US Army Corps of Engineers

Aliso Creek Mainstem Ecosystem Restoration Study

Without-Project Economic Analysis

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Google Maps

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Introduction

Purpose

The purpose of the Without-Project Economic Analysis is to describe the existing and future without-project economic conditions in the Aliso Creek Mainstem Ecosystem Restoration Feasibility Study area. This description will serve as a baseline for the economic analysis of the various potential project alternatives that will be investigated at subsequent study stages. As noted below, this report is intended to lay a foundation upon which a more detailed, thorough analysis of the economic impacts (costs, benefits, trade-offs, etc.) associated with the various project alternatives that are carried forward into the next study phase (the with-project analysis). It is at the next study phase where the economic analysis may include (depending on the types of alternatives and the various measures considered): a cost-effectiveness and incremental cost analysis of the various ecosystem restoration alternatives; an estimate of the economic value of recreational opportunities created as part of the alternatives; and a description and/or estimate of the economic impact of one or more projects to the local and regional economy.

Guidance and References

The principal controlling guidance of the analysis comes from the U. S. Army Corps of Engineer's (USACE) ER 1105-2-100, *Planning Guidance Notebook*, with specific guidance from Appendix D – Economic and Social Considerations. This economic appendix provides a description of the existing and future without-project economic conditions. Both the comparison of alternatives and the analysis of economic and social impacts of potential projects will be included as part of this feasibility study's with-project (F4) analysis. Guidance and policy documents referenced for this analysis include the following: For topics related to the incremental cost analysis, IWR Report #95-R-1, *Evaluation of Environmental Investments Procedures Manual – Interim: Cost Effectiveness and Incremental Cost Analyses* (May 1995); For topics related to the regional economic development (RED) and the other social effects (OSE) accounts, EC 1105-2-409, *Draft Interim Implementation Procedures* (January 2006). Damages and costs are expressed as annual values and calculated utilizing the FY 10 discount rate of 4.375 percent with a period of analysis of 50 years. All damages and costs are expressed at an FY 10 price level, except for the flood inundation damage analysis that was completed for the Aliso Creek Watershed Report dated October 2002.

Notes on Defining the Without-Project Condition

While describing the existing conditions within the study area is straightforward, the future conditions in the study area are by nature uncertain and more difficult to define with confidence. The forecast of future conditions is simply a forward-looking snapshot from a particular point in time. It is important that the forecast incorporate the best information currently available about future developments while being very judicious when making assumptions, predicting actions, or extrapolating from existing trends. Also, it is important to capture and consider what information does exist about likely future developments that may result from actions by both private agents and public entities.

Important for this study's description of future without-project conditions is potential future action by Orange County and the communities along the area adjacent to Aliso Creek. The current condition and potential for revitalization of Aliso Creek has become an important issue for the County, the communities along the creek, and numerous organizations with varied interests and concerns. The

County has developed a conceptual, long-term vision for what it calls a revitalization of the lower stretches of the creek. The concept plan envisions a beautified creek landscape, passive and active recreational areas, and habitat creation and improvement.

While at this point it is not known to what extent Orange County will be able to implement the vision described, given the cost and complexity associated with habitat creation in the creek corridor, in the absence of Federal participation it is unlikely that the County will undertake any significant habitat restoration projects within the river corridor.

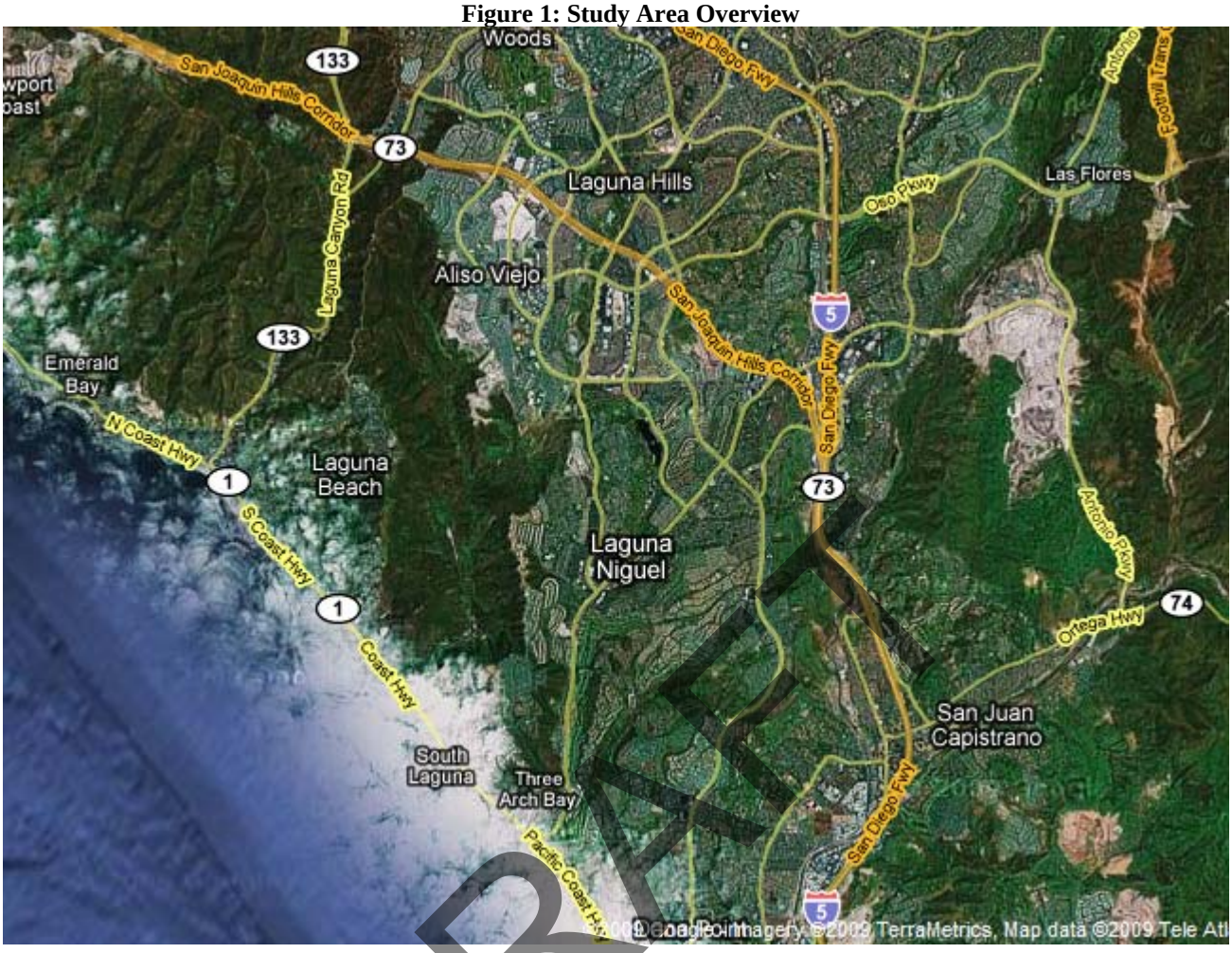
Study Area

Study Area Overview

The study area is located within the Aliso Creek watershed which is located in southern Orange County, California. The creek flows nearly 20 miles from its headwaters at approximately 2,400 feet above sea level in Cleveland National Forest's Santiago Hills to its outlet at the Pacific Ocean near South Laguna Beach. The headwaters begins in a natural and rugged mountain environment, which transitions to more level floodplain in the middle reaches, and on through a narrow coastal canyon on the way to its ocean inlet. In particular, the study area only focuses on the downstream segment of the watershed, beginning at Aliso Viejo Parkway and extending to the Pacific Ocean, a distance of about 8.2 miles.

Communities within the watershed area include Portola Hills, Mission Viejo, Lake Forest, El Toro, Laguna Hills, Laguna Woods (Leisure World), Aliso Viejo, Laguna Niguel, and Laguna Beach. Major tributaries to Aliso Creek include English Canyon, Sulphur Creek, and Wood Canyon.

