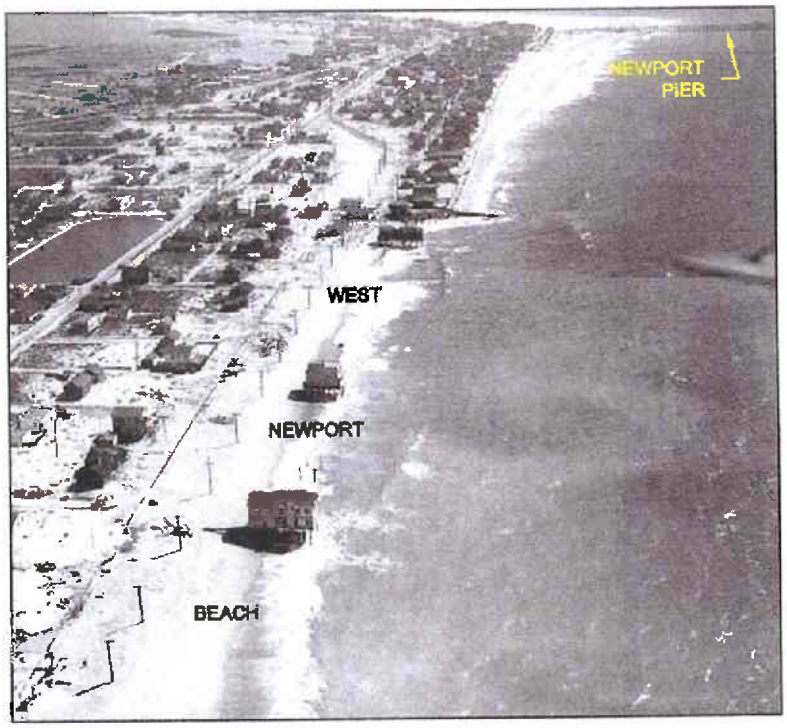

PHOTO TAKEN ON OCTOBER 10, 1934

PHOTO TAKEN ON NOVEMBER 12, 1998

Sources: UCLA Department of Geology, Spence Collection
Noble Consultants, Inc.

WEST NEWPORT BEACH

Figure 3.

