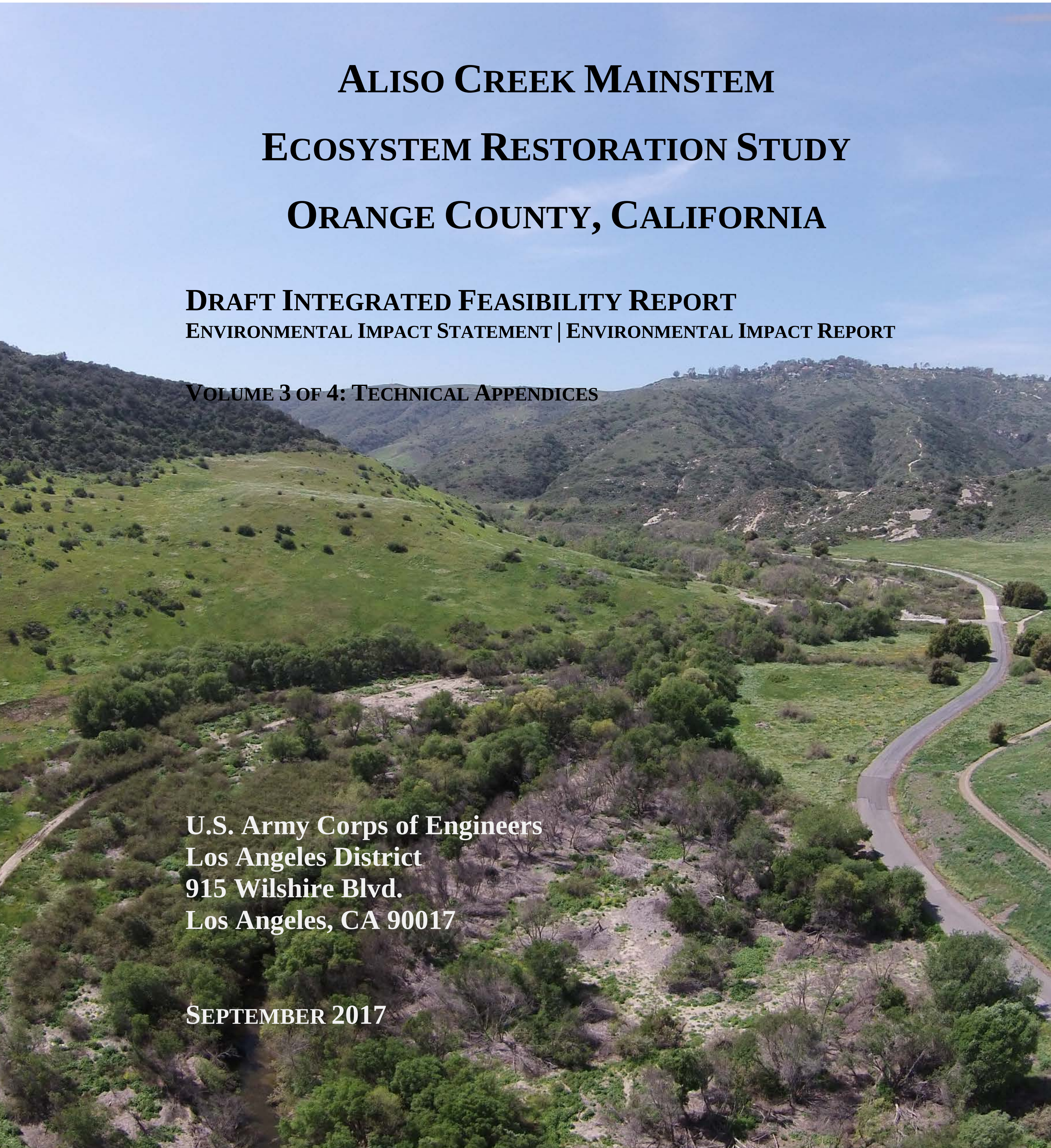
US Army Corps of Engineers®

Orange County Public Works
Environmental Resources
Department



ALISO CREEK MAINSTEM
ECOSYSTEM RESTORATION STUDY
ORANGE COUNTY, CALIFORNIA

DRAFT INTEGRATED FEASIBILITY REPORT
ENVIRONMENTAL IMPACT STATEMENT | ENVIRONMENTAL IMPACT REPORT

VOLUME 3 OF 4: TECHNICAL APPENDICES

U.S. Army Corps of Engineers
Los Angeles District
915 Wilshire Blvd.
Los Angeles, CA 90017

SEPTEMBER 2017

USACE. 2017. Aliso Creek Mainstem Ecosystem Restoration Study. Draft Integrated Feasibility Report Environmental Impact Statement Environmental Impact Report. Orange County, California. Volume 3 of 4: Technical Appendices. U.S. Army Corps of Engineers, Los Angeles District, Los Angeles, California. September.

Volume 3

Appendix B: Environmental

- **B-1: Notice of Intent and Public Scoping**
- **B-2: Combined Habitat Assessment Protocols**
- **B-3: Restoration Review**
- **B-4: Air Quality**
- **B-5: Cultural Resources**
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- **B-7: 404(b)(1)**
- **B-8: Adaptive Habitat Management Plan**
- **B-9: Greenhouse Gases**
- **B-10: Planning Aid Letter**

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DRAFT INTEGRATED FEASIBILITY REPORT ENVIRONMENTAL IMPACT STATEMENT / ENVIRONMENTAL IMPACT REPORT (EIS/EIR)

APPENDIX B: ENVIRONMENTAL

ALISO CREEK MAINSTEM
ECOSYSTEM RESTORATION STUDY
Orange County, California

September 2017

US Army Corps of Engineers

Orange County Public Works
Environmental Resources
Department

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APPENDIX B-1: Notice of Intent and Public Scoping

ALISO CREEK MAINSTEM
ECOSYSTEM RESTORATION STUDY
Orange County, California

September 2017

US Army Corps
of Engineers

Orange County Public Works
Environmental Resources
Department

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There are no capital costs or operating and maintenance costs associated with this collection.

Dated: April 3, 2009.

David A. Stawick,

Secretary of the Commission, Commodity Futures Trading Commission.

[FR Doc. E9–8017 Filed 4–8–09; 8:45 am]

BILLING CODE 6351–01–P

DEPARTMENT OF DEFENSE

Department of the Army; Corps of Engineers

Intent To Prepare a Draft Environmental Impact Statement/Environmental Impact Report (DEIS/EIR) for the Aliso Creek, Orange County, CA

AGENCY: Department of the Army, U.S. Army Corps of Engineers, DOD.

ACTION: Notice of intent.

SUMMARY: The purpose of the study is to evaluate an approximately 7-mile reach of the Aliso Creek and 1,000 feet of the Wood Canyon tributary to Aliso Creek located in Orange County in the Cities of Laguna Beach, Laguna Nigel, and Aliso Viejo, CA and unincorporated Orange County. Much of the 7-mile reach is located within the Aliso and Wood Canyons Wilderness Park, which is owned and managed by Orange County. The focus of the project will be on watershed improvements to restore the creek's dynamic function and habitat for endangered species by developing alternatives for ecosystem restoration for impacted reaches of the creek. The restoration project will focus on revitalization of the riparian vegetation community; establishment of an environmental corridor to benefit wildlife and sensitive species; creek stabilization, and addressing flood risk management. The 7-mile reach of Aliso Creek is located entirely within Orange County, CA.

DATES: Provide comments by May 10, 2009.

ADDRESSES: Submit comments to Deborah Lamb at U.S. Army Corps of Engineers, Los Angeles District, CESPL–PD–RL, P.O. Box 532711, Los Angeles, CA 90053–2325.

FOR FURTHER INFORMATION CONTACT: Deborah Lamb, Regional Planning Section at (213) 452–3798; fax (213) 452–4204 or e-mail at *Deborah.L.Lamb@usace.army.mil*

SUPPLEMENTARY INFORMATION:

1. *Authorization*. The proposed study is authorized by House Document No. 838, 76th Congress 3rd Session, dated May 1954, which reads as follows:

"Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the reports on (a) San Gabriel River and Tributaries, published as House Document No. 838, 76th Congress, 3rd Session; and (b) Santa Ana River and Tributaries, published as House Document No. 135, 81st Congress, 1st Session; and (c) the project authorized by the Flood Control Act of 1936 for the protection of the metropolitan area in Orange County, with a view toward determining the advisability of modification of the authorized projects in the interest of flood control and related purposes."

2. *Background*. Aliso Creek. While much of the Aliso Creek project area is within an Orange County wilderness park and within the Natural Communities Conservation Plan/Habitat Conservation Plan (NCCP/HCP) Nature Reserve of Orange County (NROC), the creek is in a highly urbanized area with a high population concentration. As such, Aliso Creek has numerous water resource issues related to both human actions and natural processes which have raised concerns about the long-term survival of the watershed ecosystem. Fundamental problems that have been identified include channel instability, degraded water quality, loss of fish and wildlife habitat, and flood damage. Since 1997, there has been a multi-jurisdictional effort to address problems within the Aliso Creek watershed. The Aliso Creek Watershed Management Feasibility Study, sponsored by the U.S. Army Corps of Engineers, Orange County, and municipalities and water districts within the Aliso Creek watershed boundary, was completed in July 1999. A wide range of technical studies have since been completed. Re-establishment of a healthy and sustainable watershed environment would serve to improve the environmental and economic conditions of the creek, including improving water quality, native habitat, and reducing flood damage.

Alternatives to be considered are those that will further reduce degradation of the creek and the riparian ecosystem, improve ground and surface water quality, and reduce adverse water quality impacts from runoff.

3. *Scoping Process*. a. A scoping meeting is scheduled for 7, May 2009, 6:30pm to 8:30pm at Mission Viejo City Council Chamber, 200 Civic Center Mission Viejo, CA 92691, (949) 470–3000.

For additional information on dates, times and locations please contact Deborah Lamb (see **ADDRESSES**), or at (213) 452–3798 or e-mail at: *deborah.l.lamb@usace.army.mil*.

Potential impacts associated with the proposed action will be evaluated. Resource categories that will be analyzed include: Physical environment, geology, biological resources, air quality, water quality, recreational usage, aesthetics, cultural resources, transportation, noise, hazardous waste, socioeconomics, safety, and sustainability.

b. Participation of affected Federal, state and local resource agencies, Native American groups and concerned interest groups/individuals is encouraged in the scoping process. Public participation will be especially important in defining the scope of analysis in the Draft EIS/EIR, identifying significant environmental issues and impact analysis of the Draft EIS/EIR and providing useful information such as published and unpublished data, personal knowledge of relevant issues and recommending mitigation measures associated with the proposed action.

c. Those interested in providing information or data relevant to the environmental or social impacts that should be included or considered in the environmental analysis can furnish this information by writing to the points of contact indicated above or by attending the public scoping meeting. A mailing list will also be established so pertinent data may be distributed to interested parties.

Dated: March 27, 2009.

Thomas H. Magness,

Colonel, U.S. Army, District Commander.

[FR Doc. E9–8107 Filed 4–8–09; 8:45 am]

BILLING CODE 3720–58–P

DEPARTMENT OF DEFENSE

Department of the Army; Corps of Engineers

Notice of Intent To Prepare a Draft Environmental Impact Statement for the Town of Nags Head, Beach Nourishment Project in Dare County, NC

AGENCY: Department of the Army, U.S. Army Corps of Engineers, DoD.

ACTION: Notice of intent.

SUMMARY: The U.S. Army Corps of Engineers (COE), Wilmington District, Regulatory Division, has received a request for Department of the Army authorization, pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899, from the Town of Nags Head to dredge

PUBLIC MEETING

FOR THE

ALISO CREEK MAINSTEM ECOSYSTEM RESTORATION FEASIBILITY STUDY

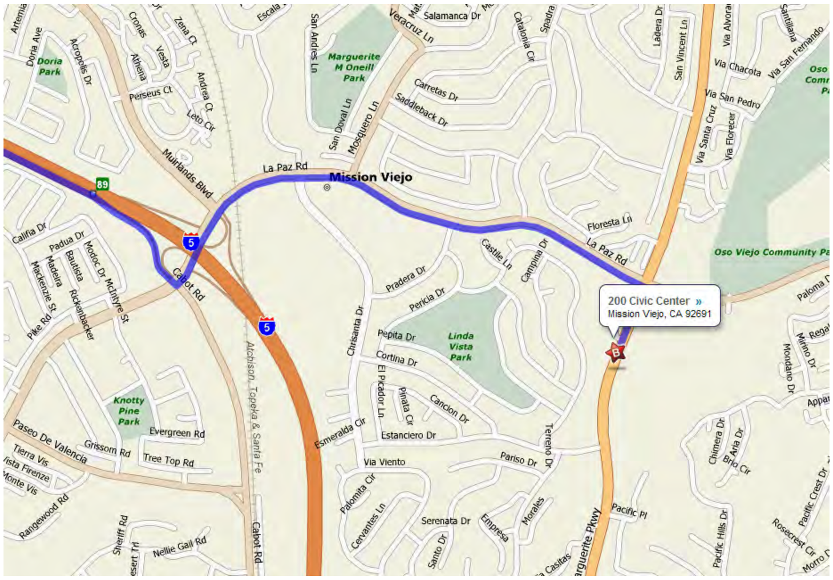
ORANGE COUNTY, CALIFORNIA

The United States Army Corps of Engineers (Corps), Los Angeles District, in partnership with the County of Orange, Watershed and Coastal Resources, will hold a Public Scoping Meeting for the Aliso Creek Mainstem Ecosystem Restoration Feasibility Study on May 7^{th}, 2009, 6:30-8:30 p.m., at the Mission Viejo City Council Chambers, located at 200 Civic Center, Mission Viejo, California, 92691. The purpose of this meeting is to raise issues or concerns in advance of preparing an Environmental Impact Statement/Report as well as solicit input from the public for the Feasibility Study (Study). The public, as well as Federal, state, and local agencies are encouraged to actively participate in the scoping process by attending the meeting and/or submitting data, information, and comments pertaining to environmental, historic preservation, and socioeconomic issues to be addressed in the Study. Useful information includes other environmental studies within the watershed, published and unpublished data that may be relevant to this study area, issues and alternatives which could be addressed in the analysis, and potential constraints associated with any proposed action.

The 905(b) Reconnaissance Report for this Study was completed by the Corps in May 2001. The reconnaissance study reviewed and assessed trends within the Aliso Creek Mainstem and tributaries, and identified opportunities for addressing ecosystem restoration and creek re-stabilization issues. Issue areas briefly investigated included hydrology, hydraulics, flooding, river geomorphology, erosion, sedimentation, land use, geology, soils, water quality, groundwater, vegetation, endangered species, and cultural resources. The feasibility study will focus on the lower Aliso Creek, downstream of Pacific Park Drive to the Pacific Ocean, and also Wood Canyon Creek in the vicinity of the confluence with Aliso Creek. The feasibility study will address the following:

1. Degradation of the environment, both physical and biological
2. Water quality degradation
3. Restoration of dynamic functions of the creek system
4. Restoration of terrestrial and aquatic habitat
5. Protection of sensitive and endangered species
6. Flood risk management

For questions and additional information, please contact Mr. Jonathan Vivanti, Lead Planner at (213) 452-3809; or Ms. Debbie Lamb, Environmental Coordinator, at (213) 452-3798.



Directions from the I-5:
Take the I-5 south
Take the La Paz Road exit
Turn left onto La Paz Road
Turn right onto Marguerite Parkway
Turn right into 200 Civic Center, Mission Viejo, CA 92691

US Army Corps of Engineers
Los Angeles District

COUNTY OF ORANGE CALIFORNIA

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, US ARMY CORPS OF ENGINEERS
PLAN FORMULATION BRANCH
P.O. BOX 532711

OFFICIAL BUSINESS

FIRST CLASS MAIL

From: Greg_Hill@ca.blm.gov [mailto:Greg_Hill@ca.blm.gov]
Sent: Wednesday, April 22, 2009 8:16 AM
To: Lamb, Deborah L SPL
Cc: Samuel_Gaugush@blm.gov; Sandra_McGinnis@blm.gov
Subject: ER 09-398 (CE NOI DEIS EIR)

The Bureau of Land Management appreciates the opportunity to review and provide comment regarding the subject ER 09/398, NOI for DEIS/EIR Aliso Creek, Orange County, CA. However, the BLM has no jurisdiction or authority with respect to the project, the agency does not have expertise or information relevant to the project, nor does the agency intend to submit comments regarding the project.

Greg Hill
Planning & Environmental Coordinator
BLM Palm Springs-South Coast Field Office
1201 Bird Center Drive
Palm Springs, CA 92262
(760) 833-7100

CCRPA

California Cultural Resource Preservation Alliance, Inc.

P.O. Box 54132
Irvine, CA 92619-4132

An alliance of American Indian and scientific communities working for the preservation of archaeological sites and other cultural resources.

May 26, 2009

Johathan Vivanti
Los Angeles District, U.S. Army Corps of Engineers

This letter is in regard to the Notice of Preparation for the Aliso Creek Mainstem ecosystem Restoration Project. The CCRPA is concerned about the potential impacts to more than 20 archaeological sites that are on or near Aliso Creek. These sites represent thousands of years of prehistoric occupation and include components of several recognized coastal southern California cultural traditions. The sites include the remains of large prehistoric villages with human burials as well as associated special activity sites and most certainly meet the criteria for listing on the National Register of Historic Places as an archaeological district. In addition, the creek also contains significant paleontological resources.

Archaeological sites are fragile and non-renewable and will be impacted by any ground disturbing activity. Therefore we want to emphasize the importance of preservation, as opposed to archaeological excavations to recover data, as “mitigation” for impacts to significant archaeological sites. Scientific studies do not mitigate for the disturbance of Native American burials and other cultural values. This is reflected in the 2004 amendments to 36 CFR 800 Protection of Historic Properties that remove data recovery excavation as a means of reducing adverse effects to a no adverse effect determination.

If incorporated into the early planning stages of a project, preservation measures such as avoidance and site stabilization and burial are feasible alternatives to destruction and data recovery mitigation. Please make preservation an important priority in the planning for the restoration of Aliso Creek. If you have any questions, I can be reached at pmartz@calstatela.edu

Sincerely,

Patricia Martz

Patricia Martz, Ph.D.
President

California Natural Resources Agency
DEPARTMENT OF FISH AND GAME
South Coast Region
4949 Viewridge Avenue
San Diego, CA 92123
(858) 467-4201
http://www.dfg.ca.gov

ARNOLD SCHWARZENEGGER, Governor
DONALD KOCH, Director

July 2, 2009

Zoila Finch
County of Orange
2301 N. Glassell Street
Orange California, 92865
Phone #: (714) 955-0618
Fax #: (714) 955-0639

Subject: Department Comments on the Notice of Preparation of a Draft Environmental Impact Report/ Environmental Impact Statement for the Aliso Creek Ecosystem Restoration Project, Orange County (SCH # 2009041066)

Dear Ms. Finch:

The Department of Fish and Game (Department) has reviewed the above-referenced Notice of Preparation (NOP), for a Draft Environmental Impact Report/Environmental Impact Statement (DEIR/DEIS) relative to impacts to biological resources. The following statements and comments have been prepared pursuant to the Department's authority as Trustee Agency with jurisdiction over natural resources affected by the project (CEQA Guidelines Section 15386) and pursuant to our authority as a Responsible Agency under CEQA Guidelines Section 15381 over those aspects of the proposed project that come under the purview of the California Endangered Species Act (Fish and Game Code Section 2050 *et seq.*) and Fish and Game Code Section 1600 *et seq.* The Department administers the Natural Community Conservation Plan (NCCP) program.

The Project encompasses an approximate seven-mile reach of lower Aliso Creek and 1,000 feet of Wood Canyon tributary located within the Cities of Aliso Viejo, Laguna Beach, Laguna Hills, Laguna Niguel, Laguna Woods, Lake Forest, and Mission Viejo, and unincorporated Orange County. A majority of the Creek is within Aliso and Wood Canyons Wilderness Park, a County-owned and managed Reserve within the Orange County Central/Coastal NCCP.

The Aliso Creek watershed has been the focus of multi-agency efforts to reduce flows, erosion, and maintain important habitats. The U.S. Army Corps of Engineers (Corps) funded a Feasibility study in 1999. This EIR will satisfy the non-federal sponsor's (County of Orange) CEQA obligations to complement the Corps' National Environmental Quality Act (NEPA) Environmental Impact Statement (EIS) which the Corps is in the process of completing. The proposed project includes an ecosystem restoration plan for the seven-mile reach of Aliso Creek. The restoration will focus on revitalization of the riparian vegetation, restoration of natural processes, channel stabilization, and reduction in flood risk.

Aliso Creek and the surrounding upland habitats support a wide variety of NCCP-"Covered" and listed species. Covered species known to occur within the watershed include, but are not limited to: coastal rosy boa (*Lichanura trivirgata roseofusca*); red diamond rattlesnake (*Crotalus exsul*); orange-throated whiptail (*Aspidoscelis hyperythrus beldingi*); coastal western whiptail (*Cnemidophorus tigris multiscutatus*); sharp-shinned hawk (*Accipiter striatus*); red-shouldered hawk (*Buteo lineatus*); coastal California gnatcatcher (*Polioptila californica californica*); cactus

Conserving California's Wildlife Since 1870 wren (*Campylorhynchus brunneicapillus*); southern California rufous-crowned sparrow (*Aimophila ruficeps canescens*); coyote (*Canis latrans*); gray fox (*Urocyon cinereoargenteus*); and conditionally covered species foothill mariposa lily (*Calochortus weedii* var. *intermedius*). Also supported are other California-listed rare, special concern, threatened or endangered plants and animals not covered under the NCCP including but not limited to: southern California steelhead (*Oncorhynchus mykiss*); tidewater goby (*Eucyclogobius newberryi*); southwestern pond turtle (*Actinemys marmorata pallida*); summery holly (*Comarostaphylis diversifolia*), federal and state threatened, CNPS list 1B.2; big-leaved crownbeard (*Verbesina dissita*), and federal and state threatened and CNPS list 1B.1 Laguna Beach dudleya (*Dudleya stolonifera*).

To enable Department staff to adequately review and comment on the proposed project we recommend the following information, where applicable, be included in the DEIR/DEIS.

Specific Comments

1. Pursuant to CEQA guidelines § 15126 the DEIR/DEIS shall discuss all phases of the project when evaluating its impact on the environment. The DEIR/DEIS shall discuss subjects listed in CEQA guidelines §15126 in separate sections, paragraphs, or the DEIR/DEIS shall include a table showing where each of the subjects is subsequently discussed.

2. Recent baseline surveys for **all** sensitive terrestrial and aquatic species should be conducted, see *General Comments* below. Particularly, southwestern pond turtle (pond turtle) is a State Species of Special Concern (SSC) that is located in the Aliso Creek Watershed (Dudek 2001). Focused surveys for the pond turtle, including live trapping, should be conducted within the project area to assist in determining the current reproductive status of the local pond turtle population, site use by pond turtle, and optimal upland habitat on the site for nesting and flood refugia. Live trapping surveys for pond turtle should be conducted on consecutive days and nights during at least two separate sampling periods between April and June. Based on the results of focused surveys, the DEIR/DEIS should thoroughly discuss project design features, Best Management Practices (BMPs), avoidance, and minimization measures to prevent direct and indirect impacts to streams, upland burrows, and aquatic water quality. Because pond turtle have been documented within the project area, they should be assumed to utilize Aliso Creek and associated suitable upland habitat on site on at least an occasional basis regardless of trapping results.

3. The project occurs within the Department-administered Orange County NCCP Habitat Conservation Plan (HCP) and within the Coastal sub-region "Reserve". The DEIR/DEIS should evaluate if the various alternatives would result in the permanent loss of existing natural vegetation during the siting, operation, and maintenance of infrastructure within project limits.

    a. If new permanent impacts to existing natural vegetation would occur from construction of new, expansion of existing, or movement of existing infrastructure the impacts should be evaluated under NCCP/HCP Section 5.9.3, *Construction of New Facilities,* and determine if proposed impacts would exceed allotted habitat removal authorized under the NCCP.
    b. The DEIR/DEIS should incorporate construction guidelines associated with the NCCP/HCP.
    c. The NCCP/HCP covers several listed species. The DEIR/DEIS should evaluate

if the various alternatives would result in impacts to these species, and if so, evaluate that the impacts and mitigation measures are consistent with the NCCP/HCP.

d. For any species not covered under the NCCP/HCP, the DEIR/DEIS should disclose any reasonably foreseeable impacts to those species recognized as rare, endangered, threatened, or SSC. Adverse project impacts to state and federally threatened and/or endangered species, SSC, federal Species of Concern, locally identified significant plants, and California Native Plant Society (CNPS) 1B (rare) listed plants are considered significant under CEQA (CEQA Guidelines Sections 15380 (d), 15065 (a)). The Department recommends avoidance of impacts and/or onsite preservation or offsite acquisition and preservation of habitat of equal or greater value to mitigate for direct, indirect and cumulative impacts to sensitive species below a significant level under CEQA.

4. The Department acknowledges Aliso Creek has numerous water resource issues related to both human actions and natural processes that have raised concerns about the long-term survival of the watershed ecosystem. To the maximum extent feasible the DEIR/DEIS should analyze and consider incorporating design features into the project description to lessen direct and indirect impacts below a level of significance. The Department anticipates that some of the post-project riparian habitat and streambed will have greater function and value. However, some of the post-project riparian habitat and stream may not have greater function and value. The DEIR/DEIS should analyze the Project's affects to determine if post-project riparian habitat and streambed acreage will provide function and value for wildlife equal to or greater than existing habitat. The Department requests the following be included in the document.

    a. Existing fish passage should be analyzed and the DEIR/DEIS should integrate fish passage standards from the California Salmonid Stream Habitat Restoration Manual. Chapter 12 of the California Salmonid Stream Habitat Restoration Manual contains pertinent information on fish passage design with regard to jump heights, flow velocities, slope and length of in-stream structures for salmonid species. The California Salmonid Stream Habitat Restoration Manual including Chapter 12 can be accessed by accessing the world-wide web, utilizing an internet browser, and following the provided web address http://www.dfg.ca.gov/fish/Administration/Grants/FRGP/GuidanceTools.asp

    b. Identify past compensatory habitat mitigation sites within the project area, and quantify the amount of existing habitat affected by the project. Direct impacts to habitat mitigation should be disclosed in the project description, along with whether the impacts would be permanent or temporary. The project description should include:

        i. Acreage of permanent and temporary direct impacts to vegetation communities, including staging, storage, and lay-down areas. Permanent and temporary direct impacts to compensatory mitigation sites should be called out separately from any other permanent and temporary impacts.
        ii. Acreage of vegetation communities created. Acreage created for permanent and temporary direct impacts to functioning compensatory mitigation sites should be replaced with acreage of similar habitat types greater than the acreage permanently and temporarily affected.
        iii. Direct impacts to existing native riparian vegetation communities without

previous restoration, enhancement, or rehabilitation activities should be replaced with acreage greater than acreage affected.

c. All plants utilized within project boundaries should be native to southern California. Additionally, seed and container stock utilized should be local to Orange County and Aliso and Wood Canyons Wilderness Park.

   i. The DEIR/DEIS should include a complete plant palette, and disclose performance standards associated with habitat restoration of permanent and temporary impacts. Performance standards for restoration should include: relative cover after 3 years equal to existing plant communities at local reference sites (DEIR/DEIS should discuss which reference sites used); ≥ 80% survival of replacement plants in first three years; replacement planting required if ≤ 80% survival after three years; ≤5 % cover of non-native plant species after 5 years; elimination of all exotic invasive plants (examples listed on the California Invasive Plant Council website, such as *Arundo donax*, *Cortaderia selloana*); eradication/control of exotic animals; annual biological surveys; relocation/exclusion of aquatic animal species.

d. A long-term invasive control plan for both plant and animal species should be included in the DEIR/DEIS, and the potential funding source should be identified.

e. Time periods when construction would occur. If construction would occur during the rainy season or within flowing water, then the project description should disclose this, conceptually describe stream diversion around work areas, describe erosion and turbidity minimization measures, biological resource avoidance and minimization measures, and disclose whether groundwater dewatering wells will be needed to facilitate successful restoration.

f. Discussion of construction methods utilized to achieve project purpose. For example, bank restoration might include un-grouted rock rip rap or un-grouted with soil blanket on top, soil cement or bio-engineered bank structures.

5. The NOP states in the project description that the purpose of the project is to "restore and revitalize riparian vegetation communities, natural processes, stream channels, and to reduce erosion and flood risk." The DEIR/DEIS should identify what facilities and infrastructure require reduction in flood risk, and identify a flood risk objective for frequency and level of seasonal flooding at identified locations. For example, a project goal might be to protect infrastructure from erosion, flood inundation, or both in certain locations. Other locations could provide certain riparian vegetation communities access to seasonal scouring and inundation by creek water thereby facilitating restoration and reduction in erosion and flood risk.

   a. The DEIR/DEIS should evaluate the conversion of the County of Orange property located off of Highway 1 and Aliso Way, which is presently utilized for vehicle parking and passive recreation. All or parts of this property should be evaluated to allow for seasonal inundation and retention of water and revitalization of vegetation communities near the confluence of Aliso Creek with the Pacific Ocean.

b. The DEIR/DEIS should evaluate the modification of the Aliso Creek Wildlife Habitat Enhancement Project (ACWHEP). Particularly the ACWHEP drop structure, and the permanent vehicle crossing on the top of the structure joining western and eastern banks. Vehicle access to the eastern bank for infrastructure maintenance can be obtained from South Orange County Wastewater Authority (SOCWA) facility. In addition to evaluating limiting vehicular access to the eastern bank, the DEIR/DEIS should evaluate relocating existing infrastructure on the eastern bank of Aliso Creek to the western bank.

6. The DEIR/DEIS should conduct a cumulative analysis of existing and future proposed water quality BMPs upstream of project limits. Particularly the DEIR/DEIS should evaluate BMPs related to water detention and retention, water use, and water treatment. In addition, the DEIR/DEIS should evaluate water diversions including groundwater and invasive plant species removal.

General Comments

7. A complete, recent assessment of flora and fauna within and adjacent to the project area, with particular emphasis upon identifying endangered, threatened, and locally unique species and sensitive habitats (Attachment 1).

a. A thorough recent assessment of rare plants and rare natural communities, following the Department's Guidelines for Assessing Impacts to Rare Plants and Rare Natural Communities (Attachment 2).

b. A complete, recent assessment of sensitive fish, wildlife, reptile, and amphibian species. Seasonal variations in use of the project area should also be addressed. Recent, focused, species-specific surveys, conducted at the appropriate time of year and time of day when the sensitive species are active or otherwise identifiable, are required. Acceptable species-specific survey procedures should be developed in consultation with the Department and U.S. Fish and Wildlife Service.

8. The Department's Wildlife Habitat Data Analysis Branch in Sacramento should be contacted at (916) 322-2493 to obtain current information on any previously reported sensitive species and habitats, including Significant Natural Areas identified under Chapter 12 of the Fish and Game Code. Also, any Environmentally Sensitive Habitats or any areas that are considered sensitive by the local jurisdiction that are located in or adjacent to the project area must be addressed.

a. A thorough discussion of direct, indirect, and cumulative impacts expected to adversely affect biological resources, with specific measures to offset such impacts. This discussion should focus on maximizing avoidance, and minimizing impacts.

b. CEQA Guidelines, Section 15125(a), direct that knowledge of the regional setting is critical to an assessment of environmental impacts and that special emphasis should be placed on resources that are rare or unique to the region.

c. Project impacts should also be analyzed relative to their effects on off-site habitats and populations. Specifically, this should include nearby public lands, open space, adjacent natural habitats, and riparian ecosystems. Impacts to and maintenance of wildlife corridor/movement areas, including access to undisturbed habitat in adjacent areas are of concern to the Department and should be fully evaluated and provided. The analysis should also include a discussion of the potential for impacts resulting from such effects as increased vehicle traffic, outdoor artificial lighting, noise and vibration.

d. A cumulative effects analysis should be developed as described under CEQA Guidelines, Section 15130. General and specific plans, as well as past, present, and anticipated future projects, should be analyzed relative to their impacts on similar plant communities and wildlife habitats.

e. Impacts to migratory wildlife affected by the project should be fully evaluated including proposals to removal/disturb native and ornamental landscaping and other nesting habitat for native birds. Impact evaluation may also include such elements as migratory butterfly roost sites and neo-tropical bird and waterfowl stop-over and staging sites. All migratory nongame native bird species are protected by international treaty under the Federal Migratory Bird Treaty Act (MBTA) of 1918 (50 C.F.R. Section 10.13). Sections 3503, 3503.5 and 3513 of the California Fish and Game Code prohibit take of birds and their active nests, including raptors and other migratory nongame birds as listed under the MBTA.

f. Impacts to all habitats from City or County required Fuel Modification Zones (FMZ). Areas slated as mitigation for loss of habitat shall not occur within the FMZ.

g. Proposed project activities (including disturbances to vegetation) should take place outside of the breeding bird season (February 1- September 1) to avoid take (including disturbances which would cause abandonment of active nests containing eggs and/or young). If project activities cannot avoid the breeding bird season, nest surveys should be conducted and active nests should be avoided and provided with a minimum buffer as determined by a biological monitor (the Department recommends a minimum 500-foot buffer for all active raptor nests).

9. A range of alternatives should be analyzed to ensure that alternatives to the proposed project are fully considered and evaluated. A range of alternatives which avoid or otherwise minimize impacts to sensitive biological resources including wetlands/riparian habitats, alluvial scrub, coastal sage scrub, Joshua tree woodlands, etc. should be included. Specific alternative locations should also be evaluated in areas with lower resource sensitivity where appropriate.

   a. Mitigation measures for project impacts to sensitive plants, animals, and habitats should emphasize evaluation and selection of alternatives which avoid or otherwise minimize project impacts. Compensation for unavoidable impacts through acquisition and protection of high quality habitat elsewhere should be addressed with offsite mitigation locations clearly identified.

   b. The Department considers Rare Natural Communities as threatened habitats having both regional and local significance. Thus, these communities should be fully avoided and otherwise protected from project-related impacts (Attachment 2).

   c. The Department generally does not support the use of relocation, salvage, and/or transplantation as mitigation for impacts to rare, threatened, or endangered species. Department studies have shown that these efforts are experimental in nature and largely unsuccessful.

10. A California Endangered Species Act (CESA) Permit must be obtained, if the project has the potential to result in "take" of species of plants or animals listed under CESA, either during construction or over the life of the project. CESA Permits are issued to conserve, protect, enhance, and restore State-listed threatened or endangered species and their habitats. Early consultation is encouraged, as significant modification to the proposed project and mitigation measures may be required in order to obtain a CESA Permit. Revisions to the Fish and Game Code, effective January 1998, require that the Department issue a separate CEQA document for the issuance of a CESA permit unless the project CEQA document addresses all project impacts to listed species and specifies a mitigation monitoring and reporting program that will meet the requirements of a CESA permit. For these reasons, the following information is requested:

    a. Biological mitigation monitoring and reporting proposals should be of sufficient detail and resolution to satisfy the requirements for a CESA Permit.

    b. A Department-approved Mitigation Agreement and Mitigation Plan are required for plants listed as rare under the Native Plant Protection Act.

11. The Department opposes the elimination of watercourses (including concrete channels) and/or the canalization of natural and manmade drainages or conversion to subsurface drains. All wetlands and watercourses, whether intermittent, ephemeral, or perennial, must be retained and provided with substantial setbacks which preserve the riparian and aquatic habitat values and maintain their value to on-site and off-site wildlife populations. The Department recommends a minimum natural buffer of 100 feet from the outside edge of the riparian zone on each side of a drainage.

    a. The Department requires a Streambed Alteration Agreement (SAA), pursuant to Section 1600 et seq. of the Fish and Game Code, with the applicant prior to any direct or indirect impact to a lake or stream bed, bank or channel or associated riparian resources. The Department's issuance of a SAA may be a project that is subject to CEQA. To facilitate our issuance of the Agreement when CEQA applies, the Department as a responsible agency under CEQA may consider the local jurisdiction's (lead agency) document for the project. To minimize additional requirements by the Department under CEQA the document should fully identify the potential impacts to the lake, stream or riparian resources and provide adequate avoidance, mitigation, monitoring and reporting commitments for issuance of the Agreement. Early consultation is recommended, since modification of the proposed project may be required to avoid or reduce impacts to fish and wildlife resources.

Thank you for this opportunity to provide comment. Please contact Mr. Matt Chirdon, Environmental Scientist, at (760) 757-3734 if you should have any questions and for further coordination on the proposed project.

Sincerely,

Edmund J. Pert
Regional Manager
South Coast Region

Attachments (2)

Reference:

Dudek 2001. Least Bell's vireo & southwestern willow flycatcher survey for Aliso Creek emergency sewer and parks improvement project, Orange County, CA. Submitted to California Natural Diversity Database, Sacramento, CA.

cc: Ms. Helen Birss, Los Alamitos
Ms. Mary Larson, Los Alamitos
Mr. John O'Brien, Los Alamitos
Mr. Matt Chirdon, Oceanside
Ms. Tamara Spear, San Diego
Ms. Marilyn Fluharty, San Diego
State Clearinghouse, Sacramento

Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened, and Endangered Plants and Natural Communities

State of California
THE RESOURCES AGENCY
Department of Fish and Game
December 9, 1983
Revised May 8, 2000

The following recommendations are intended to help those who prepare and review environmental documents determine **when** a botanical survey is needed, **who** should be considered qualified to conduct such surveys, **how** field surveys should be conducted, and **what** information should be contained in the survey report. The Department may recommend that lead agencies not accept the results of surveys that are not conducted according to these guidelines.

1. Botanical surveys are conducted in order to determine the environmental effects of proposed projects on all rare, threatened, and endangered plants and plant communities. Rare, threatened, and endangered plants are not necessarily limited to those species which have been "listed" by state and federal agencies but should include any species that, based on all available data, can be shown to be rare, threatened, and/or endangered under the following definitions:

   A species, subspecies, or variety of plant is "endangered" when the prospects of its survival and reproduction are in immediate jeopardy from one or more causes, including loss of habitat, change in habitat, over-exploitation, predation, competition, or disease. A plant is "threatened" when it is likely to become endangered in the foreseeable future in the absence of protection measures. A plant is "rare" when, although not presently threatened with extinction, the species, subspecies, or variety is found in such small numbers throughout its range that it may be endangered if its environment worsens.

   Rare natural communities are those communities that are of highly limited distribution. These communities may or may not contain rare, threatened, or endangered species. The most current version of the California Natural Diversity Database's List of California Terrestrial Natural Communities may be used as a guide to the names and status of communities.

2. It is appropriate to conduct a botanical field survey to determine if, or to the extent that, rare, threatened, or endangered plants will be affected by a proposed project when:

   a. Natural vegetation occurs on the site, it is unknown if rare, threatened, or endangered plants or habitats occur on the site, and the project has the potential for direct or indirect effects on vegetation; or
   b. Rare plants have historically been identified on the project site, but adequate information for impact assessment is lacking.

3. Botanical consultants should possess the following qualifications:

   a. Experience conducting floristic field surveys;
   b. Knowledge of plant taxonomy and plant community ecology;
   c. Familiarity with the plants of the area, including rare, threatened, and endangered species;
   d. Familiarity with the appropriate state and federal statutes related to plants and plant collecting; and,
   e. Experience with analyzing impacts of development on native plant species and communities.

4. Field surveys should be conducted in a manner that will locate any rare, threatened, or endangered species that may be present. Specifically, rare, threatened, or endangered plant surveys should be:

   a. Conducted in the field at the proper time of year when rare, threatened, or endangered species are both evident and identifiable. Usually, this is when the plants are flowering.

When rare, threatened, or endangered plants are known to occur in the type(s) of habitat present in the project area, nearby accessible occurrences of the plants (reference sites) should be observed to determine that the species are identifiable at the time of the survey.

b. Floristic in nature. A floristic survey requires that every plant observed be identified to the extent necessary to determine its rarity and listing status. In addition, a sufficient number of visits spaced throughout the growing season are necessary to accurately determine what plants exist on the site. In order to properly characterize the site and document the completeness of the survey, a complete list of plants observed on the site should be included in every botanical survey report.

c. Conducted in a manner that is consistent with conservation ethics. Collections (voucher specimens) of rare, threatened, or endangered species, or suspected rare, threatened, or endangered species should be made only when such actions would not jeopardize the continued existence of the population and in accordance with applicable state and federal permit requirements. A collecting permit from the Habitat Conservation Planning Branch of DFG is required for collection of state-listed plant species. Voucher specimens should be deposited at recognized public herbaria for future reference. Photography should be used to document plant identification and habitat whenever possible, but especially when the population cannot withstand collection of voucher specimens.

d. Conducted using systematic field techniques in all habitats of the site to ensure a thorough coverage of potential impact areas.

e. Well documented. When a rare, threatened, or endangered plant (or rare plant community) is located, a California Native Species (or Community) Field Survey Form or equivalent written form, accompanied by a copy of the appropriate portion of a 7.5 minute topographic map with the occurrence mapped, should be completed and submitted to the Natural Diversity Database. Locations may be best documented using global positioning systems (GPS) and presented in map and digital forms as these tools become more accessible.

5. Reports of botanical field surveys should be included in or with environmental assessments, negative declarations and mitigated negative declarations, Timber Harvesting Plans (THPs), EIR's, and EIS's, and should contain the following information:

a. Project description, including a detailed map of the project location and study area.
b. A written description of biological setting referencing the community nomenclature used and a vegetation map.
c. Detailed description of survey methodology.
d. Dates of field surveys and total person-hours spent on field surveys.
e. Results of field survey including detailed maps and specific location data for each plant population found. Investigators are encouraged to provide GPS data and maps documenting population boundaries.
f. An assessment of potential impacts. This should include a map showing the distribution of plants in relation to proposed activities.
g. Discussion of the significance of rare, threatened, or endangered plant populations in the project area considering nearby populations and total species distribution.
h. Recommended measures to avoid impacts.
i. A list of all plants observed on the project area. Plants should be identified to the taxonomic level necessary to determine whether or not they are rare, threatened or endangered.
j. Description of reference site(s) visited and phenological development of rare, threatened, or endangered plant(s).
k. Copies of all California Native Species Field Survey Forms or Natural Community Field Survey Forms.
l. Name of field investigator(s).
j. References cited, persons contacted, herbaria visited, and the location of voucher specimens.

Sensitivity of Top Priority Rare Natural Communities in Southern California

Sensitivity rankings are determined by the Department of Fish and Game, California Natural Diversity Data Base and based on either number of known occurrences (locations) and/or amount of habitat remaining (acreage). The three rankings used for these top priority rare natural communities are as follows:

S1.# Fewer than 6 known locations and/or on fewer than 2,000 acres of habitat remaining.

S2.# Occurs in 6-20 known locations and/or 2,000-10,000 acres of habitat remaining.

S3.# Occurs in 21-100-known locations and/or 10,000-50,000 acres of habitat remaining.

The number to the right of the decimal point after the ranking refers to the degree of threat posed to that natural community regardless of the ranking. For example:

S1.1 = very threatened
S2.2 = threatened
S3.3 = no current threats known

Sensitivity Rankings (February 1992)

Rank	Community Name
S1.1	Mojave Riparian Forest
	Sonoran Cottonwood Willow Riparian
	Mesquite Bosque
	Elephant Tree Woodland
	Crucifixion Thorn Woodland
	Allthorn Woodland
	Arizonan Woodland
	Southern California Walnut Forest
	Mainland Cherry Forest
	Southern Bishop Pine Forest
	Torrey Pine Forest
	Desert Mountain White Fir Forest
	Southern Dune Scrub
	Southern Coastal Bluff Scrub
	Maritime Succulent Scrub
	Riversidean Alluvial Fan Sage Scrub
	Southern Maritime Chaparral
	Valley Needlegrass Grassland
	Great Basin Grassland
	Mojave Desert Grassland
	Pebble Plains
	Southern Sedge Bog
	Cismontane Alkali Marsh
S1.2	Southern Foredunes
	Mono Pumice Flat
	Southern Interior Basalt Flow Vernal Pool

S2.1	Venturan Coastal Sage Scrub Diegan Coastal Sage Scrub Riversidean Upland Coastal Sage Scrub Riversidean Desert Sage Scrub Sagebrush Steppe Desert Sink Scrub Mafic Southern Mixed Chaparral San Diego Mesa Hardpan Vernal Pool San Diego Mesa Claypan Vernal Pool Alkali Meadow Southern Coastal Salt Marsh Coastal Brackish Marsh Transmontane Alkali Marsh Coastal and Valley Freshwater Marsh Southern Arroyo Willow Riparian Forest Southern Willow Scrub Modoc-Great Basin Cottonwood Willow Riparian Modoc-Great Basin Riparian Scrub Mojave Desert Wash Scrub Engelmann Oak Woodland Open Engelmann Oak Woodland Closed Engelmann Oak Woodland Island Oak Woodland California Walnut Woodland Island Ironwood Forest Island Cherry Forest Southern Interior Cypress Forest Bigcone Spruce-Canyon Oak Forest
S2.2	Active Coastal Dunes Active Desert Dunes Stabilized and Partially Stabilized Desert Dunes Stabilized and Partially Stabilized Desert Sandfield Mojave Mixed Steppe Transmontane Freshwater Marsh Coulter Pine Forest Southern California Fellfield White Mountains Fellfield
S2.3	Bristlecone Pine Forest Limber Pine Forest

Department of Toxic Substances Control

Maziar Movassaghi, Acting Director
5796 Corporate Avenue
Cypress, California 90630

Linda S. Adams
Secretary for
Environmental Protection

Arnold Schwarzenegger
Governor

April 27, 2009

Ms. Zoila Finch
County of Orange
OC Watersheds Program
2302 Glassell Street
Orange, California 92865
Zoila.Finch@ocpw.ocgov.com

NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT REPORT FOR ALISO CREEK MAINSTEM ECOSYSTEM RESTORATION, (SCH# 2009041066), ORANGE COUNTY

Dear Ms. Finch:

The Department of Toxic Substances Control (DTSC) has received your submitted Initial Study and Notice of Preparation (NOP) for a subsequent draft Environmental Impact Report (EIR) No. 507 for the above-mentioned Project. The following project description is stated in your document: "The proposed project involves ecosystem restoration in a seven-mile reach of Aliso Creek and 1,000 feet of the Wood Canyon tributary. The restoration activities currently being reviewed for suitability include, but are not be limited to, the establishment of low drop structures interspersed with pools to improve natural flow and channel stability, removal of existing rip rap and replacement with natural vegetation, terracing and flattening of the channel banks and establishment of riparian vegetation to reduce instability, removal of invasive species and establishment of new riparian habitat, and modification of existing concrete drop structures. The array of specific actions to be taken is still under consideration, but will be fully developed and analyzed within the Draft EIR. The project site extends from creek mouth at the Pacific Ocean to approximately Pacific Park Drive in Aliso Viejo and extends through the City of Laguna Beach, unincorporated Orange County, City of Laguna Niguel, and City of Aliso Viejo." DTSC has the following comments:

1) The EIR should identify the current or historic uses at the project site that may have resulted in a release of hazardous wastes/substances, and any known or potentially contaminated sites within the proposed Project area. For all identified sites, the EIR should evaluate whether conditions at the site may

pose a threat to human health or the environment. Following are the databases of some of the pertinent regulatory agencies:

- National Priorities List (NPL): A list maintained by the United States Environmental Protection Agency (U.S.EPA).

- Envirostor: A Database primarily used by the California Department of Toxic Substances Control, accessible through DTSC's website (see below).

- Resource Conservation and Recovery Information System (RCRIS): A database of RCRA facilities that is maintained by U.S. EPA.

- Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS): A database of CERCLA sites that is maintained by U.S.EPA.

- Solid Waste Information System (SWIS): A database provided by the California Integrated Waste Management Board which consists of both open as well as closed and inactive solid waste disposal facilities and transfer stations.

- Leaking Underground Storage Tanks (LUST) / Spills, Leaks, Investigations and Cleanups (SLIC): A list that is maintained by Regional Water Quality Control Boards.

- Local Counties and Cities maintain lists for hazardous substances cleanup sites and leaking underground storage tanks.

- The United States Army Corps of Engineers, 911 Wilshire Boulevard, Los Angeles, California, 90017, (213) 452-3908, maintains a list of Formerly Used Defense Sites (FUDS).

2) The EIR should identify the mechanism to initiate any required investigation and/or remediation for any site that may be contaminated, and the government agency to provide appropriate regulatory oversight. If necessary, DTSC would require an oversight agreement in order to review such documents. Please see comment No. 11 below for more information.

3) All environmental investigations, sampling and/or remediation for the site should be conducted under a Workplan approved and overseen by a regulatory agency that has jurisdiction to oversee hazardous substance cleanup. The findings of any investigations, including any Phase I or II Environmental Site Assessment Investigations should be summarized in the document. All sampling results in which hazardous substances were found should be clearly summarized in a table.

4) Proper investigation, sampling and remedial actions overseen by the respective regulatory agencies, if necessary, should be conducted at the site prior to the new development or any construction. All closure, certification or remediation approval reports by these agencies should be included in the EIR.

5) If buildings or other structures, asphalt or concrete-paved surface areas are being planned to be demolished, an investigation should be conducted for the presence of other related hazardous chemicals, lead-based paints or products, mercury, and asbestos containing materials (ACMs). If other hazardous chemicals, lead-based paints or products, mercury or ACMs are identified, proper precautions should be taken during demolition activities. Additionally, the contaminants should be remediated in compliance with California environmental regulations and policies.

6) Project construction may require soil excavation or filling in certain areas. Sampling may be required. If soil is contaminated, it must be properly disposed and not simply placed in another location onsite. Land Disposal Restrictions (LDRs) may be applicable to such soils. Also, if the project proposes to import soil to backfill the areas excavated, sampling should be conducted to ensure that the imported soil is free of contamination.