Figure 1: Study Area Overview



Study Reaches

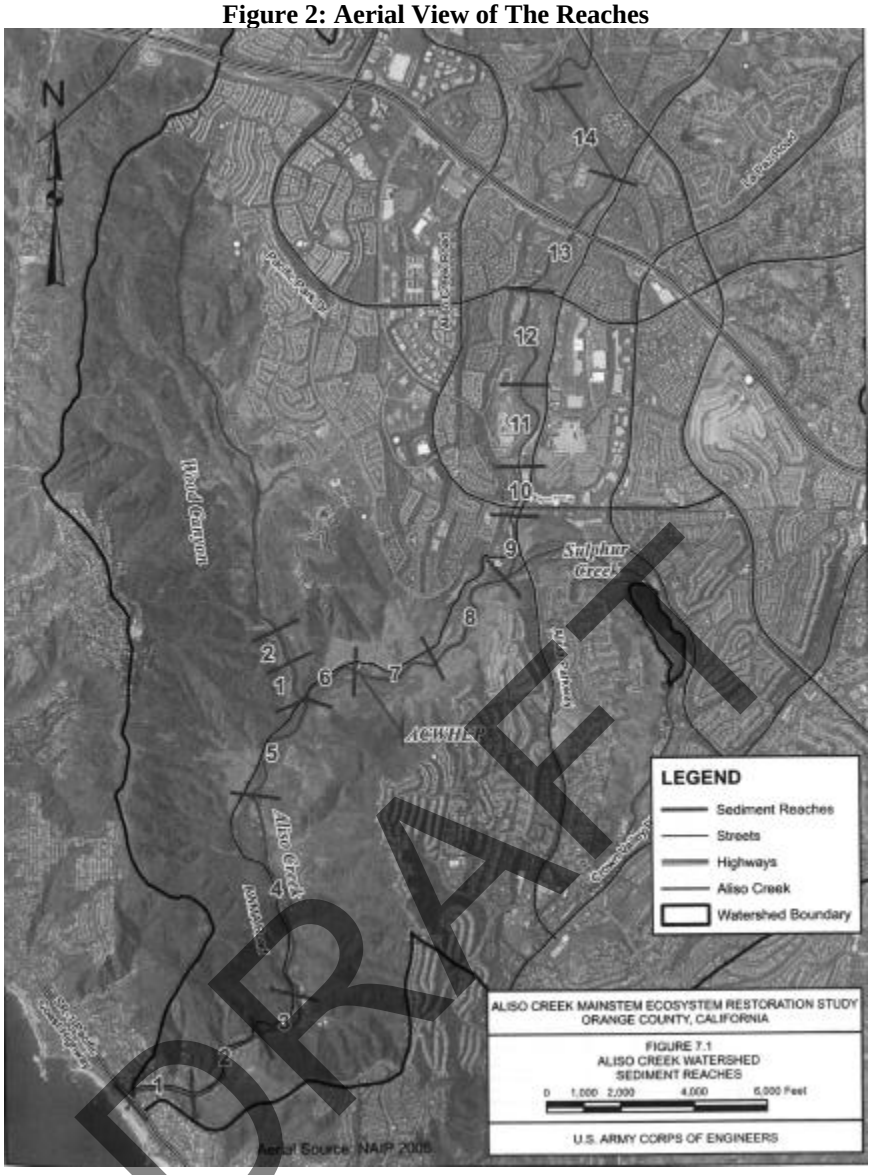
The study area is divided into 14 reaches to facilitate the economic assessment and the geographic description of without project conditions. The 14 reaches are identified in the table below were identified in the Hydraulic and Hydrologic (H&H) Appendix. Also, the H&H Appendix provides figures that show geographical location of the station numbers that were incorporated into this study.

Table 1: Reach Locations

Reach Locations			
Reach	**Downstream Feature** **Upstream Feature**	**Station** (1)	**Reach Length (ft)**
1	Ocean Outlet to D/S End of Golf Course	0.6 5	1440
2	D/S End of Golf Course U/S End of Golf Course	7 14	2300
3	U/S End of Golf Course Coastal Treatment Plant	16 21	1640
4	Coastal Treatment Plant Horseshoe Bend	22 40	5910
5	Horseshoe Bend Wood Canyon Creek Confluence	41 50	2950
6	Wood Canyon Creek Confluence ACWHEP Structure	51 55	1310
7	ACWHEP Structure Channel Bend	57 65	1970
8	Channel Bend Sulphur Creek Confluence	66 75	3280
9	Sulphur Creek Confluence D/S Concrete Drop Structure	76 80	1310
10	D/S Concrete Drop Structure U/S Concrete Drop Structure	81 84	980
11	U/S Concrete Drop Structure Rip Rap Drop Structure	86 92	1970
12	Rip Rap Drop Structure Pacific Park Drive Crossing	93 101	2620
13	Pacific Park Drive Crossing to Aliso Viejo Middle School	103.64 116	3970
14	Aliso Viejo Middle School to Aliso Viejo Parkway Bend	117 125	2930

According to the information presented in the H&H Appendix, the 14 reaches were delineated according to the hydraulic conditions along the creek. With this in mind, reaches were delineated based on slope, existing hydraulic and bed controls (e.g., bridges, drop structures, etc.), and on a comparison of hydraulic parameters, primarily top width and velocity. The following figure provides an aerial view of the location of the 14 reaches. The description of the reaches presented in this report matches those included in the H&H Appendix.

Figure 2: Aerial View of The Reaches



Ocean Outlet to Coastal Treatment Plant (Reach 1-3: Station 0.60 to 19.00). The previous 1999 study did not include the comparison of streambed profiles due to lack of historical information prior to 1998. Available mappings for this area include information from 1998 and 2006. From 1998 to 2006, this reach shows consistent degradation (from 1.5 to 2.5 feet). However, for the reach through the Golf Course (upstream of the pedestrian bridge no.1), no significant degradation or aggradation trend was evident.

Reach #1 extends from the Pacific Ocean outlet (0.60) to the first pedestrian bridge (Station 5.00) downstream of the golf course at the Aliso Creek Inn. Below the Pacific Coast Highway (PCH), the sand-channel reach flows through Aliso Beach and is frequently blocked by littoral drift. Upstream of the PCH it is an improved earthen channel. The overall slope is less than 0.3 percent, and the bottom width varies from 30 to 70 feet. The left overbank is occupied by a

parking lot and the right overbank includes the access road to the Aliso Creek Inn and maintenance buildings for the South Coast Water District.

Reach #2 extends from Station 7.00 to the upstream end of the Aliso Creek Golf Course (Station 14.00) and has a slope of 0.5 percent. The main channel is 20 to 70 feet wide, shallow and sandy, and is crossed by six pedestrian bridges. In the lower part of the reach, the overbanks are occupied by the Aliso Creek Inn buildings and facilities. In the upper part of the reach, both overbanks are broad and flat and are occupied by the golf course.

Reach #3 extends from the upper end of the golf course (Station 16.00) to the access bridge for the treatment plant for South Orange County Wastewater Authority (SOCWA) at Station 21.00. It passes through a narrow portion of the canyon that separates the Aliso and Wood Canyons Wilderness Park from the ocean outlet and has a channel slope of 0.4 percent. The bottom is 30 to 75 feet wide and overbanks are well vegetated. An unpaved road follows the right overbank and connects AWMA Road through the canyon to the golf course. The treatment plant discharges treated effluent through a 36-inch concrete pipe that extends underground from the plant through Reaches 1, 2, and 3 to an outfall in the ocean.

Coastal Treatment Plant to ACWHEP Structure (Reach 4-6: Station 19.00 to 56.00). The 20-foot ACWHEP drop structure is the largest drop structure along Aliso Creek. It appears that some headcuts were migrating upstream, and the structure checked the migration for several years. However, the 1998 storms have caused severe undercutting at the toe of the structure, compromising its integrity. The channel bed degraded between 3 and 6.5 feet from 1994 to 1998 over a channel length of 6,500 feet downstream of the drop structure. Between 1998 and 2003, no pattern of significant degradation or aggradation was observed. However, from 2003 to 2006, channel degradation ranging between 3 to 6 feet was renewed in this reach likely as a result of the 2005 storms.