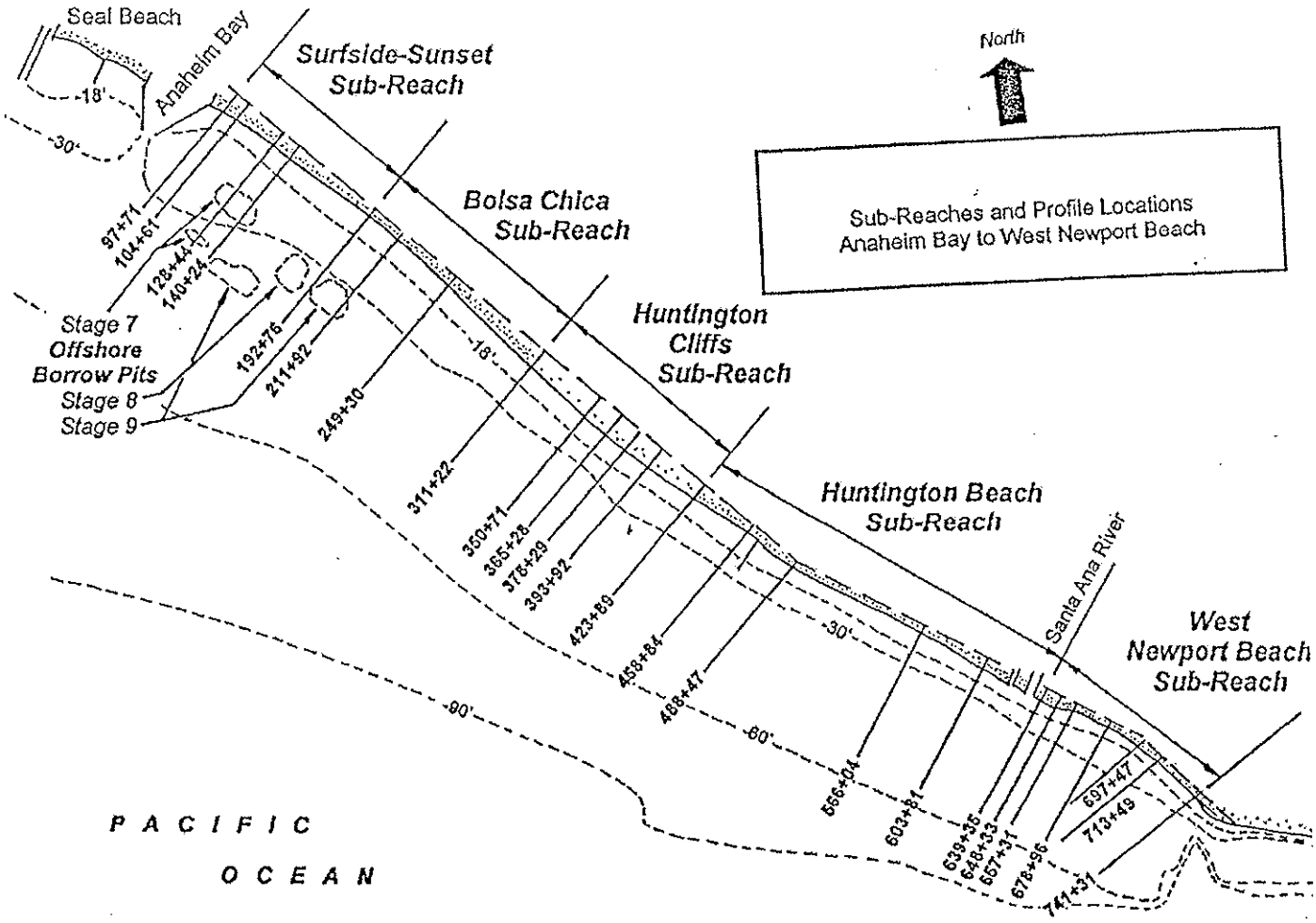

Figure 4. Survey Transect Locations, Huntington Beach Littoral Sediment Sub-cell (Anaheim Bay to Santa Ana River Mouth). (From USACE, Los Angeles District, Dec. 2002)

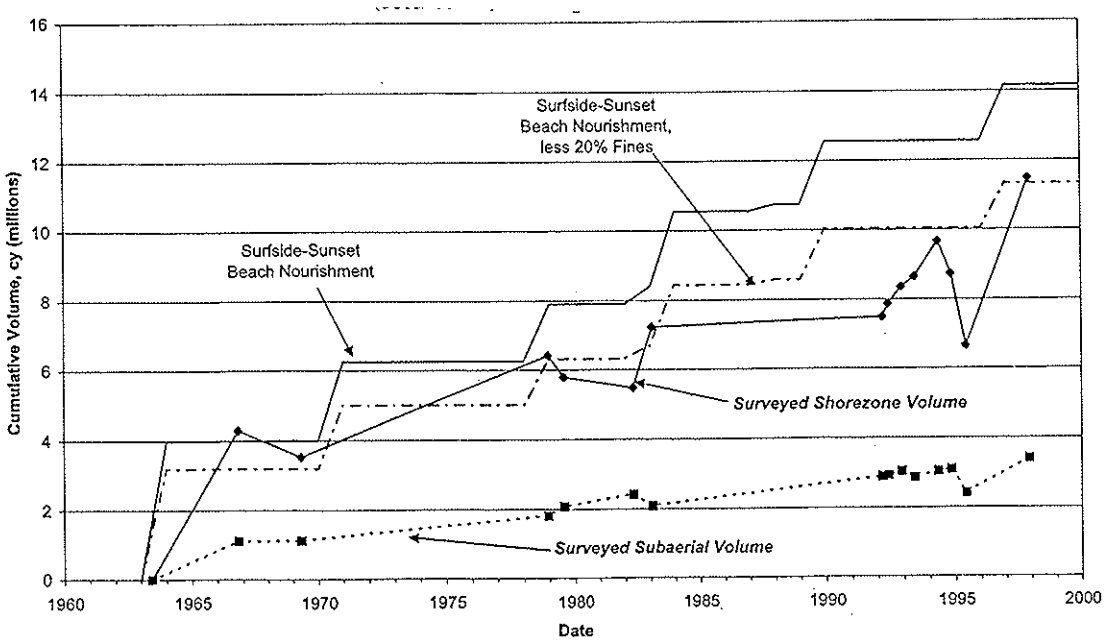

Figure 5. Time History of Cumulative Volumes (Shorezone Nourishment), 1963-1997. (From USACE, Los Angeles District, Dec. 2002)