7) Human health and the environment of sensitive receptors should be protected during the construction or demolition activities. If it is found necessary, a study of the site and a health risk assessment overseen and approved by the appropriate government agency and a qualified health risk assessor should be conducted to determine if there are, have been, or will be, any releases of hazardous materials that may pose a risk to human health or the environment.

8) If it is determined that hazardous wastes are, or will be, generated by the proposed operations, the wastes must be managed in accordance with the California Hazardous Waste Control Law (California Health and Safety Code, Division 20, Chapter 6.5) and the Hazardous Waste Control Regulations (California Code of Regulations, Title 22, Division 4.5). If it is determined that hazardous wastes will be generated, the facility should also obtain a United States Environmental Protection Agency Identification Number by contacting (800) 618-6942. Certain hazardous waste treatment processes or hazardous materials, handling, storage or uses may require authorization from the local Certified Unified Program Agency (CUPA). Information about the requirement for authorization can be obtained by contacting your local CUPA.

9) If during construction/demolition of the project, the soil and/or groundwater contamination is suspected, construction/demolition in the area should cease and appropriate health and safety procedures should be implemented.

10) If the site was used for agricultural, livestock or related activities, onsite soils and groundwater might contain pesticides, agricultural chemical, organic waste or other related residue. Proper investigation, and remedial actions, if necessary, should be conducted under the oversight of and approved by a government agency at the site prior to construction of the project.

11) DTSC can provide guidance for cleanup oversight through an Environmental Oversight Agreement (EOA) for government agencies, or a Voluntary Cleanup Agreement (VCA) for private parties. For additional information on the EOA or VCA, please see www.dtsc.ca.gov/ SiteCleanup/Brownfields, or contact Ms. Maryam Tasnif-Abbasi, DTSC's Voluntary Cleanup Coordinator, at (714) 484-5489.

If you have any questions regarding this letter, please contact Mr. Rafiq Ahmed, Project Manager, at rahmed@dtsc.ca.gov or by phone at (714) 484-5491.

Sincerely,

Greg Holmes
Unit Chief
Brownfields and Environmental Restoration Program - Cypress Office

cc: Governor's Office of Planning and Research
State Clearinghouse
P.O. Box 3044
Sacramento, California 95812-3044
state.clearinghouse@opr.ca.gov

CEQA Tracking Center
Department of Toxic Substances Control
Office of Environmental Planning and Analysis
1001 I Street, 22nd Floor, M.S. 22-2
Sacramento, California 95814
nritter@dtsc.ca.gov

CEQA# 2554

DEPARTMENT OF TRANSPORTATION
District 12
3337 Michelson Drive, Suite 380
Irvine, CA 92612-8894
Tel: (949) 724-2241
Fax: (949) 724-2592

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FAX & MAIL

May 13, 2009

Zoila Finch
County of Orange
OC Watersheds Program
2301 N. Glassell Street
Orange, California 92865

File: IGR/CEQA
SCH#: 2009041066
Log #: 2263
SR-1, SR-73

Subject: Aliso Creek Mainstem Ecosystem Restoration Project

Dear Ms. Finch,

Thank you for the opportunity to review and comment on the **Notice of Preparation (NOP) for the Aliso Creek Mainstem Ecosystem Restoration Project.** The proposed project consists of revitalization of the riparian vegetation community, restoration of natural processes, channel stabilization, and reduction of erosion and flood risk. The project area is a seven mile reach of lower Aliso Creek and 1,000 feet of the Wood Canyon tributary. The nearest State routes to the project site are SR-1 and SR-73.

The Department of Transportation (Department) is a responsible agency on this project and we have the following comments:

1. If any project work (e.g. storage of materials, street widening, emergency access improvements, sewer connections, sound walls, storm drain construction, street connections, etc.) will occur in the vicinity of the Department's Right-of-Way, an encroachment permit is required prior to commencement of work. Please allow 2 to 4 weeks for a complete submittal to be reviewed and for a permit to be issued. When applying for an Encroachment Permit, please incorporate Environmental Documentation, SWPPP/ WPCP, Hydraulic Calculations, Traffic Control Plans, Geotechnical Analysis, Right-of-Way certification and all relevant design details including design exception approvals. For specific details on the Caltrans Encroachment Permits procedure, please refer to the Caltrans Encroachment Permits Manual. The latest edition of the manual is available on the web site: http://www.dot.ca.gov/hq/traffops/developserv/permits/

2. All work within the State Right of Way must conform to Caltrans Standard Plans and Standard Specifications for Water Pollution Control, including production of a Water Pollution Control Program (WPCP) or Storm Water Pollution Prevention Plan (SWPPP) as required. Any runoff draining into Caltrans Right of Way from construction operations, or from the resulting project, must fully conform to the current discharge requirements of the Regional Water Quality Control Board to avoid impacting water quality. Measures must be incorporated to contain all vehicle loads and avoid any tracking of materials, which may fall or blow onto Caltrans roadways or facilities. (See Attachment: *Water Pollution Control Provisions*)

Please continue to keep us informed of this project and any future developments, which could potentially impact the State Transportation Facilities. If you have any questions or need to contact us, please do not hesitate to call Marlon Regisford at (949) 724-2241.

Sincerely,

Christopher Herre

Christopher Herre, Branch Chief
Local Development/Intergovernmental Review

C: Terry Roberts, Office of Planning and Research

STATE OF CALIFORNIA — Arnold Schwarzenegger, *Governor*

NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-6251
Fax (916) 657-5390
Web Site www.nahc.ca.gov
e-mail: ds_nahc@pacbell.net

May 4, 2009

Zoila Finch
COUNTY OF ORANGE
2301 N. Glassell Street
Orange, CA 92865

Re: SCH#2009041066 CEQA Notice of Preparation (NOP); draft Environmental Impact Report (DEIR) for **The Aliso Creek Ecosystem Restoration Project** located in the Aliso Creek Watershed Area; Orange County, California

Dear Zoila Finch:

The Native American Heritage Commission (NAHC) is the state 'trustee agency' pursuant to Public Resources Code §21070 designated to protect California's Native American Cultural Resources. The California Environmental Quality Act (CEQA) requires that any project that causes a substantial adverse change in the significance of an historical resource, that includes archaeological resources, is a 'significant effect' requiring the preparation of an Environmental Impact Report (EIR) per the California Code of Regulations §15064.5(b)(c)(f) CEQA guidelines). Section 15382 of the 2007 CEQA Guidelines defines a significant impact on the environment as "a substantial, or potentially substantial, adverse change in any of physical conditions within an area affected by the proposed project, including ...objects of historic or aesthetic significance." In order to comply with this provision, the lead agency is required to assess whether the project will have an adverse impact on these resources within the 'area of potential effect (APE)', and if so, to mitigate that effect. To adequately assess the project-related impacts on historical resources, the Commission recommends the following action:

√ Contact the appropriate California Historic Resources Information Center (CHRIS) for possible 'recorded sites' in locations where the development will or might occur.. Contact information for the Information Center nearest you is available from the State Office of Historic Preservation (916/653-7278)/ http://www.ohp.parks.ca.gov. The record search will determine:

- If a part or the entire APE has been previously surveyed for cultural resources.
- If any known cultural resources have already been recorded in or adjacent to the APE.
- If the probability is low, moderate, or high that cultural resources are located in the APE.
- If a survey is required to determine whether previously unrecorded cultural resources are present.

√ If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.

- The final report containing site forms, site significance, and mitigation measurers should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum, and not be made available for pubic disclosure.
- The final written report should be submitted within 3 months after work has been completed to the appropriate regional archaeological Information Center.

√ The Native American Heritage Commission (NAHC) performed:

- A Sacred Lands File (SLF) search of the project 'area of potential effect (APE)': The results: No known Native American Cultural Resources were identified within one-half mile of the 'area of potential effect' (APE)..; However, there are Native American cultural resources in close proximity to the APE. The NAHC urges caution with any ground-breaking activity. Also, the NAHC SLF is not exhaustive and local tribal contacts should be consulted from the attached list and the there are Native American cultural resources in close proximity..

- The NAHC advises the use of Native American Monitors, also, when professional archaeologists or the equivalent are employed by project proponents, in order to ensure proper identification and care given cultural resources that may be discovered. The NAHC, FURTHER, recommends that contact be made with Native American Contacts on the attached list to get their input on potential IMPACT of the project (APE) on cultural resources.. In some cases, the existence of a Native American cultural resources may be known only to a local tribe(s) or Native American individuals or elders.
- √ Lack of surface evidence of archeological resources does not preclude their subsurface existence.
- Lead agencies should include in their mitigation plan provisions for the identification and evaluation of accidentally discovered archeological resources, per California Environmental Quality Act (CEQA) §15064.5 (f). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American, with knowledge in cultural resources, should monitor all ground-disturbing activities.

- Again, a culturally-affiliated Native American tribe may be the only source of information about a Sacred Site/Native American cultural resource.
- Lead agencies should include in their mitigation plan provisions for the disposition of recovered artifacts, in consultation with culturally affiliated Native Americans.

√ Lead agencies should include provisions for discovery of Native American human remains or unmarked cemeteries in their mitigation plans.

- CEQA Guidelines, Section 15064.5(d) requires the lead agency to work with the Native Americans identified by this Commission if the initial Study identifies the presence or likely presence of Native American human remains within the APE. CEQA Guidelines provide for agreements with Native American, identified by the NAHC, to assure the appropriate and dignified treatment of Native American human remains and any associated grave liens.

√ Health and Safety Code §7050.5, Public Resources Code §5097.98 and Sec. §15064.5 (d) of the California Code of Regulations (CEQA Guidelines) mandate procedures to be followed, including that construction or excavation be stopped in the event of an accidental discovery of any human remains in a location other than a dedicated cemetery until the county coroner or medical examiner can determine whether the remains are those of a Native American. . Note that §7052 of the Health & Safety Code states that disturbance of Native American cemeteries is a felony.

√ Lead agencies should consider avoidance, as defined in §15370 of the California Code of Regulations (CEQA Guidelines), when significant cultural resources are discovered during the course of project planning and implementation

Please feel free to contact me at (916) 653-6251 if you have any questions.

Sincerely,

Dave Singleton
Program Analyst

Attachment: List of Native American Contacts

Cc: State Clearinghouse

Native American Contact
Orange County
May 4, 2009

Juaneno Band of Mission Indians Acjachemen Nation
David Belardes, Chairperson
32161 Avenida Los Amigos Juaneno
San Juan Capistrano , CA 92675
DavidBelardes@hotmail.com
(949) 493-0959
(949) 493-1601 Fax

Juaneño Band of Mission Indians
Sonia Johnston, Tribal Chairperson
P.O. Box 25628 Juaneno
Santa Ana , CA 92799
sonia.johnston@sbcglobal.net
(714) 323-8312

Juaneno Band of Mission Indians Acjachemen Nation
Anthony Rivera, Chairman
31411-A La Matanza Street Juaneno
San Juan Capistrano , CA 92675-2674
arivera@juaneno.com
949-488-3484
949-488-3294 Fax

Juaneno Band of Mission Indians
Anita Espinoza
1740 Concerto Drive Juaneno
Anaheim , CA 92807
(714) 779-8832

Juaneno Band of Mission Indians
Alfred Cruz, Culural Resources Coordinator
P.O. Box 25628 Juaneno
Santa Ana , CA 92799
alfredgcruz@sbcglobal.net
714-998-0721
slfredgcruz@sbcglobal.net

Juaneno Band of Mission Indians
Chairperson
1108 E. 4th Street Juaneno
Santa Ana , CA 92701
joeaocampo@netzero.com
(714) 547-9676
(714) 623-0709-cell

Juaneno Band of Mission Indians
Adolph 'Bud' Sepulveda, Vice Chairperson
P.O. Box 25828 Juaneno
Santa Ana , CA 92799
bssepul@yahoo.net
714-838-3270
714-914-1812 - CELL
bsepul@yahoo.net

United Coalition to Protect Panhe (UCPP)
Rebecca Robles
119 Avenida San Fernando Juaneno
San Clemente , CA 92672
(949) 573-3138

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed SCH#2009041066; CEQA Notice of Preparation (NOP) and draft Environmental Impact Report (DEIR) for the Aliso Creek Ecosystem Resoration Project; located on the Aliso Creek Watershed area of Orange County, California.

June 4, 2009

Deborah Lamb
U.S. Army Corps of Engineers, Los Angeles District
CESPL-PD-RL
P.O. Box 532711
Los Angeles, CA 90053-2325

Dear Ms. Lamb:

On behalf of the City of Laguna Beach, I am writing to comment on the notice of intent to prepare a draft environmental impact statement for the Aliso Creek project.

To help the City Council understand the Corps' project, as well as the somewhat parallel efforts by Orange County, we retained Philip Williams and Associates to analyze the two endeavors. The consultant's report, which was presented at the Council meeting of June 2, is enclosed for your information. Please consider the findings and options presented in the report as comments by our City.

From the brief, conceptual examination by our consultant, it appears that there are some options and modifications to the current framework of the two projects that would better achieve community objectives while concurrently reducing costs. In particular, the report by Philip Williams and Associates indicates that stabilizing the creek bed could be accomplished with lower expense, less disruption to the existing habitat and fewer manmade structures within the Regional Park. Our consultant's analysis should be evaluated as part of the environmental review.

Many of our residents testified at the recent Council meeting. A transcript of that hearing is enclosed since there were numerous, thoughtful questions and helpful comments that may be important during the environmental process. These comments include:

- Consider nonstructural, less intensive alternatives to the extent possible.
- Fully consider options for upstream mitigation, e.g. perhaps considering the large parking lot at the Federal building in Laguna Niguel.
- Consider contaminants other than bacteria, e.g., phosphorus.

Sincerely,

Kelly Boyd
Mayor

Attachment
cc: City Council

505 FOREST AVE. • LAGUNA BEACH, CA 92651 • TEL (949) 497-3311 • FAX (949) 497-0771

RECYCLED PAPER

Attached is a transcript of Item 12 from the Laguna Beach City Council meeting of June 2, 2009.

Speakers:

Councilmembers: Jane Egly
Verna Rollinger
Toni Iseman
Mayor Pro Tem Elizabeth Pearson
Mayor Kelly Boyd

Will Holoman, City of Laguna Beach Senior Water Quality Analyst

Nick Garrity, Philip Williams and Associates

Members of the Public in order of appearance

Scott Sebastian
Lisa Marks
David Pearlman
Bill Rihn
Elisabeth Brown
Ed Almanzo
Tom Osborne
Michael Beenan
Jackie Gallagher
Barbara Metzger

Martha Anderson

Martha Anderson, CMC
City Clerk

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Mayor Boyd: Okay, moving on to Item 12, Enhancements of Aliso Creek SUPER Project. Gentlemen, I believe you are taking this?

City Manager Frank: Yes. Let me make this one comment, Will. This is follow-up from what you directed us to do April 28, and two of the Council members and Will and I worked with two members of the Environmental Committee; came up with a consultant, came up with a report. Will's going to provide a quick summary of the process, and then the consultant—going to introduce the consultant.

Holoman: Hi Mayor Boyd, Council Members. Yeah, the city hired Phillip Williams and Associates to do this report, formulate comments for the Army Corps study of Aliso Creek alternatives. This is Philip Williams & Associates' representative, Nick Garrity. He's a P.E., and I guess without further ado, I'll go ahead and introduce him and have him go up to the podium. He's going to talk about the report and answer questions.

Egly: Can I just do one little bit of an intro in the idea that what the whole point of this was, was to—and thank you very much Environmental Committee and Scott Sebastian and Lisa Marks for encouraging us to find a consultant that would help us know what to say to the Army Corps in terms of making remarks. And that process was started and your company was the one we selected and thank you for being so quick at being able to come forward and helping us. So thank you all.

Nick Garrity: You're welcome. And good evening, Council Members, Mayor Boyd and thank you for the opportunity to assist the city with reviewing the project.

My name is Garrity Councilmember Egly and I'm with Phillip Williams and Associates. We're an environmental hydrology firm, specializing in restoration and the types of issues that are dealt with in the Aliso Creek stabilization project. So I was going to just go through a quick summary of the memorandum or report that you have. We reviewed both the Orange County SUPER Project Stabilization Plan and the Army Corps of Engineers' Water Shed Management Feasibility Study, two separate processes. We reviewed both and provided comments, both on how to improve the projects to better meet the city's goals, and also to submit comments to the Army Corps on the CEQUA process they are starting to prepare an environmental impact report for their water shed management plan. So in summary, we agree with both the supervisors' report and the Corps study in that we agree that Aliso Creek has eroded and both the channel has down-cut and the channel has widened. And we expect the widening to continue and threaten the utilities along the creek if nothing is done to protect the creek. However, we think there are alternatives to the approaches presented by the SUPER Project and the Corps study that are less invasive to the creek and the existing habitats in the creek within the park that would better meet the city's goals of stabilizing the creek, protecting the infrastructure, preserving the existing habitats and the existing values of the Aliso and Wood Canyons Wilderness Park. So, just to briefly review, the SUPER Project proposes to use 24 grade control structures that are engineered concrete structures that allow the difference in the creek slope to be made up, and to stabilize the creek essentially, and the SUPER project also involves armoring the banks to prevent further widening, and filling the channel which has now eroded below the former flood plain—filling it back up by about 30 feet, which is very large amount of fill volume, of fill material, and would also severely impact the existing habitat within the creek. So, as part of our review, we performed a geomorphic reconnaissance of the creek, which involved going down into the creek, looking at deposition patterns within the creek, and looking for evidence of erosion. And based on our review, and also looking through the reports, we feel that actually the reach that is being proposed to stabilize is closer to equilibrium than the report suggests, and that it could be stabilized with fewer structures within the creek. So as opposed to the 24 structures proposed by the supervisor, roughly half of those structures could be used to stabilize the creek without filling in the creek by 30 feet, and preserving the existing habitat that is within the creek channel. And I just wanted to point out one correction to our memo where on Figure 4 in our memo, we have a figure showing two-foot drop structures, and those would actually be six foot drop structures, so somewhat larger and if they were to be two foot, there would need to be more, possibly nine. So I apologize that we were unable to make that correction, but we will provide a revised version of this memorandum tomorrow. And this was something we caught ahead of doing this presentation. Also, as part of our review, we looked at the potential to reduce storm water from the urbanized water shed as a measure to control erosion within the creek. And based on our literature review and our professional judgment, we would advise the city to expect fairly modest results in terms of reducing runoff to the point that you reduce erosion within the creek. Just because the watershed is so built out, about 75 percent built out rather densely, there doesn't seem to be large, flat spaces where runoff can be either detained or infiltrated with—and prevented from going straight into the creek. And a secondary goal of the SUPER Project is to improve water quality, and the alternative proposed by the SUPER Project is to treat water in the creek at the mouth of the creek by diverting low flows from the creek running into a treatment facility where they would be treated for suspended solids and bacteria and then returned to the creek. And the idea here is to reduce bacterial levels and beach closures. And we agree that may be an effective approach. It won't do anything to remove dissolved metals, nutrients and other pollutants that are coming down the creek from the watershed and it won't improve water quality in the creek itself. Now the Corps study previously looked at approaches to control pollution from within the watershed and, since this study, there have been projects that are continuing to be planned in the watershed and so we recommend an evaluation of those projects and to get a better sense of the balance between controlling pollution within the watershed and the system at the beach. And with that if you have any questions, I'd be happy to answer them.

Iseman: Thank you very much. And this is like a Ph.D. project. I think you should hand it in and somehow get credit for it. I'm happy to say that I understood a lot of what you said. I've learned a lot in the last year or two. There's one thing, however, that just went right over my head and it was something to do with 'reach closer to the equilibrium?' Could you—do you remember—it was pretty early in the—could you explain what that was?

Garrity: Sure, sure. So, just to give you a quick walk-through, basically before the watershed was developed, Aliso Creek was a fairly steep slope. And as the watershed was urbanized, the runoff from the urban areas is much higher. And you have no sediment coming with those storm flows into the creek. So, due to higher flows and less sediment, the flows down the creek are able to erode the creek. And so the grade gets flatter. The grade gets flatter due to more water and less sediment; it erodes the sediment right from the creek bed. Therefore, it down-cuts. And as it down-cuts, the channel then widens; the banks fail and erode out. Now, eventually, it will reach a new equilibrium with the hydrology and the sediment coming from the watershed. And that equilibrium slope essentially is—there's a few ways that you can estimate that, and the SUPER Project did it using one method, which we then checked from there—they measured it off the profile. And we checked that and thought that well, actually, it may be steeper than they suggest. And therefore, the creek was already down-cut and according to the SUPER Project will continue to down-cut significantly. We think that actually the stable slope is steeper than they suggest, and therefore currently if we do expect it to keep ensizing some, but not as much as suggested by the SUPER Project. And therefore, you would require less grade control structures along that slope to stabilize that slope.

Iseman: Okay. Thank you.

Garrity: You're welcome.

Boyd: Jane?

Egly: Well, I did want to ask again, and you commented on this. That you feel like it's going to be difficult to stop urban flow now occurring, so best to concentrate on new development in the hinterlands and have suggested some ways to clean the water that comes from there, from the urban flow? Such as something like Crissy Field?

Garrity: Oh, that's—

Egly: That's at the end.

Garrity: The suggestion of lagoon restoration I see as separate from the runoff issue.

Egly: Right. Right.

Garrity: We did find a historic map showing that—

Egly: That was Alyssa Lagoon

Garrity: Alyssa Lagoon.

Egly : Isn't that where the county parking lot is, next to the beach?

Garrity: Yes.

Egly: That used to be a lagoon, okay.

Garrity: Um-hm. But separate from that is the runoff issue, and being able to control—the hydrology is very modified for the watershed and being able to go back in time to the pre-development hydrology is a major challenge. It involves taking all the runoff from roofs and streets and instead of having that runoff go straight to the storm drain and off to the creek, either holding it within a basin and then letting it out slowly after the storm, or infiltrating it into the ground. And that requires a large amount of space, and it would require retrofitting the existing storm water system. However, for new development, there are hydromodification plans that are being implemented in counties. I believe it's part of Orange County's MS-4 permit to control runoff from new development through low impact development measures infiltrating the runoff on site or holding it within a detention basin before it gets to ____.

Egly: Thank you.

Rollinger: Are there communities that are essentially built out that are retrofitting that we could look to for suggestions?

Garrity: I don't know of a retrofit program that's actually being implemented. I know of others that are being planned and are in the early stages of planning. But not one that's been implemented.

Rollinger: Thank you.

Pearson: Couple of questions. So you are suggesting that the SUPER Project should reduce their drop structures from 24 to 12?

Garrity: Roughly, yes. Nine, actually is the number that's on the estimate.

Pearson: Okay, and that they wouldn't have to be as high as they've got planned right now, that's what you're saying?

Garrity: Basically, you've got a height drop to make up and you can do that with different combinations of different sizes of structures?

Pearson: Okay, and with the diversion at the end of the line, what does get taken out? What kind of pollutants get taken out and what remains?

Garrity: This is not exactly my focus and field of expertise, but the SUPER Project is proposing to treat for bacteria. And before they treat for bacteria, the suspended solids—total suspended solids—need to be filtered out of the water. Now there are a number of pollutants associated with those sediment solids and basically attach to the sediment particles, which can include metals and other pollutants, so the primary focus of the alternative they're proposing is to remove bacteria, but because they're proposing to remove suspended solids also, there would be some other benefits.

Pearson: But if you're familiar with the permits that come down from the Water Board, the TMDL's are more related to what?

Garrity: TMDL's apply to a number of pollutants, and I think that—from what I've reviewed—bacteria is the primary issue of concern.

Pearson: And that's what we're measured on. We're measured on the TMDL's that relate to bacteria and less so than—and fined for that, less so than we are on the metals and so forth.

Garrity: Um-hm.

Pearson: And does that bacteria include animal waste?

Garrity: I believe it would, yes.

Pearson: Okay, so mostly it would be the animal waste and bacteria that would be taken out and not go to the beach, and what would be left would be metals and sediment.

Garrity: Um-hm.

Pearson: Thank you. Has this been vetted with the county yet? Have they seen this report yet?

Garrity: No,

Pearson: That's really what we're going to do? Okay. Thank you.

Boyd: Any other questions? Thank you. We'll--

Holoman: I can make a couple of comments, if you don't mind.

Boyd: Certainly, certainly.

Holoman: One, is the revised report will be posted on the website tomorrow. Water quality website—wqw.net. I think that's it for now.

Boyd: Okay, thank you very much and we'll open it to the public for comments.

Male: Thank you.

Boyd: Thank you very much. Lisa?

Scott Sebastian: My name is Scott Sebastian, a member of the Environmental Committee. And I first want to thank Nick and Phillip Williams for doing a very good job in an extraordinarily short period of time. I don't think anyone realizes how tough it was to get this done so quickly. And I want to commend them on challenging some of the assumptions that they found in the existing projects and in coming up with some very useful potential alternatives. And I would suggest that the city should accept the report and I would also like to see the city then compose a very clear letter based on the findings in the report in support of some of the alternatives that were generated in it. Thank you.

Boyd: Thank you.

Female: My name is—

Egly: One second, Lisa. Scott, did you say some of the alternatives or all of the alternatives?

Sebastion: Okay, that gets us into the fact that the alternatives are kind of components.

Egly: Yes.

Sebastion: We don't have a single design alternative here. We have a series of issues that are addressed and that might be addressed in different ways, so we need to figure out how to integrate that, I think, into a single coherent alternative. Or it may be appropriate for us simply to say we want the following issues addressed with these alternatives. I haven't written that letter and I don't know who gets to write it, but it's—I think it needs to be done so it's very clear what the city is, in fact, saying in its comments.

Egly: I would agree. Thank you. Excuse me for interrupting, Lisa.

Lisa Marks: My name is Lisa Marks, also on the Environmental Committee, and I too thank really the Council and Ken for getting that contract together so quickly and cutting such a mean deal. And Nick and Andy and the PWA for doing such a great job. Well, my comments are more complicated and lengthy than Scott's. I have a number of questions that I'd like to ask of Nick, actually, and some things—I'm a little unclear about whether—I know that Wills referred to a draft that may be produced as of tomorrow, but I had thought it was also a possibility that the next draft might incorporate some of the comments and questions from the public and yourselves and ourselves and it might be produced a little bit later in the week. On that assumption that that might occur, I feel that I'd like to ask my questions. So, one thing that I learned from the report is there really are a lot of alternatives. We can raise the stream to meet the existing flood plain. We can maintain the stream in its current height, which they think is close to its future height—or we can let it go to drop to its eventual equilibrium, and there's merits—you know, there's pros and cons of all these things. So, one thing I really like about our--PWA's--approach is that they're evaluating each kind of alternative with respect to the city's objectives. Things like wilderness park preservation, water quality and so on. So one thing I think that I'll repeat that Scott said is that I think the alternatives—I'm sorry, I have a list of—my first point or question is that I think the alternatives are wonderful and educational, but they need to be delineated really clearly. Like for example, the alternative where we allow the stream to reach its natural equilibrium naturally, but we degrade the sides to help it along towards its future side bank slope needs to be distinguished from the option where we don't do that. Those are two similar, related but different options. And I think each option sort of needs a name and a number. And so that when you write the chart at the end for comparing alternatives to objectives that—I don't know—that it's all clarified. Is that clear? Anyway... We'd really would like to know what you think is the best alternative. I think I'd love to see that there are alternatives, but I still don't know what the best one is. Should we try to keep the stream at the existing grade? Or should we let it go or shall we let it down-cut further naturally? And why? Like, it's such an assumption that we need to stabilize it and maybe we do, but why? In reference to what ultimate benefit do we need however many structures? I still need to understand that better personally. I see it as an assumption in the report that ACWHEP stays and it's so, you know—so ugly—and there's so much degradation of the creek that's occurring just below it, it seems to be part of the problem. So unless you can explain to us some reason why it needs to stay, it's beneficial for it to stay, I would like to see it—as an alternative—to consider removing it and replacing it with something better. May I? Is it over? May I continue?

Boyd: You're going way over, Lisa. Speed it up.

Marks: I know, but—but, you know what—

Egly: She's giving us the questions.

Pearson: You know what? I think her thought processes are really what's important here. I think the processes that she's alluding to are—okay, this is what's been presented—what are we trying to achieve and what are some ways that we can get there, instead of this? And I think that approach really makes sense. Because—and I think it needs to be vetted with—because none of us are engineers. We're not hydrologists, we're not engineers. We can't say we want you to do this instead. You know, if our objective is to minimize the impact on the environment and this appears—what is in the current plan appears to have a major impact--would you consider these alternatives and would they better, might be an approach that we can—I think you're going in the right direction.

Marks: Thank you.

Pearson: And maybe the next step is to take it and work with Will and take it and break it down like that. I like the way you're thinking.

Egly: Excuse me, I think that's what the report does. He gives us alternatives and some of what will happen with that. And it's really up to us, and then the next group that makes a decision—

Pearson: Well, and an EIR, you want it in a chart (crosstalk)—but you want to say instead of this, this might be a better alternative and present it in a chart.

Egly: Well, that's how I read the report

Iseman: It's helping me to hear your questions, so Kelly, if we can extend her time?

Marks: Thank you. So, it was unclear to me—I will admit I read the draft that was produced for us Friday and I've been out of town and I haven't read the most recent draft. But it's unclear to me just how many drop structures were being recommended. I thought 1.2, 1.5—tonight I hear 9, so it's—I'd like for that to be really clear. And then of course, why? I always ask that question, why? Why do we want drop structures? One thing that's—even though I so appreciate Phillip Williams and I dislike in a way taking issue with anything, I was sad to see the judgment that we should have really modest expectations about what's going to happen upstream. From my learnings, there's all kinds of ways to infiltrate water—you can catch it—you can--even one little dip in a small piece of landscape catches water, so that every bit of landscape where the water rolls off to the street is actually an opportunity to sink a little in. So I'm not sure that all upstream projects need to be massive, institutional scale projects. And I guess I don't know if there's really—while it's good for us to be confronted with that opinion and to be perhaps sobered by it, I don't know if that really belongs in our EIS scoping comments. Because it's discouraging of a direction that I think is really important for our society to go. So that was my fifth comment. Sixth, the SUPER Project assumes that we want to return the creek to the level of the historic flood plain, and I am aware now that the lower it drops, it dries out the flood plain. But a new flood plain is being created and one thing the report didn't address was why would we, or why wouldn't we want to bring that streambed up to the historic level? I mean, I have a natural inclination to appreciate letting it heal itself and letting a new flood plain emerge, and yet I still feel that that needs to be addressed. What are the benefits and the dis-benefits of returning the creek to the historic level? So that was number six. Seven, one thing I didn't see in the report that I think is important is the long-term maintenance implications of the various alternatives. I'm told the more manmade structures we have, the more it costs to keep it going. So I'd love to see something on that. And then lastly, the report suggests on page 25 that biofiltration would be a useful method to improve water quality, and it would be so nice to see a little bit more on that topic. It was a really short paragraph. And maybe even some suggestions as to locations within the wilderness park, if that's where you feel that that should occur. So that's—I'd like to reiterate Scott's point that we need to make a plan for a letter that goes on top of the report and hopefully maybe the team will get back together. You know, Scott and I would volunteer to do a first draft, but that's up to you. And I think that's it for me. Thanks for the extra time.

Holoman: Did you want responses, or...

Boyd: No, no. Not at this time. Sir?

David Pearlman: Good evening, Council Members, Mayor Boyd. My name is David Pearlman. I live at 908 La Mirada in Laguna. I am here both as a private citizen and as the Chair of the Orange County Conservation Committee of the Sierra Club. My reading of the PWA report results in one overarching conclusion: that the city must not commit to the Aliso Creek SUPER Project as is currently defined in the concept plan report. The PWE technical review reports two overarching shortcomings: "The SUPER Project recommends a water quality treatment facility at the mouth of

Aliso Creek to divert low flows from the creek, treat water for total suspended solids and bacteria, and return treated water to the creek." Still quoting: "We agree that the SUPER Project's end-of-pipe treatment approach may be effective in reducing bacteria levels in the ocean receiving waters and beach closures. However this approach would not remove dissolved metal, nutrients, oil and grease, and pesticides and would not improve water quality." In other words, the question you asked, Councilwoman Pearson, about animal waste is possibly the e-coli and dog poop would be killed. And I may be wrong about this, but the poop itself would go right out in the ocean, correct?

Pearson: (off mike)

Boyd: Well then you're—sir?

Pearlman: Oh, okay.

Boyd: Direct that questions here please. We'll write them down.

Pearlman: Okay. "To deal with creek bed erosion,"—still quoting—"the Corps study recommends that no further consideration be given to non-structural approaches to managing the creek and the SUPER Project contains only structural approaches." That's an attitudinal problem because really the number one goal should be preserving the character of the park. That, above all. The park we made large sacrifices to create—we don't want to destroy it. "In contrast to the"—this is more quotes—"In contrast to the findings of the Corps and SUPER Project reports, our field geomorphic reconnaissance and preliminary assessment of the channel profile suggests that much of the channel through the Aliso and Woods Canyon Wilderness Park between the coastal treatment plant bridge and the ranger station downstream from the ARMA Road bridge may be close to or at equilibrium gradient and is in fact starting to form a new flood plain through sediment deposition. We therefore question whether such a large number of heavily engineered structures are needed to prevent further incision." One more reason, which was already mentioned, to distrust the design of the Army Corps. If you want to see Army Corps designs, and I hope that you, the Council members, have either bicycled or walked upstream from the ARMA Bridge? Just bicycle or walk upstream a couple of miles and look at the condition of the creek, and you can see what the Army Corps has done there and I think you'll conclude that you don't want that done in the park. It appears therefore from the language of the PWA report that the SUPER Project proposal relies on pouring concrete and ignores natural processes and the preservation of the wilderness park itself. As far as the water flow is concerned, we do have a water shortage, and that runoff is fresh water. It's much easier to convert fresh water into drinking water than it is salt water. And there are three desalinization plants planned for this section of the coast, or proposed.

Boyd: Sir, can you wrap it up? You've gone about a minute and half over. So could you please wrap it up.

Pearlman: Oh, I'm sorry. That's really all I want to point out is that we have a resource and it shouldn't just be disposed of. It should be actually used. Thank you.

Bill Rihn: Good evening, I'm Bill Rihn. I'm just speaking for myself tonight. For me, I looked at this report from the following perspective. Two, three, four weeks ago, there was a meeting at this Mission Viejo city hall? And it had to do with the SUPER Project and the new study that the Corps is doing. And at that meeting, Mary Anne Skorpanich—I think you all know who she is—she said the SUPER Project will not proceed until this new study, whatever it is, by the Corps is completed. So I thought this report had to do with input to an EIR or some environmental study and therefore, I don't think you need to prioritize things or put them in order. You need to submit the whole report so that everything in there is included in the environmental study. Now, that's the way I looked at it. And I'll admit that meeting at Mission Viejo was confusing to me and to a lot of other people. Anyway, that's the way I looked at it. So, when I read this report I kept getting pleasantly surprised—page after page, I was pleasantly surprised. Let me give you a couple examples that in all my hollering at the county and to the Corps through them, nobody seems to ever want to have considered. But on the goals and objectives here, two of them really resonated with me, because they are things I've been saying all along. One of them, number five, it says that one of the goals is to 'preserve, enhance, restore, the flood plain habitats and functions.' And another one:

'allow for normal geomorphic processes such as channel migration.' I read that to mean stream meandering; that's the way I learned it in geology. And another one, 'manage creek erosion to maintain a balance between excessive incision and beach starvation.' Where do you think the sand at the beach at Aliso comes from? It comes out of Aliso Creek and if you put all these concrete things in there, no more sediment is going to get down there and Aliso Creek is going to look like a bunch of rocks—I mean Aliso Beach is going to look like a bunch of rocks. The only thing I would add to this and I think it's important—I know it's not the county—but somehow a study like this needs to include what happens on the private property, otherwise known as Ben Brown's or Aliso Creek and Golf Course. If you don't do that, if you control the stream, all of a sudden when it gets to the private property, it could encounter a wall or it could encounter a waterfall. They need to be coordinated. And I'll leave you with one last thought. As I read this, I understood all of it except for one thing. On page three was a word I never heard of before, doway(sp?)—I never heard it before, so I had to go look it up. So I learned something new as a minimum, that one.

Iseman: What does it mean?

Rihn: Well, we need a picture, but it's the lowest point in a creek, as the creek goes down. You take the lowest point where the water is and you follow that down, that's the doway—I probably mispronounced it.

Boyd: Thanks, Bill. Anyone else?

Elisabeth Brown: Good evening, Elisabeth Brown, Laguna Green Belt. I can't follow that, but I'm just going to make a couple of comments. I, too, like this report. I thought it was a valuable informational report and it was eye-opening. It came up with some—sort of to point us to look at some of the uncertainties and some of the technical areas that we can't get just from eyeballing or from following it on Google maps or something. I thought the part about addressing the sand supply was great, very nice. I have one—there was one part that I thought could be bulked up a little bit? And that's the part about the storm water detention? It's clear in a quick report like this from people who are basically unfamiliar with the area—they don't know where all the bones are buried, where the little nooks are—and one little nook is the parking lot at the Ziggeraut, which has never been more than 40 percent full; right there before we go into the park. It's federal; if it's a federal project, they can do what they want. We could take part of that parking lot and make a detention basin. The other one is something we've probably all forgotten. But in the mid or late 80's or early 90's—I can't remember—Mallard Marsh was a large wetland sponge in upper Wood Canyon and it was destroyed by too much water coming out of Aliso Viejo. It leaped its banks, the creek there leaped its banks and went down the road and cut through the marsh and drained the whole thing. This was the kind of sponge that we're bringing back in Laguna Canyon by moving the road, and this is—it's a natural detention basin—and this is the kind of places where you look for some of this storm water reduction. Because, it's clear that there's too much water coming into that little creek, and it would help if we would do all those things, together, incrementally. I'm going to be looking more about Mallard Marsh and the worst thing is trying to find pictures—nobody has pictures. But anyway, that was it. But otherwise, I think it's a good report, it's a good basis for the city to reiterate its goals and communicate those to the county and the other folks that are involved in the SUPER or Aliso Creek or Mainstream, or whatever it's called.

Egly: Elisabeth?

Brown: Yeah.

Egly: On page 28 of the amended report, they do make reference to, for example, "the Corps study may present the opportunity to retrofit the large parking lot for the Chet Hollofield Federal Building along the…"

Brown: Oh, that's it.

Egly: Yeah, that's in there.

Brown: That's not—you know, the one I got didn't have that. Great.

Egly: Well, you know, they made some amendments and they didn't--is it fair to say you didn't reject the idea of trying to improve the water quality flow from developed areas? It's just that it may be so difficult because it is developed. Is that—

Frank: Well, let me ask a question ________________

Egly: Yeah, yeah.

Frank: Because people have referred to your comment at the bottom of page two, and as I read that, it talks about having fairly modest expectations about using upstream storm water control. You weren't talking about summer nuisance water; you're talking about storm water. And maybe somebody that's been on the Council for awhile—remember when we looked at what it would take in retention in Laguna Canyon in order to preclude the need to expand the channel and basically we'd flood the entire canyon. That's all he's saying; that in a storm condition, you're not going to capture that water. You need so much—no, it doesn't mean that you can't do water quality, as Elizabeth or as the report says, by using existing land in dry weather flows.

Egly: Yeah. Thank you.

Boyd: Anyone else?

Ed Almanzo: Ed Almanzo, I'm speaking on behalf of Laguna Ocean Foundation. I want to thank the Council, Environmental Committee and staff and PWA for pulling this together. We will be writing our own letter in response to the NOI and we think that our mission overlaps very neatly with what the city's objectives ought to be, relative to this. And we think it's two issues. This is about an EIS and it's about our resources. It's about an EIS because this letter responds to the notice where we're supposed to tell them what we want in that environmental document. And we get another chance after the EIS is created, and it goes public and we get to talk about what was in the document. So we don't have to resolve what we think the preferred alternative ought to be. But we ought to lay out what we think should be considered in that document and I think the city should lay out clearly its criteria for what the preferred alternative ought to be. The other thing that's important here is that although this project that's addressed in the PWA report covers a geographic area of about 7 miles of that segment, the scope of the EIS is the geographic area of all the impacts of whatever happens in that 7- mile stretch. From our point of view, the impacts to our resources on the coast are relevant to the Aliso lagoon, which is a very significant resource. It's the only lagoon we have; it's where the bluebelt and the greenbelt converge and it deeply needs restoration. We have always thought it would be restored. In fact, there are three agencies looking at it, all with different design criteria and objectives for different key species. There's a potential train wreck embedded in that. If the hydrology upstream is altered so that the hydrology at the creek is designed as a result to be inconsistent with the habitat requirements of those key species, then we have a problem. And that's in our backyard. Meanwhile, all these other agencies—Fish and Wildlife, (-?-), Fish and Game, the County Corps of Engineers—are planning these projects, and what is the City of Laguna Beach doing? I think this is a great start. I think this is really important. But I think the city's letter has to be expressed in the much larger context of the watershed, not just those 7 miles, and the impacts, particularly downstream, to the unique resources that are in the city limits. So, that's what our letter is going to emphasize.

I've got some bullet points here that I'd like to share with you, just in case the city wants to sort of feed off of our ideas. And I think that's it.

Egly: Well, Ed, would you share with us the letter that you're going to be presenting for the EIS?

Almanzo: Yeah, I have a question as to when that letter is due. Does anybody know?

Egly: Is it June—what's the new date?

---: (off mike)

Egly: You're not getting on the tape, Lisa. Would you stand up here with—and just do the date and when it's to be done.

Marks: All right, the date is Tuesday, June 9th. They have not amended their NOI at the federal registry which they should truly do, so it's not official. I have emails.

Male: (off mike)

Marks: Officially, according to federal registry, it was May 10. I have emails saying then June 6, which is a Saturday and then I have another email from John Vivante, the project manager at Army Corps saying early next week.

Egly: Now, in discussions, you didn't get the sense that 'we're not going to look at yours because it's coming too late...'

Marks: They said they would look at it—not only will they look at it, but they'll look at it for the first stage of the EIS. It goes in stages. The first stage is the no project baseline. They'll look at it for that in their very initial study phase.

Egly: Okay.

Almanzo: Thank you. Why does the city attorney always leave when I get up to speak?

Tom Osborne: Tom Osborne, 31651 Santa Rosa Drive in South Laguna. And having worked on the climate protection issue, that seems almost like child's play compared to the complexity of this one. I went to that very confusing meeting that Bill Rihn alluded to a few minutes ago, and like him and others, I was scratching my head halfway through that meeting and all the way to the end, trying to wrap my mind around the fact that they were focusing there on restoration of the creek and not on the SUPER Project itself. So I came away from that meeting with two thoughts in mind. First of all, I would urge you to be as mindful as you can of the multiple jurisdictions involved--the city's, the watershed, the county, the federal. There's so much to manage. And I came away from that meeting in Mission Viejo with the distinct impression—and I think I'm right about this—that there is no agency overseeing the whole process and that scares me even more. I think we're all working with different pieces of the puzzle, but who oversees the whole process itself, and sees how the parts could fit together very creatively and in the public interest? And the second thought that occurred to me when I came away—and I would urge you to keep this in mind—is that there are some very valuable human resources that are at risk. I spent a morning going through a box of documents related to the Orño Indians who have been living in this area for half a millennium, and anthropologists have identified at least 20 sets of human remains and human artifacts going way back into our past; and that leads me to think that there's a lot more there that's buried. And to even disturb that ground will risk, I think, damaging or destroying what's left. We have a connection to all of that. Our roots go back to this earlier period and to these people and I think it's in our interests to try to keep that intact as much as possible. So these are just some thoughts that I'd like you to keep in mind as I continue to work with anthropologists on the cultural resources that are in stake in this larger project. Thank you.

Iseman: Tom, Tom? Tom-tom?

Osborne: Okay.

Iseman: I know there are some magic maps that none of us can see that are kept at the county about what you cannot disturb. Have you had access to the magic maps?

Tom: Nothing that was labeled as such.

Iseman: Do you know what I'm talking about?

Osborne: Yes, I did—I did come across some maps.

Iseman: Okay. I learned that it's—and this is logical but surprising—that if you have a sacred burial area that may have valuable relics, you never tell anybody because if they knew that they were there, somebody would go out and dig them up. So they don't tell us; they don't let us know; but they know. Now I'm assuming at some point along this area that somebody who knows needs to be at the table. Does that automatically happen, do you know?

Osborne: I don't know for sure.

Iseman: Okay.

Osborne: I'm fairly confident that there are people who do know and I know some of the people who do know. And I won't say anymore at this point; I'll have more to say on this later.

Iseman: Thank you.

Boyd: Anyone else wishing to speak?

Michael Beenan: Good evening, Mayor, Council and our community. Michael Beenan, South Laguna Civic Association, although I'm speaking as a resident. We haven't had a chance as a board to vote one way or another on the PWA report. I too want to thank PWA for stepping up quickly on this, and thank the Environmental Committee for deliberating and doing all the research to bring this issue forward. I also want to thank our community that's been educating themselves at these very, very, very long, drawn-out meetings, and becoming articulate about what's going on at Aliso Creek. Just as a benchmark consideration, I would urge you next time you're going south out of San Clemente, if you get over into the right-hand lane on the freeway you can look down into San Mateo Creek area. And what you see there is maybe what Aliso Creek used to look like. So it's a little hard to imagine, given the condition there right now, what it used to look like in its historical, natural condition. The San Mateo watershed is about 24 square miles; Aliso is around 30-32 square miles, and we share the same sort of rain and mountain conditions. Key to the San Mateo Creek area is a permanent sand berm. And it turns out that the berm is really important for us, both in terms of water quality during the dry weather seasons, which is about nine or ten months here, and even during storm water conditions. The berm at San Mateo creek rarely breaches except for major storm events and I think that's what we want to be aiming for, is the integrity of the berm at the beach. And then use that as our litmus test if you will, to see if we're being successful or not. I just have one copy, but it shows a plume from a post-storm event, and the brown area represents the sediment, and within that sediment are chemicals. One is called—I may mispronounce this—Diltrin. And Diltrin is an insecticide that's banned around the world, but it's still being detected in the runoff that gets out to Aliso Creek and the ocean. Another major contaminant is phosphorous. I know we're concerned about bacteria, and bacteria will make us sick, but a lot of these things are carcinogens that we're not tracking. Phosphorous is really fertilizer, and fertilizer is what triggers these massive algae blooms that we endure. The photos--also if you look very closely there's a big green cloud offshore. And that's an algae bloom and these have become increasingly persistent over the years. And so it really is about the amount of water coming through the creek transporting these contaminants. And that brings me to—I think we need to reframe this situation? Here we have this water, this incredible resource, and we're only making one use of it—it's once through—whereas, in most societies now we're using water over and over again. And I realize when we start doing the math about storm events it seems like an insurmountable amount of water, but what I would suggest is to look at it in smaller pieces and consider retrofitting inland areas. I would encourage anyone in the community that's looking at an endeavor to consider a company, a corporation, or a collective that would harvest rainwater. Texas and Florida are already harvesting rainwater for beneficial use and making money with it, and they get water bonds to do it. Essentially, we have—I'll end here—essentially we have a failed inland development system and those of us that live in Laguna work on old homes. And so for us, we're used to doing the impossible, we're used to fixing things that don't work. So I look at this as really a remodel project, inland. And that we need to consider this possibly for federal stimulus funding for infrastructure repair. Maybe we need to reach out to professional grant writers right now, who are hungry, and engineering firms who are hungry and ask them not tell us what they can't do; start telling us what they can do. And I think we'll find some exciting alternatives. And finally, the Tree People up in LA have been successful in retrofitting older communities and it might be useful to have them come down and do a presentation. Thank you very much.

Boyd: Thank you.

Jackie Gallagher: Good evening, Council members. My name is Jackie Gallagher. And as Mike reiterated about the community members in town trying to make themselves aware of what's going on in this issue, over the last two years there's been all kinds of meetings that I've seen a big representative of our town. In fact, they've been shocked—and happily—to see how many people show up at the San Diego Regional Water Quality, the County Board of Parks, etcetera. We've been representing ourselves there, because we see this issue as very important to us. We're here to ask you to see it as an important issue. I'm not going to reiterate many of the things they've said. One of the big things—I have a few points I just wrote down that people didn't talk about. A lot of the original design was studied ten years ago. If you think it pragmatically, in the last ten years, most of the growth has grown in the upper cities, so we probably are close to our equilibrium because we're close to our grow-out points in the upper cities. I think that's a big key issue we have to understand about the equilibrium of the floor; it's a natural process. We're trying to stabilize a creek to protect some pipes that can be moved, so I wanted—my question is if we move all those pipes and we move that road, do we need this SUPER Project? Upstream—if they're taking care of their business upstream and they're retaining this water, they're recycling this water—it's being done here in Orange County—the National Water Research is infiltrating water into the ground and it's being done here now. They're having people retain it, picking it up in trucks and taking it back to the water tables in Orange County. And letting that, then, clean out the water. These things are being done. We have to urge the upper cities to get together with us. I know that Toni and Elizabeth have been working with the upper cities. If you would like to sit down with any of us and talk about some of the major solutions that we've come up with, including the Ziggaraut and other things, we'd love to sit down with you, because we do not know what the chatter has been up there. But we do know that they are attending many of these meetings, and they're resisting the MF4 permit and it cannot be resisted. This is our responsibility. We're the toilet here at the end. So, another thing I want to say is we had a professor from the environmental studies at UCSB come and take a tour of the canyon about eight months ago. His first reaction was that floor, that basin of that canyon can handle the water. That ACWHEP needs to be removed and I'd like to have that in our—what happens if we remove the ACWHEP and go from there with the design? Why are we keeping a piece of concrete in the ground that's not doing anything—it's not doing its function. Let's remove it. And that is one thing I would like. I know it's a short study; these guys did a fabulous job on it; but there a couple areas that I, like Lisa, have questions on, and I can see my time running out. Thank you very much.