Reach #4 extends from above the treatment plant bridge (Station 22.00) to the upstream side of the remnant of the major horseshoe bend at Station 40.00. The channel bottom width is typically 30 to 70 feet, with some widening to over 175 feet near Station 35.00. The channel slope is 0.35 percent and downcutting is evident through all but the lower portion of this reach. AWMA Road follows the right overbank. The SOCWA 36-inch effluent transmission main (ETM) and the Moulton Niguel North Coast Interceptor 24-inch sewer are buried utilities that follow the left bank at setbacks that vary from 0 to 300 feet. Short stretches of riprap bank protection have been installed to prevent bank erosion at the treatment plant and to prevent damage to the buried utilities.

Reach #5 extends from Station 41.00 to the Wood Canyon Creek Confluence at Station 50.00. The slope is 0.3 percent, and the bottom width varies from 30 to 100 feet. It is a fairly straight, incised reach with AWMA Road on the west side, and the buried utilities on the east. The AWMA Road crossing over Wood Canyon Creek has three 2-foot corrugated metal pipes for low flows and a concrete dip section for the higher flows. The downstream side of the structure was a badly eroded drop, and the resulting scour hole had undermined the road. In the spring of 1998, grouted riprap was installed downstream of the drop, and concrete was pumped under the road to fill the cavity. The riprap on the bank immediately downstream of the road does not

extend much above the road surface, and will not protect the bank against higher flows. The project is not considered a permanent solution.

Reach #6 continues upstream from the Wood Canyon Creek confluence (Station 51.00) to the downstream end of the ACHWEP drop structure at Station 55.00. The channel slope of the reach is 0.7 percent, and the bottom widths vary from 15 to 40 feet. The scoured area downstream of the structure is almost 175 feet wide. The ACWHEP structure is a 20-foot high, grouted concrete drop structure that is intended to function as a grade control and as a means to collect creek water for irrigation of floodplain vegetation in the downstream overbanks. It includes a low-flow pipe that outlets into the grouted slope on the downstream side and a concrete dip section that forms the grade control and passes the higher flows. The downstream end of the structure has been undermined by a scour hole, and the (inflexible) grouted riprap on the banks has continued to fracture in large pieces. The large events that occurred over the winter of 1997/98 have undermined the broken up protection even further.

Aliso Creek Wildlife and Habitat Enhancement Project (ACWHEP) Structure *to AWMA Road Crossing* (Reach 7-8: Station 56.00 to 78.00). This reach shows consistent degradation (from 3 to 13 feet) from 1967 to 1994. According to the Raub (1982) report, much of the erosion in this (and the following) portion of the channel occurred in the flood of 1980. However, since 1994 the channel has actually aggraded slightly due to the impoundment caused by ACWHEP. From 2003 to 2006 there is slight erosion seen in the profile. This trend since 1994 of minimal change indicates that the channel is likely in an equilibrium stage with smaller responses due to significant events. Three drop structures have been constructed in this reach since 1967: a 4-foot drop just upstream of the AWMA Road crossing, a 6.5-foot drop at the AWMA Road crossing, and a 4-foot drop just below the Sulphur Creek confluence.

Reach #7 extends from the crest of the ACWHEP structure (Station 57.00) to a channel bend at Station 65.00. Because of the grade control, the channel slope is less than 0.2 percent. Between Stations 55.88 and 61.00, the grade control serves to arrest the downcutting. The banks are generally less than 3 to 6 feet higher, and the bottom is generally 60 to 100 feet wide with a low-flow thalweg meandering through it. Above Station 61.00, the downcutting becomes evident again. Bank heights increase to 10 to 15 feet, and the bottom width narrows.

Reach #8 extends from Station 66.00 to the confluence with Sulphur Creek at Station 75.00. The channel slope is less than 0.3 percent, and the bottom width varies from 30 feet in the crossing to over 100 feet in the bends. The incisement is well pronounced with bank heights in excess of 25 feet. Near Stations 71.30 and 72.80, the outside of a bend has moved laterally and is threatening AWMA Road. At both places, sections of pavement have been lost, and concrete barriers were placed to prevent vehicles from going over the edge.

AWMA Road Crossing to Federal Building (Reach 9-10: Station 78.00 to 85.00). Two 10-foot concrete drop structures were built to maintain the original channel slope when Aliso Creek was channelized through this reach in 1969. Although the drop structures act as control points for the channel profile, they do not prevent sedimentation. A case in point is the downstream drop structure, which was visible in the 1971 survey, covered by sediment in the 1977 and 1983 surveys, and exposed again in

the 1994 survey. This demonstrates the dynamic nature of the channel. Topography since 1998 shows very little change in the profile through this reach.

Reach #9 extends from Sulphur Creek (Station 76.00), past the AWMA Road Bridge over the creek to the downstream face of the first major concrete drop structure at Station 80.00. Between Stations 75.50 and 77.00, the channel is earthen and has a bottom width that varies from 50 to 100 feet. The remainder of the reach is a combination of earth, riprap, and concrete with a 50-foot bottom width and 1.5:1 side slopes. The area under the AWMA Road Bridge is protected by concrete and includes a 3-foot drop. The overall channel slope is 0.6 percent.

Reach #10 is the section between the two major concrete drop structures. It extends from Station 81.00 to Station 84.00 and passes under the Aliso Creek Road Bridge between Stations 81.51 and 81.91. The slope is less than 0.3 percent, and the channel is a uniform section with a 60 to 70 foot bottom width and 2:1 side slopes protected by riprap.

Federal Building to Pacific Park Drive (Reach 11-12: Station 86.00 to 101.00). One rip rap drop structure is located within this reach and the upper concrete structure is located at the downstream end and Pacific Park Drive is located at the upstream end. The profile dropped significantly between 1983 and 1994 to reflect the construction of the drop structures. Following that construction the profile has remained stable through this reach.

Reach #11 extends from Station 86.00 at the upstream concrete drop structure to the channel bend at Station 92.00 near Aliso Viejo Middle School. The channel slope is roughly 0.25%. The low flow thalweg shows a consistent bottom width of 30 feet but the entire bottom width, which is heavily overgrown with arundo, varies in width up to 150 feet. The right overbank is occupied by a high school and athletic grounds and the left overbank is a broad paved area that is a remnant of a previous road and development.

Reach #12 extends from the channel bend at Station 93.00 to the outlet of the Pacific Park Drive Basin at Station 101.00 The 3,000-foot reach has a slope of 0.7% and a bottom width of 15-29 meters. The banks are both earthen and riprap, and are currently eroding laterally near stations 95.00, 96.00, and between stations 97.00 and 99.00. The left and right overbanks in this reach are up to 500 feet wide, but are no longer inundated except during extreme events (>500-year) due to the peak discharge reduction at the Pacific Park basin.

Pacific Park Drive to Channel Bend (Reach 13-14: Station 103.64 to 125.00). This reach of Aliso Creek is natural with a pedestrian bridge and riprap drop structure near the upstream end of Reach 14. This reach exhibits fluctuations in the profile over time as can often be seen in a natural channel. However the overall profile has maintained a steady elevation.

Reach #13 includes the Pacific Park Basin. It extends from the inlet at the low-flow structure (station 103.64) to a tributary inlet near station 116.00. It crosses under the San Joaquin Hills Transportation Corridor bridge between stations 110.29 and 110.97. The 4100-foot reach has a slope of 0.6%. Downstream of the transportation corridor, the channel meanders through heavy vegetation. The bottom width varies up to 150 feet, but a low-flow thalweg is consistent at roughly 30 feet. Upstream of the corridor, the channel straightens out and has a consistent

bottom width between 8-10 meters. The outlet to the basin is a three barrel, 10-feet high by 8-foot high, concrete box culvert that has little effect on the lower events. The 2- and 5-year flows follow the existing low-flow thalweg. The 10- and 25-year flows pond somewhat at the culvert and spread out to occupy the remainder of the low-flow channel. In the 50-year events and higher, the ponding extends upstream to the vicinity of station 108.00 and inundates the low channel completely.

Reach #14 extends from the aforementioned confluence near station 117.00 to a channel bend near station 125.00. The 3,300-foot reach has a slope of 0.7%. The low-flow channel is fairly straight, and is incised 3 to 10 feet within a floodplain that is up to 300 feet wide. While this reach is outside of the project limit it is included in the analysis to provide a sediment supply reach into the Pacific Park detention basin.

Problems & Opportunities

Environmental Resources

The quantity and quality of environmental resources within the Aliso Creek watershed has been reduced dramatically over the last few decades. Much of the change is related to the increasing development in the watershed, which has caused changes in hydrologic and hydraulic conditions, which in turn have adversely affected riparian, floodplain, and wetland habitat in the watershed.

Historically, Aliso Creek was a natural perennial stream with dry-weather flows no higher than a few cubic feet per second. With the advent of agriculture in the watershed in the late 1800's and the associated diversion of surface water, pumping of groundwater, and other factors, Aliso Creek became ephemeral. Since the water distribution system was connected to the Metropolitan Water District's transmission line, development intensified and urban runoff from excess landscape irrigation, wastewater reclamation plant discharges, and other activities in concert with structural modifications to Aliso Creek, produced year-round stream flows.

Urbanization of the Aliso Creek watershed has degraded the biological resources, compromised its ecological capacity, and impaired the goals of the Orange County Central Coastal Natural Community Conservation Planning Habitat Conservation Plan.

During the early to mid 1900's, agricultural practices dominated the landscape, reducing native plant communities significantly and increasing stormwater runoff and erosion to a smaller extent. Prior to the 1930s, the Aliso Creek Watershed was primarily underdeveloped with the primary land use being for agricultural production. By the end of the 1930's the 35 square-mile watershed was merely 1% developed. Development slowly increased to 15% by the early 1970's. Development doubled over the decade to 33% by 1981. By 1990 the watershed development had increased to nearly 60%. By 2005, the 22,110-acre watershed is approximately 75% (16,580 acres) developed, but only 900 acres of the remaining vacant land is open to urban development. As the watershed has become more urbanized, the quantity and quality of water have been more significantly affected. The drainage system for urban areas in the watershed has been designed to speed water quickly out of the built environment into stream channels which lead ultimately to the ocean. The increase in volume and velocity during storm events has caused significant erosion and loss of the riverine vegetation type including cottonwood-

willow mulufat association as well as freshwater marsh, and more quickly transports pollutants into the stream channels and ocean. The loss of floodplain and wetland areas have reduced groundwater recharge and further reduced native plant communities. Invasive non-native plants, such as giant reed, eucalyptus, pampas grass, castor bean, among others have invaded the study site over hundreds of years due to the continual disturbance and land practices that have occurred. Giant reed has infested greater than 85% of the study site and in most places in dense stands.

Table 2: Historical Percent of Development

Year	Percent Developed
1938	1
1959	4
1968	8
1972	15
1981	33
1986	47
1990	59
1998	74
2005	75

The Aliso Creek watershed exhibits diverse topography and land forms resulting in a wide range of habitat types and biological diversity. The Aliso Creek ecosystem supports aquatic, wetland and riparian, as well as adjacent upland terrestrial habitats. The aquatic habitats of freshwater marsh and riparian habitats include riparian herb community, southern willow scrub, mulefat scrub, southern sycamore woodland, southern coast live oak, southern arroyo willow, southern black willow forest, and canyon live oak ravine forest. The upland terrestria1 habitats include coastal sage scrub, chaparral, grassland, and woodland. Historically, the wildlife inhabiting the Aliso Creek ecosystem was highly diverse due to the wide range of topographic relief ranging from sea level to several hundred feet above sea level.

A natural environment will experience disturbances from processes such as flooding and channel migration. In fact, disturbances in a riverine system often lead to a healthier, more diverse ecosystem. So the native plant and animal taxa are adapted to the processes of period river scour.

However, these are not the same set of disturbances experienced in an urbanized environment, which may have a permanent effect on the spatial distribution, density, and diversity of the native species and habitats. In some sites within the Aliso Creek watershed, the ecosystem has been severely impaired and riverine plant and animal assemblages may be below there natural distribution and carrying capacity. Nonetheless, some locale within the riverine ecosystem appear to be thriving, such as freshwater marsh and in some locales, verdant stands of southern willow scrub, mulefat scrub southern arroyo willow, southern black willow forest, and cottonwood-mulefat woodlands. Of noted interest, the study site has recorded upwards of nine least Bell's vireo pairs along with similar numbers of yellow-breasted chats, a federal and state species of concern.

Historically, the wildlife inhabiting the Aliso Creek watershed was probably highly diverse due to the topographic relief ranging from sea level to approximately 2,400 feet above sea level. Within the watershed are ocean beaches, relatively flat valleys, rolling hills, and steep mountains, supporting the habitats described above. The relatively flat valleys and rolling hills and their associated habitats and streams have nearly been eliminated as a result of residential and commercial development, flood

control facilities, and highways. Therefore the species diversity or species richness has decreased over time.

The ecological health of Aliso Creek is degraded. However, there is potential to recover some of the lost ecological functional capacity and equally important, prevent further loss of ecological functional capacity. There is a cause and effect relationship between development and the ecologically degraded condition of the Aliso Creek ecosystem and its congruent floodplain.

Adverse impacts of environmental degradation are not limited to plant and animal communities. Human health risks associated with impaired water quality and economic losses due to changing channel conditions are also of significant concern.

Flooding and Erosion Impacts

While most development within the study area for the Aliso Creek Mainstem Ecosystem Restoration Study is safely outside the regulatory floodplain, those private and public developments that are within the creek's floodplain experience repeated damages flood inundation. In addition, the dramatic scale of the Aliso Creek Watershed's urbanization has contributed to increases in the peak discharge rates for a given amount of rainfall due to the increase of impervious areas, elimination of temporary depression storage, and increases in the efficiency of drainage.

With development have come investments in transportation and utility infrastructure within the study area that have suffered damage from instability of the creek channel. Channel migration as well as widening and deepening of the channel have historically caused repeated damages to transportation investments (road and bridges) and to water and sewer utilities serving the developed portions of the watershed and surrounding communities.

Channel instability and flooding within the study area have resulted in a wide range of economic costs – both national and regional in scope. Historic economic damages in the watershed have resulted from flood inundation of structures and their contents, inundation of golf courses and public parks, and erosion resulting from channel instability (lateral stream bank erosion and migration, and/or vertical streambed down cutting). Channel instability has contributed to damages to utility and transportation infrastructure, with wide-ranging economic effects, including public health and safety costs, regulatory/legal costs, and costs associated with the closure of recreation facilities. Table 3 details the flood and erosion damages that have occurred since 1969.

Flooding and erosion damages are not new to the structures and infrastructure within the study area. The Corps of Engineers Los Angeles District prepared a Floodplain Information Report on Aliso Creek in 1973 documenting the damaging floods in the Aliso Creek Watershed for the years 1916, 1927, 1937, and 1969. While no dollar estimates of damages are available for the early floods (1916-1937), documentation shows that bridges spanning the creek were the primary source of damages.

Dollar estimates of flooding and erosion damages within the Aliso Creek Watershed (records do not differentiate the two) resulting from two storms in 1969 amounted to $6,352,000. The first storm, occurring in January caused damages of $2,278,000, while damages from a second storm in February amounted to $4,074,000. The February 1969 storm event flooded the Aliso Creek Inn, located in reach 2, where 78 guests were evacuated by the fire department without injury. Mud stood three feet deep in

most guestrooms at the Inn destroying most of the rooms' contents. Additional damaging storms occurred in 1992, 1995, and during the recent El Nino storm events in the winter of 1997-1998.

In 1992, the dollar estimates of flooding and erosion damages within the study area totaled $4,759,000. The storm flooded 47 rooms attached to the Aliso Creek Inn. The flooding in 1992 washed out the access bridge to the SOCWA Treatment Facility. Without the bridge, staff was unable to service and maintain the plant. Fortunately the U.S. Marines were available to fly in a temporary bridge until a new bridge could be constructed; averting what would otherwise have been a major spill of untreated sewage into Aliso Creek and then the Pacific Ocean. The depreciated replacement cost and cost of the temporary bridge totaled $311,000.