Barbara Metzger: Hi, Barbara Metzger. I wanted to comment first of all that this report is absolutely outstanding. I've never seen a report of this kind written in a way that everyone could understand. The authors have figured out what it is that we wouldn't know about and set aside paragraphs to describe it. I think as we listen this evening it becomes clear that when the city makes a response to the notice of intent, it needs to include some of the things that people have been talking about tonight, the concern for the archeological resources, the concern for what happens downstream if they do modifications upstream, because our concern is where the creek meets the ocean, just as this is the inland park. So some such letter, I would hope that you would get your committee together again and write a letter that includes a lot of the things that have been said tonight.

Boyd: Anyone else? Seeing none, close the public hearing. Comments?

Frank: Do you have any comments, Nick?

Garrity: There's a number of comments and questions I'd be happy to answer if there's time or if there's any particular questions? No not all of my _____?________ is here, and I have some notes from other people's comments.

Frank: The process you went through was to get a report that would be an initial response to the SUPER Project and to the work of the Corps of Engineers to start with. As Bill said, they've done exactly what we asked them to do in a relatively understandable manner and did they answer every question about cost and long-term maintenance? No. Did they have a preferred alternative? We didn't really ask them for an alternative. Their goal was to look at the projects, look at the assumptions and raise questions. And the key question is are they using the appropriate gradients in the creek?

Seems like we could transmit this within a couple of days, with a relatively short cover letter, to the agency head at the county and we can indicate that the city has these objectives. Looking at the objectives, our consultant questions whether the SUPER Project has—could be redesigned to better meet the city's objectives. And we could do something similar to the Corps of Engineers. I don't know that we need a huge amount of additional work. Does this answer every question? No. But I think it brought us exactly where we wanted to be at this point.

Boyd: Jane?

Pearson: I agree. I think the entire report should be submitted and whoever—the mayor—we need the mayor's signature or whoever should be on the letter. And I think we need to reiterate our objectives and concerns, but I want to make sure that you understand that the reason Toni and I started approaching the cities—there are seven cities in this watershed, six others other than us—and they all contribute to the problem. And we wanted to make it perfectly clear to them early on that 'you need to be part of the solution to this.' So as issues—as you identify what you think are issues, and opportunities for them to improve, I think we should maybe sit together and talk about those and remit them as suggestions. One of the reasons why I wanted us to work with them is I want them to help pay for it, and so I don't want to do it in a way that says "shame on you" and "you're the reason" because I want them to write checks to us, to the county. The county is managing the whole project because it covers all these cities in this jurisdiction. And they're the ones that are able get the money. We can't pay for this. Our city can't pay for this by itself. We can't pay our part as of today. But, you know, it's going to be a big bill for all seven cities, and guess who has the most frontage, which city has the most frontage on Aliso Creek and probably has the least amount of money to contribute. But they need to pay their pro rata share—it's Aliso Viejo. It's Aliso Viejo. And we've kind of put together the pro rata distributions based on other projects that we've had to do together on Aliso Creek—monitoring and so forth. And it's a lot of money. And so I think we do want to give them suggestions, but we also want them to help pay for it. We don't want to alienate them so much that they're not going to write checks. And we've been kind of playing with the numbers and what the shortfall is going to be after the county is able to get X and Y dollars--Z still has to be gotten by the cities—and it's going to be significant, what we ask of them. So if we have suggestions to them, in addition to writing checks, I think that's great. And I think we should do it. And I think Toni and I can organize that and put it together, and we can talk to them in a way that is not offensive. And I like that idea. So, start working on that and then in the meantime, I don't want to alienate them so they get to the point they don't want to write a check.

Rollinger: I agree that we need to work with our neighbors, but I have a question about what our next step is? Are we writing general comments to the county and the Corps or are we responding to the notice of intent?

Frank: Well, my intent would be to transmit the report, both to the county and to the Corps of Engineers. And for the county I would think that they may want to look at some of the additional analysis as proposed on page 31. Be hard for them not to think that they should do that, and we should call that to their attention. Secondly, in terms of the Corps of Engineers, we would provide them with the report—and it does have other alternatives—and it does have items they need to look at. And they should be able to incorporate those into their—the start of their environmental process.

Rollinger: I'd like to suggest that we also send a copy of the minutes of this meeting so that the public comments go as well?

Egly: I agree with Verna. I'm very pleased with the report and again want to thank Lisa Marks and Scott Sebastian for pushing us in the direction of looking for more friendly ways to fix the creek, for a better term. And that we've gotten exactly what we wanted in the sense of some alternatives that we can see are better than what we heard about from the Corps and from the SUPER Project. And I would agree that the whole report should go, along with the comments that we've heard tonight, with a cover letter kind of describing what our friendly suggestions are, in summary.

Boyd: Toni?

Egly: That's a motion.

Iseman: Oh, I want to thank Lisa and Scott for really making this happen in the way that it did. And it brings to mind when Laguna Beach signed on to the mayor's climate issue. Tom Osborne, are you still here? Tom-Tom?

Tom really led the way and when I was in Seattle I was interviewed by a radio station, and the question was, "And how do you get the community—how do you lead the community to do these things?" And I said, "No, in Laguna Beach, the community leads us." And you have led us in a very positive way and your efforts will have a huge impact on what ultimately happens. And I do think—and I can't remember who said this—but what we consider a luxury in the past is a necessity today. And when we look at how we're going to be dealing with water issues--I sit on the SOCWA board, and we're going to see big changes in the amount of flow that goes into the SOCWA because people are limiting their water use—low-flow everything. And as a result, there's going to be more room, I suspect, for diversion. And that means that these dry-flow diversions, which are so important in terms of keeping the nasty stuff out of the creek, could be accommodated. So I think every change we make is really an important move and thank you and thank you, Nick.

Egly: One little addition to the motion is if we get Almanzo'sletter, I don't know that we incorporate it—I don't know quite how to do it.

Voice: ----

Egly: Public comment. It will just come with the public comment and that's all. That would be included in that. And his exhibit that he brought with that.

Pearson: This is all due—

Egly: I know. In twelve minutes.

Pearson: Within a week, so—

Boyd: (off mike)

Egly: Pardon? Yes, yes. And his comments will be in the minutes, so that will be part of the package as well as his exhibit.

Pearson: And so should we direct staff to draft a letter?

Frnak: Kelly's signature is fine.

Boyd: Do we have a motion?

Egly: Yes.

Frank: Let me add one thing.

Female: Okay.

Frank: --spend money, but.

All: Oh-h-h-h...

Frank: Let's say for a couple dollars, say like a thousand dollars, I talked to Nick, we could spend a little time better explaining the number of drop structures and clarifying that, and I think we could respond to a couple of the other questions that Lisa raised, and also the consultant could probably explain some of the answers to Lisa. So, I don't know where the money would come from, but I'd find it somewhere if you wanted to authorize another thousand dollars just to –

Egly: So moved.

Iseman: Second.

Boyd: All in favor.

Voices: Aye.

Boyd: Opposed.

Egly: Yeah, Ken.

Boyd: Second was Toni.

Egly: And so included in that was the motion for the whole project and letter.

Pearson: Right. It was a double motion.

Egly: Okay.

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MEMORANDUM

Date:	May 29, 2009 – *revised June 5, 2009*
To:	Kenneth Frank
Organization:	City of Laguna Beach
From:	Andrew Collison, Ph.D. and Nick Garrity, P.E.
PWA Project #:	1977
PWA Project Name:	Aliso Creek Stabilization Project Review
Subject:	Project Review and Comments
Copy(ies) To:	William Holoman

This memorandum documents PWA's technical review of the U.S. Army Corps of Engineers' Aliso Creek Watershed Management Study (referred to in this memo as the "Corps Study") and Orange County's 2007 Draft Aliso Creek SUPER (Stabilization, Utility Protection, and Environmental Restoration) Project Concept Plan Report (referred to as the "SUPER Project"). The memorandum also provides scoping comments for the Corps Study Draft Environmental Impact Statement/Environmental Impact Report (DEIS/EIR) for Aliso Creek on behalf of the City of Laguna Beach, as well as comments for future phases of the SUPER Project. This work was carried out on behalf of the City of Laguna Beach.

EXECUTIVE SUMMARY

PWA was hired by the City of Laguna Beach to refine a set of goals and objectives for Aliso Creek stabilization projects; review and comment on the Corps Study's Aliso Creek Watershed Management Report, Feasibility Phase ("Feasibility Report") (USACE 2002) and Orange County's SUPER Project Draft Plan; conduct a field geomorphic reconnaissance to look at conditions in the creek; and write a memo that identifies whether there are areas where the Corps Study and the SUPER Project can be improved to better meet the City's goals and objectives. The City's goals are: water quality improvement, urban runoff reduction, infrastructure protection, erosion control and sediment management, ecosystem recovery, preservation and enhancement of the Aliso and Wood Canyons Wilderness Park, and sustainability.

The Corps Study and the SUPER Project report both provide good assessments of the extent and causes of channel degradation in Aliso Creek. We are in agreement with their findings regarding the high degree of channel incision and widening that has resulted from urbanization in the watershed. We agree with the conclusion that significant amounts of creek widening and bank erosion are highly likely in future, and that such widening threatens infrastructure that runs alongside the creek (the Aliso Water Management

Agency (AWMA) Road and the utility pipelines) if they are left in their current locations and no action is taken.

Based on an estimate of the ultimate equilibrium (stable) gradient of the channel, both reports argue that there will be approximately 20 feet of future incision (bed erosion and lowering) at the ACWHEP structure if nothing is done to stabilize the channel and recommend placing a number of large, heavily engineered grade control structures in the channel (composed of soil cement, articulated concrete and grouted rip rap) to prevent future incision. In addition the SUPER Project report proposes filling the channel and its newly formed floodplain by up to almost 30 feet to counter previous incision, reconnect the former floodplain and allow fish passage over the ACWHEP structure and the AWMA Road bridge, and re-grading the banks in some places. The Corps Study recommends that no further consideration be given to non-structural approaches to managing the creek, and the SUPER Project contains only structural approaches.

In contrast to the findings of the Corps and SUPER Project reports, our field geomorphic reconnaissance and a preliminary assessment of the channel profile suggest that much of the channel through the Aliso and Wood Canyons Wilderness Park between the Coastal Treatment Plant (CTP) bridge and the ranger station downstream of the AWMA Road bridge may be close to equilibrium gradient and is in fact starting to form a new floodplain through sediment deposition. We therefore question whether such a large number of heavily engineered structures are needed to prevent further incision. Further analysis is needed to determine what the stable channel gradient is, since this will greatly affect the stabilization approach taken. A rapid assessment of equilibrium gradient undertaken as part of this review suggests that the channel could be stabilized by as few as nine 2-foot (or three 6-foot) grade control structures in the Wilderness Park and two 6-foot structures near the Sulphur Creek confluence. If upstream fish passage is a project goal, this could be achieved by constructing an additional 1,000-foot long boulder step-pool and fill structure in the channel below the ACWHEP structure. Utility protection could be met by relocating the road and pipelines away from the creek and grading back the banks, accelerating natural recovery of the creek and its floodplain. This approach would potentially be more resilient than either of the proposed approaches, and would involve less impact to the existing creek habitat.

The City of Laguna Beach asked PWA to consider the potential to use stormwater source control in the watershed to minimize the need for structural approaches to stabilize Aliso Creek. A more quantitative assessment that is beyond the scope of this study is needed to reach more definitive conclusions on this question. Based on our literature review and field reconnaissance, using upstream stormwater control to reduce downstream erosion to the point that fewer structures would be needed would be challenging owing to the highly built out nature of the watershed, the dense development pattern, and the relative lack of flat open space areas for infiltration and detention of water. However, it is in the City's interests to ensure that future development upstream does not make the creek erosion problems worse, and to incrementally improve the existing situation through low impact development and stormwater detention when opportunities present themselves.

The SUPER Project recommends a water quality treatment facility at the mouth of Aliso Creek to divert low flows from the creek, treat water for total suspended solids and bacteria, and return treated water to the creek. We agree that the SUPER Project's "end-of-pipe" treatment approach may be effective in reducing bacteria levels in ocean receiving waters and beach closures. However, this approach would not remove dissolved metal, nutrients, oil and grease, and pesticides, and would not improve water quality for beneficial uses of Aliso Creek, including wildlife habitat. The Corps Feasibility Report recommended measures throughout the watershed to improve water quality, including stormwater treatment best management practices (BMPs) and water quality treatment wetlands. Runoff treatment wetlands, in conjunction with stormwater source control measures, may provide an alternative or supplemental approach to the SUPER Project's approach. We recommend an evaluation of the effectiveness of water quality enhancement projects that have been implemented in the watershed since the 2002 Corps Feasibility Report to inform the need and appropriate balance between additional water quality treatment measures in the watershed and at the creek mouth.

In conclusion, although the Corps Study and SUPER Projects represent feasible alternatives, there are other feasible, less invasive approaches, such as those identified above and discussed further in this memorandum, that will meet the project goals and that merit additional consideration. We recommend that additional analysis is performed to assess the following issues:

- Identify equilibrium channel gradient to develop a better estimation of the design slope (e.g. by surveying a detailed channel thalweg profile with an associated geomorphic assessment, and/or developing a calibrated sediment transport model)
- Develop and evaluate alternatives that minimize the impact footprint in the creek corridor and maximize preservation of existing channel and floodplain habitats
- Develop and evaluate alternatives that involve relocating the utilities and AWMA Road away from the creek
- Develop and evaluate alternatives that use a step-pool channel reach to provide fish passage over the ACWHEP structure and the AWMA Road Bridge
- Develop a quantitative feasibility assessment of the potential for stormwater control to offset the need for erosion mitigation in the channel

1. INTRODUCTION

1.1 Project Background

Aliso Creek extends approximately 20 miles from its mouth at Aliso Beach and the Pacific Ocean in the City of Laguna Beach, CA to its headwaters in the Santiago Hills within the Cleveland National Forest. The 35 square mile Aliso Creek watershed is located within the cities/communities of Laguna Beach, Laguna Nigel, Laguna Hills, Aliso Viejo, Lake Forest, Mission Viejo, Portola Hills, El Toro, Leisure World, and unincorporated Orange County. Within the Aliso and Wood Canyons Wilderness Park, Aliso Creek has incised (downcut) by approximately 20 ft and doubled in width over a 30-year period, reducing stream function and values and threatening infrastructure adjacent to the creek. Prior reports suggest that Aliso Creek erosion is primarily due to increased runoff from upstream urban development. Upstream development has increased paved (impervious) surface areas, thereby increasing stormwater runoff and reducing sediment supply. Increased creek flows and reduced sediment supply have resulted in increased channel bed and bank erosion, and destabilization. Upstream development has also likely increased pollutant discharge to the creek, affecting water quality.

Current plans for an Aliso Creek stabilization project include both the Corps Study and Orange County's SUPER Project, which are described below.

Corps Study. The Corps Study has produced the Aliso Creek Watershed Management Report, Feasibility Phase (USACE 2002) (referred to as the "Corps Feasibility Report"). In April 2009, the Corps issued a notice of intent to prepare a Draft Environmental Impact Statement/Environmental Impact Report (DEIS/EIR) to evaluate ecosystem restoration and enhancement, creek stabilization, and flood risk management alternatives for the lower 7 miles of Aliso Creek and 1,000 ft of the Wood Canyon Tributary. Orange County is the local sponsor for the Corps Study.

The next phase of the Corps Study is to document baseline conditions and evaluate the "Without Project Conditions" for the DEIS/DEIR. The Corps Study has not yet developed project alternatives, though a number of potential project elements are discussed in the Corps Feasibility Report. This memorandum provides comments for the scoping phase of the DEIS/DEIR on behalf of the City of Laguna Beach, including a technical review of the Corps Feasibility Report and recommendations for alternatives to be considered and additional analyses to be performed for the DEIS/DEIR.

SUPER Project. The primary goal of Orange County's SUPER Project is to stabilize a 3.5-mile reach of Aliso Creek between the Aliso Water Management Agency (AWMA) Road bridge and the Coastal Treatment Plant (CTP) located approximately one mile upstream of the creek mouth. Orange County is planning the SUPER Project separate from the Corps Study process, but has used information from the Corps Study as the basis for the SUPER Project and the consultant from the Corps Study (Tetra Tech, Inc.) to produce the SUPER Project Draft Plan Report. Orange County is seeking funding for the SUPER Project through the Corps' Environmental Infrastructure (219) Program. It is reasonable to assume that the Corps Study may consider alternatives similar to the SUPER Project.

The SUPER Project evaluates three stream stabilization alternatives, which consist of different configurations of grade control structures. The SUPER Project Draft Plan recommends an alternative with twenty-four (24) 2-foot high in-stream grade control structures, which consist of grouted rip rap, soil cement and articulated concrete. The recommended alternative also includes placement of buried riprap protection along the utility corridor east of the main channel. The SUPER Project also evaluates three "end-of-pipe" water quality treatment alternatives and recommends a low-flow water quality treatment facility near the creek mouth to meet the secondary goal of improving water quality at the beach.

1.2 Memorandum Scope and Organization

This memo is organized as follows:

- Section 2. Goals and objectives.
- Section 3. A primer on equilibrium channel gradient, channel evolution, and channel stabilization and restoration.
- Section 4. Summary of Aliso Creek stabilization projects.
- Section 5. PWA field geomorphic reconnaissance.
- Section 6. Technical review.
- Section 7. Alternatives to be considered
- Section 8. Conclusions and recommendations

PWA was hired by the City of Laguna Beach to carry out a series of tasks to review and comment on the proposed Aliso Creek stabilization projects. The full scope is included as Attachment 1, with the key points as follows:

- Help the City refine a set of goals and objectives for the projects that better reflect its priorities
- Review the Corps Study Feasibility Report and the SUPER Project Draft Plan, along with some supporting documents
- Conduct a field geomorphic reconnaissance to look at conditions in the creek
- Write a memo for the City that identifies whether there are areas where the Corps Study and the SUPER Project can be improved to better meet the City's goals and objectives.

2. GOALS AND OBJECTIVES

The City's goals and objectives for projects in lower Aliso Creek are listed below. Specific objectives are provided for each goal.

1. **Water Quality Improvement** – Reduce current high levels of bacteria and other pollutants (dissolved metal, nutrients, oil and grease, and pesticides) which adversely affect the creek, the beach, and ocean receiving waters.
    a. Provide water quality conditions within the creek suitable to support beneficial uses and ecosystem function
    b. Eliminate or reduce the frequency of beach closures at Aliso Beach
2. **Urban Runoff Reduction** – Reduce runoff from existing and future urban development in the flood and dry seasons to levels that approach natural or historic hydrology using stormwater best management practices within the Aliso Creek watershed
    a. Reduce urban runoff to the creek and resulting creek erosion through runoff detention or infiltration (i.e., reduce hydromodification)
    b. Provide hydrology suitable for supporting native habitat and ecosystem function
    c. Reduce pollutant loading to the creek and ocean receiving waters
3. **Infrastructure Protection** – Maintain existing infrastructure services and prevent infrastructure damage and failure attributable to creek flows and erosion, either by protecting infrastructure in place or relocating infrastructure away from the creek. Infrastructure to be protected includes the following:

    Infrastructure along the west side of Aliso Creek within the Wilderness Park (from Alicia Parkway to the Coastal Treatment Plant)

    - Aliso Water Management Agency (AWMA) Road/bike path

    Note that the ACWHEP irrigation pipe and habitat mitigation downstream of the ACWHEP structure are failed and abandoned. Protecting the ACWHEP structure for its original purpose (irrigation) is not an objective.

    Infrastructure along the east side of creek within the Park

    - Unpaved maintenance road
    - South Orange County Wastewater Authority (SOCWA) 36" – 39" effluent transmission main
    - Two SOCWA 4" sludge force mains
    - Moulton-Niguel Water District (MNWD) 18" sewer line
    - SOCWA Coastal Treatment Plant (CTP)

    Infrastructure along the creek upstream of the Park (from AWMA Rd. to Pacific Park Dr.)

    - SOCWA 24" – 30" effluent transmission main

- MNWD 24" interceptor sewer
- Tri-Cities MWD 42" – 60" water transmission line

4. **Erosion Control and Sediment Management** – Manage creek erosion to maintain a balance between excessive incision and beach starvation.
    - Prevent progressive creek bed incision and bank erosion that threatens infrastructure services and ecosystem function
    - Use a holistic "sandshed" management approach for sediment delivered from the watershed to the creek and the coastal zone.
5. **Ecosystem Recovery** – Foster the recovery of a functional ecosystem, including the recovery of native riparian habitat and processes and the plant and animal communities that depend on them either through active restoration or preservation and enhancement of existing habitats, as well as recovery of estuarine lagoon and ocean ecosystems at the creek mouth
    - Preserve, enhance, or restore floodplain habitats and functions
    - Eradicate invasive species such as *Arundo donax* (Giant cane)
    - Allow for natural geomorphic processes such as channel migration to enhance habitat diversity and complexity
    - Provide for and improve fish passage
    - Restore estuarine lagoon habitat and functions and enhance ocean habitat conditions at the creek mouth
6. **Wilderness Park Preservation and Enhancement** - Preserve and enhance the wilderness characteristic and aesthetic values of the creeks and canyons within the Aliso and Wood Canyons Wilderness Park.
    - Minimize human intervention and man-made structures in the creeks and the Wilderness Park
    - Any necessary structures should be consistent with the natural setting and aesthetics of the Wilderness Park, using native materials and vegetation as possible
    - Rehabilitate existing grade control structures (e.g., ACWHEP structure)
7. **Sustainability** – Maintain infrastructure services, preserve natural resources and Wilderness Park values, and improve ecosystem functions in the long-term for future generations.
    - Use self-sustaining, low maintenance systems where possible
    - Provide systems that are resilient to episodic and long-term trends and natural disturbances, such as large flood events
    - Provide solutions that are suitable and/or adaptable to potential future reductions in urban runoff from the watershed as a result of implementing stormwater BMPs
    - Accommodate and plan for climate change and accelerated future sea level rise at the creek mouth.

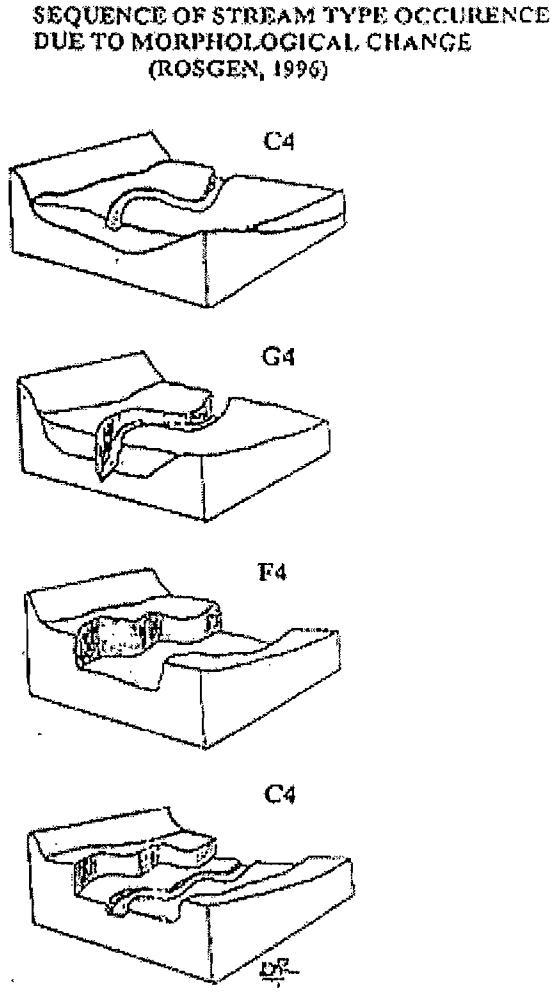
3. A PRIMER ON EQUILIBRIUM CHANNEL GRADIENT, CHANNEL EVOLUTION, AND CHANNEL STABILIZATION AND RESTORATION

In our review of the Corps Study and the SUPER Project, and in our discussion of the field reconnaissance a key point will be to question what the equilibrium gradient of Aliso Creek is (also referred to as the stable gradient). Because this technical question has significant implications for the recommended action to stabilize Aliso Creek, and because this memo is intended to help inform a wide group of stakeholders, it is useful to start with a primer on equilibrium gradient, how channels respond to urbanization in the watershed, and the different stabilization and restoration approaches that can be taken.

The equilibrium gradient of a creek channel is the gradient which is just steep enough for the water delivered by the watershed to transport the incoming sediment load delivered by the watershed. If water, sediment and channel gradient are in balance the creek will transport its sediment load and neither incise into its bed or aggrade (deposit surplus sediment on its bed). A channel with an equilibrium gradient will be vertically stable, though it may still migrate laterally by meandering. If the channel is steeper than equilibrium gradient the water will be able to transport more sediment than the watershed delivers, and the creek will erode its bed to get back into balance. This will eventually flatten the channel gradient, bringing the channel into equilibrium. If the channel is flatter than equilibrium gradient the water will not be able to transport all the sediment delivered by the watershed, and surplus sediment will be deposited in the channel. This sediment build up will eventually steepen the gradient, bringing the channel into equilibrium.

Because of these two self regulating mechanisms, natural creek channels reach stable gradient over time so that their gradient transports the mixture of sediment and water load delivered by the watershed. Urbanization disturbs this natural balance by increasing water (due to an increase in impermeable surfaces and the loss of infiltrating soil areas) and reducing sediment delivery (due to hardscape and erosion control). The usual channel response is for the channel to incise, reducing channel gradient to a new equilibrium that is flatter than the original condition. This incision process undercuts the creek banks and causes extensive erosion, destruction of channel habitat, disconnection and drying out of the old floodplain, and damage to infrastructure if it is located nearby. The process of incising the channel to the new, flatter stable gradient can take many decades, with disruption occurring throughout this period. Eventually however a channel will reach a new stable gradient that is in equilibrium with the changed water and sediment balance delivered by the watershed. As this point is approached the rate of bank erosion will slow and bank material will be deposited and reworked on a new floodplain that forms around the channel. There are several conceptual models that describe this in similar ways, including those of Schumm et al. (1984), Simon and Hupp (1986) and Rosgen (1996). We include the diagram of Rosgen below since this closely resembles the appearance of Aliso Creek.

Figure 1. Typical pattern of channel incision and widening (Rosgen, 1996, after Schumm, 1984)



Undisturbed
This is analogous to the pattern we can see looking upstream of Pacific Park Drive with a well connected, densely vegetated floodplain and a non-incised creek.

Incising
This is the situation that would have existed during the 1970s and 1980s as the creek downcut in response to urbanization, but before much widening occurred.

Widening
This is the situation through parts of the Aliso and Wood Canyons Wilderness Park, especially immediately downstream of the ACWHEP structure.

Recovering and New Floodplain Creation
This is the situation starting to occur upstream of the ACWHEP structure and the CTP Bridge through much of the Wilderness Park.

When a creek is still eroding, creek restoration and stabilization plans can take four different approaches, or a combination of the four:

1. **Stabilize bed and banks of the creek in its current configuration using grade control and bank hardening**
   Benefits – prevents future erosion if performed successfully
   Disadvantages – expensive, high impact to existing creek habitat, 'fossilizes' creek and floodplain in an unstable condition, lowest level of natural functions following project, not much resilience and severe consequences if structures fail during a large flood event

Typical Application - most appropriate for highly unstable creeks that are a long way from natural recovery and where loss of land adjacent to the creek would be unacceptable (e.g. where urban development goes to the creek bank)

2. **Accelerate recovery by regrading the channel and banks to their eventual equilibrium gradient and condition**
   Benefits – rapidly brings creek to a sustainable condition where it can function naturally, highest final quality of habitat, resilient in the face of large flood events
   Disadvantages – high initial cost and moderate to high initial impact to habitat from excavating floodplain and banks, requires a lot of land around the creek
   Typical Application - most appropriate where there is available undeveloped land around the creek, or where the creek is close to natural recovery
3. **Build creek bed back up to pre-disturbance elevation and stabilize in place using drop structures**
   Benefits – rapidly restores creek and floodplain connectivity leading to the widest possible floodplain with relatively natural stream physical and habitat functions, stabilizes high banks and buries exposed utilities, relatively resilient in the face of large flood events
   Disadvantages – high initial cost and highest initial impact to habitat from filling existing channel and floodplain, relies upon drop structures for stability
   Typical Application - most appropriate where the creek is still incising, where re-grading the banks is not feasible, and where upstream fish migration is critical
4. **Move vulnerable utilities out of the creek corridor and allow the creek to reach its own equilibrium by natural erosion and floodplain creation**
   Benefits - brings creek to a sustainable condition where it can function naturally, avoids initial impact to habitat, naturally resilient in face of large flood events
   Disadvantages – may take a long time (decades) if creek is a long way from natural recovery, ongoing erosion and habitat damage during recovery, requires a lot of land around the creek, does not protect against future degradation due to future urbanization.
   Typical Application - most appropriate where the creek is starting to recover and where there is available undeveloped land around the creek

In developing any of these approaches it is critical to correctly estimate the channel's equilibrium gradient. If the estimated design gradient is too steep the creek will continue to incise, undercutting the new channel and threatening the success of the project. If the estimated gradient is too flat the channel will aggrade, which tends to accelerate lateral channel migration and bank erosion. In addition, selecting too flat a design gradient will require an unnecessarily large number of step or drop structures. Since structures are typically expensive and have a large construction footprint this is both a waste of resources and an unnecessary impact on the channel and riparian corridor. If the channel has already reached stable gradient no additional bed structures will be needed, and adding structures in such cases would create unnecessary impacts. Because stable gradient is such a critical design parameter to channel stabilization we tend to use multiple lines of evidence to estimate it. These include field evidence, empirical equations and sediment transport equations. The typical field approach is to select a stable reference reach anchored by a downstream grade control structure and measure the gradient until a knickpoint is reached.

4. SUMMARY OF ALISO CREEK STABILIZATION PROJECTS

The Corps' Aliso Creek Watershed Management Report, Feasibility Phase (USACE 2002) and Orange County's Aliso Creek Draft SUPER Project Conceptual Plan (OC Watersheds 2007) are summarized below.

4.1 Differences between the Corps Study and the SUPER Project

The Corps Study has produced a Feasibility Report for a Watershed Management Plan, whereas the SUPER Project report is a conceptual plan report. As a Feasibility Report, the Corps Study has gathered and evaluated a very wide menu of potential project elements and conducted a relatively coarse scale assessment of their feasibility and appropriateness to the problem described. Based on that assessment some potential project elements and approaches have been rejected from further analysis, while others have been recommended for more detailed analysis, refinement and potentially design. Typically a Feasibility Report will be followed by a Conceptual Report that is more prescriptive and presents a smaller number of more detailed alternatives along with design drawings that show in general where project elements will be constructed (e.g. approximate extent and depth of grading; number, approximate location and approximate scale of structures such as bank protection and grade control; approximate cross sections and specifications for features). A Conceptual Report is typically followed by a Preliminary Report that refines the placement and specifications of those measures selected in the preferred alternative to a level that allows permitting, culminating in a Final Design which is used for project construction.

The SUPER Project Plan is a Conceptual Plan commissioned by the County of Orange Resources and Development Management Department (RDMD). As a conceptual plan it is further along the design process than the Corps Study. It has identified a smaller number of specific approaches and refined them to the point of producing conceptual level design drawings that show the approximate layout and extent of features, along with their approximate cost. It has then identified a preferred alternative to be carried forwards to preliminary and final design.

The two projects cover much of the same ground: they both develop potential approaches to stabilizing Aliso Creek, they have overlapping sponsors, and common technical consultants in Tetra Tech, Inc. The

SUPER project appears to have been developed in an effort to move the key aspects of the Corps project further along the planning process.

4.2 USACE Aliso Creek Watershed Management Study

We have reviewed the Aliso Creek Watershed Management Study, Orange County, CA – Watershed Management Report, Feasibility Phase published in 2002 by the US Army Corps of Engineers Los Angeles District. We focused primarily on the creek stabilization plan and water quality plan.

The Corps Study has identified a number of watershed problems, opportunities and solutions (see USACE, 2002 pages 1-3 and 1-4). Primarily the study identifies channel degradation, migration and erosion as the processes driving of a series of related problems including drying and loss of habitat on the former floodplain, loss of aquatic and riparian habitat and the expansion of non-native species, reduced recreation experience and opportunities, and damage to structures. In addition it identified poor water quality and flood damage as problems, related to high water volumes from the watershed, damage to sewers and thermal pollution from drop structures.

The Corps Study project goal is to "improve environmental and economic conditions in the Aliso Creek watershed and to reestablish a stable, healthy and sustainable watershed environment." (page 1-4). These goals were broken down into a series of planning objectives: "reverse channel degradation in lower watershed, improve aquatic habitat, improve surface water quality, restore floodplain moisture, restore wetland and riparian habitat, reduce flood inundation damages, reduce erosion damages, remove invasive species, and reduce impacts to existing recreation opportunities" (page 1-4).

The Study recommends a series of Watershed Management Plan Components (Table 1.1, page 1-5) to address these problems and meet the project goals. The major components include stabilization of lower and middle Aliso Creek with what the report refers to as "riffle structures" and side regrading, floodplain and riparian habitat restoration, off channel aquatic and riparian habitat restoration, as well as a series of smaller site specific restoration actions in Sulphur Creek, Wood Canyon Creek, English Canyon and Pacific Park. The Study also recommends water quality wetlands in Dairy Fork and English Canyon to address the water quality goals, invert stabilization at the CTP Bridge, limited bank stabilization and spot fixes along English Canyon, and flood proofing of the Aliso Creek Inn. Finally, the Study recommends a watershed education plan for non-point source pollution, monitoring of water quality, and watershed-wide removal of exotics.

A key conclusion of the Corps Study is that "study of the Aliso Creek mainstem indicates that the slope of the creek is over-steepened for an equilibrium condition" (page 9-24), indicating that the channel has not adjusted to reach a stable gradient. The study suggests that the equilibrium gradient is 0.15% (0.0015 feet of drop per foot of horizontal distance). The primary evidence for this is the measured channel gradient from what is referred to as a stable reference reach immediately upstream of the ACWHEP structure, backed up by a sediment transport analysis using the USACE sediment transport model SAM. The assessment that the current channel is steeper than equilibrium gradient leads to the conclusion that the creek is likely to experience further downcutting and bank erosion in future. As a consequence, the study recommends construction of a series of structures to stabilize the bed at a flatter angle.

The structural approach recommended is described in the Corps Study as "riffle-pool structures". This term is a little misleading since riffle-pool sequences are very different from the proposed structures in terms of particle size, spacing, geometry and visual appearance. Riffle-pool sequences are relatively subtle topographically and visually and have a specific spacing and size that is related to channel width (riffles are typically found approximately every 6 channel widths, and for a channel the size of Aliso Creek typically lower the channel elevation by a few inches or a foot over 10-20 feet). The proposed structures in the Corps Study consist of 4 foot drops constructed from rip rap, with stilling basins constructed from articulated concrete and a spacing of every 2,300 feet. Similar features are more usually referred to as boulder step-pools or roughened channels.

The study discusses allowing the creek to continue eroding until it reaches equilibrium gradient without intervention, but rejects this approach, stating "non structural stabilization is not recommended for future study (page 9-32).

4.3 Draft Aliso Creek SUPER Project Concept Plan Report Summary

We have reviewed the Draft Aliso Creek SUPER Project Concept Plan Report produced by Tetra Tech, Inc. in February 2007.

The SUPER Project concept was commissioned by the County of Orange Resources and Development Management Department (RDMD). The concept report focuses on channel stabilization and water quality treatment at the mouth of Aliso Creek, along with what it terms "terrestrial restoration", although this appears primarily to be riparian restoration. It is more detailed and focused than the Corps Study, as one would expect from a conceptual plan compared to a feasibility study. It describes three stream stability alternatives, and three water quality alternatives, before recommending preferred project alternatives for both goals.

The report starts with a stream stability assessment. This reviews evidence for up to 20 feet of channel incision and a doubling of channel width between 1971 and 1998, with increasing incision occurring with increasing distance upstream of the two grade control structures (the CTP Bridge crossing and the ACWHEP structure). The report describes the incision and bank erosion in Aliso Creek in the framework of a conceptual model for disturbed creeks developed by Schumm at al. (1984) (described on page 8 of this memo). This model is widely applicable to disturbed creeks in California and from our reconnaissance appears well suited to Aliso Creek.

The report states that "Based on observations during the field visit, the channel incision process is still in its early stages and will continue into the future." (page 12). This conclusion is based on a discussion of equilibrium gradient. The report describes finding a stable channel reference reach immediately upstream of the ACWHEP structure. The report states that, though formerly a dispositional reach this has now formed a channel and is stable. The gradient of this reach is given as approximately 0.15%, and is used as the assumed equilibrium gradient for the creek in the project reach. By comparison the current channel between the CTP Bridge and the ACWHEP structure is stated as 0.35%. The report states that taking the difference between these two gradients over the length of the reach gives a vertical difference of 20 feet immediately downstream of the ACWHEP structure, which would be the anticipated amount of future incision under existing watershed conditions. (Note that we calculate the potential for 27 feet of additional incision at the base of the ACWHEP structure or 23 feet at the base of the toe rip rap based on the difference between the existing 0.35% slope and a 0.15% slope, rather than 20 feet as reported for the SUPER Project.) Such incision would trigger large increases in channel widening, further threatening the utilities in the creek corridor. Eventually this widening would create a negative feedback loop and reduce excess erosive energy in the channel, leading to a new floodplain development and a stable channel, though with considerable erosion and impact to the existing utilities during the process.

The report lays out three stabilization plans to prevent future channel erosion and to bring the channel back into connection with its former floodplain. These all involve the construction of grade control structures that will raise the bed of the creek as a series of steps between the CTP Bridge and the ACWHEP structure, so that at the upstream end of the steps the channel will connect to the top of the ACWHEP structure. This will allow fish passage (currently impossible due to the height and the water velocities over the ACWHEP structure) and will bring the channel back into close vertical proximity to the original floodplain, recreating inundation, increasing moisture content and restoring riparian conditions. Filling the channel through a series of steps will also reduce the heights of the stream banks, reducing erosion risk and reducing the risk to utilities. The three grade control alternatives were:

1. Eight 6-foot grade control structures between the CTP Bridge and the ACWHEP structure, with two additional 6-foot grade control structures downstream of the Aliso and Sulphur Creek confluence. The grade control structures will consist of 15-foot deep soil cement structures (effectively buried dykes) that span the creek from the AWMA Road to the maintenance road, a 120-foot long by 3-foot thick grouted rock ramp to carry flow (width not stated but shown as

approximately 100 feet on plans) and a 60-foot long by 5-foot deep grouted rock stilling basin. The channel bank on either edge of the rock ramp would be constructed from articulated concrete. This alternative will involve backfilling the creek between the CTP Bridge and the ACWHEP structure (~9,300 feet), and laying back the banks upstream of the ACWHEP structure.

2. Eleven 6-foot grade control structures between the CTP Bridge and the AWMA Road Bridge. The grade control structures will consist of 15-foot deep soil cement structures (effectively buried dykes) that span the creek from the AWMA Road to the maintenance road, a 120-foot long by 3-foot thick grouted rock ramp to carry flow (width not stated but shown as approximately 100 feet on plans) and a 60-foot long by 5-foot deep grouted rock stilling basin. The channel bank on either edge of the rock ramp would be constructed from articulated concrete. This alternative will involve backfilling the creek between the CTP Bridge and the ACWHEP structure (~9,300 feet), and laying back the banks upstream of the ACWHEP structure.
3. ***Preferred SUPER Project alternative.*** Twenty four 2-foot grade control structures between the CTP Bridge and the ACWHEP structure, with two additional 6-foot structures downstream of the Aliso and Sulphur Creek confluence. The 2-foot drop structures will consist of 10-foot deep soil cement structures (effectively buried dykes) that span the creek from the AWMA Road to the maintenance road. The 2-foot drop structure dimensions are not given for Alternative 3 but we can infer that they will be 40-feet long by 3-feet thick grouted rock ramp to carry flow (width not stated but presumably around 50 feet) and a 30-foot long by 3-foot deep grouted rock stilling basin. The channel bank on either edge of the rock ramp would be constructed from articulated concrete. This alternative will involve backfilling the creek between the CTP Bridge and the ACWHEP structure (~9,300 feet), and laying back the banks upstream of the ACWHEP structure.

Associated with the three grade control alternatives are two utility protection alternatives.

A) Locking the low flow channel in place with toe rock and soil wraps (presumably biodegradable fabric pillows) directly forming the channel banks from the CTP Bridge to the AWMA Bridge (3.2 miles). The rock would be 2 feet above ground with 5 feet below grade to allow for scour. The soil wraps would be 3 feet above the rock. This option would not allow the creek to migrate.

B) ***Preferred SUPER Project alternative.*** Burying a rock barrier alongside the maintenance road on the east side of the creek from the CTP Bridge to Alicia Parkway (3 miles). This option allows the creek to migrate laterally. If it migrates into the road it will expose the buried rock, preventing further migration.

The preferred alternative in the report is Alternative 3B – filling approximately 9,000 feet of channel and floodplain, stabilizing the channel with twenty four 2-foot grade control structures and two 6-foot grade control structures, and placing 3 miles of buried rock to protect the utility and maintenance road. Alternative 3 is recommended by the report because the 2-foot structures are more sustainable (less prone to erosion and outflanking), have better hydraulic characteristics in floods, are less sensitive to changes in equilibrium channel gradient if the watershed changes, require less bank protection and are more accommodating of fish passage. No rationale appears to be presented for Alternative B over Alternative A.

The final portion of the report addresses water quality. The focus of the report is on high bacteria levels that result in beach closures at Aliso Beach during the summer dry weather period. Three water quality alternatives were put forward:

1. *Treat for Total Suspended Solids (TSS) and divert to outfall 1.5 miles offshore.* This option would intercept all summer flows before they reached the beach, treat them for TSS and pump them to the ocean. There are various regulatory and technical obstacles involved in placing additional flows into the outfall. It is not stated in the report, but it appears that this option would dewater the creek between the treatment facility and the beach during the summer.
2. ***Preferred SUPER Project Alternative*** *- Treat for TSS and bacteria and return to creek.* This option would treat water and then return it to the creek. This would avoid some of the technical problems with Alternative 1. A potential problem is water being contaminated between the return point and the beach, for example by bird feces.
3. *Treat for TSS and bacteria and reuse.* This option would treat the water and then reuse if for irrigation. The main problem with this alternative is that treated water produced by the CTP is currently not used – there is more supply than demand for reused water. It is therefore unlikely that water produced by the new facility would be used. There would also be significant regulatory hurdles due to the consumptive reuse of water. Finally, though not stated, it is assumed that this alternative would dewater the creek between the treatment facility and the ocean.

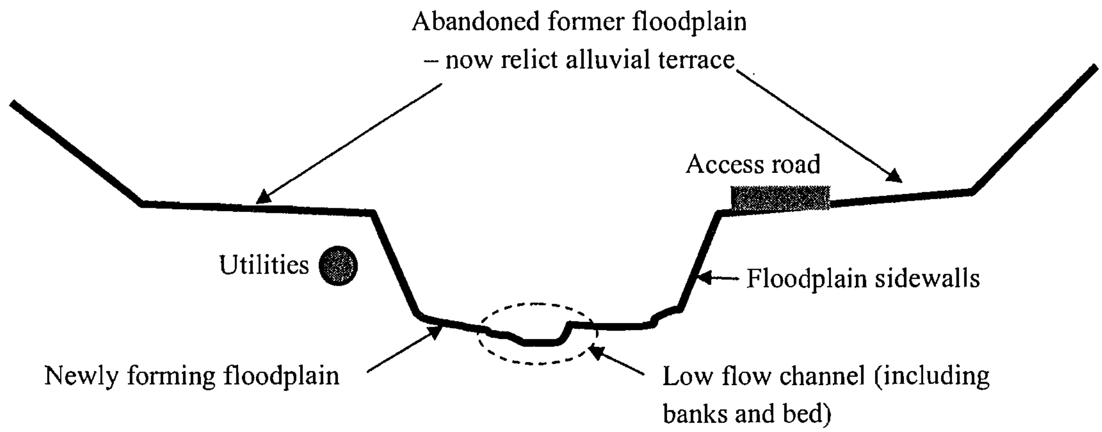
Based on the assessment, Water Quality Alternative 2 was selected by the report for more detailed design.

5. PWA FIELD GEOMORPHIC RECONNAISSANCE

A reconnaissance was conducted on May 15th 2009 by PWA staff Andrew Collison, Ph.D. and Nick Garrity, P.E. The reconnaissance started with visits to overlooks at Pacific Park Drive bridge and along Alicia Parkway, before proceeding down the AWMA Access Road through Aliso and Wood Canyons Wilderness Park. From the AWMA Road we were able to gain access to the creek banks and bed in several locations between the AWMA Bridge and the CTP. We were also able to walk up and down the creek bed around the Wood Canyon Creek confluence to examine its geomorphic form. During the site visit water was occupying the low flow channel (approximately 3-4 cfs upstream of the CTP).

Before discussing our findings it is important to recognize the limitations of a one day field reconnaissance. Creeks, especially in areas such as southern California, exhibit dynamic conditions that can include cycles of erosion and deposition on different time scales ranging from hours to millennia. Geomorphologists are taught to piece together lines of field evidence and reach conclusions about longer term functions and channel evolution from site visits, but also to recognize that static observations of creek form can overlook trends. We provide our observations of Aliso Creek recognizing this limitation. It is also important to be clear in using terminology. The schematic below (looking downstream) shows how we use the terms bank, channel and terrace when describing erosion and deposition.

Figure 2. Terminology used to describe Aliso Creek



We interpret Aliso Creek's form between the AMWA Road bridge and the CTP Bridge as follows: In the last few decades the channel of Aliso Creek appears to have deeply incised into its former floodplain, and widened, leaving the floodplain abandoned above the new active flow area to form a relict alluvial terrace. Between the edges of the terrace the channel has started to create a new floodplain, by migrating from side to side and laterally eroding into the toe of the alluvial terrace to create floodplain sidewalls. These sidewalls are steep, mostly unvegetated and appear to be actively eroding through scour at the toe and mass failure (landslides or slumps) above. This process of erosion and slumping has broken utility pipes and undercut the road in several places. The Corps Study and the SUPER Project documents state that approximately 20 feet of incision has taken place and the field evidence supports this.

A key question is the rate and likely future evolution of these geomorphic features. Based on our field observations, we expect the floodplain sidewalls to continue to erode and retreat away from the channel, widening and forming new floodplain in their place. Evidence for this comes from the very steep nature of large sections of sidewall, the absence of vegetation in many places and the presence of tension cracks along the top edge of the sidewalls. These factors suggest that the sidewalls are still actively failing and have not yet reached an equilibrium gradient at which they will self stabilize provided they are not subjected to further toe erosion. We think that further erosion of these slopes is likely in future, and that infrastructure located on the terrace (the access road and the utilities) is at risk in its current location.

We believe that there is ambiguity over how close the channel is to equilibrium gradient, and hence uncertainty over how much future incision is likely. Throughout the study area the low flow channel appears to be non-incised, with a new floodplain forming. The floodplain is covered with recently deposited sand and is vegetated by trees that appear to be up to around 10 years old, indicating that the current channel bed has not incised for at least 10 years. The overall channel planform is meandering. In the reaches where we gained access we observed some reaches which had a riffle-pool form and others where there were mid-channel sand bars. In both cases the low flow channel was shallow, had a relatively high width:depth ratio and little evidence of scour. Vegetation occupied the point bars and there was little elevation difference between floodplain vegetation and the low flow channel. Riffle-pool formation is generally viewed as evidence for a vertically-stable channel that is in sediment transport equilibrium (i.e. incoming sediment load is approximately matched by outgoing sediment load, with no net erosion or deposition). Mid channel bar formation is generally viewed as evidence for a depositing channel (one where more sediment enters the reach than leaves it). Neither form is compatible with an actively incising channel. Similarly, a well connected vegetated floodplain with vegetation touching the low flow water level is also evidence of a stable or depositional channel. In actively incising channels the bed tends to be deeper relative to its width, the channel tends to be free of vegetation, there is not evidence for sediment deposition on the floodplain and new floodplain formation does not take place. Incising channels are often relatively straight rather than meandering.

The field evidence suggests that for the last ten years at least (as evidenced by the age of the floodplain trees), the channel has been vertically stable or slightly aggradational. This observation is consistent with the actively eroding floodplain sidewalls: aggrading systems tend to exhibit more rapid rates of lateral migration and bank erosion as sedimentation and vegetation establishment on point bars promotes meander migration.

As stated at the beginning of this section, it is important to note that there can be cycles of stability or deposition during periods when the long term trend is towards erosion. It is possible that we have observed evidence of such a short term cycle reflecting a pause in the vertical channel erosion process. However, there is also evidence in the Corps and SUPER Project reports to suggest that incision may be close to its limits (see discussion below).

6. TECHNICAL REVIEW OF CORPS AND SUPER PROJECT REPORTS

Based on our review and field reconnaissance we have come to many of the same conclusions as the two reports discussed in this memo. We agree that Aliso Creek is deeply incised, that it is actively widening, that this widening is likely to continue in future, and that this poses a significant threat to the road and utility pipelines in their current locations. We concur that incision has resulted in an abandoned floodplain terrace that has dried out and lost its riparian functions and habitat. We also concur that Aliso Creek's equilibrium gradient has been flattened from its historic gradient due to urbanization of the watershed. In places where the existing gradient is significantly steeper than the stable gradient, we agree that stabilizing the bed using step-pool structures or roughened channels is a measure that should be considered by future stages of any stabilization or restoration plan to prevent further channel degradation and infrastructure threats.

However, there are a number of areas where the proposed project could be improved to be more sustainable and resilient, have a lower environmental impact, and potentially be less expensive. We also believe that some alternatives have been eliminated from further consideration without sufficient analysis.