A series of damaging El Nino driven storm events occurred in the winter of 1997-98. Dollar estimates of flooding and erosion damages that occurred within the Aliso Creek Watershed due to El Nino storms were estimated at $7,884,000. The portion of the total watershed damages that occurred to commercial property and infrastructure within the study area was estimated at $6,611,000 ($5,018,000 in flood damage, $1,593,000 in erosion damage). Two of these El Nino events again flooded the Aliso Creek Inn and Golf Course causing $5,012,000 in damages including $1,823,000 of damages to the Golf Course, $1,367,000 to structures and contents, and $1,822,000 in lost income.

The EL Nino storm events during the winter of 1998-99 destabilized the embankments on Sulphur Creek and Aliso Creek located near the AWMA Road. The destabilized embankment caused damages to a 36" effluent pipeline and two 4" sludge pipelines serving SOCWA, and 18" sewer line owned by Moulton Niguel Water District. The two agencies spent $494,000 in repairing these damages in the winter of 1998-99.

In 2006, the storm events from January through March, destabilized the west embankment of Aliso Creek resulting in the collapse of AWMA Road into Aliso Creek. The AWMA Road was repaired by SOCWA and repair costs totaled $331,000.

In addition to the direct costs associated with storm damages, general instability and unpredictability of the Aliso Creek channel cause recurring unanticipated operation and maintenance expenditures for the repair and protection of utility infrastructure due to steady long-term erosion of the Aliso Creek channel.

South Coast Water District (SCWD) has spent $68,000 to $84,000 per year on bank protection along Aliso Creek during the period of 1983 to 1998. In 1992 the SCWD spent $424,000 for bank control protection along the access road through Aliso and Wood Canyons Wilderness Park.

The South Orange County Wastewater Authority (SOCWA) spent approximately $5.3 million during the period of 1979 to 1994, or an average of $332,000/year repairing erosion damages along the creek. In 2003, SOCWA repaired a pipeline after steady erosion damaged the encasement for effluent pipeline, The total cost of the repairs to effluent pipeline was $280,000. SOCWA considers all repairs along Aliso Creek temporary due to instability of the creek, stating "Until Aliso Creek is stabilized, anything SOCWA does in and along its banks should be considered temporary".

In 2008, the U.S Army of Corps of Engineers partnered with SOCWA in constructing a bank protection project for protecting the access bridge to SOCWA Treatment Facility located in Aliso Woods Canyon Wilderness Park. The total cost for the project was $679,000.

Table 3: Historical Flood and Erosion Damages

Historical Flood and Erosion Damages Damages are based on FY 2010 Price Level	
Year	Damages
1969	$6,352,000
1979	$332,000
1980	$332,000
1981	$332,000
1982	$332,000
1983	$400,000
1984	$400,000
1985	$400,000
1986	$400,000
1987	$400,000
1988	$400,000
1989	$400,000
1990	$400,000
1991	$400,000
1992	$5,583,000
1993	$400,000
1994	$400,000
1995	$68,000
1996	$68,000
1997	$68,000
1998	$6,592,000
1999	$494,000
2003	$280,000
2006	$331,000
2008	$679,000
Total Damages	$26,243,000

Recreation

Aliso Creek is a popular Orange County recreation destination, offering a variety of recreation opportunities including, hiking, walking, biking, mountain biking, and nature appreciation. Aliso Creek offers unique natural recreation opportunities in the increasingly developed region. A February 1996 article in Los Angeles Times cited the Aliso and Wood Canyon Regional Park as one of Orange County's three best parks, recommending "Make your way to this 3,400 acre park for an idea of what the County looked like before the invention of concrete – abundant hiking and biking trails."

Aliso Creek provides a range of unique environmental resources and recreation experiences in an increasingly developed region. The freshwater marsh and riparian communities found along Aliso Creek have been degraded and are at risk of further declines due to poor water quality and channel instability. The popular recreation activities provided along the creek are repeatedly closed to the pubic due to public health and safety risks associated with water quality and threatened/damaged roads, paths, and tails.

Summary of Opportunities

Due to the long historical record of flood and erosion problems occurring in the study area, there appears to be opportunities to reduce flooding and erosion risks through several potential ecosystem restoration measures. In addition, these measures are expected to provide additional benefits for the following objectives: reduce the creek instability, restore the connectivity to the floodplain and tributaries, restore the riverine (aquatic and terrestrial) and estuarine habitat, improve water quality and enhance passive recreational opportunities.

Importantly, while this Feasibility Study will investigate ways to potentially restore habitat to the area, it will also consider the impacts of any action on the flood protection provided by the creek. Maintaining the existing level of flood protection is a critical constraint of any potential ecosystem restoration project, and all potential projects will be formulated in a way that improve the quantity and quality of habitat along the creek, while at the same time not adversely impacting the ability of the creek to protect the people and property along its banks, or damage existing recreation facilities.

Without-Project Conditions

Development & Land Use

Existing Land Use

A significant portion of the study area is located within the boundaries of the Aliso and Wood Canyons Wilderness Park. The park has approximately 3,900 acres of wilderness and natural open space, which includes mature oaks, sycamores and elderberry trees, and over 30 miles of hiking trails. The land uses surrounding Aliso and Wood Canyons Wilderness Park include the communities of Aliso Viejo, Laguna Niguel, Laguna Niguel, Laguna Hills, Laguna Woods, and Laguna Beach. These communities are densely populated with residential and commercial development. In addition, the land uses in the study area include the following recreational areas: Moulton Meadows Park, Laguna Niguel Regional Park, Laguna Wilderness Park, Aliso Viejo Community Park, Woodfield Park, Foxorough Park, Hillview Park, Aliso Creek Golf Course, and Aliso Beach.

Population

Current Population

Orange County California spans over 948 square miles and had nearly three million residents in 2007. It is the smallest county in Southern California. The County is famous for its tourism with Disneyland, Knott's Berry Farm, and the sunny beaches along its 40 mile coastline. Thirty-four incorporated cities are located in Orange County. The County has a very diverse population according to the Census Bureau's 2006 American Community Survey with 46.92% white Non-Hispanic, 32.89% Hispanic, 16.38% Asian-Pacific Islander, 1.67% African American, 0.38% Native American, and 1.76% from other races.

The Tables below show respective populations and geographic sizes for the County and cities in the watershed.

Table 4: Study Area Demographics

Demographics						
Area - Square Miles	Entity	Population 2007	2000	1990	1980	1970
948	Orange County	2,997,033	2,846,289	2,410,556	1,932,709	1,421,233
10.2	Aliso Viejo	41,424	40,225	7,612	na	na
6.5	Dana Point	35,678	35,110	31,896	na	na
9.7	Laguna Beach	24,161	23,317	23,170	na	na
6.4	Laguna Hills	31,881	31,178	27,445	na	na
14.7	Laguna Niguel	64,374	61,963	44,400	na	na
3.2	Laguna Woods (1)	18,208	16,252	na	na	na
12.6	Lake Forest	78,243	58,806	na	am	na
	(1) formally Leisure World Laguna Hills					
Source: US Census Bureau . California Department of Finance						

Except for the City of Laguna Beach all the cities in the Aliso Creek Watershed are relatively newly incorporated cities. The table above shows the growth rate of the population from 1990 to 2007 in the Watershed was greater than the County as a whole.

Future Population

The California Department of Finance forecasts that the average annual rate of growth of the population of Orange County will continue its current downward trend over the course of the next forty years, and that the population will increase slowly through 2050. Future growth for the cities in the study area will be limited to the few areas where developable land still exists.

Table 5: Population Forecast - Orange County

Population Forecast - Orange County			
Year	**Population**	**% Change**	**Average Annual % Change**
2007	2,997,033	NA	NA
2010	3,227,836	7.70%	2.50%
2020	3,520,265	9.06%	0.87%
2030	3,705,322	5.26%	0.51%
2040	3,849,650	3.90%	0.38%
2050	3,987,625	3.58%	0.35%
Source: California Department of Finance, Demographic Research Unit			

Economic Profile

The Table below shows some of the basic economic indicators at the county level, comparing Orange County to other Cities in the Aliso Creek Watershed. As the Table shows, median household income in Orange County was $71,600 in 2007. All the other cities in the Watershed have higher household income with the exception of Laguna Woods which is a retirement community.

Table 6: Economic Indicators FY 2007

ECONOMIC INDICATORS					
Entity	Median Age - 2007	Median Household Income 2007	In 2007 Pecent Owner-occupied	Median Valued Owner-occupied Housing 2007 (2)	In 2007 Pecent with Social Security Income
Orange County	35.5	$71,601	62.3%	$688,000	22.5%
Aliso Viejo	34.9	$92,280	62.6%	$730,000	7.8%
Dana Point	44.9	$81,665	64.1%	$976,000	29.0%
Laguna Beach	47.7	$90,017	60.9%	$1,620,000	26.8%
Laguna Hills	41.1	$89,781	77.3%	$829,000	20.9%
Laguna Niguel	40.8	$95,925	75.5%	$850,000	19.9%
Laguna Woods (1)	78.0	$37,980	84.9%	$280,000	87.8%
Lake Forest	36.9	$90,084	74.8%	$660,000	17.0%
(1) formally Leisure World Laguna Hills - retirement community, (2) DQNews					
Source: US Census Bureau					

Laguna Woods formally known as Leisure World, is a retirement community. Accordingly, housing sizes are smaller and incomes are lower than the surrounding communities. As a whole the communities in and around the Aliso Creek Watershed are more affluent than the County and State as a whole. It should be noted that due to the current economic down turn, housing values are much lower than shown in the above table.

Without Project Flood and Erosion Damages

In October 2002, the Aliso Creek Watershed Management Study was completed for the purpose of identifying solutions to environmental and economic problems in the Aliso Creek Watershed. The report summarizes a damage assessment that analyzed the expected flood and erosion damages in the watershed.

Maintaining the existing level of flood protection is a critical constraint of any potential ecosystem restoration project, and all potential alternatives will be formulated in a way that improves the quantity and quality of habitat along the creek, while at the same time not adversely impacting the ability of the creek to protect the people and property along its banks. The damage assessment presented in Aliso Creek Watershed Management Study was not updated for this report since the primary purpose of this report is to identify measures that improve the quantity and quality of habitat along the creek.

Without Project Flood Damages Analysis

Expected annual flood damages to structures and their contents in the Aliso Creek watershed were estimated to provide a baseline forecast of anticipated future damages without the implementation of any new management measures within the study area. A complete survey of structures within the Aliso Creek regulatory floodplain was conducted in 1998 to estimate expected annual flood inundation damages. This survey identified 20 structures at risk of flood inundation. These structures, all located within the current study area, included the pump house for the SOCWA Treatment Facility located in Aliso &Wood Canyons Regional Park, 17 structures of the Aliso Creek Inn and Golf Course, and two maintenance facilities belonging to the SOCWA and Orange County near the Pacific Coast Highway. The damage assessment analysis for flood inundation was based on 1998 price levels and a discount rate of 6.875%. Average annual flood inundation damages to structures and contents within the study area were estimated at $35,100.

In addition to the damages to structures and contents in the study area, potential damages exist at the 9-hole golf course at the Aliso Creek Inn. Frequency-based future damages to the golf course were estimated by overlaying the flood overflow maps generated in the Watershed Study's hydrologic and hydraulic analyses together with golf course layouts to determine depth-damage relationships for storm events of varying magnitude. A damage estimate of $123,000 per hole inundated was used for forecasting future damages. The damage assessment was based on 1998 price levels and a discount rate of 6.875%. Average annual golf course damages within the study area were estimated at $105,000.

Without Project Erosion Damage Analysis

Streambank erosion throughout the Aliso Creek Watershed has contributed to recurring damages to utility, transportation, and recreation infrastructure over time. At-risk utility infrastructure includes pipelines for the transmission of water supplies, raw sewage, treated effluent, reclaimed water, and gas. These pipelines run alongside and cross under the Aliso Creek channel. Ruptured mains incur a variety of costs including emergency repair costs, public heath and safety costs, legal costs associated with regulatory fines and penalties, and costs associated with service interruptions to homes and businesses.

The frequency of erosion related damages in the study area can to some extent be attributed to the fact that the creek channel is allowed to migrate more freely – especially through the Aliso and Wood Canyons Wilderness Park. The encroachment of development in the upper watershed has led to more channelized and bank protected reaches that are safer from damages due to the degradation of the creek channel. Hydrologic, hydraulic, and sedimentation studies conducted as part of the watershed study have indicated that the instability in the lower reaches is likely a natural response in part to the hydraulic modifications upstream. These studies found the creek to be highly unstable and unpredictable through study area.

Throughout the watershed, numerous bridges and pipelines cross Aliso Creek. A number of different configurations of bank protection and grade control structures have been installed to protect infrastructure threatened by the creek. The hydraulic analyses evaluated the susceptibility of each structure to failure from scour by comparing computed scour depths for each event to the depth of each structure. In the case of bridges, a non-damaging discharge is one in which the computed scour depth

is less than the depth to the bottom of the bridge footing. This assumes that the bridge is vulnerable once flood flows are actually scouring around the pilings that support the footing. In the case of a pipe crossing, the non-damaging discharge is one in which the scour depth is less than the depth to the top of the pipe. Once the top of the pipe is exposed, it is subject to impact by debris carried along the bottom during a flood. In the case of bank protection, the non-damaging discharge is one in which the scour depth is less than the depth to the toe. This assumes that once the toe is undermined, the riprap will settle and expose the bank and any utility infrastructure.

There are numerous bridge and pipeline crossings on Aliso Creek, some of which are protected by bank revetment. The potential for failure by long-term degradation and local scour was evaluated in the H&H Appendix that compared the computed scour depths for a range of events with the depth of each structure. The largest discharge for which failure is not expected is termed the "non damaging discharge." The non-damaging frequency for the structure in question is the frequency (expressed as return interval) associated with the non-damaging discharge. Discharges in excess of the non-damaging discharge are expected to cause significant damage or failure. Discharges that are less than the non-damaging discharge are expected to cause no significant damage to the structure. Table 8 shows the public utilities and bridges that were included in the scour evaluation. Specific dollar damage estimates were not derived for public infrastructure for this analysis.

Table 7: H&H Analysis of Public Infrastructure

H&H Analysis of the Non-Damage Event for Public Infrastructure in the Study Area Source: Hydrology and Hydrualics Appendix		
	Reach	Non-Damaging Event
Pacific Coast Highway Bridge	1	100-yr
Aufdenkamp Transmission Main Connection	1	100-yr
Aliso Creek Golf Course Bridge #1	1	100-yr
Aliso Creek Golf Course Bridge #2	2	100-yr
Aliso Creek Golf Course Bridge #3	2	100-yr
Aliso Creek Golf Course Bridge #4	2	100-yr
Aliso Creek Golf Course Bridge #5	2	100-yr
Aliso Creek Golf Course Bridge #6	2	100-yr
SOCWA Access Bridge	3	Protected
Aliso Creek Outfall Onshore Pipes 33" and 12"	3	100-yr
SOCWA 36" Effluent Transmission Main	3	100yr
24" North Coast Intercerptor Extension	3	100-yr
AWMA Road Bridge	9	100-yr
Aliso Creek Road Bridge	10	100-yr
Tri-Cities MWD 42" Transmission Pipleline	10	100-yr
Tri-Cities MWD 42" Concrete Pipeline	12	100-yr

Environmental Resources

In order to measure the current and future environmental quality of Aliso Creek Study Area, the study team will use a new approach. The new approach is called CHAP which stands for Combined Habitat Assessment Protocols. The previous modified Habitat Evaluation Procedure (HEP) model used to measure the performance was deemed to be out-date and in need of revision. Instead this new

approach combines habitat appraisal and barter (HAB) method with a crossover approach to HEP in order to determine Habitat Units (HUs).