6.1 Selection of the Correct Equilibrium Gradient

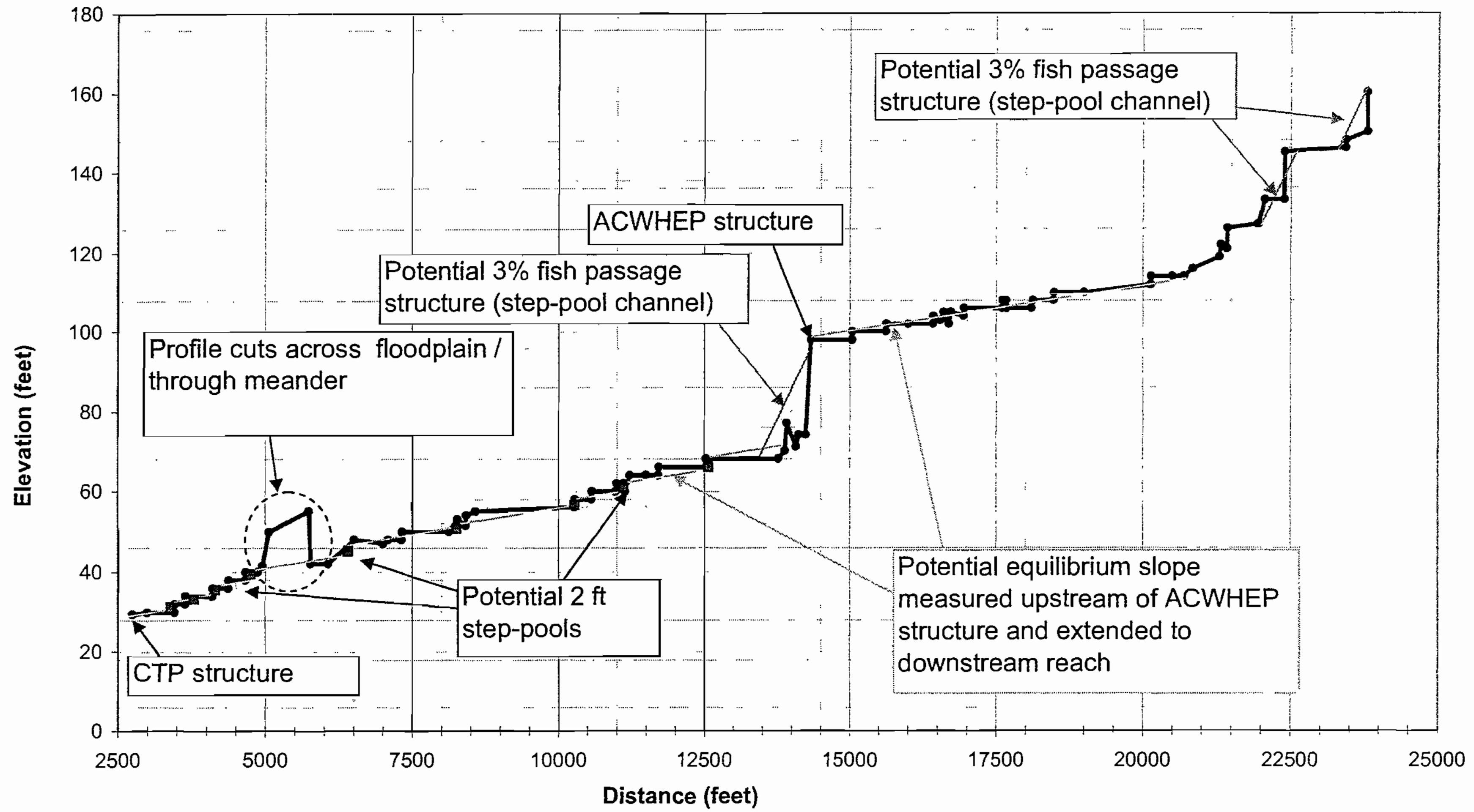
As stated in the introductory primer, if an incorrect equilibrium gradient is selected for the design then incorrect assumptions will be made about how far the creek is from reaching stability, what the best method of reaching stability is, and the design and number of structures (if any) needed to reach stability. Both reports reach conclusions based heavily on the assessment of equilibrium gradient from a single reference reach, the few hundred feet upstream of the ACWHEP structure. Our field reconnaissance suggested that this reach is a backwater due to the ACWHEP structure intruding into the flow, causing ponding upstream (see Figure 3). Thus it is likely flatter than the true equilibrium gradient, which should be a slope that transports sediment rather than causes it to deposit. Use of an artificially low design gradient will result in an unnecessarily large number or height of drop structures, and associated impact and cost from construction. It also has the potential to trigger accelerated channel lateral migration and aggravate existing bank erosion problems.

Our field reconnaissance suggests that most of the channel bed between the CTP bridge and the ranger station downstream of the AWMA Road Bridge is vertically stable (subject to the caveats stated above). We have transferred the SUPER Project long profile into MS Excel to examine the gradient in different reaches. The gradient for the reach approximately 5,000 feet upstream of the ACWHEP structure is around 0.23% (see Figure 4). This includes (and extends beyond) the stable reference reach noted by the Corps Feasibility Report and SUPER Project report. We note that the SUPER Project did not plan to stabilize this 5,000 foot reach, suggesting that that report's authors also considered this reach to be in equilibrium. If the gradient for the channel 5,000 feet upstream of the ACWHEP structure is taken as the equilibrium gradient and applied to the downstream reach between the CTP bridge and the ACWHEP structure it can be seen that most of this reach is also closer to equilibrium gradient than the Corps Study and SUPER Project reports suggest (see Figure 4). This indicates that the amount of future incision and grade control structures required to prevent further incision may be less than estimated for the Corps Study and SUPER Project (i.e., 27 ft of incision calculated for the Corps Study and SUPER Project versus 18 ft of incision calculated for our estimate of equilibrium gradient). Bringing the existing gradient to the 0.23% level would require nine 2-foot drop structures (or three 6-foot structures) in the main body of the Wilderness Park (shown in Figure 4), instead of the twenty four 2-ft structures (equivalent to eight 6-ft structures) proposed in the SUPER Project report. The two 6-foot structures close to Sulphur Creek proposed by the SUPER Project report would still be required since this section is unquestionably steeper than equilibrium gradient. The projected incision downstream of the AWMA Road bridge is more serious (approximately 40 feet of incision potential downstream, which could undermine the bridge and road) and as such should be stabilized.

The proposed design of the grade control structures and Corps "riffles" leans towards a heavily engineered approach. There may be potential to use non-grouted boulder structures for the 2-foot drops, which will allow better soil placement and greater vegetation growth between rocks. Non-grouted boulders which can settle are also more resilient than grouted structures, which tend to crack if undercut or if settling occurs (which requires maintenance). More detailed hydraulic analysis (beyond the scope of this memo) would be needed to determine the stresses imposed by floods in Aliso Creek and from this determine whether a less heavily engineered approach would be sufficiently resistant. We concur with the SUPER Project report that, where grade control is needed, multiple 2-foot drop structures are preferable to fewer 6-foot drop structures because 2-foot structures are subjected to less hydraulic stress, are more resilient, and can be less heavily engineered (smaller rock, less need for grout, etc.).

Although more analysis is needed to identify the correct equilibrium channel gradient, it appears likely that the channel could be vertically stabilized with many fewer grade control structures than currently proposed.

Figure 3. View upstream of the ACWHEP structure showing the reach used as a reference reach for equilibrium gradient by the SUPER Project and Corps Study. The reach appears to be depositional rather than in equilibrium.



Source: Long profile data from TetraTech
Note: profile shows hypothetical 2-foot drops used to maintain equilibrium gradient between the CTP and ACWHEP structures

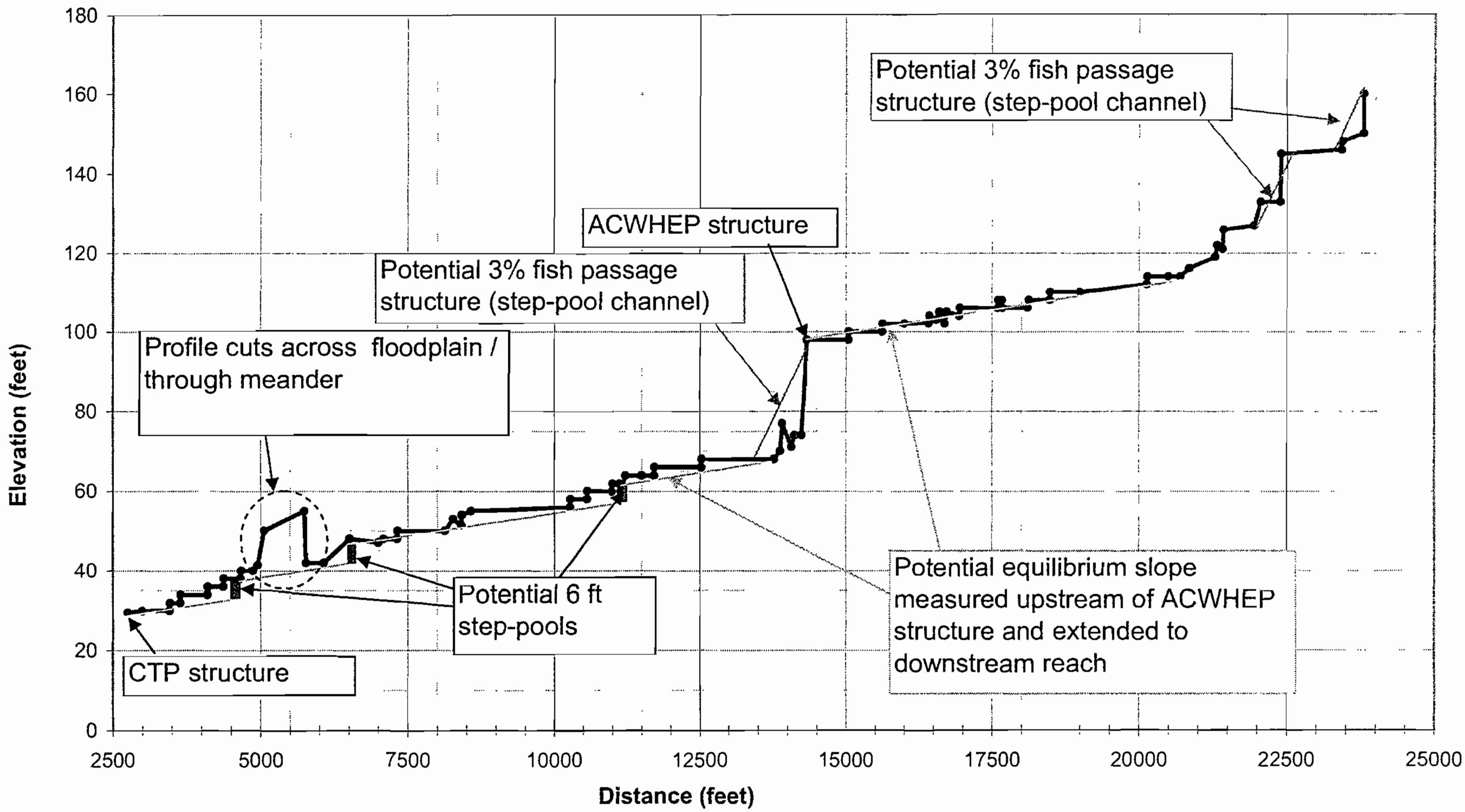
figure 4a
Aliso Creek Review

Aliso Creek Long Profile with 2-ft Step-Pools

PWA Ref #: 1977

PWA

Copy of Fig3_Existing_Channel_gradient-rev3.xls / Profile (2)



Source: Long profile data from TetraTech
Note: profile shows hypothetical 6-foot drops used to maintain equilibrium gradient between the CTP and ACWHEP structures

figure 4b
Aliso Creek Review

Aliso Creek Long Profile with 6-ft Step-Pools

PWA Ref #: 1977

PWA

Copy of Fig3_Existing_Channel_gradient-rev3.xls / Profile (6)

6.2 Channel Cut and Fill

Channel fill is proposed by the Corps and SUPER Reports to bring the channel back into equilibrium with its former floodplain, to stabilize the banks and to meet fish passage objectives. The extent of this fill is substantial: 9,300 feet in length, occupying the entire channel and new valley floor, with a depth of almost 30 feet at the ACWHEP structure. It would destroy all the riparian and aquatic habitat in the area between the ACWHEP structure and a point 2000 feet upstream of the CTP Bridge (approximately 21 acres of channel and floodplain). The structures required to secure this fill would be heavily engineered, covering 1,700 feet of channel in grouted rip rap (14% of the total channel length in the reach between the CTP Bridge and the ACWHEP Structure, or approximately 3.8 acres of channel and floodplain habitat).

We agree that this approach is worthy of consideration as a project alternative because of the area of floodplain it restores and the bank stability benefits. However, there is a heavy impact associated with both the fill and the structures required to maintain the channel at its former valley gradient. An alternative would be to stabilize the channel bed at its current elevation (using the additional structures as described above), pull the road and utilities back from the bank edge, and either allow the floodplain sidewalls to erode until they reach equilibrium or proactively re-grade them in advance. Relocating the infrastructure and allowing the channel to reach equilibrium (or assisting this process by regrading the banks while leaving the channel undisturbed) has two advantages over the proposed alternatives in the SUPER Project. Firstly, it minimizes impact to the newly emerging floodplain and channel habitat in the Aliso Wilderness Park. Secondly, it will allow an equilibrium system to self-form. Such a system is likely to be more resilient to large flood events than a system that is kept out of equilibrium using hardscape, require less long-term maintenance, and function and appear more natural.

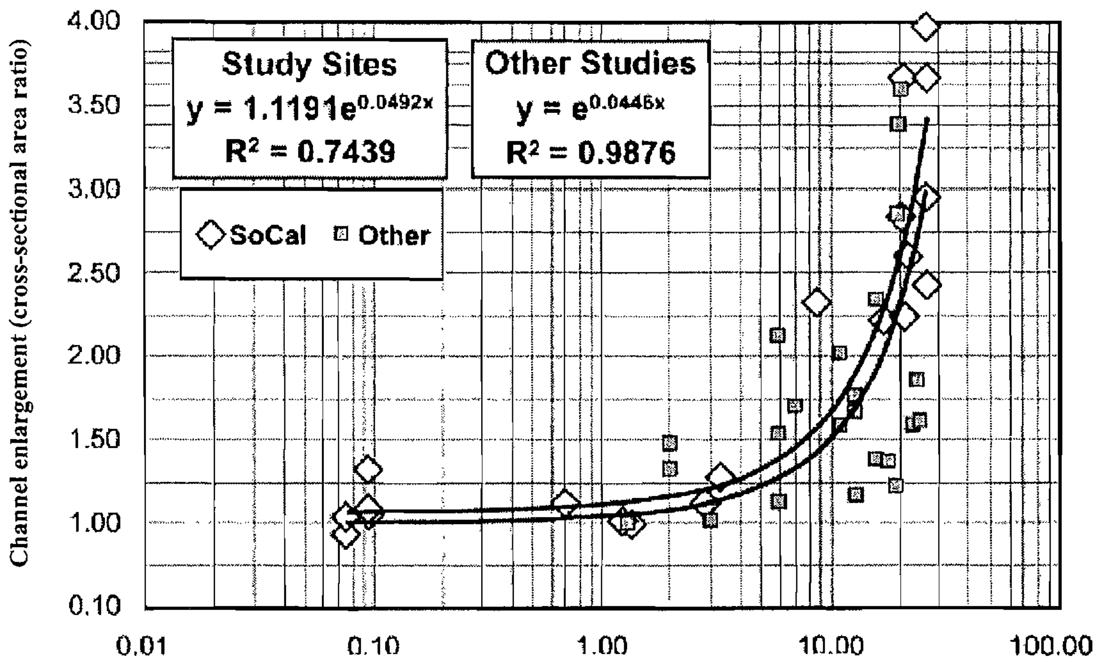
6.3 Potential to Manage Stormwater Runoff to Preserve and Stabilize Aliso Creek

The underlying cause of erosion in Aliso Creek is the increase in the peak and frequency of runoff from the watershed due to urbanization, and the reduction in sediment supply creating so called "hungry water." This process is often referred to as hydromodification. In theory, if the watershed could be retrofitted to mimic the pre-urban natural hydrograph the erosion potential in Aliso Creek could be reduced to pre–urban levels. This would reduce, but not eliminate, the need for utility protection measures in the creek. It would reduce the erosion capacity of flows that occur in the 0.5- to 10-year frequency (which are responsible for most of the erosion in a creek) to pre-development levels. This would create a steeper equilibrium gradient (requiring fewer if any structures to stabilize the gradient) and less bank erosion. It would not eliminate the need for utility protection measures because the creek has already incised, creating a more vulnerable system that can be eroded at lower flows (compared to pre-development conditions).

Mimicking the natural hydrograph would require a Hydrograph Modification Management Plan (HMP). An HMP is planned for Orange County as part of its MS4 Permit application to the Regional Water Quality Control Board. Based on HMPs developed for other counties, it will likely require new developments to mimic the pre-development hydrograph for flows that cause most creek erosion using a combination of Low Impact Development (LID) approaches and detention basins. LID focuses on infiltrating stormwater to reduce the volume of runoff, while detention basins store peak flows and release them at non-erosive rates. The challenge for Aliso Creek is that the watershed is already 74% urbanized, so hydromodification has already occurred. Most HMPs exempt already-developed areas from significant measures. A typical HMP will allow re-development or infill to occur provided that the net impervious area is not increased.

A stormwater retrofit program could be set up to develop an HMP for an urban area such as the Aliso Creek watershed. Although quantitative analysis would be required that was beyond the scope of this project, there are methods to calculate the amount of stormwater control that would be needed to have a measurable effect on the level of erosion in Aliso Creek. Figure 5 shows the relationship between impervious area (expressed as a percentage of the watershed area) and channel enlargement resulting from increased runoff from impervious areas, which provides a rough approximation of the required amount of stormwater control. This relationship shows that the effective impervious area in the watershed would need to be reduce to below 10% (i.e., control runoff from all but 10% of the watershed area) to sustain the pre-development channel size and associated equilibrium gradient. The reduction in effective impervious area that would be required to control runoff to the point where the existing channel gradient would be stable would be even greater because Aliso Creek is already greatly incised (which confines flood flows within the channel compare to pre-development conditions) and is sediment starved.

Figure 5. Channel enlargement curve for Southern California streams (Coleman and others 2005). The curve shows the relationship between effective impervious area in a watershed and channel enlargement or erosion.



Based on the reasons outlined above and our literature review and field reconnaissance, using upstream stormwater control to reduce downstream erosion to the point that fewer structures would be needed would be challenging owing to the highly built out nature of the watershed, the dense development pattern, and the relative lack of flat open space areas for infiltration and detention of water. We therefore advise the City to have realistic expectations of what is achievable through a retrofit program. However, it is very much in the City's interests to make sure that future development does not make the situation worse, and to incrementally reduce the amount of uncontrolled runoff in the watershed when opportunities present themselves (e.g. when redevelopment of a site occurs, or through voluntary programs for homeowners).

6.4 Effect on Aliso Beach and Coastal Sediment Processes

Based on our review of the SUPER Project Draft Concept Plan Report, the conceptual-level discussion of the potential influence of the SUPER Project on Aliso Beach and adjacent beaches appears to be adequate for existing and recent historic conditions. (Note that we have not reviewed the source documents referenced in the SUPER Project Report discussion to confirm the information presented.) However, the SUPER Project assessment does not address three key points:

1. **Storm Recovery**: recent research (Revell and Griggs, 2007; Revel et al, 2007) has shown that many California beaches fluctuate in response to somewhat cyclical climatic changes, and sand supply following erosive conditions greatly affects beach recovery and potential damages to coastal communities;
2. **Regional Sand Management**: contemporary practice is focused on maintaining and increasing delivery of sand to California beaches (http://www.dbw.ca.gov/CSMW/smp.aspx);
3. **Climate change and sea level rise**: we will need more sand in the future to maintain beaches with higher sea level, and higher sea level will change the creek profile in the lower reaches (Pacific Institute, 2009; PWA, 2009).

Overall, the wave-driven, longshore sand transport on the Orange County coast appears to be supply-limited. Climatic conditions such as El Nios can result in erosion of the sand deposits in the Orange County coves, inducing offshore transport to depths difficult for smaller, typical waves to move the sand back to shore. Once eroded, the coves are dependent upon longshore transport to recover. Therefore, the sand discharge from Aliso Creek is very important to the system in terms of providing sand following erosive events. If the delivery of sand from Aliso Creek to Aliso Beach is reduced by stabilizing the creek, the beaches will take longer to recover, causing impacts to the beach ecology and increasing erosion and flooding risks, and reduction in recreational opportunities.

It is therefore important that discussions of sediment management in Aliso Creek take into consideration a wider watershed sediment management context that includes the coastal zone (the "sandshed" approach).

It is also important that this approach incorporates changing conditions including sea-level change. Sea level rise is expected to accelerate in the next 100 years. The coast will then likely erode, and beaches will tend to transgress upwards and inland depending on sediment supply and the erosive characteristics of the back beach areas. If there is not sufficient sediment delivered by coastal watersheds (and if it is not delivered fast enough) and/or if the back beach is erosion resistant, beaches will be "squeezed" between rising sea and inland barriers and "drowned." This will have major adverse effects to ecology and water quality, as well as increase coastal erosion and flooding hazards and reduce recreational opportunities. The stream gradients in the lower reaches will also flatten. Overall, greater quantities of sand will be needed in future. Therefore, the sand in the Aliso Creek system should be viewed in a wider context as a local and regional resource that should not be "locked in place" to stabilize the creek. It is important that the design should be resilient within a moving frame of reference that includes factors such as sea level change.

6.5 Water Quality

We agree that the SUPER Project's "end-of-pipe" approach to treat dry weather flows for TSS and bacteria, and return flows to the creek, may be effective in reducing bacteria levels in ocean receiving waters and beach closures. This approach would not remove dissolved metal, nutrients, oil and grease, and pesticides, which are not considered as treatment priorities by the SUPER Project.

Treatment at the creek mouth would not improve water quality for beneficial uses of Aliso Creek, including wildlife habitat. The restored floodplain habitats proposed by the SUPER Project may provide some ancillary water quality treatment functions during wet weather flows: however, the SUPER Project does not evaluate the potential benefit.

Runoff treatment wetlands, in conjunction with stormwater source control measures, may provide an alternative or supplemental approach to the "end-of-pipe" treatment proposed for the SUPER Project. Treatment wetlands can reduce the concentrations of multiple pollutant constituents, including metals, nutrients, TSS, and bacteria in both dry and wet weather flows (SCCWRP 2008). Multipurpose wetlands can provide both treatment and habitat functions.

The Corps Feasibility Report recommended measures throughout the watershed to improve water quality, including stormwater treatment BMPs (e.g., on-site biofiltration/infiltration) and water quality treatment wetlands. Water quality enhancement project planning and implementation in the watershed has continued since the 2002 Corps Feasibility Report, driven in part by the 2001 directive from the San Diego Regional Water Quality Control Board (RWQCB) for an investigation of urban runoff in the Aliso Creek watershed. Attachment 2 contains an Aliso Creek Watershed Project List (April 2009) provided by OC Watersheds that includes information on water quality enhancement projects, and a previous table of planned water quality enhancements from the October 2003 Aliso Creek Watershed Tenth Quarterly Report to the San Diego RWQCB (County of Orange and others 2003). An evaluation of the effectiveness of water quality enhancement projects recently implemented in the watershed is outside the scope of our review. We recommend this evaluation to inform the need and appropriate balance between additional water quality treatment measures in the watershed and at the creek mouth.

7. POTENTIAL ALTERNATIVES AND ASSESSMENT OF THE EXISTING ALTERNATIVES

We recommend that the possible alternative creek stabilization approaches discussed above, as well as additional possible alternatives or project elements, be fully considered in the Corps Study (i.e., for the DEIS/DEIR) and the SUPER Project. These possible alternatives are summarized below in Section 7.1 and compared to the City's goals in Section 7.2. We recommend further development and evaluation of these alternatives in future phases of both the Corps Study and SUPER Project.

7.1 Possible Additional Project Alternatives To Evaluate

1. Preserve existing channel and floodplain. An alternative in which the minimum number of drop structures is used to stabilize the creek bed should be fully considered. For example, as discussed in Section 6.1, our review suggests that this alternative could be achieved by using nine 2-foot drop structures or three 6-foot structures to achieve a stable gradient of 0.23% between the CTP bridge and ACWHEP structure. This alternative would minimize impacts to existing channel and floodplain habitats and reduce construction costs.

2. Non-grouted boulder grade control structures. As discussed in Section 6.1, there may be the potential to use non-grouted boulder structures for 2-foot drop structures. Non-grouted structures allow better soil placement and greater vegetation growth between rocks. This type of structure is likely to improve habitat conditions and natural aesthetics. The Dougherty Valley Stream Restoration provides an example of non-grouted boulder grade control structures and the alternative to re-grade the floodplain sidewalls discussed below (see PWA project summary included in Attachment 3).

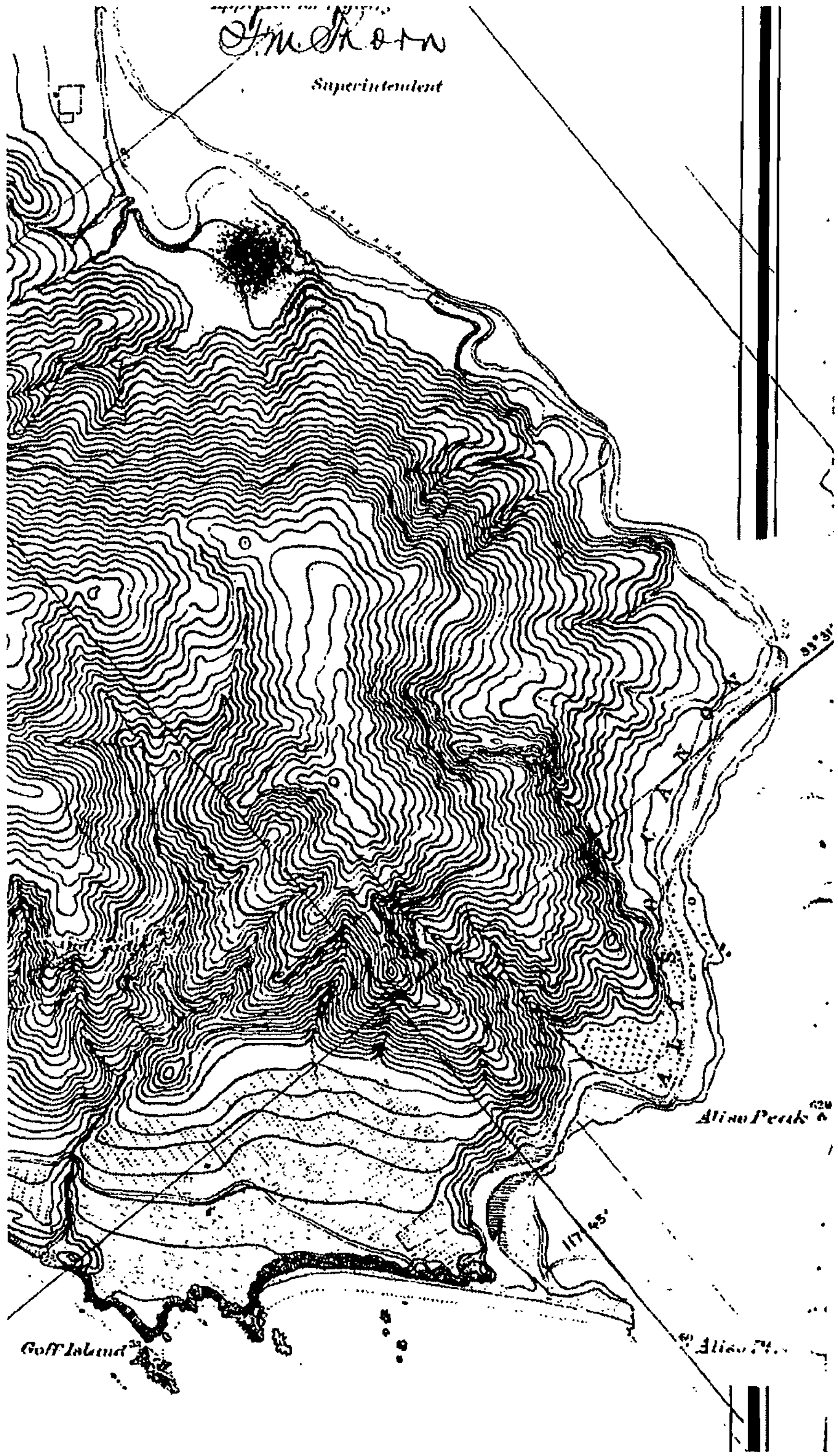
3. Re-grade the floodplain sidewalls or allow them to erode. An equilibrium condition for the floodplain width and sidewall slopes could be achieved by either allowing the floodplain sidewalls to erode, thereby expanding the existing floodplain, or by re-grading the sidewalls to stable slopes and planting the slopes. This alternative could be accomplished in conjunction with an alternative to relocate infrastructure as described below. This alternative would avoid impacting the newly emerging floodplain and channel habitat in the Wilderness Park. It would allow an equilibrium system to self-form, which would be more consistent with Wilderness Park and aesthetic values and more resilient to large flood events (thereby requiring less long-term maintenance). Allowing the sidewalls to erode would preserve the existing trend of sand transport and delivery to the beach.

4. Relocate infrastructure. Relocating infrastructure away from the floodplain sidewalls may eliminate or reduce the need to protect the infrastructure in place. Replacing portions of the water/wastewater utility pipelines may be desirable due to infrastructure aging and capacity issues (e.g., replacing the two SOCWA 4" sludge force mains with one larger pipe per M. Dunbar, SCWD, pers. comm.) In one alternative, a new or improved road on the eastern side of the creek over the utility pipelines could be used for access to the CTP (M. Dunbar, SCWD, pers. comm.). This alternative would have the advantage of separating access to the CTP (currently provided by AWMA Rd.) from public access along AWMA Rd. A second alternative may involve moving the utility pipelines to the western side of the creek (M. Dunbar, SCWD, pers. comm.). Either alternative should consider setting back access roads and utility pipelines farther from the floodplain sidewalls than the current locations of AWMA Rd. (western side) and utility pipelines (eastern side) to allow room for erosion or re-grading of the sidewalls. Setback distances should be determined from a plan for stabilizing the sidewalls or an assessment of sidewall erosion and equilibrium condition.

5. Boulder step-pool structures below ACWHEP structure and AWMA Rd. Bridge. Boulder step-pool channel reaches could be constructed below the ACHWEP structure and AWMA Rd. Bridge to provide fish passage over these structures. For example, a 1,000-ft long boulder step-pool and fill structures could be constructed at a 3% grade below each structure.

6. Upstream measures to reduce urban stormwater runoff and pollutants. These measures could include BMPs and low impact development approaches in the watershed including infiltration (where geotechnical conditions allow), detention basins, water quality treatment wetlands, and other measures. These measures could be implemented by opportunistically retrofitting stormwater systems, and by incorporating these measures in future development and re-development. For example, the Corps Study may present the opportunity to retrofit the large parking lot for the Chet Holifield Federal Building along Alicia Parkway in Laguna Niguel.

7. Estuarine lagoon restoration. The Corps Study offers the opportunity to restore an estuarine lagoon at the mouth of Aliso Creek. Figure 6 shows a historic map of the lagoon from 1885. The historic map suggests that the lagoon may have consisted of un-vegetated open water and sand shoals. The Aliso Beach overflow parking lot appears to be built on the lagoon's historic flood shoal. Presumably, the historic creek mouth was only intermittently open during high creek flow and/or high coastal water level and large wave events, as the tidal flow through the lagoon inlet (tidal prism) may be low relative to longshore sand transport and deposition in the inlet. Restoring an area of lagoon habitat has the potential to keep the inlet open for longer periods of time. The Crissy Field Lagoon Restoration and Carmel River Lagoon Enhancement are examples of lagoon restoration projects (see PWA project summaries included in Attachment 3).



Source: USCGS, 1885

figure 6

Aliso Creek Stabilization Project Review

1885 Historic Map of Lower Aliso Creek

PWA Ref #: 1977

PWA

7.2 Assessment of SUPER Project and Possible Alternatives relative to the City of Laguna Beach's Goals

Table 1 compares the SUPER Project and the possible alternatives/project elements we recommend for consideration relative to the City of Laguna Beach's project goals described in Section 2. The Corps Study has proposed potential project measures or elements, but has yet to develop any alternatives and is therefore not included in the comparison.

Table 1. Comparison of SUPER Project and Recommended Possible Alternatives/Project Elements.

	Water Quality Improvement – Bacteria	Water Quality Improvement – Other Pollutants	Urban Runoff Reduction	Infrastructure Protection	Erosion Control/Sediment Mgmt. – Creek Erosion Control	Erosion Control/Sediment Mgmt. – Beach Sediment Management	Ecosystem Recovery	Wilderness Park Preservation and Enhancement	Sustainability
SUPER Project	+			+	+	-	+/-*	-	-
1. Preserve existing channel and floodplain					+	+	+	+	+
2. Non-grouted boulder grade control structures					+		+	+	+
3. Relocate infrastructure				+				+	+
4. Re-grade/allow erosion of floodplain sidewalls					+	+	+	+	+
5. Boulder step-pool structures							+		
6. Upstream measures to reduce urban runoff	+	+	+						
7. Estuarine lagoon restoration							+		
Combination of recommended alternatives/elements	+	+	+	+	+	+	+	+	+

Legend:

+ Meets City's goals and objectives
- Conflicts with City's goals and objectives

Goals and objectives that are not addressed by an alternative are left blank

*Note that the SUPER Project would impact existing channel and floodplain habitat in order to restore floodplain habitat.

8. ADDITIONAL ANALYSES TO BE PERFORMED

The following analyses would provide a greater degree of certainty to evaluate both the Corps and SUPER Project approaches and the alternatives that we have provided.

1. *Equilibrium channel gradient analysis*
   This is a key task that needs to be performed before any of the alternatives are taken to a higher level of design. A thalweg profile should be surveyed that encompasses the deepest part of the channel bottom, with points taken t least every 100 feet and wherever a break in channel gradient (such as a headcut or riffle-pool sequence) is visible. The long profile should be conducted by a geomorphologist and should be accompanied by a geomorphic assessment of the channel conditions so that the gradient can be related to features indicating channel stability or instability. The channel profile should be extended from the CTP Bridge to the AWMA Bridge. The product should be an assessment of the equilibrium channel gradient.
2. *Sediment transport assessment of equilibrium channel gradient*
   A sediment transport model should be set up to identify future erosion and deposition zones in the channel. Ideally the model should be calibrated if bedload samples are available or can be monitored in future winters.
3. *Reassessment of channel profile stabilization needs*
   Based on the revised equilibrium gradient assessment and sediment transport model, the channel profile should be reexamined to determine whether the stability goals can be met with fewer structures.
4. *Sandshed sediment budget and management plan*
   A more detailed assessment of beach sediment dynamics and the extent to which beaches in Orange County are dependent on sand supplied from Aliso Creek would allow planners to assess the potential significance of changing sediment supply on beach stability. This analysis should account for projected sea level rise.
5. *Upstream Flow Reduction Analysis*
   A continuous hydrologic simulation may be performed to estimate the amount of runoff that would need to be controlled to significantly reduce channel erosion, and the area of detention or infiltration facilities that would be required to achieve this. This will give the City a sense of the feasibility of retrofitting areas to achieve stormwater control.

9. REFERENCES

California State Sediment Master Plan, California Sediment Management Workgroup, http://www.dbw.ca.gov/CSMW/smp.aspx

Coleman, D., C. MacRae, and E. D. Stein, 2005. Effect of Increases in Peak Flows and Imperviousness on the Morphology of Southern California Streams. Southern California Coastal Water Research Project Technical Report 450. April.

County of Orange, Orange County Flood Control District, City of Aliso Viejo, City of Laguna Beach, City of Laguna Hills, City of Laguna Niguel, City of Laguna Woods, City of Lake Forest, City of Mission Viejo, 2003. San Diego Regional Water Quality Control Board Directive Issued Pursuant to California Water Code Section 13225, Aliso Creek Watershed, Tenth Quarterly Progress Report. October 31.

County of Orange Resources and Development Management Department Watershed and Coastal Resources Division (OC Watersheds), 2007. Draft Aliso Creek SUPER Project Concept Plan Report. Prepared by Tetra Tech, Inc. February. http://www.ocwatersheds.com/WMAs/default.aspx?ID=1055

Dunbar, Mike. South Coast Water District (SCWD), General Manager. Personal communication to Lisa Marks and Scott Sebastian, May 19, 2009. Documented by Lisa Marks in "Sewage Pipes in Aliso Creek – Summary of conversation between Mike Dunbar, Lisa Marks, and Scott Sebastian – May 19, 2009"

Pacific Institute, 2009; The Impacts of Sea Level Rise on the California Coast, Funded by the California Energy Commission, California State Department of Transportation, and the Ocean Protection Council http://www.pacinst.org/reports/sea_level_rise/index.htm.

PWA, 2009, California Coastal Erosion Response to Sea Level Rise, Prepared for the Pacific Institute with funding from the Ocean Protection Council, May, 2009 http://www.pwa-ltd.com/about/about_news.html#OPC_Report.

Revell, D.L. and G.B. Griggs. (2007). Regional Shoreline and Beach Changes in the Santa Barbara Sandshed. In *Coastal Sediments 2007.*ASCE New Orleans, LA May 2007. pg 1740-1753.

Revell, D. L., Dugan, J.E., Hubbard, D.M., 2007. Physical and Ecological Responses of Sandy Beaches to the 1997-98 El Niño. *Journal of Coastal Research.*

Rosgen, D.L. (1996). Applied River Morphology.

SCCWRP (Southern California Coastal Water Research Project), 2008. Habitat Value and Treatment Effectiveness of Freshwater Urban Wetlands, Final Report to Los Angeles Regional Water Quality Control Board for the Assessment of Effectiveness of Treatment Wetlands for Stormwater BMPs and Compatibility with Wildlife Beneficial Uses. Prepared by M. Sutula, J. Brown, and E. Fetscher, SCCWRP; M. Mattson, Aspen Environmental, Inc.; S. Madon, G. Santolo, and E. Bryon, CH2MHill, Inc.; and C. Stransky, Nautilus Environmental, Inc. Technical Report 559.

Schumm, S.A., M. D. Harvey, and C. C. Watson, 1984. Incised Channels: Morphology, Dynamics, and Control.

Simon, A. and C. R. Hupp, 1986. Channel Evolution in Modified Tennessee Channels. Proceedings of the Fourth Federal Interagency Sedimentation Conference March 24-27, 1986, Las Vegas, Nevada. Volume II. 1986. p 5-71 to 5-82, 5 fig, 3 tab, 11 ref.

U. S. Army Corps of Engineers (USACE) Los Angeles District, 2002. Aliso Creek Watershed Management Study, Orange County, CA, Watershed Management Report Feasibility Phase. October. http://www.ocwatersheds.com/WMAs/default.aspx?ID=1055

USCGS (U. S. Coast and Geodetic Survey), 1885. Topography of Part of Coast Between Newport Bay and San Juan Capistrano, California.

10. LIST OF PREPARERS

The following PWA staff assisted in preparation of this document:

Andrew Collison, Ph.D., Principal
Nick Garrity, P.E., Senior Associate
Bob Battalio, P.E., Principal
Setenay Bozkurt, Associate

11. LIST OF ATTACHMENTS

Attachment 1. PWA Scope of Work
Attachment 2. OC Watersheds' Aliso Creek Watershed Project List – April 2009 and Table 3.1 Planned Water Quality Enhancements from the October 2003 Aliso Creek Watershed Tenth Quarterly Report to the San Diego RWQCB. (County of Orange and others 2003)
Attachment 3. PWA project summaries as examples of alternatives to be considered.

Attachment 1. **Aliso Creek Stabilization Project Review**
Philip Williams & Associates, Ltd. (PWA)
April 23, 2009 – revised May 12, 2009

SCOPE OF WORK

PWA will complete the following scope of work. PWA will use the City's Consultant Scope of Work, attached as Appendix A, for guidance.

Task 1. Review Project Documentation

PWA will review readily-available existing documentation on the Aliso Creek stabilization project, which may include:

- Aliso Creek Watershed Management Feasibility Study (USACE 1999)
- Aliso Creek SUPER Project Conceptual Plan Report Draft and Draft Appendices (OC Watersheds 2007)
- Aliso Creek Watershed Management Plan (USACE and Orange County).

Task 2. Site Visit and Meetings

PWA project staff (Nicholas Garrity, P.E. and Andrew Collison, Ph.D.) will visit the Project site to perform a reconnaissance assessment of creek conditions and erosion within the Aliso Creek stabilization project study area. We will identify the scale of erosion, verify likely causes, and compare the specific proposed project elements with on-site conditions. PWA staff will also participate in two meetings:

- One meeting with USACE and Orange County staff to refine our understanding of the proposed Aliso Creek stabilization project
- One meeting with City representatives, expected to occur following submittal of PWA's Draft Project Review and Comments Memorandum (from Task 4) to the City.

Deliverable*: Site visit and two meetings.*

Task 3. Refine Project Goals and Objectives

PWA will assist the City to refine the draft project goals and objectives included in the RFP, which are creek and ocean water quality improvement, water quantity management, and the preservation and enhancement of the Wilderness Park. PWA will provide a revised statement of project goals for review and comment by the City. PWA will revise the goals statement in response to comments. PWA will use these goals as a basis of evaluating the Aliso Creek stabilization project and will include the goals statement in the Project Review and Comments Memorandum (Task 4).

Deliverable*: Draft and revised goals statement.*

Task 4. Project Review and Comments Memorandum

PWA will review and comment on the Aliso Creek stabilization project and the technical basis of the plan. We will evaluate how the current project meets and/or conflicts with the City's goals (from Task 3). We will also identify any major potential environmental impacts related to project hydrology.

PWA will identify potential conceptual alternatives and/or refinements to the project that meet the City's goals for the project (from Task 3), which may include:

- Upstream measures to reduce urban stormwater runoff, and associated pollutants, in lower Aliso Creek and restore a more natural hydrologic regime. Measures may include detention basins and/or distributed runoff infiltration swales;
- Realignment of existing infrastructure away from the creek corridor;
- Biotechnical approaches to creek stabilization, such as plantings;
- Alternative design of control structures that stabilize creek incision and act as elevation-drop structures that mimic step-pool sequences in natural rivers.

We will briefly describe conceptual alternatives and refinements, their benefits, and feasibility considerations, using examples from other projects as appropriate. We will compare how the potential conceptual alternatives identified and the current project are expected to perform with respect to the City's goals.

We will review the technical basis for the current Aliso Creek stabilization project (i.e., technical hydrology, hydraulics, and channel stability analyses performed to develop the plan). If appropriate, we may also recommend additional technical analyses to support a more in-depth review of the project and more detailed descriptions of alternatives and refinements.

We will document our review and comments in a Project Review and Comments Memorandum, and will provide this memo to the City for its use and submittal to the USACE, Orange County, and/or others. This memo will be up to approximately 10 pages in length. We will provide a draft of the memo for City representatives to review and comment on. We will provide a revised final memorandum in response to comments.

Deliverable: *Draft and Final Project Review and Comments Memorandum.*

ATTACHMENTS

Appendix A. City's Consultant Scope of Work (to be used as guidance in performance of the above scope of work)

Attachment 1, Appendix A

Consultant Scope of Work

The Aliso Creek Wilderness Park is a tract of land owned by the County of Orange which is designated as open space and is open for public use. The Park has issues with erosion in the streambed which threaten buried and surface infrastructure. The County, with assistance from the Army Corps of Engineers, has concept plans for a project which will address the erosion in the Park and reduce bacteria levels at its discharge point at Aliso Beach. The Stabilization, Utility Protection and Environmental Restoration project, deemed SUPER, is entering the NEPA process at this time. The City of Laguna Beach has a vested interest in the project because Aliso Beach lies within the city limits and both the beach and the Park are important to locals and tourists.

The Consultant is expected to use professional judgment based on past experience and current practices within the field of ecosystem and stream restoration, including the most appropriate and enviromentally sensitive techniques and technologies available, to make impartial comments and suggestions as to how the ACOE concept plan and other concept alternatives to be developed by the Consultant will affect the City's interests within the Aliso Creek watershed. The Consultant's report will provide the basis for the City's EIS/EIR scoping comments the ACOE study (see NOI, Federal Registry, 4/9/09).

Consultant to develop a set of objectives for the City with regard to Aliso Creek including but not limited to:

1) Water Quality Improvement – Reduction of current high levels of bacteria and other pollutants which adversely affect the creek, the beach and ocean receiving waters.
2) Water Quantity Reduction – The best management of existing water quantities in flood and dry season conditions and the ways in which both of these may be reduced to the point where the estuary and native habitats can be reestablished.
3) Erosion Control – Management of creek bed erosion to maintain the balance between excessive incision and beach starvation.
4) Utility Protection – Utilities including pipelines, bridges, roads and other public property must be protected from damage or failure attributable to dry weather or flood flows in the creek.
5) Historical Ecosystem Function – The creek and canyon must be returned to conditions which support California native flora and fauna and promote ecosystem function reflective of its pre-developed state.
6) The Preservation and Enhancement of the Wilderness Park.

The consultant shall propose concepts that support the City's Objectives and evaluate the ACOE Concept plan with respect to its benefits, dis-benefits, its appropriateness to the conditions of the site, and its ability to adapt to changes in the up-stream water regime over time. Questions and issues to be considered in evaluating the alternatives, including the ACOE Concept Plan, may include, but are not limited to, the following:

1) Water Quality – Do the alternatives significantly improve water quality in the creek and at the beach? How much improvement could reasonably be expected and to what constituents will these improvements likely be related? To what extent will the improvements be realized in the

ocean? What alternatives should be explored by the alternatives to better meet the water quality objective?

2) Water Quantity – Do the alternatives adequately address dry and wet weather water quantity in the creek? Are there overlooked opportunities within the watershed to attenuate flows therefore reducing the need for flow related aspects of the alternatives? Do the alternatives represent the best management of the quantities of flow expected in dry and wet weather conditions?
3) Erosion Control – Do the alternatives adequately address erosion problems in the creek? Are the proposed mitigation measures likely to be successful? Are there alternative erosion control techniques which may better meet the goal of returning the creek to more natural erosive conditions?
4) Utility Protection – Will the alternatives meet the goal of infrastructure protection within the floodplain?
5) Historical Ecosystem Function – Do the alternatives reasonably approach ecosystem restoration in the creek? Are there other biologically diverse and self-maintaining ecosystems which are more likely to be achieved and which would also meet the City's Objectives?
6) Short-term Effects - Have the short-term effects of project construction activities on City objectives been adequately addressed ?
7) Long-term Costs and Maintenance – Have long-term costs been properly addressed in the alternatives? What costs need to be accounted for?
8) Are there other objectives the City should consider – has the City missed anything? Are there other missed opportunities which should be explored?

The Consultant shall prepare a memorandum detailing the findings of the project and alternatives review to be presented to the Laguna Beach City Council and City staff by May 29, 2009.

Attachment 2.

Aliso Creek Watershed Project List – April 2009

#[1]	Project	Scope	Project Lead/Agency	Comments
1	Aliso Creek Water Harvesting Project	Divert 0.8 MGD Aliso Creek water, for filtration, salts removal through RO or microfiltration process, and blend this water with the District's recycled water to lower the overall salt content.	Mike Dunbar, South Coast Water District (949) 499-4555	Working on permits and other approvals required. Anticipate project could be in place in 2008.
2	Coastal Treatment Plant Access Bridge Stabilization Project		Tom Rosales Brian Peck SOCWA	Completed
~~3~~	Rehabilitation of East Aliso Creek Emergency Sewer Project	Sludge force main to Regional plant	Bob Gumerman, MNWD (949) 643-2006	Project incorporated into Aliso Creek Water Quality SUPER Project.
4a	Middle Sulphur Creek Ecosystem Restoration	2,000 l.f. stream restoration project	USACE/City of Laguna Niguel	Ph. I completed Spring 2006. Ph. II Federal funding confirmed; work proceeding 2007.
4b	Orange Coast Watershed Center	8,000 s.f. learning center (proposed)	Marlene Brajedic, OC Parks Niguel Botanical Preserve	Partnership with OC Parks under development. Probable site is in Aliso Woods Canyon Wilderness Park.
5	Upper Sulphur Creek Restoration	1.7 mile stream restoration on HOA properties	Nancy Palmer, City of Laguna Niguel (949) 362-4384 USACE	Construction completed February 2006. See www.coastalconservancy.ca.gov/scwrp/Projects/2003-Project-Descrips.pdf
6	Wetland Capture and Treatment @ J03P02	3 treatment wetlands serving 0.9 sq. mi.	Nancy Palmer, City of Laguna Niguel (949) 362-4384	Completed - 2004
7	City of Laguna Niguel Narco Channel/Sulphur Creek Restoration (same as Narco Channel Water Quality Improvement Restoration)	800' stream restoration at flood channel	George Edwards, County of Orange, OC Watersheds Program (714) 955-0614 Nancy Palmer, City of Laguna Niguel (949) 362-4384	Construction under way Spring 2007. Planting completed in September 2007.
8	J01P28 Media Filter and UV Light Disinfection Treatment System.	Treats drainage from Aliso Town Center area.	George Edwards, County of Orange, OC Watersheds Program (714) 955-0614	County successfully repaired dissipation basin, refitted treatment facility components, and restarted the treatment facility in late June 2008. Basket strainer water supply modifications were made in late November 2008 to modify the wash system such that the

[1] *Projects marked with X were either combined into other projects or not implemented, see Comments*

#[1]	Project	Scope	Project Lead/Agency	Comments
				filtered water rather than pre-filtered water is used in the wash system. County to continue to evaluate performance and determine whether to implement basin pretreatment modifications or to continue to refine existing treatment facility components and operational practices.
9a	Wood Cyn. Stabilization & Restoration Project (spin-off of Aliso Creek Watershed Study)	Restore degraded riparian habitat along approximately 3.5 miles of Wood Canyon Creek and its tributaries, which flow into the Aliso Creek.	Zoila Finch, County of Orange, OC Watersheds Program 714-955-0618	Project will be incorporated in the Aliso Creek Watershed study being conducted by the USACE.
9b	Wood Canyon Emergent Wetland Project	Create wetland habitat using native riparian/wetland plant species to enhance habitat-support functions within an existing detention basin.	City of Aliso Viejo – Moy Yahya (949) 273-0272 John Whitman (949) 425-2530	City continues the implementation of a mitigation monitoring plan. The objective of the plan is to evaluate performance standards and the success of this project. Monitoring plan includes water quality testing and site observations of the plant and aquatic habitat species
10	Aliso Creek Mainstem Ecosystem Restoration Study		Zoila Finch, County of Orange, OC Watersheds Program 714-955-0618 USACE	The Corps is currently completing a number of technical studies: Hydrology & Hydraulics, Sediment Transport, Geotechnical, Environmental Resources, Economics, and Cultural Resources to finalize the baseline conditions analysis and move into the analysis of project alternatives. NEPA public scoping meeting will be held on May 7, 2009.
11	English Creek Aquatic Habitat Restoration Project	Aquatic and habitat restoration, slope stabilization and structural modifications to prevent scour at bridge crossings and at storm drain outfalls.	Mission Viejo Joe Ames (949) 470-8419. USACE – Kirk Brus (213) 452-3876	Total project value is estimated at $5.2 million. The Army Corps is currently writing the Detailed Project Report that will outline the chosen management measure for future design and construction. Estimated completion of the DPR: June 2009.
12	Streambank Stabilization		Bob Hill, El Toro Water District (949) 837-7050 x219	
13	Munger Sand Filter Water Quality Project	Upstream filtration	George Edwards, County of Orange OC Watersheds Program (714) 955-0614	Performance evaluation of the pilot scale system completed in March 2007. System presently inactive pending County decision on ultimate disposition of the presently undersized system.