CHAP Evaluation

The Northwest Habitat Institute supports an approach to appraise wildlife-habitats using a spatially based multi-purpose field inventory and assessment tool called *Habitat Appraisal and Barter* (HAB). HAB is an accounting tool and when applied to a site or area can generate an appraised habitat value for fish and wildlife. Unlike many other previous efforts to calculate the wildlife habitat value (HU) on a piece of land, the HAB approach does not rely on predictive models of species population or population response to derive intrinsic value. Rather, it is based first and foremost on standardized field inventory of existing conditions within a framework that allows visual presentation of the information. A habitat value is calculated using two sets of numbers; one that shows how many fish and wildlife species might occur and how they might influence their environment, such as a woodpecker (a primary excavator) making a cavity in a tree. The other set of numbers evaluates how many habitat components can characterize functions like flowers representing pollination. Each set of numbers has two-parts a potential and observe value associated with it.

The habitat components and definitions that are field inventoried are also supported by a crosswalk to the California Department of Fish and Game (CDFG) California Wildlife-Habitat Relationships (CWHR) and CDFG California Natural Diversity Database (CNDDB) data sets and a detailed, peer reviewed database of species, habitat and functional relationships called an Integrated Habitat and Biodiversity Information System (IBIS). The HAB approach has been successfully used by several federal and state agencies to solve and account for wildlife related issues such as the determining a site's habitat baseline condition value, evaluating the effects of management actions, and assessing and reporting cumulative impacts. Because of the need for the Corps to address the outcome of the habitat assessment in terms of HU's, there is a need to connect back to the method that initially created the concept, which is the US Fish and Wildlife Service's Habitat Evaluation Procedures (HEP). To do this, we use the HAB approach to describe and evaluate a site and then convert to HU's by using a standard of comparison, which was the key method in determining HEP's HU's. A standard of comparison can either be a reference site(s) or a desired future condition. When the HAB method employs a standard of comparison to convert to Habitat Units, it is referred to as Combined Habitat Assessment Protocols (CHAP). The evaluation of without project conditions applying the CHAP method has not been completed as of the date of this Report.

Without-Project Recreation Use Analysis

For this baseline economic assessment's study of recreation opportunities and impacts from watershed instability and flooding, the recreation market area is assumed to be Orange County, California. This assumption is based upon discussions with local experts from the Orange County Department of Harbors, Beaches, and Parks. Aliso Creek offers unique recreation experiences that are enjoyed by residents throughout the County. Although Aliso Creek recreation opportunities do attract some visitors from outside Orange County, for example from Riverside and San Bernardino Counties, their numbers are small enough relative to Orange County visitors to make their effect on this recreation analysis insignificant. Growth in attendance rates is based upon growth in the population rate for the market area. This assumption was determined reasonable by the Orange County Department of Harbors, Beaches, and Parks because the majority of growth in Orange County will take place in the

relatively less developed southern portion of the Country. The close proximity of the Aliso Creek to these growth areas will attract recreation visitors.

Valuing Potential Future Recreational Resources

The valuation of recreational resources is *not* an assessment of the economic value of the site in terms of employment, income, or tourism. It is simply an estimate, based on well-established national parameters developed by federal water resource agencies, of users' willingness to pay for recreational experiences at the site. USACE Principles and Guidelines describe three techniques which have been developed to estimate recreation demand and value. The three methods are: 1) Travel Cost; 2) Contingent Valuation; and 3) Unit Day. Because of its simplicity and general acceptability, and because the focus of the study is ecosystem restoration, the Unit Day method (Unit Day Value, or UDV) was selected for use in this analysis.

Unlike the Travel Cost method, the UDV method does not attempt to account for the impact of price on visitations to a recreation site. Instead, an assigned user day value is applied to the total number of estimated visitors. User day values are simulated market values derived from a range of values agreed to by Federal water resource agencies. It is intended to represent a typical user's average willingness to pay for a full day of recreation activity at the site when considering key characteristics such as the range of possible activities, the accessibility of the site, and the overall quality of the recreation experience. When a properly formulated unit day value is applied to estimated use, an approximation of the area under the site demand curve is obtained, which is used in estimating recreation value at a site as well as the net recreation benefits of a proposed project.

Aliso and Wood Canyons Wilderness Park Recreation Analysis

Recreational facilities within Aliso and Wood Canyons Wilderness Park are managed by the Orange County Department of Harbors, Beaches, & Parks. The roads within the park are managed by SOCWA. The park offers over 80 parking spaces for cars and trucks and about 20 spaces for horse trailers at the parking lot located next to Alicia Parkway. In addition, many of the park visitors either enter the park through the bike trail along Aliso Creek or walk from the nearby housing tracts.

The following table shows the annual attendance at the park from 1991 through 2008. Park rangers have no set rules on how to count the number of people in the park. The park has 15 locations where people could enter. The park's Chief Ranger estimates park attendance monthly. While parking is limited, many park users park along nearby roads or enter the park by bike or by foot from the surrounding developments and trails. Special events have been held at the park with 10,000 people in attendance.

Table 8: Annual Attendance - Aliso & Wood Canyons Wilderness Park

Annual Attendance Aliso and Wood Canyons Wilderness Park	
Year	Annual Attendance
1991	35,139
1992	57,473
1993	126,949
1994	153,494
1995	149,759
1996	117,752
1997	81,115
1998	25,930 (records through September)
1999	179,774
2000	109,964
2001	116,475
2002	115,046
2003	108,995
2004	67,507
2005	101,195
2006	124,692
2007	115,337
2008	113,057

Over the 10-year period ending in 2008, average annual park attendance was about 115,000. According to Orange County Department of Harbors, Beaches, & Parks, the park has lost up to 100 acres of land for recreational use from the degradation of the stream banks. In addition, SOCWA roads and sewage lines running through the park have been damaged by streambed degradation and bank erosion. The AWMA Road, running through the park is severely threatened near the entrance to the park and will cause a park closure when any further failure occurs to protect human health and safety.

The value of existing and future without project general recreation at Aliso and Wood Canyons Wilderness Park was calculated using a user day value and annual visitation estimates for years 2015-2064. The next Table shows the judgment factors and point values that were used to calculate the unit day value for general recreation.

The recreation experience was calculated to be 10 on scale of 0 to 30, because the park offers several general activities: horse backing, nature study, hiking, bicycling, and walking. The calculation for the availability of opportunity at the park was determined to be 3 on scale of 0 to 18, because three wilderness parks are within thirty minutes of driving time (Ronald W. Casper Regional Park, Laguna Wilderness Park, and Thomas S. Riley Wilderness Park). Aliso and Wood Canyons Wilderness Park carrying capacity was calculated to be 8 on scale of 0 to 14, because the park offers adequate facilities for hiking and bicycling activities. The calculation for the accessibility to the park is 12 on scale of 0 to 18, because of parking facilities as well as the ability of citizens in surrounding communities to enter the park by foot or bike through many corridors. The environmental value at the park was calculated to be 5 on scale of 0 to 20, because while the park is intended to offer a pristine environment for people

to explore nature, but the creek instability, poor water quality, and the subsequent loss of species has limited the value of the natural recreation experience offered.

Table 9: Aliso and Wood Canyons Wilderness Park - Unit Day Value

Aliso and Wood Canyons Wilderness Park Calculations of the Unit Day Value General Recreation		
Recreation Criteria	**Range of Values**	**Judgement Value**
Recreation Experience	0 to 30	10
Availability of Opportunity	0 to 18	3
Carrying Capacity	0 to 14	8
Accessibility	0 to 18	12
Environmental	0 to 20	5
	Total	38
Conversion of Points to Dollar Value		$6.46

The table above provides a summary of the unit day value ratings for Aliso and Wood Canyons Wilderness Park. The ratings total to 38 points, which correspond to a dollar value of $6.46 based upon the Economic Guidance Memorandum 09-03, Unit Day Values for Recreation, Fiscal Year 2009.

For the without-project recreation analysis a base year of 2015 was assumed. To calculate the expected annual recreation value of Aliso and Wood Canyons Wilderness Park, attendance projections were calculated for years 2015 through 2064. The attendance projection was derived by averaging the annual attendance from the most recent ten years that had complete attendance records (1999-2008). The ten year average was calculated to be 115,204. This ten year average is realistic because it incorporates years with different weather patterns. This ten year average attendance number was assigned to 2008. It was then increased annually by the annual rate of population growth in the recreation demand area through the end of the fifty-year period of analysis (2064).