Attachment 2.

#[1]	Project	Scope	Project Lead/Agency	Comments
14	Recreation Analysis for AWCWP & Aliso Beach (part of Aliso Creek Mainstem Project)			Project discontinued, incorporated into the Aliso Creek Mainstem Project.
15	Laguna Hills Wetlands at J05 (Aliso Hills Channel)	Constructed wetlands in J05 (Aliso Hills Channel) near Aliso Creek, and the western pond turtle habitat mitigation project as identified in the EIR for the Laguna Hills Community Center.	City of Laguna Hills Ken Rosenfield (949) 707-2650	Project has been completed.
16	Identification of Regional BMP Retrofitting Opportunities (Draft)	Study to determine possible sites and projects to mitigate against pollutants of concern within watersheds.	Richard Boon County of Orange OC Watersheds Program (714) 955-0670, Richard.Boon@rdmd.ocgov.com	Prepared by RBF Consulting, Inc.
17	Dairy Fork Bio-Filtration Basin	Flood Program	County Flood Control District	Grant not implemented.
18	ACWHEP Stabilization		Zoila Finch, County of Orange, OC Watersheds Program 714-955-0618	Project incorporated into Aliso Creek Water Quality SUPER Project
19	NROC Exotic Species Abatement & Bio-Monitoring Stations		Trish Smith, Irvine Ranch Land Trust	w/USGS
20	Vista Del Sol Debris Basin	Expand .08 acre flood control debris basin to .15 acre	Three Arch Bay Community Services District	Construct 3 to 9ft compacted fill berm, concrete spillway and grade 530 cu yards of material to increase volume of basin.
21	Aliso Creek Golf Course/ Montage Group	Golf course re-design, BMPs, bioswales, retention, streambank stabilization	Greg Vail, Athens Group 949-499-4794	
22	Prop 50 ET Controller Grants	Decrease urban runoff	Joe Berg, MWDOC (714) 593-5008	
23	Landscape Renewal Rebates (e.g, "Greenback")	Decrease urban runoff and pollution	City of Laguna Niguel City of Laguna Hills	Implementation of pollution prevention projects completed September 2006. Sulphur Solution Project final report was completed and submitted this quarter.
24	Sulfur Solution "Control" SubProject	Retrofit catch basins with screens to catch debris	City of Laguna Hills City of Laguna Niguel	Project completed – 258 catch basins retrofitted. Sulphur Solution Project final report was completed and submitted this quarter.
25	Alicia Parkway Median Island Landscape Rehabilitation Project	Conversion to low water use plants on Alicia Parkway Median Island from Moulton Pkwy. to Paseo De Valencia	City of Laguna Hills Ken Rosenfield (949) 707-2650	Project completed in Winter of 2007. Final Reporting shall be completed in early 2008. Sulphur Solution Project final report was completed and submitted this quarter.

#[1]	Project	Scope	Project Lead/Agency	Comments
26	El Toro Road Traffic and Landscape Project	Installation of a new hydrodynamic separator and retrofit catch basins with filter inserts.	City of Lake Forest Devin Slaven (949) 461-3436	
27	Prop 40 SmarTimer Edgescape Evaluation Project (SEEP)	Pollution reduction and water conservation via automatic irrigation controller rebate program and outreach/education	Watershed Cities, MWDOC, IRWD, and SWRCB. Steve Hedges, MWDOC (714) 593-5023	Pre-Monitoring started Spring 2007. BMP implementation at 23 sites, completing in April 2008. Post-monitoring beginning late May 2008 through August 2008.
28	El Toro Frontage Road Stormdrain Improvement Project	Installation of new stormdrain and five catch basin filter inserts	City of Lake Forest Devin Slaven (949) 461-3436	
29	CalFed Urban Runoff Evaluation Project	Evaluating BMPs Effectiveness to Reduce Volumes of Runoff and Improve the Quality of Runoff from Urban Environments	UC Cooperative Extension Darren L. Haver (714) 708-1613	Evaluation sites: Cities of: Aliso Viejo, Laguna Niguel, San Juan Capistrano.
30	El Toro Road Parkway Project	Conversion to low water use plants on El Toro Road median Island from Ave. de la Carlota to Regional Center Drive.	City of Laguna Hills Ken Rosenfield (949) 707-2650	Project to be completed by summer 2009.
31	Aliso Creek Water Quality SUPER (Stabilization, Utility Protection, Environmental Restoration) Project		Zoila Finch, County of Orange, OC Watersheds Program 714-955-0618	
32	Aliso and Wood Canyons Wilderness Park Resource Management Plan (AWCWP RMP)	AWCWP RMP – Establish general goals and specific long-range resource management policies necessary to protect, enhance, and perpetuate the resource values within the park. Elements include policies for managing and monitoring the park including a conceptual programmatic approach for water quality preservation and/or improvement.	County of Orange OCCR/ OC Parks Joanne Quirk	Draft RMP Responses to Comments being Prepared
33	Prop 13 SmarTimer evapotranspiration irrigation controllers within the J01P08 tributary area	The program promotes the retrofit of existing irrigation controllers with automatic "weather-smart" ET controllers through a rebate incentive.	City of Lake Forest, MWDOC, IRWD, and SWRCB	Letters were sent in December 2005 to individual homeowners, inviting them to participate in this rebate program. Monitoring was completed in December 2006. Findings include an approximately 10% participation (50 out of 500 homes) and a net decrease in runoff flow of

Attachment 2.

#[1]	Project	Scope	Project Lead/Agency	Comments
				approximately 55%.
34	Oso Parkway Landscape Improvements	This project will reduce runoff through landscaping, irrigation and the installation of a bio-swale. Water will be treated by the bio-swale and wetland basin.	City of Laguna Hills Ken Rosenfield (949) 707-2650	Construction of a drainage bio-swale, wetland, new landscaping, efficient irrigation

Attachment 2

Table 3.1
Planned Water Quality Enhancements

PROJECT NAME	Project Identified From		PROJECT SUMMARY	LEAD	ESTIMATED PROJECT COST	STATUS
Non-Structural Control						
Watershed Education Plan	205(j) Water Quality Planning Grant		Directed at improving water quality and environmental health through public education initiatives that demonstrate the cause and effect relationship of human behavior on the watershed and water quality.	County of Orange/PFRD & Watershed Cities	$75,000	Conceptual
Non-Point Source Public Awareness Plan	205(j) Water Quality Planning Grant		Directed at improving water quality and environmental health through efforts to increase public awareness about water quality problems, sources and solutions.	County of Orange/PFRD & Watershed Cities	$75,000	Conceptual
Environmental Interpretive Facility Along Sulphur Creek	Specific Interest		Environmental interpretive center along Sulphur Creek that will address watershed-wide issues and constituents of concern.	City of Laguna Niguel	up to $1,500,000	Pending
Structural Controls		**To Mitigate Impacts from**		Total for Non-Structural Controls	**> = $1,650,000**	
Dairy Fork Biofiltration Basin	205(j) Water Quality Planning Grant	J06	Project will create a series of three flow-through vegetated ponds each separated by large rocks to filter the outflow from the Dairy Fork storm drain (J06) before it enters Aliso Creek	County of Orange/PFRD & Watershed Cities	NA	Project is stopped due to denial of 401 certification
Munger Storm Drain Infiltration Basin	205(j) Water Quality Planning Grant	J01P01	Project will treat low nuisance flows from Munger storm drain as it enters Aliso Creek. The treatment system consists of an underground sand filter with 4 chambers to treat the low flows and will discharge the treated water back into Aliso Creek	County of Orange/PFRD & Watershed Cities	$630,000	Pending Grant Contract Approval
Laguna Hills Wetlands	Specific Interest	J01P04 to headwaters	Construction of a 1.0 acre wetlands within Aliso Creek to act as a biofilter.	City of Laguna Hills	$250,000	Construction Complete, now in maintenance
Laguna Hills Catch Basin Inserts	Specific Interest	J04P02, J04P03, J04P04	Installation of catch basin filters that will address debris, hydrocarbons, oils, sediment and potentially microorganisms .	City of Laguna Hills	$50,000	Installation Complete, now in maintenance program
Wetland Capture And Treatment (WetCAT) Network	Clean Up and Abatement Order 99-211	J03P02	Project will complete a low-flow inlet and piping system, parallel to the existing high-flow storm drains, which will divert virtually all gutter low flows into three constructed wetlands before releasing flows into the creek	City of Laguna Niguel	$375,000	Under construction
Sulphur Creek Aquatic Ecosystem Restoration Project	Army Corps of Engineers Study	J03P05, J03P01, J03TBN1, J03TBN2	Army Corps of Engineers Section 206 project to stabilize a 2000' length of Sulphur Creek.	City of Laguna Niguel and Army Corps of Engineers	$1,370,000	Approved
La Paz Park Mitigation Project	Specific Interest	Park drainage to Sulphur Ck	On and off-site mitigation project creating three vegetated swale/basins to treat water coming off the park	City of Laguna Niguel	$200,000	Monitoring
Catch Basin Retrofit Program	Specific Interest	J04, J03P01, J03TBN2	Retrofit of catchbasin trash grates and particulate/grease removal devices at commercial zones	City of Laguna Niguel	$92,400	Pending
Upper Sulphur Creek Restoration	Specific Interest	J03, J03TBN1, J03TBN2	V-ditch conversion to natural stream	City of Laguna Niguel	$928,000	Funding approved
Wetlands, Stormwater Separators and Low Flow Diversions	Specific Interest	Local drains	The Project will provide constraints and opportunities, direction, design, and construction of improvements to watershed tributaries to reduce pollutants from entering the storm drain system and outletting into Aliso Creek.	City of Lake Forest	$960,000	Under construction
English Canyon Channel Improvements	Specific Interest	J07P02	Repair extensive scour and prevent build-up of litter.	City of Mission Viejo	$85,000	Project Completed
Aliso Beach Project	Clean Beach Initiative	J01P28 and (second location to be defined)	Project will install a Clear Creek treatment system at two locations, at J01P28 and (second location to be defined) to treat creek water to REC 1 levels and for possible beneficial reuse	County of Orange/PFRD	$500,000	Construction of J01P28 CCS complete, now in maintenance
				Total for Structural Controls	**> = $5,440,400**	
				Total for Identified Projects	**> = $7,090,400**	

Attachment 3.

PWA
PROJECT SUMMARY

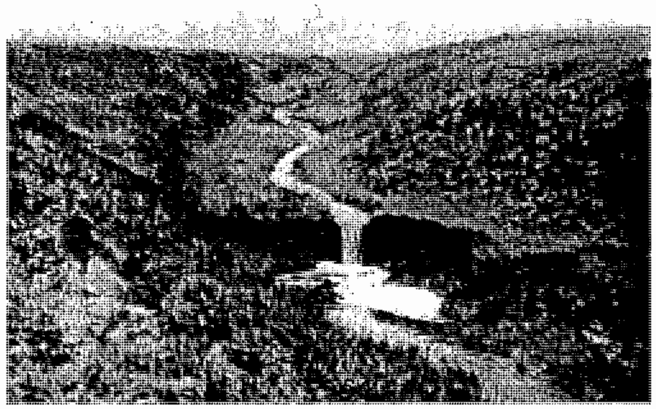
Dougherty Valley Stream Restoration

PWA designed a stream restoration for two miles of a severely incised reach of Alamo Creek and its eastern tributary, in coordination with a 6,000-acre residential development in Dougherty Valley. PWA provided detailed hydrologic and hydraulic analyses to determine existing and future flood flows from the site, assess development impacts and the effectiveness of proposed detention basins, and prepare restoration designs.

The restoration design involved enhancing 6,500 feet of Alamo Creek and relocating 3,500 feet of the eastern tributary. The design objectives were to provide geomorphic stability and re-establish riparian habitat. Elements of the design included floodplain grading, rock grade control structures, step pools, rock vanes and biotechnical stabilization structures. Design work occurred from conceptual through final design stages (plans, specifications and estimates). PWA provided full-time construction support throughout project implementation.

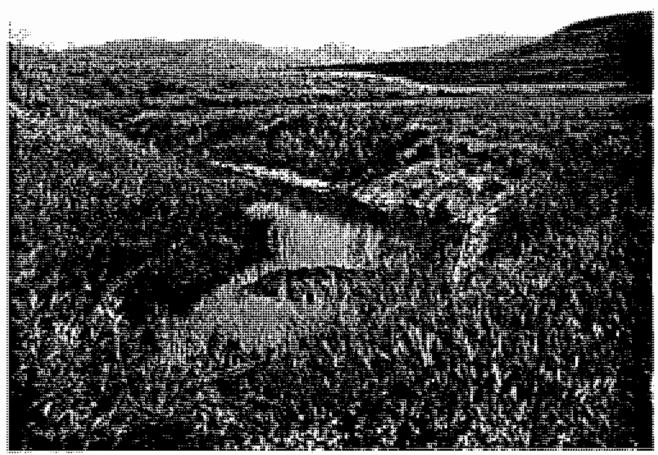
PWA also provided water quality best management practices design for the development. PWA performed hydraulic and hydrologic design and analysis for fourteen water quality detention basins that will capture storm water runoff from the development before discharging it into Alamo Creek and its tributaries. The extensive restoration of Alamo Creek and its tributaries is also expected to contribute to water quality by reducing sediment loads in the creek.

BEFORE



Main Branch Alamo Creek, Winter 1998

AFTER



Main Branch Alamo Creek, Spring 2002

Client: *Contra Costa County Public Works*
Project location: *Contra Costa County, California*
Period of Performance: *1996-2001*

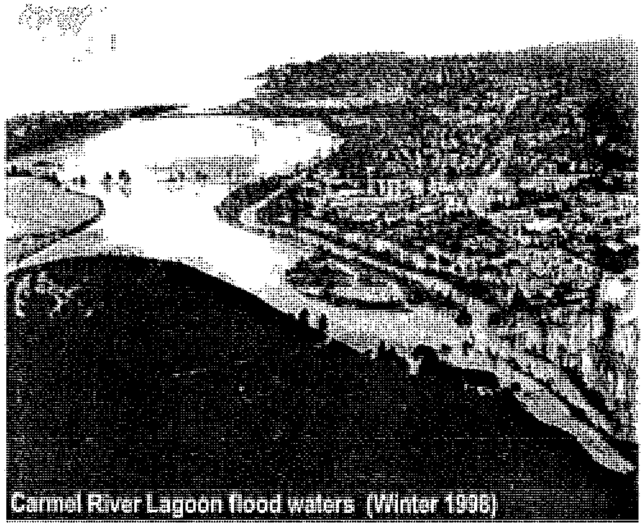
PHILIP WILLIAMS & ASSOCIATES
CONSULTANTS IN HYDROLOGY

Attachment 3

New south arm of Carmel River Lagoon under construction (Summer 2004)

PWA designed a 12-acre expansion of the remnant lagoon at the mouth of the Carmel River. The newly constructed lagoon extension will provide valuable habitat for endangered steelhead trout. The project also includes grading and planting 100-acres of former agricultural fields to re-establish natural floodplain function.

Project implementation in summer 2004 represents the culmination of 12 years of planning and project stewardship by PWA. Earlier planning work included developing conceptual alternatives, and evaluating these alternative using geomorphic assessment and two-dimensional hydraulic modeling. PWA has worked with California State Parks and Recreation Department, California Coastal Conservancy and other project stakeholders to reach consensus on the final implementation strategy for the site. PWA also prepared the engineering design documents and provided construction support.


Carmel River Lagoon flood waters (Winter 1998)

PWA has also developed a companion restoration plan for the 90-acre site just upstream. The proposed design for this project also involves levee removal and site grading to enhance floodplain connectivity and allow regeneration of riparian habitat. The combined projects will provide restored habitats along 2 miles of the lower Carmel River and lagoon.

Client: *California State Coastal Conservancy*
California Department of Parks & Recreation
Project location: *Carmel, California*
Period of Performance: *1992 - 2004*

PHILIP WILLIAMS & ASSOCIATES
CONSULTANTS IN HYDROLOGY

Attachment 3.

Sustainable Wetland Design at Crissy Field

PWA
PROJECT SUMMARY

Summary: This multi-objective project restored a 14-acre National Park System coastal lagoon. PWA designed, and routinely monitors, the site, which is largely influenced by wave-driven sand transport inside San Francisco Bay.

San Francisco's Crissy Field, once a 127-acre tidal marsh, was filled in during construction of the 1915 Panama Pacific International Exposition. It later became an airfield as part of the Presidio military installation. In the 1990s, Crissy Field was converted to a public waterfront park that features 14 acres of restored wetland. Since breaching in 1999, Crissy Field has evolved into a dynamic, in-bay coastal lagoon that serves as a focal point for visitors to the San Francisco Presidio.

The physical design of the wetland restoration was challenging. Unlike previous tidal wetland restoration projects around San Francisco Bay, large amounts of wave-driven sands are deposited along the site's shoreline. The need to preserve cultural resources and public access limited the size of the restored wetland. A key design consideration was whether the wetland would produce enough tidal scour to maintain an open connection to the Bay or whether the entrance channel would close due to excessive deposition of beach sands at the mouth of the inlet.

PWA continues to monitor the evolving beach-inlet-lagoon system. An analysis of inlet dynamics was conducted to assist in planning possible expansions of the existing tidal wetland. As part of the study, a new tool was developed to predict the frequency and duration of inlet closures based on the physical processes that govern inlet stability.

Client: *GGNRA & GGNPA*

Project location: *Presidio, San Francisco*

Period of performance: *1996 - present*

PHILIP WILLIAMS & ASSOCIATES, LTD.
ENVIRONMENTAL HYDROLOGISTS

CITY OF LAGUNA HILLS

Public Services

May 27, 2009

Mr. Jon Vivanti
U.S. Army Corps of Engineers
Los Angeles District, CESPL-PD-RN
P.O. Box 532711
Los Angeles, CA 90053-2325

Mrs. Zoila Verdaguer-Finch
County of Orange
OC Watersheds Program
2301 N Glassell St
Orange, CA 92865

SUBJECT: NOI/EIR ALISO CREEK WATERSHED

Dear Mr. Vivanti and Mrs. Verdaguer-Finch,

The City of Laguna Hills has a vested interest in working with the Army Corps of Engineers and the County of Orange on the subject project and you are requested to keep us informed as to the progress on the environmental document and project.

Specifically, please be aware in 1999 the City of Laguna Hills moved approximately 39 southwestern pond turtles to the area of your study and the turtles should be inventoried, identified and addressed in the environmental document.

It is our desire that the project adopts the turtles, addresses their habitat needs and assumes their maintenance henceforth. Please contact the undersigned should you need additional information; I can be reached at 949-707-2655.

Sincerely,

Kenneth H. Rosenfield, P.E.
Director of Public Services

24035 El Toro Road • Laguna Hills, California 92653 • (949) 707-2650 • FAX (949) 707-2633
website: www.ci.laguna-hills.ca.us

CLEAN WATER NOW! COALITION
P.O. Box 4711, Laguna Beach, CA 92652 - 949.280.2225 - www.cleanwaternow.com

"The Clean Water Now! Coalition is dedicated to the protection, restoration and preservation of aquatic and riparian ecologies worldwide.."

To: US Army Corps of Engineers and County of Orange

Re: Eco-Restoration of the Aliso Creek Mainstem

Date: May 29, 2009

Attention: Jonathan Vivanti, USACE Liaison

CC: David L Derrick, USACE
Zoila Finch, Mary Anne Skorpanich, Marilyn Thoms
OC Watersheds

Jonathan:

The following comments reflect longstanding formal positions and policies of the two (2) NGO's I represent: ***Clean Water Now! Coalition*** and ***Friends of the Aliso Creek Steelhead***.

I support limiting the initial feasibility and planning phase to the zone beginning at the uppermost point of the privately held Aliso Creek Inn and Golf Course (Resort), terminating in proximity near the junction of Pacific and Alicia Parkways. I have termed this **Phase I** reflecting prioritization, potential funding success matrices and value indexes, plus expedited implementation/installation chronology.

My comments also honor the parameters of USACE eco-restoration projects as specifically detailed in the Guidance Handbook ER-1105-2-100, referred to as Principles and Guidelines ***"P&G"***.

As to whether we pursue **NED, NER, Combined NED/NER** or **LPP**, I support project elements focused upon **NER** output values.

There are little, if any potential NED benefits, hence even a Combined NED/NER has only a marginal chance of accomplishing the objectives and/or requisite fiscal support (success).

As for a LPP, there are innumerable reasons for rejecting this complex choice outright, immediately:

(1) Large fiscal commitments from the inland Aliso Creek Watershed Stakeholders (ACWS) to pursue a LPP have little chance of success. A LPP would take an inordinate, indeterminate amount of time to progress non-Federally funded components.

As if *"Balkanized,"* each municipality and utility seems to have its own agenda, its own interest(s), in a sense is in its own sovereign domain. Basically disengaged, even pledges for contributions are historically low.

General, widespread citizen stakeholder participation is integral in *"problemsheds,"* and inland attendance is literally nil, reflected in lack of written comments for past projects or virtual engagement in the NPDES Permit renewal process itself.

Failure to accurately describe degradation and reach ACWS consensus is THE significant, if not over-riding component in explaining past lapses, may trigger funding constraints, and *problemsheds* require highly conjunctive, cooperative projects.

The County has failed to connect science, healthy environs and decision-making or agency interface for the public, so the vast majority of ACWS are MIA these past 12 years.

(2) The over-whelming majority of ACWS complainants/critics at meetings this past 2 years come from the City of Laguna Beach, and are NOT long-term historical attendees. From 1998--2006, the previous cycle of ACWS engaged were NEVER approached or in dialogue with inland HOA's and NGO's. In my entire 12-year history of perfect attendance none has ever even appeared.

ACWS attendance numbers or general interest by municipalities, water and sanitation districts, plus other public agencies have been a function of distance or mandated regulatory compliance: The further upstream one goes, the less potential for future EPA sanctions, the less interest and/or projected fiscal buy-in.

(3) Limited ACWS Interest

To spend innumerable hours developing a LPP that stands a great chance of NOT fulfilling the fundamental funding requirements to achieve restoration output values and goals, expressed ecological benefits, etc., is to waste time while the watershed eco-systems deteriorate further.

The guiding P&G should result in rationally sound decision making strategies for the primary benefit of the natural resources. They should be cost-effective, rely on the practical implementation with the least amount of constraints.

A tailored LPP would in fact encounter insurmountable odds: Selling nuanced environmental improvements or reversals (restorations) in a stream seldom visited, used or observed to apathetic, disengaged, unknown inland ACWS who have indicated no historical interest seems counter-intuitive, useless.

P & G:
"(5) Constraints are restrictions that limit the planning process. Constraints, like objectives, are unique to each planning study. Some general types of constraints that need to be considered are resource constraints and legal and policy constraints. Resource constraints are those associated with limits on knowledge, expertise, experience, ability, data, information, money and time. Legal and policy constraints are those defined by law, Corps policy and guidance. These constraints are discussed in subsequent chapters of this regulation and its appendices. Plans should be formulated to meet the study objectives and to avoid violating the constraints. Thus, a clear definition of objectives and constraints is essential to the success of the planning process."

It is important that ALL stakeholders comprehend the specific policy objectives and the enumerated, yet limited powers of the P&G. Stakeholders still don't understand the interface between governmental policies and interagency regulatory mechanisms.

The USACE needs to honestly present and identify realistic, potentially successful funding mechanisms and successful analogs per P&G:

"(1) The objective of ecosystem restoration is to restore degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. Restored ecosystems should mimic, as closely as possible, conditions which would occur in the area in the absence of human changes to the landscape and hydrology. Indicators of success would include the presence of a large variety of native plants and animals, the ability of the area to sustain larger numbers of certain indicator species or more biologically desirable species, and the ability of the restored area to continue to function and produce the desired outputs with a minimum of continuing human intervention. Those restoration opportunities that are associated with wetlands, riparian and other floodplain and aquatic systems are most appropriate for Corps involvement."

(1) General Common Misperceptions:

After listening *ad nauseum* to public comments by other Laguna-based NGO's and individuals at the Scoping Session and subsequent Workshop recently, it is critical that these particular ACWS clearly understand what is and what is not possible/probable, then integrate that information into what is and what is not the domain, fiscal and/or implemented responsibilities and goals of such partnership endeavors.

Acknowledging that problem and its genesis should come first: There is a commonly-held misperception by newer attendees who became engaged only a few years ago that such USACE projects MUST have USCWA compliance as a primary goal or objective.

In this case they also demand compliance with the:
(a) California Porter-Cologne Water Quality Control Act,
(b) Appropriate NPDES Permit issued by Cal/EPA, a repeated demanded as integral in this eco-restoration by NIMBYS
(c) California's AB 411 (Monitoring/sanctions for violations).

90% of the recent Scoping and Workshop attendees are also primarily focused upon two inseparable, inextricable entities: The rehab of the Resort and County-led estuary/recreational beach zone reconfiguration. They share a common impairment, non-compliance with bacterial pollutant loading at the evacuation point of discharge, Aliso Creek Beach. These NIMBYS expect the developer to cure the ills of an entire watershed.

Yes, compliance with California's AB411 acceptable levels or concentrations is important, but neither enforcement nor compliance regarding such exceedences are the responsibility or in the stated legal purview of the USACE. Additionally, to only value the human recreational and beneficial uses at Aliso Creek County Beach is myopic. Once again, P&G:

"(7) Water Quality. Water quality is an important component of ecosystem structure and water quality improvement can be considered as an output of an ecosystem restoration project. However, projects or features that would result in treating or otherwise abating pollution problems caused by other parties where those parties have, or are likely to have a legal responsibility for remediation or other compliance responsibility shall not be recommended for implementation."

I feel that this misperception, repeated so often that it has become a form of mimed inherent truth, needs to be explained BRIEFLY, then refuted so that the reach (Phase I) above the Resort is NOT held hostage by unreasonable and false/uninformed demands of NIMBYS. These ACWS refuse to address the general health needs of the watershed proper, their sole focus is the aesthetics of restoration and beach recreational elements.

Water quality compliance responsibilities are between the Cal/EPA and the NPDES co-permittees. Let's put this to bed. NOW.

I cannot over-emphasize that the County and USACE need to stress, need to aggressively inform the ACWS proactively about this ASAP so that more needless hours aren't taken up by endless discussions and debates when valuable staff and other ACWS time should be used in progressing the actual restoration dynamics, not wasted by Santa Claus or Tooth Fairy wish lists.

I would also implore the USCAE to consider the lack of justification for funding the protracted acquisition of more information, an endless pursuit that contradicts the P&G:

"Steps in the procedures may be abbreviated by reducing the extent of the analysis and amount of data collected where greater accuracy or detail is clearly not justified by the cost of the plan components being analyzed."

The 4-5 veterans among us were told 12 years ago that water quality will be a by-product of such projects, and as Section (7) Water Quality (above) reflects NOT specifically recommended (discouraged) for implementation. Worthy or lofty goals are fine, but if unrealistic, if unachievable, if untimely then let's move on to what's possible and fundable NOW.

NOTE:
I would like to point out that this is mainly due to the County of Orange and its water/sanitation districts repeated attempts to encourage and/or facilitate permits from the State Water Resources Control Board to allow the diversion of up to 7-8 mgd from the mainstem and tributaries for low flow treatment to achieve USCWA, P-CWQCA, California AB 411 and NPDES compliance.

The claim that the base flow regime is 100% urban runoff in origin, typified as "abandoned," subject to a 100% appropriative allocation (taking), is specious. There are water separation technologies that facilitate determinations in percentile results. The County has supported this 100% nuisance water allegation, citing only anecdotal narrative or unsupported studies. As much as 50% of the mainstem base flow regime is of natural origin according to OC Parks environmental planners.

At a hearing for the CAO 99-211 imposed upon them by Cal/EPA in December 27, 1999, the County and officials from the City of Laguna Niguel in sworn testimony before the SDRWQCB in February 2000 claimed that approximately 1/3 of the flow from a sub-division (Kite Hill) was of natural origin. High concentrations of manganese (Mn) from long term water quality sampling and monitoring support this allegation.

The County has never confronted the obvious: As the mainstem gouges/erodes to a much lower elevation, the surrounding drainage area increases its subterranean contributions via gravity and topography. The aquifer is shallow, the area just above the AWMA Bridge (Alicia Pkwy.) a historical flood plain encompassing several square miles, so perched water is in such a position that Aliso Creek mainstem has virtually become a type of shallow well.

Woods Canyon, a sub-shed and significant low flow contributor, is similar, and at one time had wells or springs used by the cattle of Moulton Ranch and previously by the nomadic NA tribes.

Hydromorphology is not the strong suit of County Flood enviro-planners and analysts. Recently, to avoid the complex NPDES source identification and tracking of such a subject, the County and copermittees have typified low flow cfs speciously as *"nuisance water"* when in fact the flows could be in part or in whole a function of a lowered mainstem gradient.

This has led to a perception that these base flow regimes be viewed as *"abandoned,"* hence facilitating the commercialization (harvesting). Once again, though not proven, this results in turning low flows into a commodity, a ridiculous approach to sustaining a year round ecosystem for the flora and fauna.

In a sense, regardless of origin, what is currently *"natural,"* that is presently characteristic should prevail. Regardless of the %'s of natural drainage vs. urban runoff, we have played God by reconfiguring the topography, altering drainage patterns and ecosystems now inhabited by threatened and endangered species.

A principle addressed by USEPA that I have constantly supported addresses this, called the **Ecological Benefit Comparison**, and it has been sustained in hearings and courtrooms:
"The basic approach of an Ecological Benefit Comparison is a demonstration that the ecological value of using an effluent to support riparian and aquatic habitats exceeds the ecological benefits of removing the discharge from the water body."

Treatment plants that divert flows and return them sterilized, that lower critical base flow regimes thus stranding aquatics, are not only biologically bankrupt, but they could be held up indefinitely by fish-protection NGO's plus regulatory agencies. It also ignores the incredible millions in local startup and structural expenditures and fees plus subsequent O & M costs.

Basically, the lower reach from the Resort to the beach should be looked at as a separate phase (**Phase II**). There are multiple property owners/interests (Resort, South Coast Water District, County), too many unknown and/or random configurations/plans in progress to enumerate. Unwieldy Caltrans (DOT) as well.

One facet is obvious: The highly contentious Resort hasn't even released its DEIR for public comments. Facing strong opposition from local NGO's and The Sierra Club, it could take years for project approval---If ever at all. It would be absurd to wait while this is appealed, litigated, altered for mitigation, etc.

To facilitate via bio-mimicry the return/restoration of a viable estuarine, some of the property held by the Resort, by SCWD, and by the County would of necessity require land acquisition. Presently, there is no true lagoon for the endangered tidewater goby as there once was historically. ***O. mykiss*** uses lagoons if trapped by sandberms at creek/river mouths. There are no approved Section 1600 SAA's by DFG in place for this zone, another variable that could later be a constraint or obstacle.

Land acquisition seems to be heavily discouraged unless a significant element of necessary preventative public health and safety flood plain control is involved. Once again, purchasing property from multiple jurisdictions/owners could take a decade, protract the analysis, planning and NEPA/CEQA periods, plus questionable big ticket funding and subsequent implementation phase processes. Moreover, it would require that ALL 3 of the property owners relinquish contemporaneously their ownership for the ***"yet to be determined"*** necessary lagoon/wetland acreage.

"(5) Land acquisition. Land acquisition in ecosystem restoration plans must be kept to a minimum. Project proposals that consist primarily of land acquisition are not appropriate. As a target, land value should not exceed 25 percent of total project costs. Projects with land costs exceeding this target level are not likely to be given a high priority for budgetary purposes."

We need to be reasonable, focus our efforts on the Canyon and inland area, knowing that if implemented correctly we should achieve significant bacterial and pollutant loading reductions WITHOUT building expensive, $$$-gobbling O & M treatment plants. Once the upper reach of this phase is complete, once initial post-implementation assessments begin emerging, subsequent strategies/tactics might be significantly altered.

Successful Analogs: David Derrick's PP was interesting, but his examples were predominantly not in highly-developed, urbanized zones with little if any space for increased wetlands or other valuable eco-resource expansion and opportunities. What the USACE needs to present to the ACWS are successful analogs, similar previous restorations that were readily/easily funded and implemented quickly for such *problemsheds* in great distress.

Conclusion: As a suggestion, perhaps this lower 1.7 miles I previously discussed should be delineated as **Phase II**.

(2) Mission Statement for Phase I

To reiterate, my preference is that emphasis be placed on NER. I feel that a projected net increase in both quantity and quality that honors NER is best served by making the recolonization of the anadramous salmonoid Southern Steelhead Trout (***O. mykiss***) an integral element, the highest priority in our Mission Statement. It enjoys status as both a federally listed Endangered Species (ES) and an Evolutionary Separate Unit (ESU).

P&G:
"Measurement of NER is based on changes in ecological resource quality as a function of improvement in habitat quality and/or quantity and expressed quantitatively in physical units or indexes (but not monetary units)."

"(1) Ecosystem restoration outputs must be clearly identified and quantified in appropriate units. Although it is possible to evaluate various physical, chemical, and/or biological parameters that can be modified by management measures which would result in an increase in ecosystem quantity and quality in the project area, the use of units that measure an increase in "ecosystem" value and productivity are preferred. Some examples of possible metrics which may be used include habitat units, acres of increased spawning habitat for anadromous fish, stream miles restored to provide fish habitat, increases in number of breeding birds, increases in target species and diversity indices."

Indicator success measured by proposed ***O. mykiss*** recolonization not only facilitates integration of actions, but problem identification-----Both historical impediments to watershed and water quality endeavors. Indeed, a healthy watershed stream, safe for man, beast and plant alike, is a watercourse with the presence of a high value marker species like the Southern steelhead.

It may at first glimpse appear *"single, not multi-purpose,"* but as noted below is a mandated high priority due to this ES/ESU status, fulfills primary objectives and creates immediacy or urgency to expedite under the Endangered Species Act.

It also places the NER objective in sync with the Cal/EPA San Diego Basin Plan Objectives (Water Quality & Beneficial Uses). Lower temperature, high D.O. content, low toxicity, aquatic and riparian connectivity, acceptable sediment transport values including bed gravel for spawning, etc. are encouraged. P&G:

(e) Existing water and related land resources plans, such as State water resources plans, are to be considered as alternative plans if within the scope of the planning effort."

This goal of steelhead restoration avails itself of readily explainable goals for the ALL of the ACWS and partnered public agencies. *"Ecology," "Environment," "Watersheds,"* ***et al*** are abstract constructs to many. The attempted return of this fish to its historical habitat is elegant in its simplicity.

There are now existent recovery projects in adjacent watersheds (San Juan and San Mateo) that can be used as successful analogs.

For increased educational benefits and larger *"buy-in,"* the creek and attendant wetland habitats become living classrooms for study. Instead of being shunned or avoided as it is now, the public will become protective of the stream and riparian zones.

There may also be increased recreational benefits honoring USACE output value components. P&G:
"(1) Ecosystem restoration outputs must be clearly identified and quantified in appropriate units. Although it is possible to evaluate various physical, chemical, and/or biological parameters that can be modified by management measures which would result in an increase in ecosystem quantity and quality in the project area, the use of units that measure an increase in "ecosystem" value and productivity are preferred. Some examples of possible metrics which may be used include habitat units, acres of increased spawning habitat for anadromous fish, stream miles restored to provide fish habitat, increases in number of breeding birds, increases in target species and diversity indices."

Historically, this ES/ESU steelhead presence was observed as far upstream as the Aliso Creek confluences and flood plain near the intersection of several present municipalities, namely: (a) Laguna Woods/Leisure World,(b) Laguna Hills, & (c) Aliso Viejo.

That said, the USACE termination of its study, analysis and feasibility area near the San Joaquin Corridor Tollway @ Pacific Parkway in Aliso Viejo is only 1 mile downstream of this historical migration terminus and thus an acceptable compromise.

I would encourage both parties (County and USACE) to identify opportunities to lower solar gain (elevated temperatures) at any drop structures/riffles by placing heavy shade, overhanging trees. This way the cooler, shaded stones or concrete will not transfer as much heat to the base flow regime. Secondly, the darker shade will also provide stealth for the aquatics to help avoid/lower the incidence of illegal takings or natural predation. A third benefit: Dissolved Oxygen loss is accelerated by elevated temperatures.

Gravel Bed Nourishment: Critical in aquatic species restoration will be not only the re-introduction of gravel (predominant diameter of .5" to 3 ") but post-installation maintenance. Focusing mass broadcasting of such gravel at or near the highly oxygenating riffles (or *viffles*) where temperatures are also lower could facilitate greater population numbers. The steelhead fry are very vulnerable through their juvenile phase. Siltation, which could bury the gravel in fine particulates, needs addressing. The disturbance of sediment contaminants as well.

ACWS should promote this "windfall" regarding aquatic habitat among fishery NGO's as their involvement could provide ancillary funds via grants (restoration programs), not to mention lobbying efforts. Perhaps they could assist with the funds required to reconfigure monolithic blockage infrastructure like the ones above and below Aliso Creek Road via grants? Nonetheless, this needs specific discussion to justify the disparity between historical presence and proposed NER targeted habitats.

Offline Flood Components and Commodification of Diverted Water

I was the individual who brought up the possible sale/lease of the Chet Holifield Federal Building in Laguna Niguel as a flood control opportunity at the MVCC Chamber venue on may 7, 2009. I wish to rescind that concept for numerous reasons:

My focus was on turning the parking lot into an offline retention/detention component for peak flow events. Cistern containment during and after high quotients could be a modulator and gradual release would alleviate some erosive effects. If perforated cisterns were installed, some determined volumes dispersed into the aquifer for recharging/storage.

Further refined research and seismic risk assessment unfortunately makes this hazardous and perhaps not acceptable for accumulation: Beginning in Huntington Beach, the San Juan Capistrano Fault runs parallel to the coast and basically terminates near the junction of the 405 Fwy. and the San Joaquin Tollroad Corridor. Combined with potentially large seismic impacts from other dominant faults in the area, catastrophic and monolithic failure exacerbated by liquefaction is possible.

Overloaded (saturated) soil could deform under stress. The area is very dense with private commercial and public development, including the Laguna Niguel City Hall and Sheriff's Department.

The enormous costs plus lengthy commuter dislocation of retrofitting the Hollifield parking lot, disruption of adjacent recreational fields and Alicia Pkwy. make this a poor candidate.

Experimental diversion strategies for unpredictable amounts of future surplus flows require a great deal of analyses and intra-agency consensus for something with little NER output index value. Infrequency of major rainy events in the region might not justify such big-ticket, inordinate expenditures. P&G:

"The cost of storage and associated facilities must be repaid by the non-Federal sponsor."

"(3) New Projects. Corps provided water supply service normally means reservoir space for storing water and, where necessary, facilities in the project structure for releasing or withdrawing the stored water for water supply purposes. The non-Federal sponsor must pay all costs allocated to M&I water supply storage space."

"(b) Financial Feasibility. A test of financial feasibility must be performed to demonstrate that reallocation of storage is the most efficient water supply alternative."

ALTERNATIVE: For a long term, fiscally achievable/responsible solution, upgrading local waste treatment plants to full tertiary (Advanced Waste Treatment) would recover more water per day than any diversion and impounding of surplus water ever could. Their infrastructure and NPDES Permits for waste are already in place, as well as the effluent in ocean outfalls.

Diversions might require another level of bureaucracy, perhaps a Joint Powers Authority to accomplish stated goals. OC taxpayers are especially leery of more governmental, regulatory layers.

I am also disturbed that at every meeting recently several Laguna Beach stakeholders who are representatives for water treatment vendors see the impounding of base flows and/or such water as a commercial opportunity. Turning precious life-sustaining flows that could elongate and enlarge the aquatic and riparian habitat areas and eco-functions into crass commodities is abhorrent. It also invites mischief, a form of controversial privatization that distracts, a questionable cost benefit and delaying constraint, a tactic that should be avoided. P&G:

"(6) Minimum Flows, Minimum Drainage Area and Urban Drainage. In urban and urbanizing areas provision of a basic drainage system to collect and convey local runoff is a non-Federal responsibility."

ACWS might become convinced that taxpayer funds are, like the water itself, being diverted for enduring (permanent) minority advantage, for acquired and accrued fiscal gains that have little ACWS benefit. The public would be double-billed: Once for the infrastructure impounding then storing/treating it, then secondly by being forced to subsequently purchase it back at tiered rates they have no ability to control! Lacks feasibility.

Inherent in such mechanical solution deficiencies is the USACE P&G itself: Less structural devices. What we need are enhanced and/or enlarged wetlands, an increased meandering for a longer mainstem. These could be jeopardized if the mainstem now accustomed to perennial flow is drained. Lower depths equal stranded aquatics, less riparian or flood plain moisture.

Beneficial uses and water quality improvement objectives, a mutual concern for the USACE and a priority for EPA, must not be perceived as opening doors for subsidizing private corporate gain, squeezed out of local natural resources.

These diversion strategies legitimately fail the P&G "Completeness, effectiveness, efficiency and acceptability" test and also fail "Magnitude, location, timing and duration."

CONCLUDING COMMENTS:

P&G provides two elements that I feel supplement and also help sum up our preferred NER course:

"Types of Improvements. A wide range of improvements to ecosystem functions is possible including, but not limited to, use of dredged material to restore wetlands, restoring floodplain function by reconnection of oxbows to the main channel, providing for more natural channel conditions including restoration of riparian vegetation, pools and riffles and adding structure, modification of obstructions to fish passage including dam removal, modifications to dams to improve dissolved oxygen levels or temperature downstream, removal of drainage structures and or levees to restore wetland hydrology, and restoring conditions conducive to native aquatic and riparian vegetation."

"b. Specific Policies.
(1) The objective of ecosystem restoration is to restore degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. Restored ecosystems should mimic, as closely as possible, conditions which would occur in the area in the absence of human changes to the landscape and hydrology. Indicators of success would include the presence of a large variety of native plants and animals, the ability of the area to sustain larger numbers of certain indicator species or more biologically desirable species, and the ability of the restored area to continue to function and produce the desired outputs with a minimum of continuing human intervention. Those restoration opportunities that are associated with wetlands, riparian and other floodplain and aquatic systems are most appropriate for Corps involvement."

I would urge the lead agencies to educate the ACWS that support diversions/impounding/treatment and sale of flows as to cost-benefit assessments plus regulatory and funding difficulties.

As a critical agenda item presented ASAP, focus on the information and ramifications in pages 59 through 60 of the P&G: ***"Evaluation Procedures for Water Supply Projects: Future Municipal & Industrial (M & I) Supplies"***

Regarding Adaptive Management Measures for Diversions: Elaborating upon the adverse ecological impacts from lowering stream depths, and stressing the fiscal and infrastructural constraints for such tactics could remove this from ACWS consideration and resolve potential conflicting interests.

Unfortunately, instead of a return to naturally functioning ecosystems (via biomimicry), it is obvious from recent ACWS meetings that aesthetics and bacterial impairments are the constraining, prioritized criteria for the Laguna-based NGO's.

Roger von Bütow
Founder and Executive Director

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May 28, 2009

To: Ben Neill
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From: Jack Eidt
Board Member
Friends of Harbors Beaches and Parks

Re: Comments for:
Tentative Order No. R9-2009-0002
NPDES NO. CAS0108740
Waste Discharge Requirements for Discharges of Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watershed of the County of Orange, The Incorporated Cities of Orange County, and The Orange County Flood Control District Within the San Diego Region

AND

Aliso Creek Mainstem Ecosystem Restoration and proposed SUPER Project

INTRODUCTION

Friends of Harbors, Beaches, and Parks (FHBP) supports the proposed MS4 Permit requirements. Simultaneously, we oppose the County of Orange SUPER Project that proposes construction of 26 concrete drop structures in Aliso Creek, one of the last natural creeks in Orange County which flows through Aliso and Wood Canyons Wilderness Park. We also support efforts that would allow for restoration of this natural creek in conjunction with the implementation of a program that includes pollution prevention, upstream source control, and treatment-control Best Management Practices. Strengthened MS4 Permit regulations would be integral in this regard.

In a meeting arranged by Congresswoman Loretta Sanchez held on May 20, 2009, with representatives from Sierra Club and Friends of Harbors, Beaches, and Parks, Dolores Gonzalez-Hayes, Senior Advisor, Office of Congresswoman Loretta Sanchez, Jonathan D. Vivante and Ed Demesa of U.S. Army Corps of Engineers, and Mary Anne Skorpanich, Director, OC Watersheds Program OC Public Works Department County of Orange, we discussed in detail how the implementation of the new MS4 Permit and Aliso Creek Mainstem Ecosystem Restoration are inseparable with respect to a total restoration and clean up of the entire watershed. At the May 20th meeting Ms. Gonzalez-Hayes advised the County that their “Project Implementation Priorities” needed to be adjusted to indicate that the “priority” project is in fact the Aliso Creek Mainstem study and not the proposed SUPER Project.

In addition, it was suggested to the County representative that an update be provided to the City of Laguna Beach on the County’s watershed priorities since the City has publicly supported the SUPER Project over a plan for restoration of the creek. Presentations should also be given to the surrounding municipalities, including Laguna Niguel, Aliso Viejo, Laguna Hills, Laguna Woods, and Mission Viejo. Furthermore, the Laguna Beach City Council will be voting on support of the MS4 Permit this coming Tuesday, June 2, 2009, with a staff recommendation to oppose the Tentative Order.

FHBP advocates that the County of Orange and the Army Corps should support the new MS4 permit or else the efforts at natural control and pollution reduction of the flow of Aliso Creek will not be achieved without destructive engineering solutions. Mr. Vivanti advised that the Corps’ support was implied in their planned restoration efforts.

FHBP also requested a more comprehensive study than the area outlined in the Aliso Creek Mainstem in order to regulate future projects on the use of low-impact development micro-scale integrated management practices and retrofit existing polluting developed areas. Chronic illegal discharges from MS4 storm drains by Co-permittees contribute in excess of 5,000,000 gallons each day of polluted urban runoff perpetuate a significant public health and safety nuisance at Aliso Beach in South Laguna, Laguna Beach, California. Marine life and critical habitat in locally protected coastal receiving waters and Environmentally Sensitive Areas (ESA) remain degraded by elevated flows of abandoned imported water which constitutes the primary source of dry weather polluted urban runoff.

<u>MS4 Permit Comments</u>

FHBP supports the entire MS4 permit with emphasis on the following:

Wet weather and dry weather discharges are subject to the conditions and requirements established in the San Diego Basin Plan for point source discharges. These water quality standards must be complied with at all times, irrespective of the source and manner of discharge.

The increased runoff characteristics from new development must be controlled to protect against increased erosion of channel beds and banks, sediment pollutant generation, or other impacts to beneficial uses and stream habitat due to increased erosive force. Special note: With this implementation there would be no need for 26 concrete drop structures in Aliso Creek.

Increased pollutant loads created by increased and uncontrolled urban development must be controlled to protect downstream receiving water quality.

Development that is ordinarily insignificant in its impact on the environment may become significant in a particularly sensitive environment. Therefore, additional control to reduce pollutants from new and existing development must be required for areas adjacent to or discharging directly to an ESA. This holds particularly true for Aliso Creek. Development has been uncontrolled and unmonitored for far too long.

Non-storm water discharges should be effectively prohibited unless specifically exempted. Exempted discharges identified as a source of pollutants are required to be addressed through prohibition. Dry weather non-storm water discharges have been shown to contribute significant levels of pollutants and flow in arid, urban Southern California watersheds. The Co-permittees have identified landscape irrigation, irrigation water and lawn water, previously exempted discharges, as a source of pollutants and conveyance of pollutants to waters of the United States. In the case of Aliso Creek this is a chronic problem that is leading to not only destruction of the watershed and associated wildlife, but also to our receiving waters.

Co-permittees MUST reduce the discharge of pollutants in storm water urban runoff. This can no longer be ignored and the ongoing pollution can no longer be tolerated.

Pollutants can be effectively reduced in urban runoff by the application of a combination of pollution prevention, source control, and treatment control BMPs. Every available tool must be implemented now, with particular emphasis on construction and mobile businesses that include car detailing.

We support the assertion of the Sierra Club that the Board consider adoption of a citizen-based water quality monitoring program.

Co-permittees must be required to implement a timely, comprehensive, cost-effective storm water pollution control program to reduce the discharge of pollutants in storm water from the permitted areas so as not to exceed the MALs.

Use of Low-Impact Development (LID) site design BMPs at new development, redevelopment and retrofit must be implemented.

Enforcement of local urban runoff related ordinances, permits, and plans must be an essential component of every urban runoff management program and specifically required in the federal storm water regulations and this Order.

Retrofitting existing development with storm water treatment controls including LID, is mandatory to address storm water discharges from existing development that may cause or contribute to a condition of pollution or a violation of water quality standards. Cooperation with private landowners is mandatory to effectively identify, implement and maintain retrofit projects for the preservation, restoration, and enhancement of water quality.

Runoff treatment and/or mitigation must occur prior to the discharge of urban runoff into receiving waters.

Due to Orange County's significant, uncontrolled development, early pollutant control actions and further pollutant impact assessments by the Co-permittees are mandatory.

Discharges of Waste to State Water Quality Protected Areas (SWQPAs) or Areas of Special Biological Significance (ASBS) must be prohibited except where allowable under a State approved Ocean Plan Exception or Special Condition.

Discharges from each approved development project must be subject to the most stringent of management measures.

It is mandatory that each Co-permittee must require each Priority Development Project to implement LID BMPs which will collectively minimize directly connected impervious areas, limit loss of existing infiltration capacity, and protect areas that provide important water quality benefits necessary to maintain riparian and aquatic biota, and/or are particularly susceptible to erosion and sediment loss. With this in mind, it would be virtually impossible for the County of Orange or the Army Corps of Engineers to even remotely consider a project such as the SUPER Project.

Each Co-permittee must revise its SSMP/WQMP to implement a watershed-specific Hydromodification Management Plan (HMP) to include specific criteria for minimizing and mitigating hydrologic modification at all development and redevelopment projects. Again, this would require the County of Orange and Army Corps of Engineers to discard any notion of a project that contains any characteristics similar to the SUPER Project. The Army Corps has been tasked with an ecosystem restoration of Aliso Creek. The Corps' implied support of the MS4 Permit will assist in this effort which would include disconnecting impervious areas by reducing the percentage of Effective Impervious Area (EIA) to less than five percent of total project area; also disconnect impervious area from receiving waters using on-site or off-site storm water reuse, evapotranspiration, and/or infiltration for small precipitation events, based on limitations imposed by soil conditions, groundwater contamination potential and considerations for the use of amendments to improve soil conditions.

Each Co-permittee must annually notify the Regional Board, prior to the commencement of the wet season, of all construction sites with potential violations such as the SUPER Project or any other construction project in the Aliso Creek watershed.

Each Co-permittee must implement a retrofitting program which meets the requirements of this section, solves chronic flooding problems, reduces impacts from hydromodification, incorporates LID, supports stream restoration, systematically reduces downstream channel erosion, reduces the discharges of storm water pollutants from the MS4 to the MEP, and prevents discharges from the MS4 from causing or contributing to a violation of water quality standards.

The Watershed Permittees must develop, implement, and update annually, a Watershed Water Quality Work Plan that ranks each watershed's highest priority issues. The Watershed Water Quality Work plan shall identify planned watershed assessment, BMP evaluation, BMP selection, and BMP implementation efforts for each watershed planning area for the full 5-year Permit cycle. The goal of the work plan to is to demonstrate a responsive and adaptive approach for the judicious and effective use of available resources to attack the highest priority problems on a watershed basis. This element should have special emphasis and be brought to the attention of the Army Corps of Engineers in light of their Aliso Creek Mainstem Ecosystem Restoration Project.

Aliso Creek Mainstem Ecosystem Restoration Comments

Restoration of a healthy ocean must be achieved. We cannot protect the ocean by poisoning it with our wastewater and urban runoff. In addition, our County wilderness parks are set aside for recreation, wildlife habitat, open space, and protection of sensitive ecosystems and individual species of plants and animals. Our riparian wetland streambeds are the most productive ecosystems within the coastal sage-scrub and oak woodland zones of the chaparral ecosystems, and must be protected.

Natural, non-invasive solutions are technologically available as soon as citizens, resource agencies and elected representatives, working together, are ready to act.

FHBP applauds Congresswoman Loretta Sanchez and her senior advisor, Dolores Gonzalez-Hayes for their proactive stance in bringing the environmental community, County of Orange Watersheds and Army Corps of Engineers together. It is imperative that these two agencies move forward with a plan that will eliminate concrete from Aliso Creek (existing and future) while adopting the policies of the new MS4 Permit, which will dramatically minimize the runoff and current flow rates that are creating pollution and destroying the creek's natural resources.

The proposal to build 26 step-dams (grade-control structures built 10' deep into the soil spanning the entire flow area) in the lower Aliso Creek should be eliminated as an alternative in this feasibility study. This "engineering wonder" would turn our park into a flood control channel device and do nothing to diminish the doubling of storm water flows and dry weather urban runoff that is polluting the ocean and eroding the banks.

Alternatives that should be considered in the watershed and surrounding cities are as follows: large-scale cistern strategies that capture runoff for reuse; modernizing the Laguna Niguel sewage treatment plant by OCSD, including recycling of gray water and groundwater recharge, powering the facility with captured methane gas, and reducing the toxic sewage that is dumped 1.2 miles off Aliso Beach. As well, Low-Impact Development (LID) strategies must be applied to areas of the watershed where applicable including rain gardens and bioretention; rooftop gardens; sidewalk storage; vegetated swales, buffers, and tree preservation; rain barrels; permeable pavers; soil amendments; impervious surface reduction and disconnection; and pollution prevention programs instituted for residential properties.

CONCLUSION

With strict adherence to the MS4 Permit, a natural restoration of Aliso Creek that preserves the ecosystem and integrity of the Aliso and Wood Canyon Wilderness Park can be achieved. The County of Orange must embrace these new regulations along with the Army Corps of Engineers as they move towards an environmentally sound solution to restoration and flow controls in Aliso Creek. The Army Corps must not move forward with a restoration plan without their partner's full agreement to all terms and conditions set forth by the new MS4 Permit. Without the County's and Co-permittee's full cooperation with the new order, the Aliso Creek Mainstem Ecosystem Restoration Feasibility Study will have limited effectiveness at mitigating the significant pollution and flow impacts that degrade the integrity of the ecosystem, the wilderness park, and the water quality of the Pacific Ocean at South Laguna.

Copy: Senator Barbara Boxer
Congresswoman Loretta Sanchez
County Supervisor Patricia Bates
Lynn Abramson
Gina Semenza
Dolores Gonzalez-Hayes
Mary Anne Skorpanich
David Shissler

Laguna Greenbelt, Inc. a non-profit corporation

June 9, 2009

Deborah Lamb
U.S. Army Corps of Engineers, Los Angeles District, CESPL-PD-RL
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Los Angeles, CA. 90053-2325
Deborah.L.Lamb@usace.army.mil

RE: Army Corps of Engineers Aliso Creek Management Watershed Study
Scoping Comments for EIR/EIS

Dear Ms. Lamb,

Laguna Greenbelt, Inc., is a grassroots, nonprofit organization that has been advocating for natural lands protection in Orange County since 1968. We have long been advocates of acquisition and management of Aliso, Wood, and Mathis Canyons as wilderness. We appreciate the opportunity to comment as part of the scoping hearing for the ACOE Aliso Creek Management Watershed Study.

Background

Aliso Creek drains a watershed of 30-something square miles. Today it is 19 miles long, from the Santa Ana Mountains to the Pacific Ocean; originally, it ran more like 21 miles. Hydrologists understand that if you shorten a river through straightening, it will try to get its missing miles back downstream.

The last few miles of the creek run through Aliso and Woods Canyon Wilderness Park, where the effects of upstream shortening and increased water flow from urban runoff play out dramatically.

Through most of the park, Aliso Creek is down-cutting rapidly, as much as 15-20 feet below the adjacent banks. Where we should see a vigorous streamside community of willows and mulefat, there are only steep eroding banks. A large concrete and rock drop structure, the ACWHEP, was built in the 1980’s to raise the water level and irrigate planted willows below the structure, but the project failed to achieve its goals. The drop structure did not check erosion, the concrete armoring is being undermined by the creek, and the riparian habitat it was supposed to create was never successfully established and has vanished.

With this background, why are we facing again a project that relies on ‘concrete’ solutions? The ACOE project will do nothing to improve water quality through the park, and by placing a water treatment plant in the County parking lot, will foreclose the restoration of the large lagoon that historically buffered Aliso Creek from the Pacific Ocean.

Scoping Comments

Any project to improve the water quality and flow characteristics of Aliso Creek in Aliso & Wood Canyons Wilderness Park (AWCWP) must look upstream for part of the solution. This project covers 7 miles, but the improvements are proposed to be within a smaller area, within AWCWP.

The EIR/EIS should look again at areas for possible upstream detention basins: for example, Dairy Fork tributary near the confluence with Aliso Creek, and taking the unused part of the Chet Holifield Bldg parking lot.

There are other possibilities to slow down the flow, inside and outside of the park. For example, in lower Wood Canyon, Mallard Marsh, a wetland area that acted like a sponge, was accidentally drained some years ago when Wood Creek leaped its banks and ran down a roadway through the marsh. This area could be restored, and would provide water detention as well as habitat. The recent realignment of Laguna Canyon Road away from the center of the wetlands will improve the water holding capacity of that canyon.

Free-flowing Aliso Creek formed oxbows (there is one above the horseshoe bend), and a photo from the 1970s shows at least one reach with a smaller parallel channel. Splitting the channel within the flood plain provides further opportunities to slow down the flow and increase habitat. The horseshoe bend area in the creek should be analyzed for such possibilities.

To improve creek water quality, the EIR/EIS must examine the feasibility of creating wetlands/biofiltration projects at the Dairy Fork tributary and other possible sites. The two issues are linked; detention facilities can be opportunities to filter and improve water quality.

The EIR/EIS should evaluate diverting dry season runoff from urban areas into the sewer system or constructing a runoff interception system to keep such flows out of Aliso Creek, as in the watershed of Bell/Dove/Tick Creeks.

The EIR/EIS should evaluate pool-riffle design as an alternative to the multiple drop structures, and whether this will facilitate fish swimming upstream.

In general, nonstructural and minimally invasive techniques should be explored in the EIR/EIS as alternatives to concretizing and installing multiple drop structures. Alternatives to armoring must be examined, as this approach has already failed in Aliso Creek.

Thank you for considering these remarks. If there are questions or ambiguities, or if you want any of the historic Aliso Creek photos, I can be reached at 949-494-8190, or by email at LGreenbelt@aol.com.

Sincerely,

EMBrown

Elisabeth M. Brown, Ph.D.,
President

Cc
Jon Vivanti: jonathan.d.vivanti@usace.army.mil
Zoila Finch: Zoila.Finch@ocpw.ocgov.com
Mary Anne Skorpanich: MaryAnne.Skorpanich@ocpw.ocgov.co

Submitted by U.S. Mail and electronic mail

June 5, 2009

Deborah Lamb U.S. Army Corps of Engineers
CESPL-PD-RL
P.O. Box 532711
Los Angeles, CA 90053-2325

Re: Comments for the draft EIS/EIR for Aliso Creek, Orange County, CA.

Thank you for the opportunity to provide comments for the Army Corps of Engineers EIS Study for the Aliso Creek Watershed. This letter is a response to the NOI published April 9, 2009 at the Federal Register. It is the understanding of the South Laguna Civic Association (SLCA) that comments received by the ACOE before June 10th will be reviewed for the first phase of the EIS study. Please see attached emails from Deborah Lamb and Jon Vivanti.

Aliso Creek has its final reach and meets the ocean in South Laguna. SLCA, established in 1946, has developed policy and fostered community while improving and protecting South Laguna for over 60 years.

The NOI says: *The focus of the project will be on watershed improvements to restore the creek's dynamic function and habitat for endangered species by developing alternatives for ecosystem restoration for impacted reaches of the creek.* And it says: *Alternatives to be considered are those that will further reduce degradation of the creek and the riparian ecosystem, improve ground and surface water quality and reduce adverse water quality impacts from runoff.*

SLCA's goals for proposed projects in the region of impact of Aliso Creek include:

1. Improve and restore to the greatest extent possible biologically diverse, self-maintaining, and healthy ecosystems in the region of impact of the creek. This includes the ocean receiving waters, the beach and sand berm, the estuary or lagoon, the creek, the creek's tributaries and the various adjacent flood plains, marshes and habitats.

2. Preserve, enhance and restore the Aliso and Wood Canyons Wilderness Park as a wilderness park with minimal human impact.

3. Stabilize beach sand replenishment and sediment equilibrium.

4. Promote projects that are self-sustaining and low-maintenance.

5. Protect archeological findings.

Objectives which support the goals stated above include:

1. <u>Watershed-wide planning to reduce runoff quantity and improve water quality</u>.

Over-urbanization within the watershed and the resulting storm and dry weather runoff within the watershed at large have a great share of responsibility for the environmental degradation in the creek impacted zones. The causes of the problems in the creek are watershed-wide, and therefore a holistic watershed planning approach is appropriate and necessary. SLCA encourages the ACOE to interpret its mandate to include the watershed as a whole as it identifies alternatives for improvement and restoration.

Project Concepts for Public property –

- Large-scale detention and retention projects at school grounds, parks, the Chet Holifield Federal building parking lot of (the 80-acre ziggurat campus for stormwater management), failed inland BMP locations, and other sites should be identified.
- Aquifer replenishment where aquifer space exists and cistern catchments where aquifer space does not exist. Assist the relevant water and sanitation districts by identifying ways to reuse the runoff. The water districts within this watershed import the majority of their potable water and this is a water-poor region. The phrase “waste equals resource” applies. Apply water reuse strategies for groundwater replenishment to promote groundwater recovery wells to supplement local water supplies.
- Streets and storm drains which could lead to cisterns for the beneficial reuse of water should be identified.
- Biofiltration at storm drain outlets affecting the creek. Local examples include Aliso Viejo’s successful project at the top of Wood Canyon and Laguna Niguel’s moderately successful WETCAT project at Kite Hill. Mallard Marsh in Wood Canyon has been identified by local biologists as a suitable site. There may be others.
- The SLCA encourages the ACOE to make policy recommendations to the local cities, County, and the San Diego Regional Water Quality Control Board (SDRWQCB) including, for example, suggesting zero tolerance of all dry weather discharges to Aliso Creek at all inland MS4 storm drain outlets.

Policy Recommendations for Private property - While the ACOE can directly plan for public property, it can also make policy recommendations which apply to privately owned property. Such recommendations can inform the policies of the cities, the County, and the SDRWQCB. Recommendations can include the development of:

- Soils microcatchment and Low Impact Development (LID) principles
- Rain water catchments for residential or commercial developments
- Education leading to the voluntary control of dry weather runoff and storm water infiltration or catchments
- Rapid cleanup and abatement of all liquid waste discharges
- Prohibit and discourage the use of chemicals and substances contributing to creek and ocean pollution and find non-toxic alternatives.

2. Ocean Ecosystem Restoration

The ecosystems impacted by the creek include the ocean environment. The ocean receiving waters of Aliso Creek includes the areas from Goff Island (Treasure Island Park) to Mussel Cove (Three Arch Bay). The ocean environment is highly degraded in the plume of Aliso Creek.

Water quality is worse and beach closures are more frequent at Aliso Beach than any other location in the City of Laguna Beach. The poor water quality and the excessive water quantity both present problems to a struggling ocean ecosystem. Reduction of fertilizers and nitrogen compounds will lead to reduction of algae blooms, which are negatively affecting the nervous systems of sea mammals and birds and causing widespread deaths. Reducing all pollutant loads will be beneficial. A wide variety of pollutants and not just bacteria should be evaluated. Pesticides, herbicides, automotive fluids, trash, and animal waste are some of the major pollutants in the creek.

- Map, monitor and restore coastal receiving waters impacted by Aliso Creek referencing coastal geological data bases.
- Study the endangered species of Aliso Creek's ocean plume and recommend project alternatives for rehabilitation of the habitat and reintroduction of lost species.
- Kelp forests are the ecological equivalent of redwood forests, tropical rain forests or coral reefs. They provide habitat for all species of concern including Tidewater Gobi (USFWS/CDF&G) and the Southern Steelhead Trout (NMFS/NOAA). Kelp reforestation projects are vital components of alternatives to restore the creek impact zone. Other ocean restoration projects should be considered as well.
- Utility pipes through the creek bed bring treated sewage to the ocean outfall 1.2 miles offshore. The treated sewage degrades the ocean environment. Consider recommendations which would facilitate conversion of inland sewer treatment plants to co-generation/water filtration operations to reduce the necessity and expenses associated with the protection of utility lines in the Aliso Wilderness Park.

3. Estuarine Lagoon Restoration, Including Sand Berm

- The hydrology of Aliso Creek should be improved to support the natural sand berm, which is a feature of any well-functioning creek and estuary. Coastal sand berms are naturally occurring beach landforms created by wave action and sand accretion. Measures to protect the ecological integrity of the Aliso Beach sand berm are required as a precursor to sustainable habitat restoration for keystone species.
- Restore the Aliso Creek estuary. Study the potential and steps to restoration. Study the conditions required to restore the estuary to historic ecological conditions so that key species and endangered species can thrive. Most of the land in the former lagoon is owned by the County, South Coast Water District and Verizon and it may be quite possible to plan for and achieve a restored lagoon.

4. The Beach

- Restoration alternatives should provide for beach sand equilibrium.
- There are endangered plant species that live on the beach. Crystal Cove in North Laguna has many examples. These should be considered in any restoration planning.

5. Restoration of Aliso Creek inside the Aliso and Wood Canyon Wilderness Park:

There are three basic approaches to the vertical instability of the creek: Restore the creek bed to meet the historic flood plain; Stabilize the creek bed in its current location; Allow the creek to incise to its future equilibrium topology. We would like to see these approaches analyzed for their benefits and dis-benefits. The most significant benefit, which is also the object of the EIS study, is to achieve thriving, biodiverse, self-maintaining ecosystems. It is in relation to this benefit that alternatives should be weighed. These benefits should be considered over the short term, the intermediate term, and the long-term.

Consideration should be given to allowing lateral erosion to occur naturally, and consideration should be given to the alternative of estimating the ultimate width and slopes of the bank, grading to the predicted dimensions, and planting the banks.

Again, alternatives which create the greatest biodiversity in the short, intermediate and long-terms with the least human intervention should be the ones chosen. SLCA requests that your decision-making model or process be made very clear and transparent in the EIS alternatives analysis.

SLCA is concerned that the approach of raising the streambed to meet the historic flood plain will cause great disruption to the self-recovering riparian habitat. We are also concerned that this approach will cause ongoing maintenance issues since it requires the greatest amount of human intervention. Additionally, we are concerned that the massive amount of manmade structure required for this approach will disrupt any future self-maintaining ecological equilibrium. This approach is not consistent with our goals #2 and #4 (Preserve, enhance and restore the Aliso and Wood Canyons Wilderness Park as a wilderness park with minimal human impact; and promote projects that are self-sustaining and low-maintenance).

Raising degraded stream beds might be justified in situations where the adjacent flood plain still has higher quality habitat, where the stream bed can be raised without massive intervention and structure, or where the adjacent areas are predicted to have a far greater biological value than they would if the streambed were not so raised. Mallard Marsh may be such an example.

SLCA would like to see alternatives which emphasize holding the streambeds in their current location or allowing incision to occur if there is not a compelling biological reason to do otherwise. Such approaches would require the least intervention and would be likely to be more self-maintaining in the long-run since it would accommodate the natural equilibrium. In situations where man-made structures are deemed necessary, using non-grouted rocks or vegetative material are preferred.

Investigate the benefits of installing a regional rainwater harvesting cistern system at the Chet Holifield federal surplus site. Repurpose excavated sand, gravel and rock material to gradually raise streambed conditions utilizing a portion of stormwater flows to transport this resource to settling and rehabilitation sites within the creek.

If the stream is allowed to incise or if it is held at its existing elevation, the historic flood plain, which was grazed, should be considered for a variety of forms of restoration, not limited to riparian, for example, coastal sage scrub. Such restoration would have value for the variety of plant and animal endangered species associated with the ecosystem type. Southern Maritime Chaparral is a DFG threatened plant community which populates parts of South Laguna and there may be appropriate restoration sites for it within the wilderness park.

Utility pipes and road can be moved away from the creek which is the preference of the water and sanitation districts. Utility pipes should NOT be enclosed in rip rap, grouted rocks, cement or other hard surface inside the creek beds. This will diminish the creek's biological value and cause ongoing maintenance problems as the structures will be inclined to degrade.

- Consider minimal structural impact to the creek itself inside the wilderness park.
- Consider allowing the creek to reach its own new equilibrium.
- Consider stabilizing the grade in certain reaches of the creek where future incision seems inevitable and drastic.
- Consider using non-grouted rocks and plantings rather than concrete or grouted rocks where stabilization structures are deemed necessary for biological health and diversity.
- Consider using waddle and other biological materials to slow the water in the creek.
- Consider planting and enhancing the old flood plain and formerly grazed areas rather than raising the creek bed to meet the old flood plain.

- Consider replacing ACHWEP with something more stable and consistent with the wilderness park aesthetics.
- Consider the lifetime consequences of any man-made structures anticipated for the creek including maintenance consequences, possible major storm event destabilizations, consequences if upstream hydrology changes, and consequences for future generations.
- Consider biofiltration for storm drain outlets such as the one at the top of Wood Canyon.
- Consider the restoration of Mallard Marsh in Wood Canyon.
- Consider parts of the Wood Canyon creek beyond the currently designated 1000' scope.
- Promote re-vegetation of riparian ecology with emphasis on native trees to stabilize existing floodplain integrity, reduce creek water temperatures, increase native habitats and promote evapotranspiration of ambient flows.

6. <u>The Creek in the Golf Course Zone</u>:

How the creek is managed during its reach in the private property between the wilderness park and estuary zone is important and perhaps essential for any restoration effort at the estuary, beach or ocean receiving waters. While this is not under government control, we nevertheless encourage the ACOE to develop restoration concepts that would be consistent with its other efforts.

- Make recommendations for the improvement of and restoration of the portion of Aliso Creek, which is privately owned by the golf course and Inn owners. Such recommendations can influence and become part of the City of Laguna's Aliso Creek Specific Plan and can guide development policy.
- Discuss this part of the creek in the EIS study.
- In the EIS discuss the implications of alternatives for this part of the creek for the estuarine lagoon, beach and coastal receiving waters.

7. <u>Preserve Archeological Findings and Locations of Significance</u>:

SLCA understands that there are important findings and sites within the wilderness park. These should be identified and protected. Previous beach shell midden surveys for development at Treasure Island and elsewhere can provide baseline population data for abalone and other indigenous shellfish.

8. <u>Other Concerns and Suggestions</u>:

- Investigate carbon sequestration credits and mitigation banking opportunities to generate funds for recovery of land, coastal and ocean native plants, macro algae, animals, birds, fish and sea mammals with high carbon values.
- Inventory assessments of carbon footprint values for all proposed alternatives consistent with the City of Laguna Beach's Climate Protection Action Plan to

support measures capable of reducing greenhouse gas emissions and global warming.
- Identify and protect all federally protected species and habitats within the study area and storm water plume including coastal dolphin and California Gray Whale migration routes, California Brown Pelican and sea bird foraging grounds, fish ecologies for Totuava, Southern Steelhead Trout, Garibaldi, Giant Sea Bass, etc.
- Propose reduced "utility protection" project elements by incentivizing co-generation conversions at inland publicly owned treatment works (POTW) to produce local methane compressed natural gas (CNG) energy systems developed by the Orange County Sanitation District for filtration of sewer outfall flows to hi-purity 200 TDS water for beneficial reuse and revenues.

The South Laguna Civic Association appreciates the efforts by the Army Corps of Engineers to consider the enormous impacts of uncontrolled storm water and dry weather urban runoff flows and pollution in the region of impact of Aliso Creek. As the primary community most impacted by watershed management in the ACOE Study Area, we remain committed to full restoration of this invaluable regional resource and will continue to provide collaborative leadership and community support to this important ecological effort.

Respectfully submitted,

Bill Rihn
President

cc: Jon Vivante, USACOE
Zoila Finch, County of Orange

<u>Attachment A - Deadline for Scoping Comments</u>

>From: "Vivanti, Jonathan D SPL" <Jonathan.D.Vivanti@usace.army.mil>
>Sent: May 18, 2009 2:35 PM
>To: lisa marks <lisamarks99@earthlink.net>
>Cc: Holoman Will WQ <wholoman@lagunabeachcity.net>, Scott Sebastian
<scott@sebastianassociates.com>, "Lamb, Deborah L SPL"
<Deborah.L.Lamb@usace.army.mil>
>Subject: RE: Aliso Creek - written scoping comments due date -
>
>
> Lisa- Debbie has indicated to me that if you provide us written comments
>early in the week of June 8, we should be fine. The later you wait, the
>greater the chance of us not being able to incorporate your comments into the
>baseline report. Of course any comments received subsequent to our cut-off
>would be accepted but not considered until the subsequent report product
>(alternatives analysis)is prepared.
>
>Thanks- Jon
>
>-----Original Message-----
>From: lisa marks [mailto:lisamarks99@earthlink.net]
>Sent: Monday, May 18, 2009 10:19 AM
>To: Vivanti, Jonathan D SPL
>Cc: Holoman Will WQ; Scott Sebastian
>Subject: Aliso Creek - written scoping comments due date -
>
>Dear Jon,
>
>Has the NOI for the Aliso Creek study been amended to show the June due date
>for written scoping comments? If so, what date was that filed with the
>Federal Register? The date will help me look it up. Thank you.
>
>If the NOI has not yet been amended and you are still planning to do so, the
>later that comments are due, the better. Debbie Lamb said something like
>"June 5 or June 8, whatever." We'll take "whatever"... (just kidding).
>The City of Laguna Beach has hired a stream restoration consultant to assist
>in defining city objectives and propose some alternatives. The City Council
>and public will review their draft report on June 2nd. It is possible for
>the consultant to finish their final draft by Friday June 5th, but much nicer
>to have a few more days. Kindly let us know. Thanks.
>
>Lisa Marks

Village Laguna
P.O. Box 1309
Laguna Beach, CA 92652
June 5, 2009

Deborah Lamb
U.S. Army Corps of Engineers, Los Angeles District
CESPL-PD-RL
P.O. Box 532711
Los Angeles, CA 90053-2325

Re: Aliso Creek Mainstem Ecosystem Restoration Feasibility Study

Dear Deborah Lamb,

In response to the Corps of Engineers' Notice of Intent, recorded in the Federal Register on April 9, 2009, we offer the following comments on the scope and objectives of the proposed Aliso Creek Mainstem Restoration Feasibility Study:

The site of the study is Aliso and Wood Canyons Wilderness Park, a 4,000-acre natural park with steep hillsides, deep canyons, landscapes ranging from oak woodlands to grasslands and coastal sage scrub, and some thirty miles of trails. Dedicated to Orange County in 1979, it is designated in the County's General Plan as a wilderness park, "a regional park in which the land retains its primeval character with minimal improvements and which is managed and protected to preserve natural processes." A deed restriction placed on it in 2001 limits it to county park uses in perpetuity.

The wilderness park is part of the Laguna Greenbelt, some 20,000 acres of protected open space surrounding the city of Laguna Beach. It is bordered on the north by residential and commercial development associated with the cities of Aliso Viejo, Laguna Niguel, and Laguna Woods. At the time the park was established (as mitigation for the development of Aliso Viejo), the upstream portions of Aliso Creek were beginning to be channelized to make way for development, and county planners hoped to preserve the rest of the creek in its natural state.

Planning for the park had begun even earlier. In December 1973 the University of California, Irvine, Extension held a conference entitled "The Aliso Creek: Potentials, Problems, and Public Policy" coordinated by a former county planning commissioner and with an afternoon session led by a member of the county's planning staff. Beginning in 1974, some 40 separate land parcels were assembled to create the park. The initial planning was funded by the California Coastal Conservancy, and later work was undertaken by the county's Department of Harbors, Beaches, and Parks, often with funding from competitive state and federal grants. A proposed six-lane highway down the canyon as removed from the county's Master Plan of Arterial Highways specifically to preserve Aliso Creek in its natural configuration. Over the years the canyon's original riparian vegetation has gradually reestablished itself after more than a century of grazing. Although invasive species may be spotted in the riparian zone, the vast majority of plants are typical native riparian species, including cottonwoods, sycamores, willows, and mulefat. The county is pursuing funding for removal of the invasives, and we hope to see this work undertaken without waiting for any ultimate plan for the creek.

The Aliso Creek watershed inland of the park is now heavily developed, and recent years have seen a substantial increase in runoff as a result of this development that increased the flow of the creek, exacerbating seasonal flooding, and poured urban pollutants into it. Much of this development was made dependent on a commitment not to increase runoff into the creek, but the facilities for fulfilling this commitment have not been established.

At the same time as being the heart of the wilderness park, Aliso Canyon has become the conduit for treated wastewater from the treatment plants of the surrounding communities to the ocean outfall at Aliso Beach. The original idea, when the Aliso Wastewater Management Agency was founded in 1974, was that the inland cities would recycle their wastewater. The outfall constructed along the creek was expected to be used only in winter, when the supply of reclaimed water would exceed the demand for it. Although recycling is under way in the various inland water districts, the demand for outfall capacity has increased over the years. The existence of sewer pipes in the ground along the banks of the creek and the desire to install more of them have created a perceived need to lock the creek in place so that these pipes will not be threatened by erosion.

The project that Orange County calls the SUPER Project—whose acronym stands for Stabilization + Utility Protection + Environmental Restoration—is primarily an attempt to prevent the creek from encroaching on these pipes. It involves (1) the construction of a buried riprap wall 3 miles long beside the maintenance road east of the creek, (2) twenty-four 2-foot grouted-rock drop structures sunk into bedrock, each with a 30-foot-long basin below it that will be protected on both banks with stone, (3) two 6-foot drop structures with 150 feet of concrete revetment downstream of them along both banks, and (4) realignment significant filling of the channel. According to the County's *Aliso Creek Concept Report* (February 2006), "The actual channel will not be intact in much of the project reach" (p. 27). Grading is expected to be so extensive—involving some 70 acres of the canyon floor and moving 1 million cubic yards of earth—that there will be little opportunity to preserve desirable stands of existing vegetation (p. 28).

The objectives of the Aliso Creek Mainstem Ecosystem Restoration study bear a close resemblance to those of the SUPER Project, though the study makes no mention of protecting utilities and lacks the project's water-quality component. As does that project, it involves grade controls and the raising of the floodplain, and one Corps supporter at a recent meeting declared that restoring a creek in a developed area sometimes requires concrete. Further, the techniques for restoration of vegetation described by David Derrick of your Vicksburg office all seem to involve the import of tons of rock. All this and the fact that the SUPER Project closely follows the recommendations of an earlier Corps of

Engineers study for Aliso Creek persuade us that our concerns about damage to the creek and the wilderness park remain relevant in the new context.

Destroying the existing riparian vegetation, grading the canyon floor, and placing concrete and rock in the creek would be devastating to the wilderness park and are inconsistent with the County's General Plan.

The County's 2008 draft resource management plan for the park, produced with broad public input, is described as a blueprint for "protecting and preserving the native habitat in the park for the benefit of its natural resources and providing outdoor education and low-impact recreation consistent with resource protection goals." It proposes improving the quality of the water in the creek through such methods as manufactured wetlands and portable filters. It also calls for assessing proposed projects for their potential impacts to park resources.

The technical review of the concept plan by an outside consulting firm (*Aliso Creek Concept Plan Report, Technical Review*, prepared by Geosyntec in January 2007) stresses the importance of addressing the causes of creek instability and water-quality degradation and the potential for limited mitigation measures to have unintended consequences (p. 16). It indicates that the two-year storm event for which the channel is to be designed may or may not be appropriate (p. 10) and points to "indications that past efforts at peak-flow 'shaving' for a series of storm events (two-year and up) have not successfully protected the creek and have actually accelerated stream erosion" (p. 16). The review recommends consideration of "alternatives that may result in improvements in design, cost savings, and/or improved habitat," among them the use of (1) biotechnical streambank stabilization methods, (2) methods that could lengthen flowpaths and reduce the required amount of grade control, (3) tiered levels of protection, and (4) creek enhancement measures promoting a return closer to natural hydrologic wetting patterns and biodiversity (p. 11). It also recommends the development of upstream detention and retention facilities to "reduce pollutant loadings throughout the creek, mitigate dry weather flows, and reduce required capacity of treatment downstream" (p. ES-3). "Without an integrated, strategic approach," it concludes, "SUPER Project benefits could be limited in longevity and multi-benefits, as pollutant and hydrologic loading could stress, and potentially reimpact, the restored creek segments" (p. ES-3).

The *Concept Report* itself (p. 40) identifies five sites—two in the park and three on public land owned by cities—on which detention, infiltration, or wet basins could be constructed. An additional site that has recently attracted attention is the huge parking lot of the federal building on Alicia Parkway locally known as the Ziggurat, which is now for sale.

The *Aliso Creek Stabilization Project Review* prepared by Phillip Williams and Associates for the City of Laguna Beach (May 29, 2009) suggests that, contrary to the assessment of the earlier studies, the relevant section of the creek (from Alicia Parkway to the sewage treatment plant) may be close to or at equilibrium and starting to form a new floodplain. Accordingly, it suggests that the channel could be stabilized by introducing as few as three 2-foot and two 6-foot grade control structures or, alternatively, by stabilizing the base of the ACWHEP structure and allowing another 6 feet of incision downstream. The latter alternative would allow the self-formation of an equilibrium system that would be “more likely to be resilient to large flood events than a system that is kept out of equilibrium using hardscape, as well as likely to function [more naturally] and appear more natural” (p. 23). The PWA review advises the City to have fairly modest expectations about using upstream stormwater control to reduce erosion downstream but to take advantage of opportunities to ensure that future development upstream does not make matters worse and to improve the situation incrementally through low-impact development and stormwater detention. In further contrast to the *Concept Report,* in which the effects on sand supply to the beach are considered indeterminate, the PWA review considers the sand discharged from the creek “very important to the system” of maintenance of our beaches and not something that should be “locked in place” to stabilize the creek (p. 25).

The proposed new wastewater management regulations (Revised Tentative Order R9-2009-0002)—the MS4 permit—under review by the San Diego Regional Water Quality Control Board includes stricter regulations of discharges into the creek that can perhaps be expected to reduce the excess flow that is so important a part of the problem. It would prohibit dry-weather discharges into the creek, thus helping to return it to something more like the intermittent stream that historically it was, and require controls on stormwater discharges through the careful planning of new development and retrofitting of existing development with detention basins.

The current water shortage and new state laws requiring water efficiency in landscaping in response to that shortage are likely to serve as additional incentives for capturing and reusing much of the water that now ends up in the creek.

The various reports of the creek stabilization proposals agree that past efforts to rein in the creek with concrete and rock have been a failure and have actually contributed to its erosion. The drop structure known as the Aliso Creek Wildlife Habitat Enhancement Project (ACWHEP) is an eyesore in addition to a testament to this failure and ought to be demolished. Elsewhere in the country, we understand, the results of such efforts are being dismantled in favor of natural solutions. We hope that the feasibility study will take our concerns about this approach into account and that a noninvasive solution to Aliso Creek’s problems will emerge from it.

Sincerely,

Barbara Metzger
for the Village Laguna Board

From: Len Gardner [mailto:lgardner@fea.net]
Sent: Friday, June 05, 2009 11:13 AM
To: Finch, Zoila
Cc: Len Gardner
Subject: Aliso Creek Scoping Comments

Dear Ms. Finch,

These are my scoping comments for the Aliso Creek Mainstem Ecosystem Restoration Feasibility Study.

I am conservation chair for Laguna Hills Audubon, a chapter of the national Audubon Society. We are a chapter with around 500 members.
Many of our members live in Laguna Woods. I am authorized by the chapter to speak on its behalf.

Every year, we offer a birding walk along Aliso Creek starting near the park trailer. This is in the heart of the study area. This year, the Aliso Creek walk was on May 2. We recorded 40 species of birds there that day. It is the best place we have for Yellow-breasted Chat and Blue Grosbeak. Many other songbirds are found there, including Black-headed Grosbeak, Common Yellowthroat, Orange-crowned Warbler, Yellow Warbler, Warbling Vireo, Least Bell's Vireo, Blue-Gray Gnatcatcher, Lesser Goldfinch, Spotted Towhee, California Towhee, House Wren, Bewick's Wren, Bushtits, Song Sparrow and numerous others.

One of the main reasons for the numbers and variety of songbirds in the area is the abundance of Mexican Elderberry. This tall shrub can grow over 18 feet tall, and many individual plants in the study area do. In the spring, it flowers prolifically and bears a heavy crop of fruit all summer. This plant, in my opinion, is directly responsible for supporting a very substantial part of the migrating and nesting birds in the area. It is imperative, therefore, that any action the County of Orange or the Corps of Engineers undertake in the study area is careful to preserve, protect and enhance the elderberry, along with the willows, mulefat and other native shrubs found there.

The main naturally occurring detriment to healthy bird and wildlife populations in the area is Arundo. This non-native plant is very aggressively taking over large parts of the riparian community. It's eradication or, at least, control must be a major component of any restoration plan. The flat lands adjoining the riparian community on both sides of the creek is dominated by non-native grasses. Restoration of Coastal Sage Scrub vegetation here would be very beneficial in restoring other native species to area, such as California Gnatcatcher and, perhaps, Cactus Wren. This would certainly be desirable but will take many years to accomplish. Cactus, in particular, is slow growing and must be quite high before it is attractive to Cactus Wrens. Artichoke Thistle, along with other non-native thistles are present in the area and must be controlled. Doing so requires control activities (spraying and grubbing) every year, year after year.

I attended the project presentation at the Mission Viejo Civic center on May 2 this year. I agree with and support the suggestions made by the Sierra Club and other environmental groups at that meeting. In brief, these were that the main causes of channel instability in the area are (1) urban runoff from the developed parts of the watershed and
(2) storm water runoff that has not been allowed to percolate into the ground due to the large extent of impervious surface in those developed areas. The most efficacious way to address both causes is at the source, in the developed area. Installation of water retention facilities, both in new developments and retroactively in existing developments, was mentioned. We agree.

In summary, the instability problem stems from the developed areas, and the most effective remedies must be applied there. What then is the role of the Corps of Engineers, an agency noted for its expertise in heavy construction, in this project? This question was not adequately answered at the May 2 event. Is this restoration study just the preamble to a major construction project that would inevitably disrupt, and perhaps destroy, one of the county's most wildlife-rich parks? This concern is at the root of the distrust that permeated the meeting. The only way to dispel it, and build trust with community partners, is with honest and direct answers. I did not hear those answers that night.

Please incorporate these comments in the project's official record.
Thank you.

Len Gardner
197 Avenida Majorca Unit C
Laguna Woods, CA 92637
949-581-6940

Lamb, Deborah L SPL

From: Lamb, Deborah L SPL
Sent: Wednesday, May 20, 2009 6:58 AM
To: 'JACKATHIE2@aol.com'
Subject: RE: Aliso Canyon Project

Ms Housden,

Thank you for your comments on the Aliso Creek Ecosystem Restoration Feasibility Study. I appreciate your time and commitment to provide valuable public participation in our planning process.

Thank you,
Debbie Lamb

-----Original Message-----
From: JACKATHIE2@aol.com [mailto:JACKATHIE2@aol.com]
Sent: Tuesday, May 19, 2009 9:20 PM
To: Lamb, Deborah L SPL
Subject: Aliso Canyon Project

Dear Deborah Lamb,

I went on the tour of Aliso Canyon on May 2nd and was so impressed to know that this Canyon is still mostly wild habitat for animals and birds. It is used by citizens of this area for recreation -- biking, walking, hiking and the viewing of natural surroundings.

I requesting that the valley floor be kept free of walls of boulders and concrete. I believe there is a more natural way to accomplish the Ecosystem Restoration of that area. I am asking for natural methods to be used even though these may take longer to get in place.

Old Top of the World in Laguna Beach has been my home since 1972 and we look down on this special canyon. I believe it needs to be kept as natural as possible.

Thank you for working on this matter and listening.
With appreciation,
Kathryn R. Housden

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Jonathan Vivanti

June 2, 2009

Dear Jonathan,

Having recently perused documents at the Orange County Parks Headquarters related to the Notice of Preparation for the Aliso Creek Mainstream Ecological Restoration Project, I have some concerns I wish to register. Foremost among these is my strong suspicion that the documented Native American human remains and artifacts constitute only the tip of the proverbial iceberg. Most likely there is far more archeological material buried in that watershed. I learned from these documents that Aliso Creek has been identified for more than a decade by anthropologists and Juaneño peoples as a place of great archeological and religious importance. While this information does not confirm my suspicion that other material lies buried beneath the soil, it certainly furnishes reasonable grounds for <u>not</u> proceeding with any ground-moving project in and around Aliso Creek.

My second concern is related to the first: archeological excavations to determine the extent of Aliso Creek's cultural resources will most likely damage or destroy those resources. This is all the more reason why the CEQA provision, section 210832 must be observed. That provision states the imperative of considering "project alternatives which will allow the resources to be preserved in place and left in an undisturbed state." Preservation, clearly, is the goal here. It should take precedence over any mitigation strategies because those strategies will imperil Native American human remains and artifacts that predate the European "discovery" of California nearly half a millennium ago.

Third, because at least twenty sites of archeological and historical significance in the Aliso Creek watershed have been identified by learned specialists, that area should be placed on the National Register of Historic Places. That is the sensible alternative to disturbing the ground by excavation. That is the alternative that will preserve what is left of an ancient Native American habitat. That is the alternative that will remind southern Californians of our connections through time to a special place that stands in danger of being erased from our cultural memory.

I look forward to receiving your response.

Cordially,

Thomas J. Osborne, Ph.D.

Chair and Professor of History

Santa Ana College

31651 Santa Rosa Drive

Laguna Beach, CA 92651

From: rebecca robles [mailto:rerobles5@yahoo.com]
Sent: Friday, June 05, 2009 1:52 PM
To: Finch, Zoila
Cc: maryanneskorpanich@rdmd.ocgov.com; jonathan.d.vivanti@usace.army.mil; eduardo.t.demesa@usace.army.mil
Subject: Fwd: Notice of Preparation For Aliso Creek Mainsteam

---

-

Zoila Finch
County of Orange
June 5, 2009
Re:Notice of Preparation for the Aliso Creek Mainsteam Ecosystem Restoration Project

Dear Zoila,
I am writing to express my concerns related to the Aliso Creek Restoration Project. The Aliso Creek has at least twenty sites of archeological and historic significance. The watershed has been identified by historians, archeologists and the Acjachemen people as an ancient place with the probability that there are numerous burials in and along the creek. I write and tell you that this proposed project will undoubtly disturb and unearth ancient burial grounds, human remains and pre-historic village sites.
It is my belief that this ancient place stands to be destroyed or altered in a severely damaging way by the project.

I would like to remind you that Aliso Creek has been identified as eligible for the National Register of Historic Places. The CEQA provision that states considering "project alternatives which will allow the resources to be preserved in place and left in an undisturbed state " should be observed.
Please also consider that archeological excavation to recover data does not mitigate the impacts to significant archeological sites and especially the disturbance of Native American graves. Mitigation cannot offset the damage done to burial sites and sacred places.

The goals of improved water quality, prevention of erosion, protection of Aliso and Woods Canyon Wilderness Parks, and increased wildlife habitat are admirable efforts. These goals can be achieved by less destructive means than the SUPER Project. The reduction of upstream run-off contamination is imperative before this huge project. The MS4 Permits can help achieve this and obtaining them should be done before the 26 concrete drop down structures are allowed in the canyon.
Preservation of sacred sites, culture and history are also extremely important.It is

estimated that
more than 90% in Orange County have been destroyed due to rapid development.The Super
Projcet
is extremely destructive and should not be allowed to proceed.

Sincerely,

Rebecca Robles

119 Avendia San Fenanado

San Clemente, CA 92672

6/6/09

To: US Army Corps of Engineers and County of Orange

Attn: Jonathan Vivanti, USACE ,David L. Derrick, USACE,
Zoila Finch, Mary Anne Skorpanich, Marilyn Thoms, OC Watersheds

From: Joanne Sutch

Subject Comments, concerns and feedback re: the Aliso Creek Eco-Restoration Project

First please allow me to say how honored I am to be attending these sessions and interfacing with the U.S. Army Corps of Engineers and our top country experts. As a long-time Laguna resident, Aliso Creek has long been both a love and a concern to me, so I appreciate such strong interest and support in funding and in **true eco-restoration** of **Aliso Creek**. The Creek is both **unique** and **complex** due to its freshwater/estuarine mix and floodplain/protected Wilderness sanctuary. In looking at the County and USACE's proposed project, it is critical to take the lower estuary reach into consideration. However, as we have been informed, the USACE domain does not include (1) **privately held property** and (2) the **ocean** domain. Therefore, the scope of this proposed eco-restoration project should by definition be limited only to the region from the uppermost point of the private Aliso Creek Inn Resort to the proposed juncture of Pacific and Alicia Parkways. The lower estuary and beach area would be part of another phase or project.

After attending both the May 7th and May 13th Aliso Creek Eco-System Restoration USACE scoping sessions, I have the following concerns, input and suggestions for opportunities to render. First, I completely agree with Mr. Derrick on the need to determine a single form and driving factor for the eco-restoration. The most critical point that Dave Derrick makes, I believe, is that a creek or river can only be effectively restored if an when everyone knows and agrees on "**what they want it (the Creek) to do**." To date, we have not had that agreement in any of our proposed Creek projects.

Considering alternative NED and LPP options, as necessitated by the Corps *Principles and Guidelines (P&G),* this single item alone eliminates the possibility of either LPP or NED options in Aliso's eco-restoration. To date, as we have seen with the proposed "Super Project" (which I know is beyond the scope of the proposed 7 mile Aliso eco-restoration, but will certainly be considered in part of any proposed LPP), we have a variety of interested parties with a variety of agendas. The original Creek restoration was all about "erosion" and utility protection. Then, a second purpose, eco-restoration, was injected into the mix. Finally, improving (beach) water quality was also folded in. Confusion, different agendas and measuring yardsticks, etc. are now involved. For this reason, I do not believe that any LPPs are feasible and viable. There will be too many conflicting entities and interests involved: the county and even the State for The Wilderness Park's interests; private property owners whose plans and development may be affected by the eco-restoration; SCWD who hopes to treat and "reclaim" part of the Creek's so-called "nuisance" water in a facility right by the beach for its development client(s) for profit; all of the upper Aliso Creek entities and cities currently overbuilt and both contributing heavily to the Creek's urban runoff and sediment loss and wanting all solutions to be "end of the pipe," with no costs to them, etc.

Eliminating LPP options, NED and NER ones must next be considered. As a former financial analyst and budget expert, I can find no viable, financially beneficial NED options either. The only commodity of any value in Aliso Creek would be the water itself. However, it will never yield "potable" water, due to its toxicity, and the "recreational" benefit is already high at the Aliso/Pacific Ocean breach. Far better to consider tertiary water treatment at some alternate location. Treating Aliso Creek's water can possibly help with bacteria levels, but not the Creek's toxicity itself. The only possible future valuable commodity is the revival of the Creek's eco-restoration for fishing, particularly the **"*anadramous*" Southern Steelhead Trout**.

In February, 2009, NOAA (NMFS) sustained the position of the **Friends of Aliso Creek Steelhea**d that Aliso Creek was a historical Steelhead Habitat, part of Southern

California's Distinct Population Segment. As such, it qualifies, in every way, shape and form to USACE's Eco-restoration (NER) description as a key driver.

(1) Ecosystem restoration outputs must be clearly identified and quantified in appropriate units. Although it is possible to evaluate various physical, chemical, and/or biological parameters that can be modified by management measures which would result in an increase in ecosystem quantity and quality in the project area, the use of units that measure an increase in "ecosystem" value and productivity are preferred. Some examples of possible metrics which may be used include habitat units, **acres of increased spawning habitat for *anadromous* fish, stream miles restored to provide fish habitat,** increases in number of breeding birds, increases in target species and diversity indices. Alternate measures of ecosystem value and productivity maybe used upon approval by CECW-P. (pg. 3-25 USACE *P&G*.) Basing the entire Eco-restoration on return of a friendly Southern California Steelhead environment could also have secondary gains, such as lower bacteria levels, more reliable markers for identifying and managing increased nitrogen, phosphorous levels in the stream, return of other threatened species, lowered toxicity due to sediment replacement, etc.

That being said, allow me to introduce myself and some of my unique perspective. I am not a scientist, though I grew up with them (a metallurgist father and an organic chemist, nutritionist mother). My great-grandfather ran Canada's Niagara Power Plant for many years. The scientific method and proof has been ingrained in me. Born and raised (through my mid teens) back East near Niagara Falls, N.Y., my vacations consisted of trips to the Jersey shore, the Pocono's, and visits to my aunt's cottage on Lake Erie in Canada. As an early teen, I was suddenly shocked by the vanishing aquatic sea life in the Atlantic, and more so by the almost overnight pollution and demise of Lake Erie and Niagara Falls. The algae bloom was literally nauseating. Commercial fishing seemed as dead as the fish lying around everywhere. I followed and became involved in the cleanup process. The U.S.A.C.E. was, of course, a key player in this early, groundbreaking cleanup effort.