The attendance projections were then multiplied by the unit day value of $6.46 to arrive at a total recreation value for each year in the period of analysis. Each year's value was converted to its present value, and the stream of present values summed and converted to an average annual equivalent value of $900,000. The Table below provides the summary results of this analysis.

Table 10: Aliso & Wood Canyons Wilderness Park – Results

Aliso and Wood Canyons Wilderness Park Recreation Analysis Summary Results	
Period of Analysis	50 Years
Present Value of Recreation Benefit Stream	$18,158,000
Average Annual Equivalent Benefit	$900,000

It should be noted that this analysis does not incorporate any decline in recreation value or attendance that could result from continued channel and ecosystem degradation that could occur under the future without project conditions.

Aliso Beach Recreation Analysis

The next table shows the annual visitation at Aliso Beach from 1990 thru 2009. The annual visitation figures were obtained from U.S. Ocean Safety, which is responsible for the lifeguards and information from the Orange County Department of Harbors, Beaches and Parks.

Table 11: Annual Attendance Aliso Beach

Annual Attendance Aliso Beach	
Year	Annual Attendance
1990	1,989,050
1991	2,137,900
1992	2,111,970
1993	1,851,500
1994	2,361,513
1995	3,477,369
1996	965,961
1997	1,027,484
1998 (January-July)	846,812
1999	NA
2000	1,022,184
2001	983,074
2002	1,045,982
2003	1,023,430
2004	912,437
2005	1,099,983
2006	1,150,144
2007	1,113,123
2008	996,777
2009*	136,710
* 2009 estimate includes only the attendance from January-May	

The recent attendance figures from 1990 thru 2009 show a decline from the average annual attendance of 1,936,765 in the years 1990 thru 1997 compared to average annual attendance of 1,038,570 in the years 2000 thru 2008. The recent downward trend in park attendance estimates may be based on a combination of circumstances: 1) degraded environmental conditions including water quality have lowered recreation demand at the park; and 2) recurring sewage spills have resulted in beach closures and contributed to a reputation associating Aliso Beach with poor water quality and human health and safety risks.

The attendance projection was derived by averaging the annual attendance from the most recent nine years that had complete attendance records (2000-2008). The nine year average was calculated to be

1,038,570. This nine year average is realistic because it incorporates years with different weather patterns. This nine year average attendance number was assigned to 2008. It was then increased annually by the annual rate of population growth in the recreation demand area through the end of the fifty-year period of analysis (2064).

The recreation experience was calculated to be 7 on scale of 0 to 30, because the beach offers only general activities: surfing, picnicking, sunbathing and walking. The calculation for the beach availability of opportunity was determined to be 1 on scale of 0 to 18, because several other beaches with similar facilities are within one hour of driving time (Huntington City Beach and San Clemente). Aliso Beach carrying capacity was calculated to be 7 on scale of 0 to 14, because the beach offers adequate facilities for beach activities. The calculation for the accessibility to the beach is 12 on scale of 0 to 18, because the beach is located off Pacific Coast Highway. The environmental value at beach was calculated to be 5 on scale of 0 to 20, because of recurring sewage spills have resulted in beach closures and contributed to a reputation associating Aliso Beach with poor water quality and human health and safety risks.

Table 12: Aliso Beach - Unit Day Value

Aliso Beach		
Calculations of the Unit Day Value General Recreation		
Recreation Criteria	**Range of Values**	**Judgement Value**
Recreation Experience	0 to 30	7
Availability of Opportunity	0 to 18	1
Carrying Capacity	0 to 14	7
Accessibility	0 to 18	12
Environmental	0 to 20	5
	Total	32
Conversion of Points to Dollar Value		$5.66

For the without–project recreation analysis a base year of 2015 was assumed. The attendance projections were then multiplied by the unit day value of $5.66 to arrive at a total recreation value each year in the period of analysis. Each year's value was converted to its present value, and the stream of present values summed and converted to an average annual equivalent value of $7,111,000. Table below provides the summary results of this analysis.

Table 13: Aliso Beach - Results

Aliso Beach	
Recreation Analysis Summary Results	
Period of Analysis	50 Years
Present Value of Recreation Benefit Stream	$143,423,000
Average Annual Equivalent Benefit	$7,111,000

During the next phase of the Study, a determination will be made regarding whenever any proposed alternatives may affect existing recreation values. If so, a revaluation will be conducted to quantify these impacts.

Cost-Effectiveness and Incremental Cost Analyses

Environmental Quality (EQ) is one of the Corps' four so-called 'accounts'. The USACE Planning Guidance Notebook states,

> "The Corps objective … is to contribute to national ecosystem restoration. Contributions to national ecosystem restoration (NER outputs) are increases in the net quantity and/or quality of desired ecosystem resources… Single purpose ecosystem restoration plans shall be formulated and evaluated in terms of their net contributions to increases in ecosystem value (NER outputs), expressed in non-monetary units."

The Economist's role in the determination of the contribution of a particular project to the EQ account is to help characterize and rank the cost-effectiveness of the various alternatives that are part of a particular study. That is, each alternative can generally be a combination of measures, the sum of which has a particular level of habitat value and a particular monetary cost associated with it. A cost-effectiveness analysis is simply a way of finding, for a given level of habitat output, those combinations of non-exclusive restoration measures that provide the best value. Once the cost-effective alternatives, or plans, have been identified, the Economist performs an incremental cost analysis, which helps decision-makers understand the added cost at each additional level of habitat output. Again, from USACE guidance:

> "Cost-effectiveness analysis shall be used to identify the least cost solution for each level of environmental output considered. Incremental cost analysis compares the additional costs to the additional outputs of an alternative."

At the next study phase, when the project alternatives are analyzed and compared, the Economic Analysis will include the results of the cost-effectiveness and incremental cost analyses, identifying those plans that are and are not cost-effective. Among these cost-effective plans, so-called "best buy" plans will be identified, which are those plans that are most efficient in production as the scale of the restoration efforts (the habitat output) increases in size. From this array of plans, and after considering the planning goals and constraints, the NER alternative will be identified by the project delivery team.

Other Considerations – RED & OSE

Per USACE EC 1105-2-409, any alternative plan that has net beneficial effects across the four USACE Planning & Guidance (P&G) accounts may be the recommended plan. Furthermore, "highest budgetary priority will be given to collaborative planning activities that embrace the full range of the national Federal interest." At this point, recommendations within USACE guidance documents for the actual implementation of two of the accounts – RED and OSE – are not complete. The description of impacts related to these accounts as a result of a federal project will be included in the next report phases as warranted and as further guidance and instruction becomes available. The following will briefly describe each of the accounts, setting the stage for a potential evaluation of these two accounts at the next study phase.

Regional Economic Development (RED)

According to EC 1105-2-409, "the regional economic development account registers changes in the distribution of regional economic activity that result from each alternative plan". According to the EC, measurement of RED effects is generally to be quantitative within available and selected methods. USACE is currently developing a handbook of contemporary techniques for RED.

This type of impact analysis requires input/output modeling, which, depending on the project, can require a significant amount of additional funds and time to incorporate in a study. Regional economic impacts can be short- or long-term. The most easily identifiable impacts from a potential project would be the changes in income, employment, sales, and tax receipts that would result from the economic activity spurred by the construction of the particular project. Longer-term economic impacts, which are more difficult to forecast and quantify, could include changes in regional product, employment, sales, and tax receipts (including from property tax) that would result from a more permanent change in the local economy – for example, increased demand for residential and/or commercial properties along an improved river corridor. For this analysis however, given the uncertainty involved in forecasting future development, any RED analysis will likely be limited to evaluating a) the short-term impacts of construction expenditures in the region, and b) the longer-term economic impact of any recreation features created by the potential project(s).

Other Social Effects (OSE)

OSE is defined by EC 1105-2-409, "The other social effects account registers plan effects from perspectives that are relevant to the planning process, but are not reflected in the other three accounts". Measurement of OSE effects is generally qualitative; however quantitative data is encouraged within available and accepted methods.

For this study, the categories associated with the OSE account would likely be limited to effects like: availability and diversity of recreation and cultural opportunities, community ties, and improved aesthetics (termed "visual compatibility" or "naturalness" in EC 1105-2-409).