"By the 1950's…one 2600 square-mile portion was found to have no dissolved oxygen in its bottom waters. By the 1960s, lake shores were heaped with detergent suds, rotting algae and dead fish." (1) Everyone thought that it was due totally to major chemical dumping (from Alcoa, Cyanamid and others). Outraged citizens, however, pushed through legislation (most notably The Clean Water Act of 1972 and Canada's Water Act, setting standards for the amount of phosphates permitted in sewage effluents.) International cooperation, agreements and funding brought about slow, incredible change and restored health to Lake Erie. First, major analysis **from source** was done. Lake Erie, due to its **unique** "relatively shallow depth… lined with nutrient-rich soils…made it perfect for death by nutrient overload."(1) It was getting too many nutrients and phosphates from "Agricultural runoff, detergents in city wastewater and the dumping of virtually raw sewage into the lake for decades by Detroit, Michigan and Buffalo."(1) The result was algae bloom, which robbed the lake and its inhabitants of needed oxygen. Dump sites were identified and brought into compliance, manufacturers actually had to change their formulas for detergents, agricultural fertilization and runoff was changed. By the mid-70s, the Lake was blue again. Of course, with climate and urban changes, continual work is needed to keep it viable and clean.

First and foremost, a major source(s) analysis of the "toxic runoff" in Aliso Creek is essential. An assumption has been made that the majority comes from upstream urban runoff, but this may not be a true picture and cannot be taken as fact. Erosion itself could also be one key factor. As a result of the CWC13225 Directive, Orange County has been doing water quality and toxicity monitoring for the past 6 years. This testing is continued through the MS4 Permit monitoring program, giving us a database to work with. However, we still have a conundrum. Toxicity is purported to be low and does not appear to vary much between high and low flow. If this is the case, then why is our IBI (Index of Biological Integrity) soPoor? Barely any species can survive in Aliso Creek. If possible, considering sediment disturbance and toxicity, perhaps core samples should

(1) Great Lakes Primer, by Roger Di Silvestro. Copyright, National Wildlife Magazine, June/July 2004
http://www.nwf.org/NationalWildlife/article.cfm?issueID=68&articleID=951

be taken at critical points of the Creek. USACE's resources for toxic, hydrological and microbiological analysis could prove invaluable for Aliso's successful eco-restoration. This in no way obligates the USACE for pollution clean-up, nor does it conflict with the USACE's "hands-off" policy re: water quality. It should, however, be included in the Corp's feasibility analysis, as well as in its final post project O&Ms for the County of Orange. It would be a critical component of compliance and measurement procedures.

(7) Water Quality. Water quality is an important component of ecosystem structure and water quality improvement can be considered as an output of an ecosystem restoration project. However, projects or features that would result in treating or otherwise abating pollution problems caused by other parties where those parties have, or are likely to have a legal responsibility for remediation or other compliance responsibility shall not be recommended for implementation.

Lake Erie's strategy for cleanup is my second point. After the analysis, it was determined that several key **biomarker species** would drive the health and eco-restoration of Lake Erie. The dying **lake trout, brown bullhead (bottom feeder with liver ailments) and cormorant egg (whose shell was thinning)** were integral drivers in the cleanup. In Aliso Creek, the same can be said. If the **Southern Steelhead** population is supported for recolonization, then the Creek's health and restoration will follow. If this fish, a true "survivor" which exists at various stages in both fresh and salt water can survive and thrive in the Creek, then its water can then be considered as both fishable/swimmable.

The natural, innovative techniques being used by Mr. Derrick and the Corps, in addition to, if not, hopefully, mostly replacing concrete structures are both impressive and exciting. However, I truly did not feel that eco-restorations comparable to Aliso Creek's were depicted. As Dave Derrick mentioned, he does not do oceans. How many comparable freshwater/estuarine habitats has USACE done eco-restoration on? Can we see specific examples for better comparison?

In upstate Carpinteria, California, the Carpinteria Salt Marsh (once almost a "marina and residential development") had over 36 acres of wetland environmentally restored by

cooperative groups, with the "south and southeast portion of the estuary receiv(ing) rechanneling, removal of invasive plant species and the planting of 18,000 native plants". (2) It received the Coastal America Award (the only environmental honor of its kind given by the White House) for "restoring the wetland's waterways and fish passages and reducing pollution." Fish ladders and alternatives to high drops and concrete were integral in the restoration. "Coastal America was established in 1992 to protect, restore and preserve critical coastal and estuarine habitat. The purpose is to integrate federal efforts with state, local and non-governmental efforts to reach a common goal".
This example is not totally comparable to Aliso Creek (again, each waterway must be considered unique), but the emphasis on specific fish survival and some of the solutions may prove relevant. I definitely want to see more successful eco-restorations of comparable waterways before feeling comfortable enough to place our Aliso Creek in other's hands as an experiment or "fix-it at all costs" project. The fact is, despite all of the abuse it has endured from human intervention, Aliso Creek has actually regenerated itself in some of the back wetlands. "Kill it or cure it" is not an option for me. Changing Aliso Creek's actual low regimes would be counter-productive to its eco-restoration and definitely not an option for consideration either.

Using the Southern Steelhead for the basis of eco-restoration, I also have deep concerns with concrete dams. Fish ladders should be integrated and concrete minimized. Additionally heights, elevated temperatures, shallowness must all be taken into consideration. Currently there is controversy over what constitutes the minimum requirements for Southern Steelhead support, with large variances. These need to be tested to determine if the currently proposed minimums will even support survival of the species. Additionally, proposed widening of Aliso Creek at various points needs to be reassessed. If too shallow, too sunny, or too close to shore and humans, then Steelhead survival will again be in jeopardy of the elements and of human "take."

(2) Coastal View News. Carpinteria, California-Vol. 15, No. 32 May 14-20, 2009
www.coastalview.com

Two other key factors come to mind with this Aliso Creek eco-restoration: Diversions and Sediment Transport. I am not an opponent of all diversions, since I believe that the Niagara Falls ones are brilliant and have extended the life of the Falls by decades if not centuries. Still, Aliso Creek is fraught with diversions and their subsequent toxicity and other complications. More diversion would be counter eco-restoration and a probable death knell for Aliso Creek.

I am already on record as having concerns with Sediment Transport with the Aliso Creek Super Project. I have the same issues and questions with the USACE eco-restoration. Dredging Aliso Creek is not an option at this point (the toxins will just be re-entered into it, further poisoning and degrading it). The amount of sediment to be managed cannot be processed and supported by our current treatment plant. It will be offline more than on, with disastrous results. A key element of the USACE sediment plan is introduction of “pebbles” into the streambed to help cover and anchor the toxic silt and who knows what. A) How is the Corps going to even transport and **safely** introduce these mass quantities of pebbles into the Aliso Creek bed, particularly upstream? B) Since the replacement of these pebbles on a regular basis is key to the success of the eco-restoration and will, subsequently be handed over to the County of Orange for continued maintenance, how will the County of Orange be able to then continue this replacement? Without it, erosion will continue, with loss of soil and sediment, thus sabotaging the eco-restoration. Draining/diverting Aliso to accomplish pebbles introduction will kill all of what we are trying to protect, so again it is not an option to me. I look to the USACE and other engineers to provide answers, alternatives, but do not wish for Aliso Creek to be the “guinea pig” for experimentation of new hypotheses. As we all know, there is no going back once started. As one of the last existing Southern California Steelhead habitats and one of the last undeveloped Southern California coastal flood plains, I must insist on sanity tests and other examples of projects prior to digging.

Recognizing that the County of Orange will be taking on O&M for this Aliso Creek eco-restoration once completed, I have a few concerns to address now, to avoid confusion later. First and foremost, this management must be doable (i.e. the regular addition of pebbles into Aliso Creek, for instance). Second is an area outside of the USACE confines, but certainly within the project feasibility scoping from a funding standpoint. Time and again contributing or affected cities have refused to contribute (or pay after the fact). One argument, especially for the upper Creek cities, is that the development and problems occurred before they became cities, so they should not be responsible for contributing. I believe that it is critical to hammer out the contributions ahead of time so that the lower Creek cities do not again have to bear the brunt of expenses. According to our discussions, USACE would be responsible for 50% of funding, and the other 50% would fall to Orange County and its involved entities. Allocation should have some base criterion (land mass for water usage, for instance). Whatever method, I believe that contribution payment should be based on the MS4 permittees. Without contribution and funding agreements, the project is not fiscally feasible.

A final suggestion and request is for all to "think outside of the box." Granted, the Toll Road cannot be undone, but other things may be able to be de-done, even better.
For instance, the Chet Holifield building has been suggested for extensive underground digging, cisterns, water capture, etc. I am actually opposed to this. Not only is this a lot of excavation and expense, but also the main purpose of the cisterns seems to be to use water capture as a commodity. I do not support this. However, I do believe that the asphalt around this building could easily and economically be replaced with a new, more environmentally friendly, semi-porous material (with grass or gravel between) to allow water to actually percolate and return through natural means to the ground and Aliso Creek.

In conclusion, I support the Aliso Creek eco-restoration as an NER only, with the Southern California Steelhead as the bio-marker and driver. As noted, private property will not be included in this project. Additionally, the estuary portion below the private property should also be excluded due to its complex nature and ocean habitat.
Sediment transport and introduction of pebbles into the creekbed must be addressed as well. Funding and project maintenance must be hammered out from our side, and further

analysis done due to questions regarding toxicity versus low IBI numbers. Flow regimes should remain unchanged, too. The removal of invasive and non-native plants is also a necessary and major effort, requiring significant funding and resources. I look forward to future project meetings and information.

Respectfully submitted,

Joanne G. Sutch
(jsutch2@cox.net)

Attendance list from Public Scoping Meeting on May 7, 2009
Mission Viejo City Council Chambers
200 Civic Center, Mission Viejo, California 92692

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RICHARD Gardner		

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APPENDIX B-2: Combined Habitat Assessment Protocols

ALISO CREEK MAINSTEM
ECOSYSTEM RESTORATION STUDY
Orange County, California

September 2017

US Army Corps
of Engineers

Orange County Public Works
Environmental Resources
Department

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Combined Habitat Assessment Protocols (CHAP)
Fish & Wildlife Habitat Assessment
Final Report

Aliso Creek

Existing Baseline Conditions
U.S. Army Corps of Engineers
Los Angeles District

US Army
Corps of Engineers

Report and Analysis by
Northwest Habitat Institute

Northwest Habitat Institute
www.nwhi.org

HAB Value
Patent No. U.S. 7,681,531 B2

August 31, 2015

Contents

CHAP
Fish and Wildlife Habitat Assessment of
Aliso Creek

Executive Summary

The fish and wildlife habitat assessment of the Aliso Creek Ecosystem Restoration study encompasses 691 acres (280 ha) and evaluated 239 polygons. Baseline conditions that consisted of 7 different habitat types were determined to describe the site. The number of fish and wildlife species associated with the project totaled 196; of which there were: 7 amphibians, 1 fish, 122 birds, 41 terrestrial mammals, and 25 reptiles. The baseline existing condition evaluation for the project area showed a total of 8,916 habitat units. Breaking out the California Wildlife Habitat Types revealed there are 213 acres (86 ha) annual grassland, 113 acres (46 ha) coastal scrub, 30 acres (12 ha) of lacustrine (lake), 31 (12.5 ha) acres of riverine (open water), 55 acres (22 ha) of urban, 247 acres (100 ha) of valley foothill riparian, and 1 acre (.4 ha) of valley oak. The average existing per-acre value (HUs/acre) by type is: 9.25 for annual grassland, 13.45 for coastal scrub, 14.01 for lacustrine, 11.36 for riverine, 4.21 for urban, 17.79 for valley foothill riparian, and 14.00 for valley oak woodland. Polygons of all types within the study site ranged from 1.28 (urban) to 25.60 (valley foothill riparian).

Introduction

Throughout the United States there is a move towards assessing restoration and other conservation activities at the ecosystem level. Under current U.S. Army Corps of Engineers (USACE) authority, the objective of Civil Works ecosystem restoration is to restore degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. Even partial restoration may provide significant and valuable improvements to degraded ecological resources.

Ecosystem restoration projects should examine the need for improving or re-establishing both the structural components and the functions of the natural system. Restored ecosystems should mimic, as closely as possible, conditions which would occur in the area in the absence of human changes to the landscape and hydrology. Indicators of successful restoration would include the presence of a large variety of native plants and animals, the ability of the area to sustain larger numbers of certain indicator species or more biologically desirable species, and the ability of the restored area to continue to function and produce the desired outputs with a minimum of continuing human intervention. Those restoration opportunities that are associated with wetlands, riparian and other floodplain and aquatic systems are most appropriate for USACE involvement, given USACE jurisdiction.

The information used in formulating, evaluating and selecting ecosystem restoration alternatives in USACE Civil Works projects includes both quantitative and qualitative information about outputs, costs, significance, acceptability, completeness, effectiveness, and reasonableness of costs. Within the USACE ecosystem restoration policy, *"An ecosystem restoration proposal must be justified on the basis of its contribution to restoring the structure or function, or both, of a degraded ecosystem, when considering the cost of the proposal. Ecosystem restoration projects are justified through a determination that the combined monetary and non-monetary benefits of the project are greater than* *its monetary and non-monetary costs. As such, plan selection is not based on economic justification in terms of a traditional monetary benefit to cost analysis, since the majority of benefits associated with the primary outputs of ecosystem restoration can rarely be quantified in dollars. Therefore, ecosystem restoration proposals need not have either a benefit-cost ratio greater than 1.0, or positive net economic benefits. However, any monetary incidental benefits that are anticipated from proposed ecosystem restoration projects, and are relevant to the particular circumstances associated with the study, should be displayed to aide in decision making"* (USACE, EP 1165-2-502, 1999).

Instead of calculating economic benefits in monetary terms, USACE ecosystem restoration projects calculate the value and benefits of habitat using established habitat assessment methodologies. Evaluating habitat quality is the approach most often taken to compare ecosystem restoration alternatives because habitat is thought of as a surrogate for ecosystems; it is the setting where plants and animals live, interact, and reproduce. Habitat is frequently viewed in conjunction with species information to gain insight to various uses, structures, and functions existing within a landscape or site. Determining habitat structure and functional integrity of an area is supportive of an ecosystem management approach.

Habitat Units (HUs) are one of the currencies USACE currently uses to rate and compare the value of one ecosystem restoration alternative to another. The concept of HUs is derived from the U.S. Fish and Wildlife Service's (USFWS) single species habitat assessment methodology known as Habitat Evaluation Procedures (HEP) (1980), which USACE previously used as a habitat evaluation tool.

Currently, an ecosystem based habitat evaluation framework exists. It is known as CHAP or Combined Habitat Assessment Protocols. This approach involves a triad assessment of habitat, species, and functions (O'Neil et al., 2005; O'Neil et al. 2008), and can provide assessments at multiple scales (O'Neil and Bohannon 2014). The CHAP method generates habitat units (HUs) by using a patented algorithm (O'Neil 2010) based on an assessment of multiple species (all potential species at a site), habitat features, and functions by habitat type. A general documentation of the CHAP approach has been written specifically for the USACE (O'Neil 2015).

The overall goal of the Aliso Creek Feasibility Study was to evaluate existing habitat conditions at a fine level of resolution within an ecosystem restoration context. An ecosystem context is more holistic than assessing just a few individual species (Perkins, 2002) especially with Federal or stated listed taxa; it calls for a multiple species framework that includes an evaluation of ecological functions. Additionally, USACE would like to assess future without project and with project scenarios; hence a realistic depiction of actual habitat site conditions at a fine scale level was needed. The approach reported herein depicts the wildlife habitat existing conditions and future without project conditions (25 years and 50 years) at a fine resolution or site level-scale; uses multiple species and their habitat functions in its evaluation; and accounts for actual habitat types, structural conditions and key environmental correlates within the Aliso Creek Study Area, based on a field inventory of these habitat components.

Study Site

The Northwest Habitat Institute (NHI) conducted a wildlife habitat assessment at Aliso Creek in Orange County, California in May 2009, September 2014 and April 2015. The assessment was conducted at the site level scale. A fine level assessment scale was done over a study area along Aliso Creek that extends approximately 9 miles (14.5 km) from Interstate 5 at the north end to the South Coast Water Treatment Plant, which is about 1.2 miles (1.9 km) from its mouth in Laguna Beach at the Pacific Ocean.

The Aliso Creek project boundary falls most within the Aliso and Wood Canyons Wilderness Park, which is a respite for both wildlife and local residents and operated and maintained by Orange County Parks. At the South Coast Water Treatment Plant there is ensuing infrastructure (sewer and water pipes; electrical), which are buried parallel to Aliso Creek on both sides. The Aliso Creek Wilderness Park is surrounded mostly by a dense urban setting in which passive recreation occurs. The primary use of the park is recreation in the forms of bike riding, running, and walking. Past history shows that most (if not all) of the Aliso Creek Wilderness Park was operated as a ranch. Hence, much of the study area shows influences from long-term grazing. The urban setting that surrounds the wilderness park also appears to have had a strong influence on Aliso Creek; the portion of the creek above the Ranger Station occurs in a very narrow and confined setting with homes, schools, a private university, sports fields, wide highways and other urban settings in immediate proximity. Additionally, the urban setting may have also contributed to the introduction of exotic plants to the habitat assessment area in the Aliso Creek Wilderness Park.

The study area encompasses 691 acres (280 ha). Two-hundred-thirty-nine polygons were identified within the project boundary [Fig. 1]. These polygons were determined by delineating the California Wildlife Habitat Types that occur within the project area, which were: Valley Foothill Riparian, Riverine (Open Water), Coastal Scrub, Annual Grassland, and Urban. Initially, the habitat evaluation assessment was broken into two areas: estuary and riverine. The rationale for this is because: 1) a golf course breaks the continuity of the study site evaluation, 2) the lower portion below the golf course has more of an influence from the Pacific Ocean than the upper portion, 3) the species list for each section could be separated out into estuary and riverine, and 4) any proposed management alternatives or scenarios directed at improving or enhancing fish and wildlife habitat would be quite different in each section. In 2014, the project was brought back into one area (riverine) and the area below the South Coast Treatment Plant was dropped. In turn, because of the emphasis to reconnect Aliso Creek with 3.3 miles (5.3 km) of Woods Canyon and 1.4 miles (2.2 km) of Sulphur creek, these secondary areas are now included.

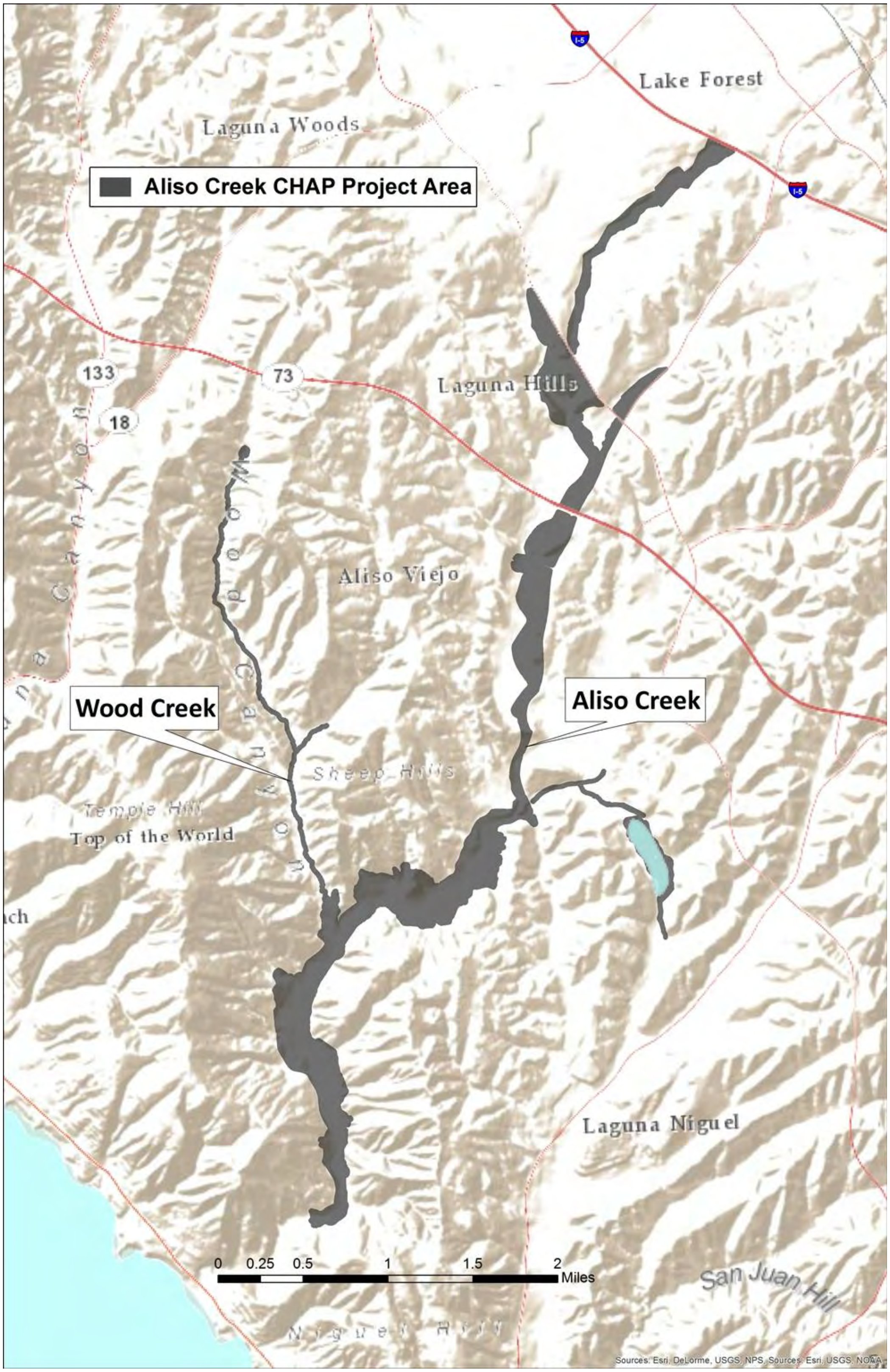


Figure1. Aliso Creek CHAP baseline habitat assessment study area.

Methods: Existing Conditions

CHAP's habitat valuing system produces Habitat Units (HUs) for baseline and alternative future scenarios. When talking about HUs it is good to clarify (especially for a non-ecologist) that CHAP's habitat values are not the same as those obtained using USFWS's Habitat Evaluation Procedures or HEP. CHAP assesses condition and function by incorporating multiple species, habitat components and functions into the analysis. When attempting to compare HUs between CHAP and HEP one would immediately see a magnitude of higher habitat values using CHAP because CHAP does not normalize the values, evaluate only a few species, or use subjective values to determine habitat quality as HEP does.

A first step in the CHAP process is to form a Habitat Evaluation Team (*hab eval team*) that consists of natural resource agency staff, stakeholders and/or interested organizations. The purpose of the *hab eval team* is to provide input as well as respond to issues or concerns that come up and provide transparency throughout the process. The CHAP approach, which is fundamentally an accounting system, is meant to be interactive and also requires documentation of decisions. For the Aliso Creek project, a *hab eval team* was established and consisted of representatives from NHI, USACE, U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), California Fish and Wildlife (CDFW), Orange County - Watershed and the Nature Reserve of Orange County staff.

The CHAP approach is visually based because it develops maps that identify all California wildlife habitat types by polygon located within the Aliso Creek project boundary. The habitat type classifications are based on the CDFG's California's Guide to Wildlife Habitats (Mayer and Laudenslayer 1988). Wildlife species associated with these CWHR habitat types are linked to NHI's IBIS data system[1] (Johnson and O'Neil 2001) in order to establish the key environmental correlates (KECs) and key ecological functions (KEFs) for each species (for species list see Appendix A). KECs represent habitat elements (physical and biological) that are thought to most influence a species distribution, abundance, fitness, and viability. KEFs refer to the principal set of ecological roles performed by each species or correlates in its ecosystem, or the main ways organisms use, influence, and alter their biotic and abiotic environments. The KECs and KEFs are key components in determining the wildlife habitat unit values. For a more detailed background and description of the method see O'Neil (2015).

A site level-scale CHAP analysis was used to calculate the habitat value calculations for the Aliso Creek polygons. The CHAP approach involves four components: 1) preliminary mapping, 2) field inventory, 3) species list, 4) data compilation and analysis, and 5) conversion to Habitat Units (HUs).

1. <u>Preliminary Mapping</u>: The Aliso Creek study site was refined by identifying and delineating polygons based on perceived differences in wildlife habitat types or structural conditions within a site. Habitat types were identified using visual differences in land formations, vegetation, and structural condition, as detected and interpreted in the imagery. At the onset, the National Agriculture Imagery Program or NAIP imagery was used in 2009 but this was later transferred to high-resolution six inch pixel size Eagle

[1] The IBIS data system is a peer expert system that contains current ecological information on more than 1,000 fish and wildlife species.

Aerial imagery supplied by Orange County Watershed Program. In 2014 and 2015, Environmental Systems Research Institute's (ESRI) World Imagery was used.

2. Field Inventory: There were three field inventories (May 2009, September 2014, and April 2015) conducted by NHI staff. These ocular surveys were done to: a) confirm the polygon delineations, b) identify and record habitat type, structural conditions, and key environmental correlates within each polygon, and c) note the amount of non-native plant species. There was a second part of the inventory that occurred in May 2009 to conduct verification transects that are stratified random samples of the vegetation. The purpose of these transects was to measure and substantiate site variables including percent cover/species of trees, shrubs, herbaceous and invasive vegetation and to serve as a double sampling technique to confirm the ocular inventory done in part one.

3. Species List: The California Wildlife Habitat Relationships database (CWHR) was used to produce a site-specific species list by considering ecological and geographical connections between species and the habitat types within the Study Area. Factors used to generate the species list are potential species linked to each of the habitat types and potential species linked to the Study Area based on species range maps and known existing conditions. That broad scale list was then reviewed and refined by a habitat evaluation team to create a fine scale list representative of the Study Area. The resulting species list is included (Appendix A).

4. Data Compilation and Analysis: Data from the mapping and field inventory was used to generate two relationship matrices. The first is a potential species by function matrix and the second is a habitat by function matrix. To create these matrices, the species list was sorted by its association with the CWHR habitat types and the list of taxa was linked to their species functions or KEFs. This first matrix determines the mean functional redundancy index (MFRI), which is the mean number of functions that are perform by species in a habitat type within the project area. The MFRI was calculated using the species list generated for the Aliso Creek CHAP habitat evaluation.

   The second matrix is based on the results of the field inventory of the project area and the list of habitat elements (KECs) observed within each CHAP polygon. The result of the second matrix is the number of functions supported by habitat elements (KECs) specific to that polygon. The second matrix also determines a MFRI, which is the mean number of functions supported by KECs within a habitat type.

   Per-acre values were then computed for each polygon by adding the species-function matrix (MFRI) value for the habitat type of the polygon and polygon specific habitat-function matrix value. In sum, for each polygon species MFRI + habitat MFRI = Per-Acre Value. The per-acre value represents the intrinsic worth of an area to fish and wildlife, determined by accounting for species, habitats, and functions. The per-acre value then was adjusted for the presence of invasive species. (For further details on the matrices see Appendix B and O'Neil 2015).

5. Conversion to Habitat Units (HUs): To determine HUs for a site baseline conditions, so that project alternatives can be compared and therefore inform the cost-benefit analysis, each polygon's per-acre value was multiplied by its acreage. These values were then summed across all polygons to calculate the total HUs for a particular condition or alternative scenario. In sum, for each polygon Per-Acre Value x Acres = HUs.

Results of the baseline CHAP analysis are contained in this report, a GIS geodatabase (*ALISO_CHAP_Baseline.gdb*) and Microsoft Excel spreadsheet (*ALISO_CHAP_Baseline_HUs.xlsx*). GIS data fields depict the CHAP polygon ID, description, acreage, CalWHR wildlife habitat type, structural condition, grass/forb invasive species, shrub invasive species, tree invasive species, CHAP invasive species deduction factors, per-acre habitat values, and Habitat Units (HUs) of each of the 239 polygons. Supporting maps illustrate: a) Study Area boundaries; b) polygon numbering; c) per-acre habitat value (adjusted to account for invasive plant species); d) percentage of non-native plant species by polygon; and e) wildlife habitat types by polygon. The spreadsheet developed contains the CHAP habitat values and a table containing the KECs observed within each CHAP polygon.

Per-Acre Adjustment Value for Invasive Species

Since the Aliso Creek project area is surrounded by a highly urban setting, there is a large influence of invasive plant species. The project area also is influenced by upstream seed sources in the Aliso Creek main stem. Prior to conversion to HUs, the per-acre baseline value of each polygon was adjusted based on the presence of invasive species. Each polygon was assigned an invasive plant value for each of three structural layers (grass/forb, shrub, and tree) based on the percent composition of invasive species in that layer, as documented in the field inventory. Because invasive species generally negatively influence ecosystem function, the per-acre values were then discounted for the presence of invasives, to arrive at a corrected per-acre value for each polygon. The value of discount applied for each layer based on presence of invasive species is described in Table 1. A deduction factor is then determined for the polygon by taking the geo-mean of the deduction factors for each of the three vegetative layers. A geo-mean is used to account for the possibility that a layer does not exist within a polygon (e.g. a polygon containing no trees). The polygon deduction factor was multiplied by the per-acre value to reach the corrected value. In sum, per-acre value x deduction factor = corrected per-acre value.

Invasive species cover	*x*
0-10%	1.0
11-35%	0.9
36-65%	0.7
66-90%	0.5
>90%	0.3

Table 1. Invasive species adjustment factors.

The percent abundance of invasive species by polygon can also be spatially displayed in a map to show their influence on the habitat value (Appendix H, Figures H2-H4). For a list of native and non-native plant species observed within the project area, please see Appendix E.

Results: Existing Conditions

Habitat Types and Vegetation Communities

The 239 polygons in the Aliso Creek project area were determined by delineating the California WHR Wildlife Habitat types that occur within the Study Area, along with further splitting of polygons by structural condition within the same habitat type. The mapping performed by NHI within the project area in 2009, 2014 and 2015 documented eight habitat types, each of which are an aggregation of several vegetation communities. Habitat types as described by the CWHR System included Annual Grassland, Coastal Scrub, Eucalyptus, Lacustrine, Riverine, Urban (Low, Medium, or High Density), Valley Foothill Riparian, and Valley Oak Woodland. The acreage of each habitat type is shown in Table 2, and their proportions to the overall project area are illustrated in Figure 2.

Table 2. California WHR Habitat Types by Acreage and Proportion of Project Area

California WHR Habitat Type	Sum of Acres	Proportion of Project Area
Annual Grassland	212.98	30.8%
Coastal Scrub	112.84	16.3%
Eucalyptus	0.34	0.05%
Lacustrine	30.29	4.4%
Riverine	30.88	4.5%
Urban	55.46	8.0%
Valley Foothill Riparian	247.58	35.8%
Valley Oak Woodland	0.89	0.1%

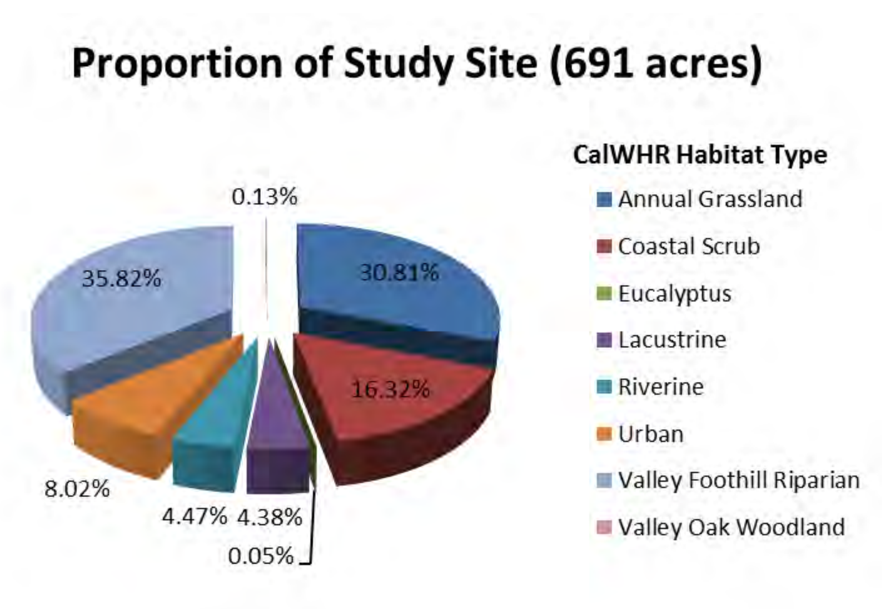


Figure 2. Proportion of Total Acreage by California WHR Habitat Type

Habitat Units

The habitat assessment shows eight habitat types currently existing within the CHAP Study Area, totaling 691 acres. The baseline existing condition assessment calculated that these acres have a total existing CHAP habitat value of 8,916.2 HUs. The HU value of each CHAP polygon is depicted in Appendix C, and contained in the GIS geodatabase.

Per-acre value or simply HUs/acre is a good way to compare the habitat value of CHAP polygons within the project site to see the highest and lowest functioning areas without any polygon size bias (Appendix H, Figure H5). Valley Foothill Riparian habitat type has the highest per-acre habitat value of the habitat types, and Valley Foothill Riparian contributes the most to the overall habitat value of the Study Area (Table 3). Valley Foothill Riparian comprises 35% of the Study Area, and is contributing 50% of the overall habitat value of the Study Area.

Table 3. Existing Conditions Average Habitat Value of Aliso Creek Habitat Types

California WHR Habitat Type	Average Per-acre CHAP Habitat Value	Sum of CHAP Habitat Units (HUs)	Proportion of Total HUs
Annual Grassland	9.25	1969.1	22.08%
Coastal Scrub	13.45	1518.0	17.03%
Eucalyptus	9.25	3.8	0.04%
Lacustrine	14.01	424.5	4.76%
Riverine	11.36	350.9	3.94%
Urban	4.21	233.6	2.62%
Valley Foothill Riparian	17.79	4403.8	49.39%
Valley Oak Woodland	14.00	12.4	0.14%

Finally, the results from the verification transects are presented to show the portion and amounts of tree, shrub, and herbaceous vegetation that were encountered along the line transects (Appendix D).

Hydrology-Geomorphology

The Aliso Creek watershed is suffering from a variety of water resource and related land resource problems. Most of these are related to widespread changes in the watershed from urbanization, including an altered hydrologic regime, channel instability, habitat loss, ecosystem degradation, and decline in water quality. The Aliso Creek watershed has suffered several dramatic changes that are negatively impacting watershed resources. The conversion of natural plant communities to first agriculture and then urbanized landscape has eliminated many native plants and their dependent wildlife. Development in the watershed has replaced natural habitat with structures, roads, and other infrastructure. Natural channels have been replaced by drains, culverts, and engineered channels.

Paved surfaces allow less infiltration and create greater runoff within remaining natural channels. Large rainfall events produce larger stormwater runoff volumes, delivered with higher velocities, resulting in higher rates of erosion. These have produced widespread negative trends in the immediate area of Aliso Creek channel. These trends include channel degradation (incision of the channel bed and erosion of the streambank slopes); severing of the majority of the stream's hydrologic connection to the floodplain; decline in floodplain function including dissipation of floodwater energies and loss to aquifer recharge through floodwater infiltration; lowering of the groundwater table, loss of riparian habitat structure and function; loss of shade canopy; increased surface water temperatures; expansion of the extent of invasive species; and damage to nearby infrastructure (wastewater pipelines and roads). Lower Aliso Creek, which is largely natural and unchannelized, is the most unstable reach in the watershed drainage system. Within the Aliso and Wood Canyons Wilderness Park, the channel bed has incised more than 25 feet in the last 40 years. Tree die-back has been observed downstream of the ACWHEP structure resulting from perched root systems. Manmade alterations have created barriers for aquatic species migration along the lower Aliso Creek mainstem and to the Wood Canyon Creek tributary, promoting isolation of aquatic resources and degradation of aquatic habitat function and value.

Because of the linear size of the project area, the number of polygons defined and the amount of figures and tables that were developed, it is difficult to capture all of these in a consistent manner for this document. In addition, the Corps SMART Planning looks for a reduction of material present so what follows is a series of appendices that offer an overview of the findings. The complete body of material can be found within the digital file that accompanies this report. The following appendices depict: A) Aliso Creek CHAP Species List; B) CHAP Habitat Relationship Matrix Descriptions; C) Acres, CalWHR Habitat Type, and Habitat Units (HUs) for each CHAP Polygon; D) Verification Transect Data; E) Field Inventory Plant Species List; F) Map of Project Area Zoom Levels; G) CHAP Polygon Identification and CalWHR Habitat Type for each Zoom Level; H) Example maps: CalWHR Habitat Type, Grass/Forb Invasives, Shrub Invasives, Tree Invasives, Per-acre Value, and Habitat Units (HUs).

Citations

Johnson, D. H., and T.A. O'Neil, (managing directors). 2001. Wildlife-Habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis, OR. pp. 736

Mayer, K.E., W. Laudenslayer (editors). 1988. A guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection. Sacramento, CA. pp.166.

O'Neil, T. 2015. General Documentation Combined Habitat Assessment Protocols (CHAP) – A Biodiversity Accounting & Valuing System. Northwest Habitat Institute, Corvallis, OR. 50 pp.

O'Neil, T., and J. Bohannon. 2014. Conservation Framework and Assessment. Southern California Association of Governments. Los Angeles, CA. 126 pp.

O'Neil, T. 2010. System for Assessing Habitat Value, Patent No. US 7,681,531. Office of Patents and Trademarks, Washington, DC.

O'Neil, T.A., C. Langhoff, and A. Johnson. 2008. Mapping with a Consistent Wildlife Habitat Classification to Improve Transportation & Conservation Planning. Transportation Research Record: Journal of the Transportation Research Board, No. 2058 - Environment and Energy, Transportation Research Board of the National Academies, Washington D.C. pp. 115-124.

O'Neil, T., B.G. Marcot, and P. Paquet. 2005. The habitat-species-function triad: a planning framework for ecoprovinces and subbasins. Northwestern Naturalist, 86(2): 111.

Perkins, J.P. Like a cool drink of water. Conservation Biology, 16(3):852-853. USACE. 1999. Pamphlet No. 1165-2-502 30 September 1999, Water Resources Policies and Authorities Ecosystem Restoration Supporting Policy Information.

Appendix A ~ Aliso Creek CHAP Habitat Evaluation Species List

Common Name	Scientific Name
Carp	*Cyprinus carpio*
Ensatina	*Ensatina eschscholtzii*
Black-Bellied Slender Salamander	*Batrachoseps nigriventris*
Arboreal Salamander	*Aneides lugubris*
Western Spadefoot	*Spea hammondii*
Western Toad	*Bufo boreas*
Pacific Treefrog	*Hyla regilla*
Bullfrog	*Rana catesbeiana*
Southwestern Pond Turtle	*Actinemys (Emys) marmorata pallida*
Red-Eared Slider	*Trachemys scripta elegans*
Southern Alligator Lizard	*Elgaria multicarinata*
Coast Horned Lizard	*Phrynosoma coronatum*
Western Fence Lizard	*Sceloporus occidentalis*
Side-Blotched Lizard	*Uta stansburiana*
California Legless Lizard	*Anniella pulchra*
Western Skink	*Eumeces skiltonianus*
Coastal Western Whiptail	*Aspidoscelis tigris multiscutatus*
Orange-Throated Whiptail	*Aspidoscelis hyperytha*
Coastal Rosy Boa	*Charina trivirgata rosafusca*
Racer	*Coluber constrictor*
Striped Racer (or Chaparral Whipsnake)	*Masticophis lateralis*
San Bernardino Ringnecked Snake	*Diadophis punctatus modestus*
Night Snake	*Hypsiglena torquata*
Common Kingsnake	*Lampropeltis getula*
Long-Nosed Snake	*Rhinocheilus lecontei*
Gopher Snake	*Pituophis catenifer*
Common Garter Snake	*Thamnophis sirtalis*
Two-Striped Garter Snake	*Thamnophis hammondii*
Western Rattlesnake	*Crotalus viridis*
Coachwhip	*Masticophis flagellum*
Western Blind Snake	*Leptotyphlops humilis*
California Black-Headed Snake	*Tantilla planiceps*
Coast Patch-Nosed Snake	*Salvadora hexalepis*
American Bittern	*Botaurus lentiginosus*
Great Blue Heron	*Ardea herodias*
Great Egret	*Ardea alba*
Snowy Egret	*Egretta thula*
Cattle Egret	*Bubulcus ibis*

Common Name	Scientific Name
Green Heron	*Butorides virescens*
Black-Crowned Night-Heron	*Nycticorax nycticorax*
Turkey Vulture	*Cathartes aura*
Wood Duck	*Aix sponsa*
Mallard	*Anas platyrhynchos*
White-Tailed Kite	*Elanus leucurus*
Northern Harrier	*Circus cyaneus*
Sharp-Shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperii*
Red-Shouldered Hawk	*Buteo lineatus*
Red-Tailed Hawk	*Buteo jamaicensis*
Golden Eagle	*Aquila chrysaetos*
American Kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
California Quail	*Callipepla californica*
Virginia Rail	*Rallus limicola*
Sora	*Borzana carolina*
Common Moorhen	*Gallinula chloropus*
American Coot	*Fulica americana*
Killdeer	*Charadrius vociferus*
Rock Pigeon	*Columba livia*
Mourning Dove	*Zenaida macroura*
Common Ground-Dove	*Columbina passerina*
Greater Roadrunner	*Geococcyx californianus*
Barn Owl	*Tyto alba*
Western Screech-Owl	*Megascops kennicottii*
Great Horned Owl	*Bubo virginianus*
Burrowing Owl	*Athene cunicularia*
White-Throated Swift	*Aeronautes saxatalis*
Black-Chinned Hummingbird	*Archilochus alexandri*
Anna's Hummingbird	*Calypte anna*
Costa's Hummingbird	*Calypte costae*
Allen's Hummingbird	*Selasphorus sasin*
Belted Kingfisher	*Ceryle alcyon*
Nuttall's Woodpecker	*Picoides nuttallii*
Downy Woodpecker	*Picoides pubescens*
Hairy Woodpecker	*Picoides villosus*
Northern Flicker	*Colaptes auratus*
Southwestern Willow Flycatcher	*Empidonax tralli extimus*
Pacific-Slope Flycatcher	*Empidonax difficilis*

Common Name	Scientific Name
Black Phoebe	*Sayornis nigricans*
Say's Phoebe	*Sayornis saya*
Ash-Throated Flycatcher	*Myiarchus cinerascens*
Cassin's Kingbird	*Tyrannus vociferans*
Western Kingbird	*Tyrannus verticalis*
Loggerhead Shrike	*Lanius ludovicianus*
Least Bell's Vireo	*Vireo bellii puscillus*
Hutton's Vireo	*Vireo huttoni*
Warbling Viero	*Vireo gilvus*
Western Scrub-Jay	*Aphelocoma californica*
American Crow	*Corvus brachyrhynchos*
Common Raven	*Corvus corax*
Horned Lark	*Eremophila alpestris*
Tree Swallow	*Tachycineta bicolor*
Violet Green Swallow	*Tachycineta thalassina*
Northern Rough-Winged Swallow	*Stelgidopteryx serripennis*
Cliff Swallow	*Petrochelidon pyrrhonota*
Barn Swallow	*Hirundo rustica*
Oak Titmouse	*Baeolophus inornatus*
Bushtit	*Psaltriparus minimus*
White-Breasted Nuthatch	*Sitta carolinensis*
Canyon Wren	*Catherpes mexicanus*
Cactus Wren	*Campylorhynchus brunneicapillus*
Bewick's Wren	*Thryomanes bewickii*
House Wren	*Troglodytes aedon*
Marsh Wren	*Cistothorus palustris*
Ruby-Crowned Kinglet	*Regulus calendula*
Blue-Gray Gnatcatcher	*Polioptila caerulea*
California Gnatcatcher	*Polioptila californica*
Western Bluebird	*Sialia mexicana*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
American Robin	*Turdus migratorius*
Wrentit	*Chamaea fasciata*
Northern Mockingbird	*Mimus polyglottos*
California Thrasher	*Toxostoma redivivum*
European Starling	*Sturnus vulgaris*
American Pipit	*Anthus rubrescens*
Cedar Waxwing	*Bombycilla cedrorum*
Phainopepla	*Phainopepla nitens*

Common Name	Scientific Name
Orange-Crowned Warbler	*Vermivora celata*
Yellow Warbler	*Dendroica petechia*
Yellow-Rumped Warbler	*Dendroica coronata*
Black-Throated Gray Warbler	*Dendroica nigrescens*
Townsend's Warbler	*Dendroica townsendi*
Hermit Warbler	*Dendroica occidentalis*
Common Yellowthroat	*Geothlypis trichas*
Wilson's Warbler	*Wilsonia pusilla*
Yellow-Breasted Chat	*Icteria virens*
Western Tanager	*Piranga ludoviciana*
Spotted Towhee	*Pipilo maculatus*
California Towhee	*Pipilo crissalis*
Lark Sparrow	*Chondestes grammacus*
Sage Sparrow	*Amphispiza belli*
Savannah Sparrow	*Passerculus sandwichensis*
Grasshopper Sparrow	*Ammodramus savannarum*
Fox Sparrow	*Passerella iliaca*
Song Sparrow	*Melospiza melodia*
White-Crowned Sparrow	*Zonotrichia leucophrys*
Golden-Crowned Sparrow	*Zonotrichia atricapilla*
Rufous-Crowned Sparrow	*Aimophila ruficeps*
Dark-Eyed Junco	*Junco hyemalis*
Black-Headed Grosbeak	*Pheucticus melanocephalus*
Blue Grosbeak	*Passerina caerulea*
Lazuli Bunting	*Passerina amoena*
Red-Winged Blackbird	*Agelaius phoeniceus*
Tricolored Blackbird	*Agelaius tricolor*
Western Meadowlark	*Sturnella neglecta*
Brewer's Blackbird	*Euphagus cyanocephalus*
Brown-Headed Cowbird	*Molothrus ater*
Hooded Oriole	*Icterus cucullatus*
Bullock's Oriole	*Icterus bullockii*
House Finch	*Carpodacus mexicanus*
Lesser Goldfinch	*Carduelis psaltria*
Lawrence's Goldfinch	*Carduelis lawrencei*
American Goldfinch	*Carduelis tristis*
House Sparrow	*Passer domesticus*
Virginia Opossum	*Didelphis virginiana*
Ornate Shrew	*Sorex ornatus*
Desert Shrew	*Notiosorex crawfordi*

Common Name	Scientific Name
Broad-Footed Mole	*Scapanus latimanus*
California Myotis	*Myotis californicus*
Western Small-Footed Myotis	*Myotis ciliolabrum*
Yuma Myotis	*Myotis yumanensis*
Long-Legged Myotis	*Myotis volans*
Fringed Myotis	*Myotis thysanodes*
Long-Eared Myotis	*Myotis evotis*
Silver-Haired Bat	*Lasionycteris noctivagans*
Big Brown Bat	*Eptesicus fuscus*
Western Red Bat	*Lasiurus blossevillii*
Hoary Bat	*Lasiurus cinereus*
Townsend's Big-Eared Bat	*Corynorhinus townsendii*
Brazilian Free-Tailed Bat	*Tadarida brasiliensis*
Brush Rabbit	*Sylvilagus bachmani*
Black-Tailed Jackrabbit	*Lepus californicus*
California Ground Squirrel	*Spermophilus beecheyi*
Botta's Pocket Gopher	*Thomomys bottae*
Little Pocket Mouse	*Perognathus longimembris*
Pacific Kangaroo Rat	*Dipodomys agilis*
Western Harvest Mouse	*Reithrodontomys megalotis*
Deer Mouse	*Peromyscus maniculatus*
Cactus Mouse	*Peromyscus eremicus*
Desert Woodrat	*Neotoma lepida*
California Vole	*Microtus californicus*
Black Rat	*Rattus rattus*
House Mouse	*Mus musculus*
Coyote	*Canis latrans*
Gray Fox	*Urocyon cinereoargenteus*
Raccoon	*Procyon lotor*
Long-Tailed Weasel	*Mustela frenata*
American Badger	*Taxidea taxus*
Western Spotted Skunk	*Spilogale gracilis*
Striped Skunk	*Mephitis mephitis*
Mountain Lion	*Puma concolor*
Bobcat	*Lynx rufus*
Black-Tailed Deer	*Odocoileus hemionus*
Rufous Hummingbird	*Selasphorus rufus*
Red Diamond Rattlesnake	*Crotalus ruber*

Appendix B ~ Relationship Matrix Descriptions

Relationship Matrix Descriptions

MATRIX 1: Potential Species by Function Matrix

The potential species list generated by IBIS (see Appendix A) is aligned with Key Ecological Functions (KEFs) that could potentially be performed in the habitat type and structural condition represented by the polygon. For example, if the polygon represents a "shrub-steppe" habitat type, the KEFs thought to be performed in that habitat type by the potential species are included in the relationship matrix. This information is acquired from IBIS. The result of this matrix is the number of potential species performing key functions in that habitat type. Example follows:

Valley Foothill Riparian Habitat Type *Species Value (Potential)*	**Function 1** ***Secondary Consumer***	**Function 2** ***Breaks up Down Wood***	**Function 3** ***Primary Excavator***	**Function 4** ***Eats Terrestrial Insects***
Downey Woodpecker	**0**	**1**	**1 (tree)**	**1**
Bobcat	**1**	**0**	**0**	**0**
Belted Kingfisher	**1**	**0**	**1 (burrows)**	**1**
Great Blue Heron	**1**	**0**	**0**	**1**

MATRIX 2: Actual KEC by Function Matrix

In this matrix, the functions, or KEFs, are again related to Key Environmental Correlates (KECs), but this time the KECs are those actually present at the site (based on field data inventory). Because this is an actual account, those KEFs not correlated to an actual KEC are then removed. The result of this matrix is the number of KEFs characterized by KECs specific to that polygon. Example follows:

Valley Foothill Riparian Habitat Type *KEC Value (Potential)*	**Function 1** ***Creates Snags***	**Function 2** ***Breaks up Down Wood***	**Function 3** ***Primary Excavator***	**Function 4** ***Eats Terrestrial Insects***
KEC 1 down wood	**0**	**1**	**0**	**1**
KEC 2 snags	**1**	**0**	**1**	**1**
KEC 3 tree cavities	**1**	**1**	**1**	**1**
KEC 4 hollow living trees	**0**	**1**	**0**	**1**

Appendix C ~ CHAP Polygons: Acres, California WHR Habitat Type, CHAP Habitat Units (HUs)

CHAP Polygon ID	CalWHR Habitat Type	Acres	CHAP Habitat Units (HUs)
AC_001	Valley Foothill Riparian	16.28	194.7
AC_002	Coastal Scrub	3.19	34.7
AC_003	Urban	0.34	1.5
AC_004	Coastal Scrub	2.55	32.9
AC_005	Annual Grassland	1.60	15.3
AC_006	Coastal Scrub	8.06	85.6
AC_007	Coastal Scrub	7.95	149.3
AC_008	Urban	0.78	3.3
AC_009	Riverine	3.96	51.5
AC_010	Valley Foothill Riparian	0.96	22.4
AC_011	Coastal Scrub	6.37	87.6
AC_012	Annual Grassland	4.39	69.7
AC_013	Annual Grassland	5.31	53.9
AC_014	Urban	0.31	1.4
AC_015	Valley Foothill Riparian	3.59	84.1
AC_016	Coastal Scrub	3.74	59.9
AC_017	Valley Foothill Riparian	2.29	52.3
AC_018	Annual Grassland	6.32	62.8
AC_019	Annual Grassland	8.52	74.1
AC_020	Valley Foothill Riparian	8.89	145.8
AC_021	Urban	0.25	1.1
AC_022	Valley Foothill Riparian	3.92	90.2
AC_023	Urban	0.72	2.1
AC_024	Urban	4.06	17.3
AC_025	Valley Foothill Riparian	0.97	14.0
AC_026	Urban	0.82	1.1
AC_027	Riverine	0.81	10.9
AC_028	Urban	1.98	2.8
AC_029	Coastal Scrub	1.22	19.7
AC_030	Riverine	0.57	7.9
AC_031	Coastal Scrub	0.60	10.0
AC_032	Valley Foothill Riparian	0.51	8.9
AC_033	Valley Foothill Riparian	0.68	10.3
AC_034	Coastal Scrub	1.64	22.5
AC_035	Coastal Scrub	3.42	38.1
AC_036	Coastal Scrub	2.82	37.8
AC_037	Valley Foothill Riparian	4.10	100.4
AC_038	Urban	0.76	1.8
AC_039	Coastal Scrub	1.06	16.7
AC_040	Annual Grassland	2.46	23.7
AC_041	Coastal Scrub	1.36	18.1
AC_042	Urban	12.15	64.8

CHAP Polygon ID	CalWHR Habitat Type	Acres	CHAP Habitat Units (HUs)
AC_043	Coastal Scrub	2.02	41.1
AC_044	Riverine	2.28	34.3
AC_045	Coastal Scrub	0.35	3.8
AC_046	Coastal Scrub	1.00	10.7
AC_047	Annual Grassland	11.07	110.0
AC_048	Coastal Scrub	5.84	59.0
AC_049	Coastal Scrub	1.08	11.1
AC_050	Annual Grassland	2.62	24.8
AC_051	Valley Foothill Riparian	0.53	5.8
AC_052	Valley Foothill Riparian	1.65	25.3
AC_053	Coastal Scrub	1.21	12.6
AC_054	Urban	2.05	2.8
AC_055	Annual Grassland	0.64	5.7
AC_056	Riverine	0.15	1.8
AC_057	Valley Foothill Riparian	5.99	150.4
AC_058	Valley Foothill Riparian	9.84	154.7
AC_059	Coastal Scrub	4.09	57.4
AC_060	Coastal Scrub	1.55	16.5
AC_061	Coastal Scrub	1.95	20.7
AC_062	Annual Grassland	22.75	226.0
AC_063	Annual Grassland	18.96	178.5
AC_064	Valley Foothill Riparian	1.20	15.4
AC_065	Annual Grassland	3.12	29.4
AC_066	Annual Grassland	12.26	114.7
AC_067	Annual Grassland	0.89	8.0
AC_068	Annual Grassland	2.33	11.4
AC_069	Coastal Scrub	12.26	105.2
AC_070	Coastal Scrub	1.47	22.7
AC_071	Valley Foothill Riparian	3.82	79.7
AC_072	Urban	0.59	2.9
AC_073	Riverine	4.83	52.1
AC_074	Valley Foothill Riparian	10.39	173.6
AC_075	Annual Grassland	3.85	28.9
AC_076	Annual Grassland	0.31	2.4
AC_077	Annual Grassland	0.16	1.2
AC_078	Annual Grassland	0.92	6.9
AC_079	Coastal Scrub	1.12	16.6
AC_080	Valley Foothill Riparian	9.40	213.1
AC_081	Valley Foothill Riparian	5.99	78.4
AC_082	Valley Foothill Riparian	1.09	24.0
AC_083	Coastal Scrub	0.62	9.3
AC_084	Valley Foothill Riparian	2.36	54.7

CHAP Polygon ID	CalWHR Habitat Type	Acres	CHAP Habitat Units (HUs)
AC_085	Valley Foothill Riparian	7.22	175.1
AC_086	Annual Grassland	7.07	98.3
AC_087	Valley Foothill Riparian	0.38	8.6
AC_088	Valley Foothill Riparian	3.13	49.0
AC_089	Valley Foothill Riparian	10.05	141.2
AC_090	Annual Grassland	18.01	149.6
AC_091	Valley Foothill Riparian	0.23	3.7
AC_092	Valley Foothill Riparian	0.21	3.3
AC_093	Valley Foothill Riparian	0.88	10.8
AC_094	Annual Grassland	6.59	54.7
AC_095	Valley Foothill Riparian	0.57	5.1
AC_096	Valley Foothill Riparian	0.23	4.2
AC_097	Valley Foothill Riparian	0.56	11.8
AC_098	Annual Grassland	1.31	10.9
AC_099	Valley Foothill Riparian	2.99	41.9
AC_100	Coastal Scrub	4.17	57.7
AC_101	Valley Foothill Riparian	21.59	320.5
AC_102	Valley Foothill Riparian	1.32	15.3
AC_103	Valley Foothill Riparian	11.11	136.2
AC_104	Coastal Scrub	3.14	34.0
AC_105	Annual Grassland	14.92	171.6
AC_107	Valley Foothill Riparian	0.21	2.6
AC_108	Coastal Scrub	2.44	46.7
AC_109	Coastal Scrub	3.32	68.1
AC_110	Coastal Scrub	0.54	5.7
AC_111	Valley Foothill Riparian	7.70	107.3
AC_112	Annual Grassland	2.39	24.0
AC_113	Annual Grassland	3.19	21.3
AC_114	Valley Foothill Riparian	1.41	11.9
AC_115	Valley Foothill Riparian	4.56	78.6
AC_116	Coastal Scrub	1.28	21.7
AC_117	Riverine	0.34	4.9
AC_118	Riverine	0.79	9.4
AC_119	Valley Foothill Riparian	1.37	25.8
AC_120	Annual Grassland	1.15	10.7
AC_121	Coastal Scrub	1.23	13.3
AC_122	Valley Foothill Riparian	0.76	12.0
AC_123	Urban	1.03	2.5
AC_124	Valley Foothill Riparian	4.53	83.6
AC_125	Riverine	0.67	9.0
AC_126	Valley Foothill Riparian	0.50	9.9
AC_127	Valley Foothill Riparian	1.14	24.2
AC_128	Coastal Scrub	2.01	36.7
AC_129	Riverine	0.40	4.6
AC_130	Riverine	1.04	9.8
AC_131	Riverine	0.95	10.3
AC_132	Riverine	0.65	7.4

CHAP Polygon ID	CalWHR Habitat Type	Acres	CHAP Habitat Units (HUs)
AC_133	Riverine	2.10	22.9
AC_134	Riverine	0.82	9.8
AC_135	Riverine	0.42	3.1
AC_136	Riverine	0.35	4.1
AC_137	Riverine	0.17	0.5
AC_138	Lacustrine	30.29	424.5
AC_139	Riverine	0.47	3.8
AC_140	Riverine	0.05	0.5
AC_141	Riverine	2.17	27.9
AC_142	Riverine	1.22	15.9
AC_143	Riverine	0.84	7.4
AC_144	Riverine	2.14	19.2
AC_145	Riverine	0.90	7.5
AC_146	Riverine	0.53	4.3
AC_147	Riverine	1.24	10.2
AC_148	Annual Grassland	16.75	91.3
AC_149	Valley Foothill Riparian	10.37	265.5
AC_150	Valley Foothill Riparian	1.27	16.9
AC_151	Urban	0.93	4.3
AC_152	Annual Grassland	3.59	44.9
AC_153	Valley Foothill Riparian	1.12	12.4
AC_154	Urban	3.33	12.0
AC_155	Urban	5.77	22.0
AC_156	Urban	0.23	1.0
AC_157	Urban	0.52	2.2
AC_158	Urban	0.71	4.2
AC_159	Urban	0.19	1.1
AC_160	Urban	1.67	7.0
AC_161	Urban	0.67	2.0
AC_162	Urban	0.05	0.2
AC_163	Valley Foothill Riparian	1.45	21.6
AC_164	Valley Foothill Riparian	0.25	1.6
AC_165	Valley Foothill Riparian	1.70	25.3
AC_166	Annual Grassland	0.34	3.2
AC_167	Valley Foothill Riparian	0.30	6.2
AC_168	Urban	0.93	3.1
AC_169	Valley Foothill Riparian	1.27	20.3
AC_170	Coastal Scrub	0.61	7.4
AC_171	Valley Foothill Riparian	0.33	5.3
AC_172	Valley Foothill Riparian	0.19	3.9
AC_173	Urban	0.65	2.8
AC_174	Coastal Scrub	0.63	6.5
AC_175	Coastal Scrub	0.22	2.8
AC_176	Valley Foothill Riparian	0.08	1.9
AC_177	Valley Foothill Riparian	0.34	6.8
AC_178	Coastal Scrub	0.58	9.9
AC_179	Valley Foothill Riparian	2.21	44.3

CHAP Polygon ID	CalWHR Habitat Type	Acres	CHAP Habitat Units (HUs)
AC_180	Annual Grassland	0.29	3.7
AC_181	Valley Foothill Riparian	1.18	23.5
AC_182	Valley Foothill Riparian	0.10	2.2
AC_183	Coastal Scrub	0.56	10.4
AC_184	Eucalyptus	0.34	3.8
AC_185	Valley Foothill Riparian	3.41	68.3
AC_186	Urban	1.42	6.1
AC_187	Urban	0.49	2.3
AC_188	Urban	0.15	0.7
AC_189	Annual Grassland	0.49	2.1
AC_190	Urban	0.98	4.5
AC_191	Urban	0.20	0.6
AC_192	Urban	0.29	0.9
AC_193	Urban	1.17	5.0
AC_194	Urban	0.60	1.8
AC_195	Urban	0.13	0.6
AC_196	Urban	0.34	1.6
AC_197	Urban	0.22	1.0
AC_198	Urban	0.27	1.3
AC_199	Urban	0.19	0.9
AC_200	Annual Grassland	2.65	25.2
AC_201	Urban	0.23	1.1
AC_202	Valley Foothill Riparian	5.28	107.2
AC_203	Valley Foothill Riparian	1.03	20.9
AC_204	Valley Foothill Riparian	0.20	4.1
AC_205	Valley Foothill Riparian	0.94	20.4
AC_206	Valley Foothill Riparian	3.31	66.6
AC_207	Coastal Scrub	0.61	12.5
AC_208	Valley Foothill Riparian	1.55	36.9
AC_209	Urban	0.23	1.0
AC_210	Valley Foothill Riparian	1.61	38.6

CHAP Polygon ID	CalWHR Habitat Type	Acres	CHAP Habitat Units (HUs)
AC_211	Coastal Scrub	3.55	65.2
AC_212	Valley Foothill Riparian	3.68	80.6
AC_213	Coastal Scrub	2.04	19.0
AC_214	Valley Foothill Riparian	2.19	47.1
AC_215	Annual Grassland	8.80	47.2
AC_216	Coastal Scrub	1.62	14.9
AC_217	Coastal Scrub	0.69	5.3
AC_218	Urban	0.88	1.6
AC_219	Urban	0.27	0.9
AC_220	Valley Foothill Riparian	0.31	5.1
AC_221	Coastal Scrub	0.57	5.6
AC_222	Coastal Scrub	0.24	2.4
AC_223	Annual Grassland	10.62	79.6
AC_224	Urban	0.26	1.1
AC_225	Coastal Scrub	0.29	3.3
AC_226	Annual Grassland	0.85	15.7
AC_227	Coastal Scrub	0.82	11.2
AC_228	Valley Foothill Riparian	8.41	181.7
AC_229	Urban	1.65	7.1
AC_230	Coastal Scrub	1.00	19.5
AC_231	Coastal Scrub	2.15	38.7
AC_232	Valley Foothill Riparian	1.45	35.0
AC_233	Valley Foothill Riparian	1.10	18.7
AC_234	Valley Foothill Riparian	1.45	27.5
AC_235	Annual Grassland	3.83	48.1
AC_236	Annual Grassland	1.68	19.6
AC_237	Valley Foothill Riparian	12.43	207.0
AC_238	Urban	2.01	8.8
AC_239	Valley Oak Woodland	0.89	12.4
AC_240	Urban	2.00	17.9

Appendix D ~ Verification Transect Data

Table D1. Grass-forbs shrub, and tree by percent cover by transect.

Aliso Creek CHAP Verification Transect Results - May 2009											
Transect	Cover Type	Grass-Forb Stratum Results (average)						Shrub Stratum Results		Tree Stratum Results	
		Height (cm)	Total Herbaceous Cover (%)	Percent Grass	Percent Forbs	Percent Non-Native	Percent Native	Percent Cover	Mean Height (cm)	Percent Cover	Mean Height (m)
6-1	Grassland	31	79	78	8	79	0	-	-	-	-
7-1	Coastal Shrub	11	59	15	41	59	0	20	62	-	-
7-1	Coastal Shrub	8	46	9	0	46	0	72	152	-	-
8-1	Grassland	3	76	21	60	76	0	-	-	-	-
9-1	Coastal Shrub	9	7	2	0	7	0	80	76	-	-
10-0	Coastal Shrub	5	33	24	16	33	0	84	168	-	-
10-1	Coastal Shrub	34	81	76	7	81	0	24	98	-	-
11-1	Grassland	21	82	82	1	82	1	-	-	-	-
15-1	Riparian	-	-	-	-	-	-	-	-	71	6
16-1	Grassland	10	94	94	2	94	0	-	-	-	-
19-1	Grassland	16	95	95	0	95	0	-	-	-	-
27-1	Coastal Shrub	34	41	26	17	31	10	48	128	-	-
58-1	Riparian	-	-	-	-	-	-	20	133	92	7
59-1	Coastal Shrub	0	0	0	0	0	0	95	152	-	-
Average: All Transects		**15**	**58**	**44**	**13**	**57**	**1**	**55**	**121**	**82**	**7**

Table D2. Shrub and trees percent cover by transect.

	Common Name	Genus/Species	Transect Number/Percent Cover								
			7-1	7-2	10-0	10-1	11-1	15-1	27-1	58-1	59-1
Shrubs	California Brittlebush	*Encelia californica*	-	4	-	-	-	-	-	-	-
	California Buckwheat	*Eriogonum fasciculatum*	8	8	4	-	2	-	-	-	-
	California Sagebrush	*Artemisia californica*	4	4	-	4	-	12	-	-	-
	California Goldenbush	*Isocoma menziesii*	8	56	16	-	-	-	-	-	-
	Coyote Brush	*Baccharis pilularis*	-	-	64	8	-	12	48	20	32
	Mule Fat	*Baccharis salicifolia*	-	-	-	12	-	-	-	-	60
Trees	Arroyo Willow	*Salix lasiolepis*	-	-	-	-	-	71	-	28	-
	Fremont Cottonwood	*Populus fremontii*	-	-	-	-	-	-	-	64	-

Table D3. Estimate native and non-native observed by polygon.

	Cover Percent							Relative Percent		
Polygon ID	Arundo	Native grass forb	Non Native grass/forb	Native shrub	Non Native shrub	Native tree	Non Native tree	Non-Native grass/forb	Non-Native shrub	Non-Native tree
AC_52a	25	5	65	5	5	40	0	92.9%	50.0%	0.0%
AC_047	0	0	93	2	0	0	0	100.0%	0.0%	0.0%
AC_104	0	1	6	55	0	5	0	85.7%	0.0%	0.0%
AC_036	15	0	20	60	1	5	0	100.0%	1.6%	0.0%
AC_031	50	0	20	25	0	0	0	100.0%	0.0%	0.0%
AC_010	30	7	52	48	0	0	0	88.1%	0.0%	0.0%
AC_015	30	7	52	48	0	0	0	88.1%	0.0%	0.0%
AC_017	25	2	47	74	2	0	0	95.9%	1.9%	0.0%
AC_022	25	0	41	40	0	5	0	100.0%	0.0%	0.0%
AC_035	0	5	30	72	0	0	0	85.7%	0.0%	0.0%
AC_034	1	0	62	50	0	5	0	100.0%	0.0%	0.0%
AC_043	0	11	21	75	0	6	0	65.6%	0.0%	0.0%
AC_117	10	2.5	14.5	50	1	5	0	85.3%	2.0%	0.0%
AC_029	30	2	55	93	0	20	0	96.5%	0.0%	0.0%

Table D4. Herbaceous vegetation status as native or non-native.

	Common Name	Genus/Species	Status	
			Non-Native	Native
Herbaceous	Star Thistle	*Centauraea* spp.	x	
	Ripgut Brome	*Bromus diandrus*	x	
	Compact Brome	*Bromus madritensis*	x	
	Soft Brome	*Bromus Hordeaceus*	x	
	Barley spp.	*Hordeum*	?	?
	Wild Oat	*Avena fatua*	x	
	Black Mustard	*Brassica nigra*	x	
	Ambrosia	*Ambrosia acanthicarpa*		x
	Winter Vetch	*Vicia villosa*	x	
	Shortpod Mustard	*Hirschfeldia incana*	x	
	Giant Reed	*Arundo donax*	x	
	Rat-tail Fescue	*Vulpia myuros*	x	
	Bedstraw	*Galium andrewsii*		x
	Italian Plumeless Thistle	*Carduus pycnocephalus*	x	
	Douglas Sagewort	*Artemisia douglasiana*		x
	Sweet Clover	*Melilotus indicus*	x	
	Maltese Star-thistle	*Centaurea melitensis*	x	
	Phacelia spp.	*Phacelia* spp.		x
	Poison Hemlock	*Conium maculatum*	x	
	Petty Spurge	*Euphorbia peplus*	x	
	Russian Thistle	*Salsola kali*	x	
	Vetch spp.	*Astragalus* spp.		x

Appendix E ~ Aliso Creek Field Inventory Plant Species List

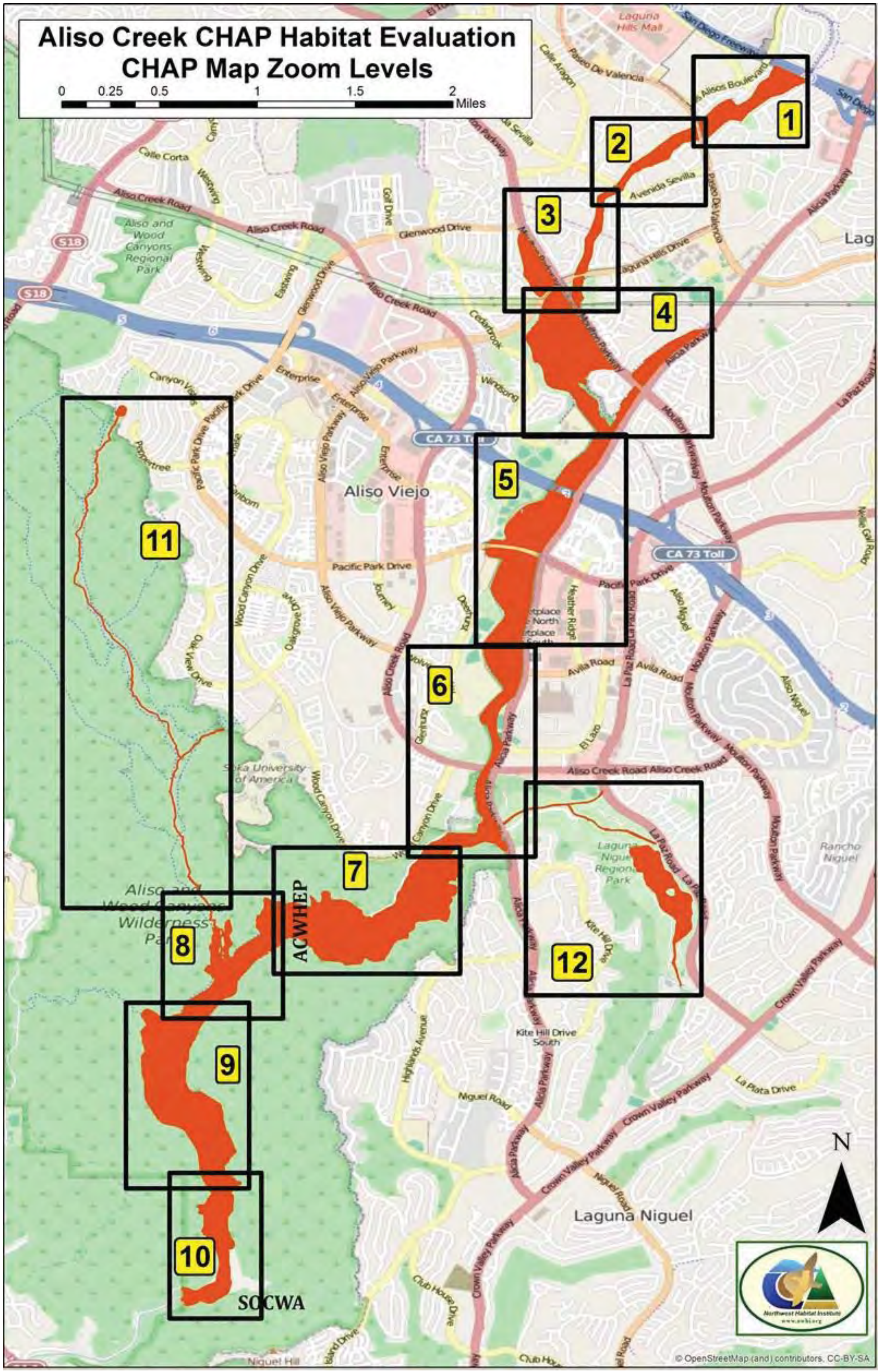
* All Native/Non Native Status' were taken from USDA Plants website. Status could not always be determined for genera or families without species level identification. USDA, NRCS. 2009. The PLANTS Database (http://plants.usda.gov, 29 June 2009). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Common Name	**Scientific Name**	**Native Status ***
Alder	*Alnus sp.*	Native
Arroyo Willow	*Salix lasiolepis*	Native
Artichoke Thistle	*Cynara sp.*	Non Native
Bushsunflower	*Simsia calva*	Native
Barley	*Hordeum sp.*	Non Native
Bermuda Grass	*Cynodon dactylon*	Non Native
Black Mustard	*Brassica nigra*	Non Native
Black Sage	*Salvia mellifera*	Native
Bottle Brush	*Callistemon citrinus*	Non Native
California Buckwheat	*Eriogonum fasciculatum*	Native
California Golden Bush	*Ericameria ericoides*	Native
California Myrtle	*Morella californica*	Native
California Oat Grass	*Danthonia californica*	Native
California Poppy	*Eschscholzia californica*	Native
Cattail	*Typha sp.*	Native
Coastal Oak	*Quercus agrifolia*	Native
Coastal Sage	*Artemisia californica*	Native
Cottonwood	*Populus sp.*	Native
Coyotebrush	*Baccharis pilularis*	Native
Curly Dock	*Rumex crispus*	Non Native
Currant	*Ribes sp.*	Non Native
Duck Weed	*Family: Lemnaceae*	Native
Elder Berry	*Sambucus sp.*	Native
Rye Grass	*Lolium sp.*	Non Native
Eucalyptus	*Eucalyptus sp.*	Non Native
Fennel	*Foeniculum vulgare*	Non Native
Garland Flower	*Daphne cneorum*	Non Native
Giant Reed	*Arundo donax*	Non Native
Gooseberry	*Ribes uva-crispa*	Non Native

Common Name	Scientific Name	Native Status *
Hedge Mustard	*Sisymbrium officinale*	Non Native
Hore Hound	*Ballota/Marrubium sp.*	Non Native
Lemonade Berry	*Rhus integrifolia*	Native
Mayweed	*Laminaria sp.*	?
Milk Thistle	*Silybum sp.*	Non Native
Monkey Flower	*Mimulus sp.*	Native
Mug Wart	*Artemisia vulgaris*	Native
Mule Fat	*Baccharis salicifolia*	Native
Palm Tree	Family: Arecaceae	?
Pampas Grass	*Cortaderia selloana*	Non Native
Plantain	*Plantago sp.*	Non Native
Poison Hemlock	*Conium maculatum*	Non Native
Prickly Pear Cactus	*Opuntia sp.*	?
Prickly Thistle	*Sonchus asper*	Non Native
Rabbit Brush	*Chrysothamnus sp.*	Native
Rabbit Foot Grass	*Polypogon sp.*	Non Native
Red Needle Grass	*Stipa sp.*	Native?
Rip Gut Grass	*Bromus diandrus*	Non Native
Rush	*Juncus sp.*	?
Salsify Plant	*Tragopogon sp.*	Non Native
Salt Bush	*Atriplex lentiformis*	Native
Scarlet Pimpernel	*Anagallis arvensis*	Non Native
Scorpion Grass	*Phacelia sp.*	Native
Sedge	Family: Cyperaceae	?
Sedum	*Sedum sp.*	?
Speedwell	*Veronica sp.*	Non Native
Stinging Nettle	*Urtica dioica*	Native
Sugar Bush	*Rhus ovata*	Native
Sweet Clover	*Melilotus sp.*	Non Native
Sycamore	*Platanus sp.*	Native
Tabacco Tree	*Nicotiana glauca*	Non Native
Tree Mallow	*Lavatera arborea*	Non Native
Vervain	*Verbena sp.*	?
Vetch	*Vicia sp.*	?
White Alder	*Alnus rhombifolia*	Native
White Sage	*Salvia apiana*	Native
Wild Cucumber	*Marah sp.*	Native

Common Name	Scientific Name	Native Status *
Wild Heliotrope	*Phacelia sp.*	Native
Wild Oats	*Avena sp.*	Non Native
Willow	*Salix sp.*	Native
Willowherb	*Epilobium sp.*	?
Yerba Mansa	*Anemopsis californica*	Native

Appendix F ~ CHAP's Zoom Levels Location Map



Appendix G ~ CHAP Polygon Identification & Habitat Types for each Zoom Level

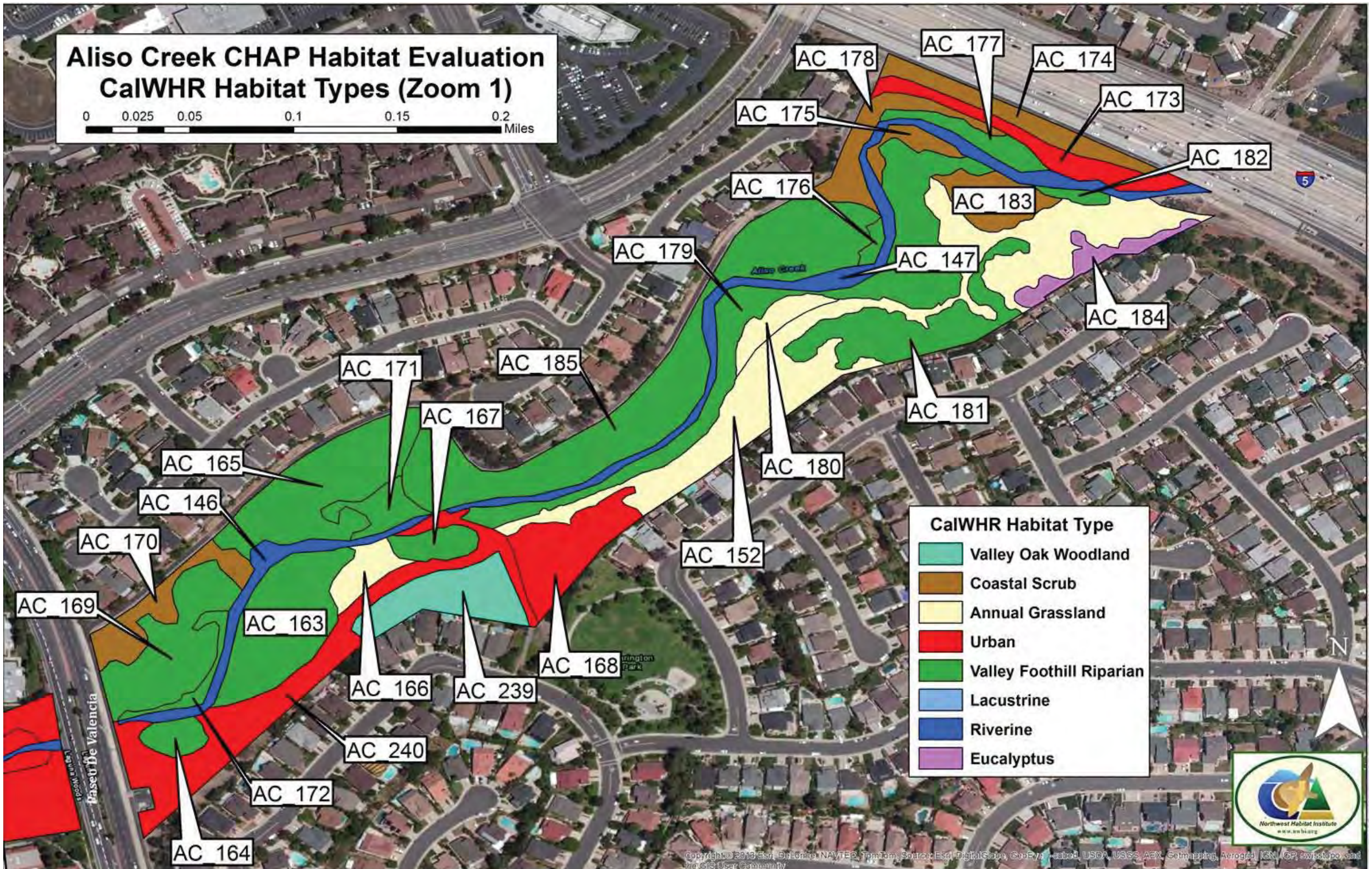


Figure G1. Polygon Identification & Habitat Type – Zoom 1

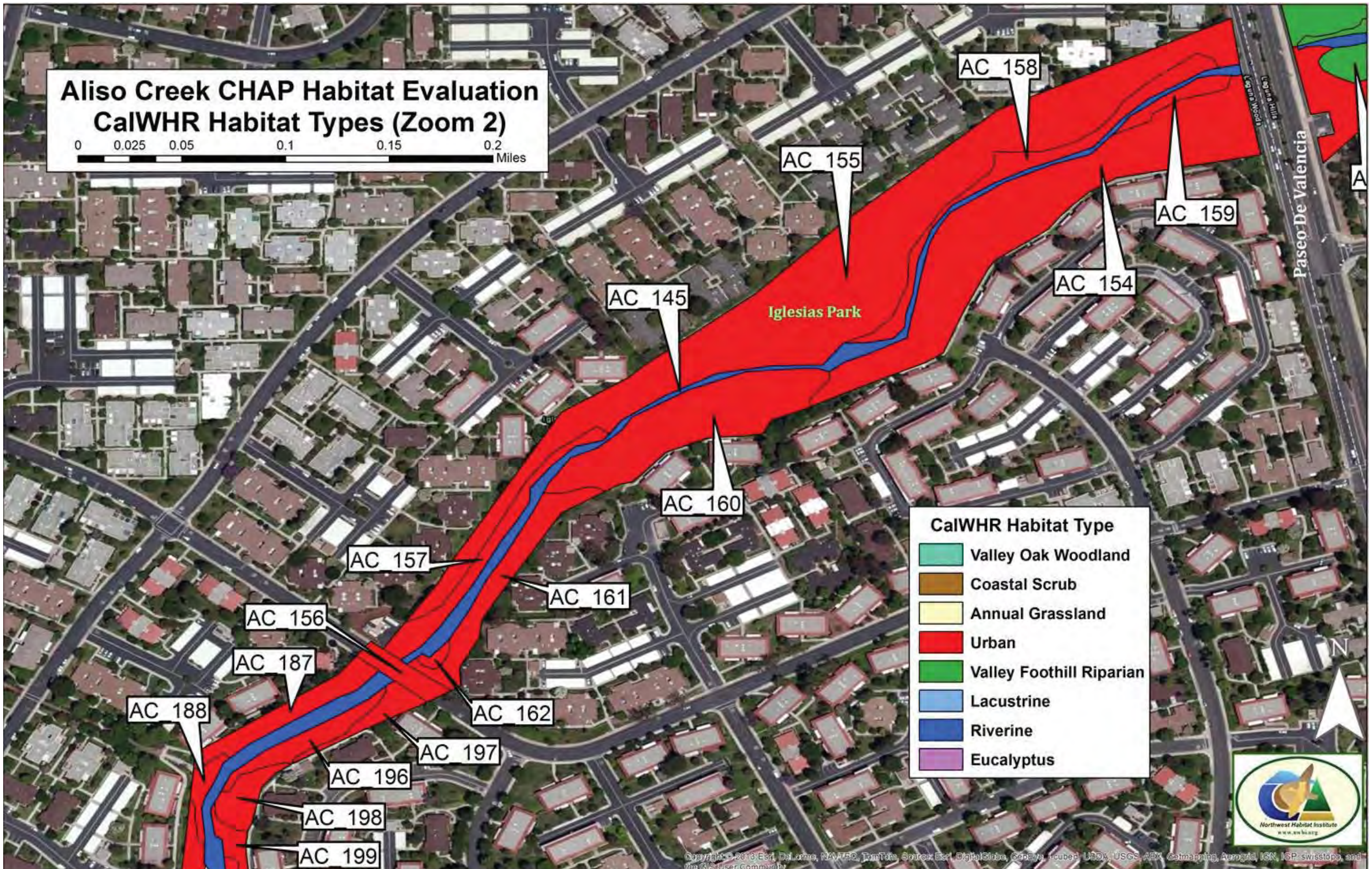


Figure G2. Polygon Identification & Habitat Type – Zoom 2

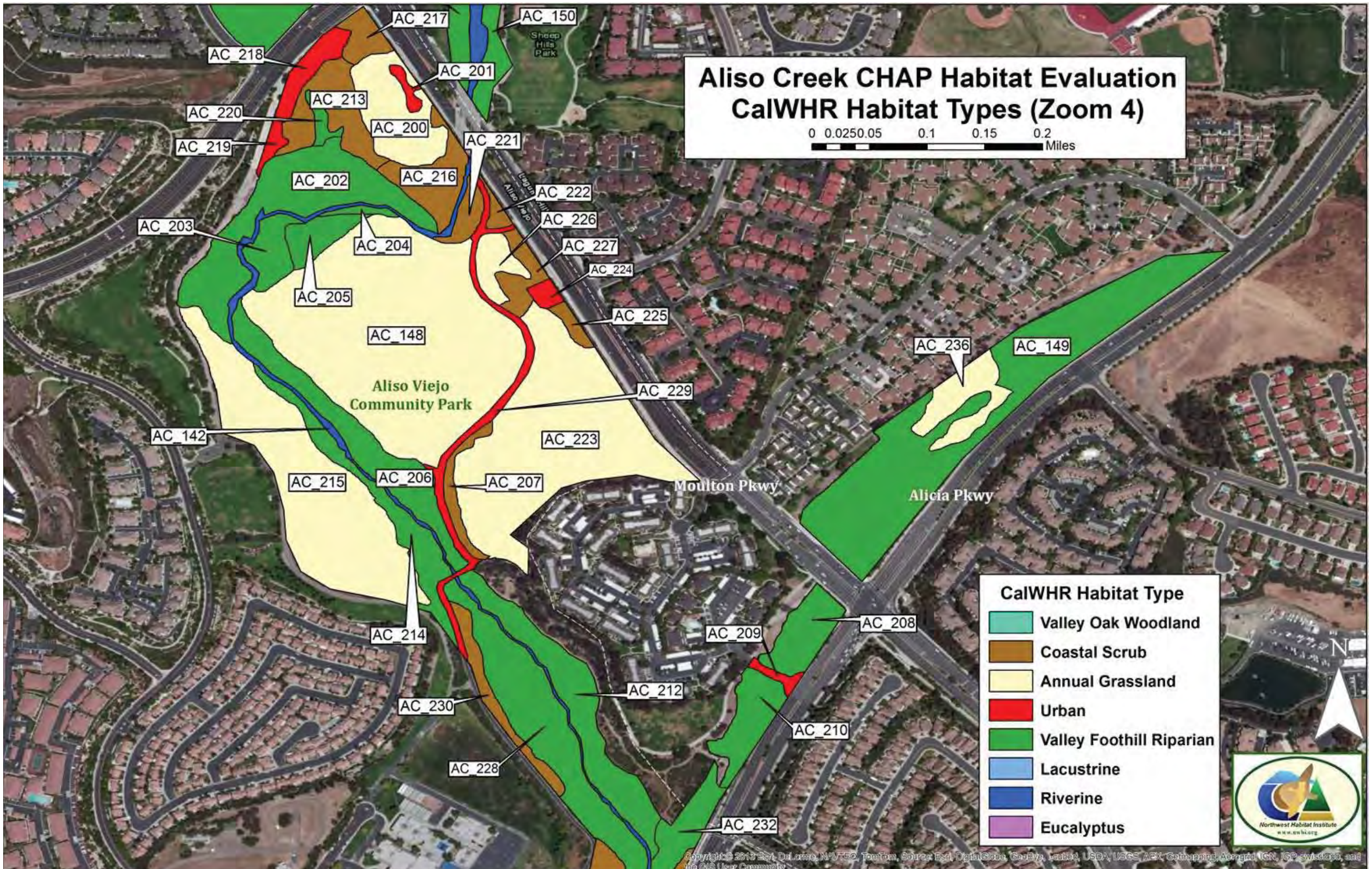


Figure G3. Polygon Identification & Habitat Type – Zoom 3

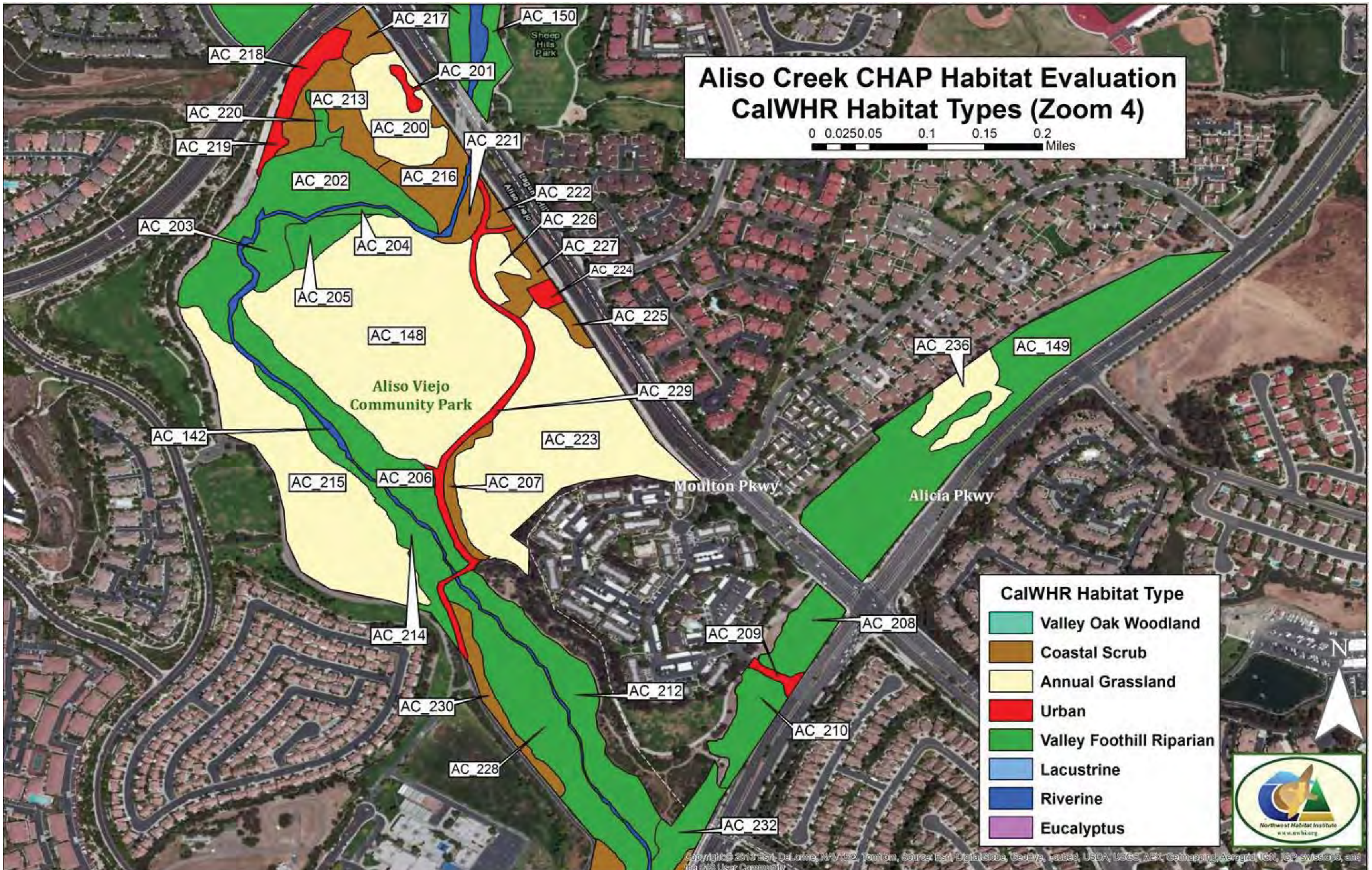


Figure G4. Polygon Identification & Habitat Type – Zoom 4

Figure G5. Polygon Identification & Habitat Type – Zoom 5

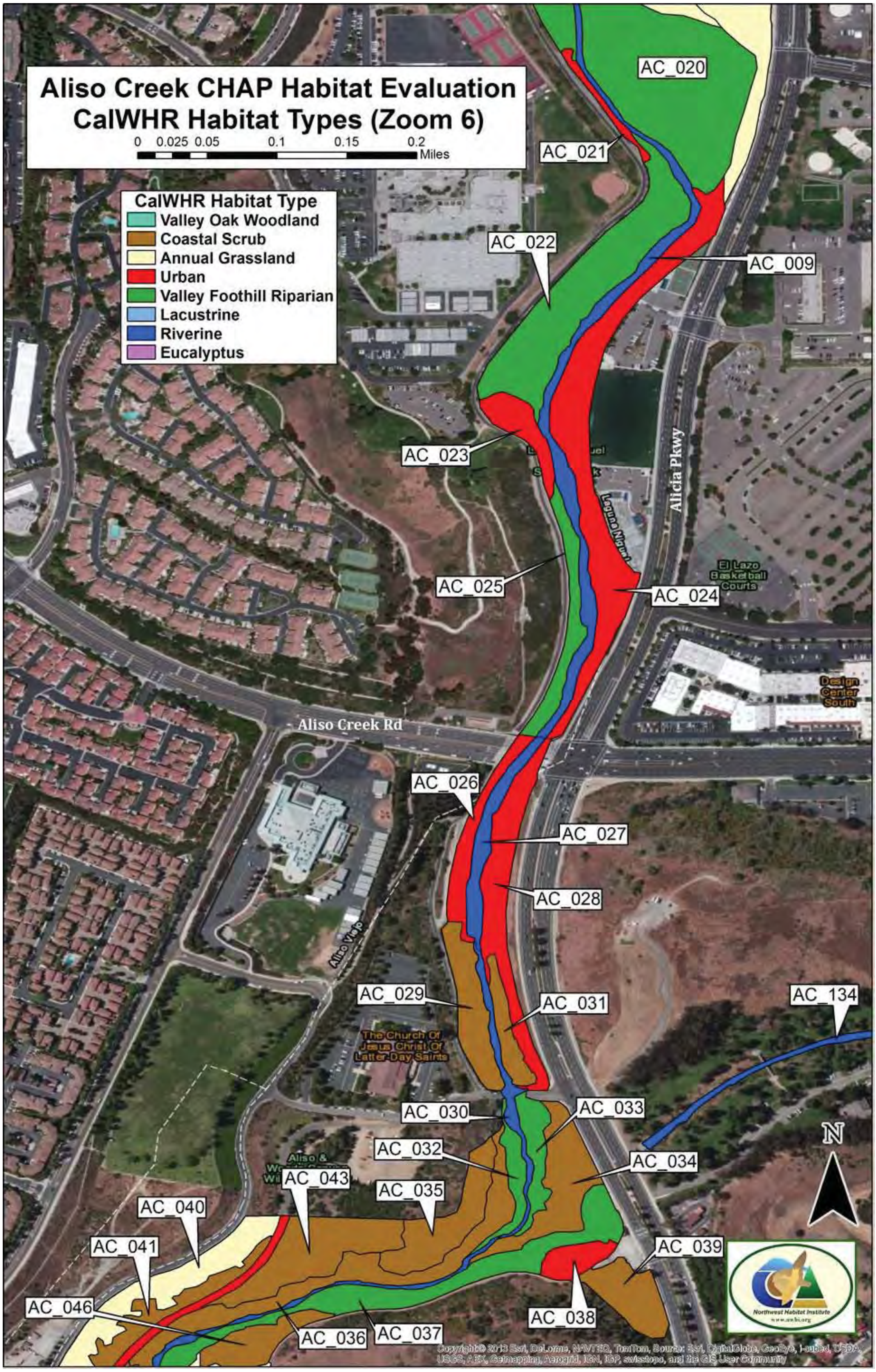


Figure G6. Polygon Identification & Habitat Type – Zoom 6

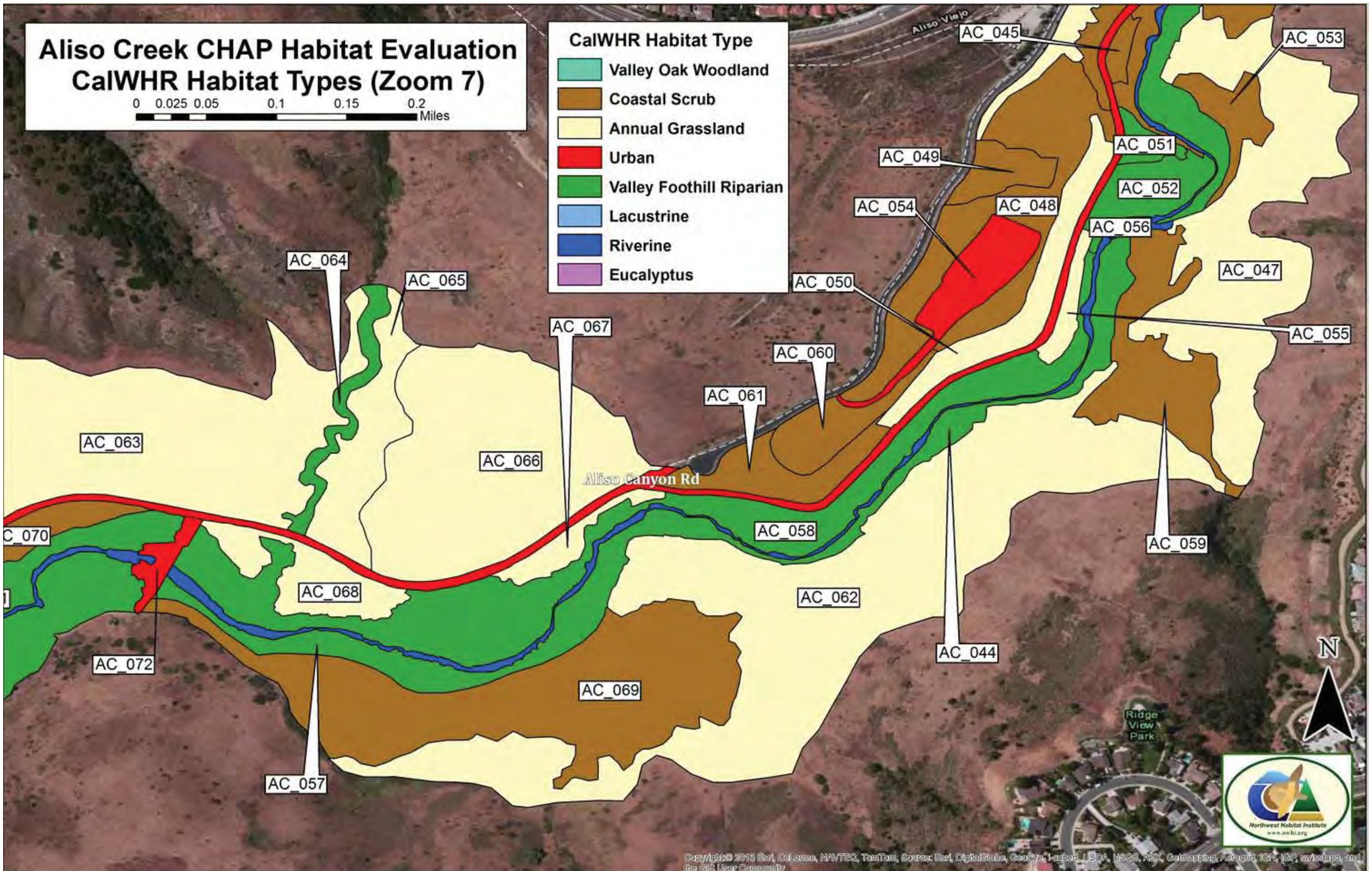


Figure G7. Polygon Identification & Habitat Type – Zoom 7

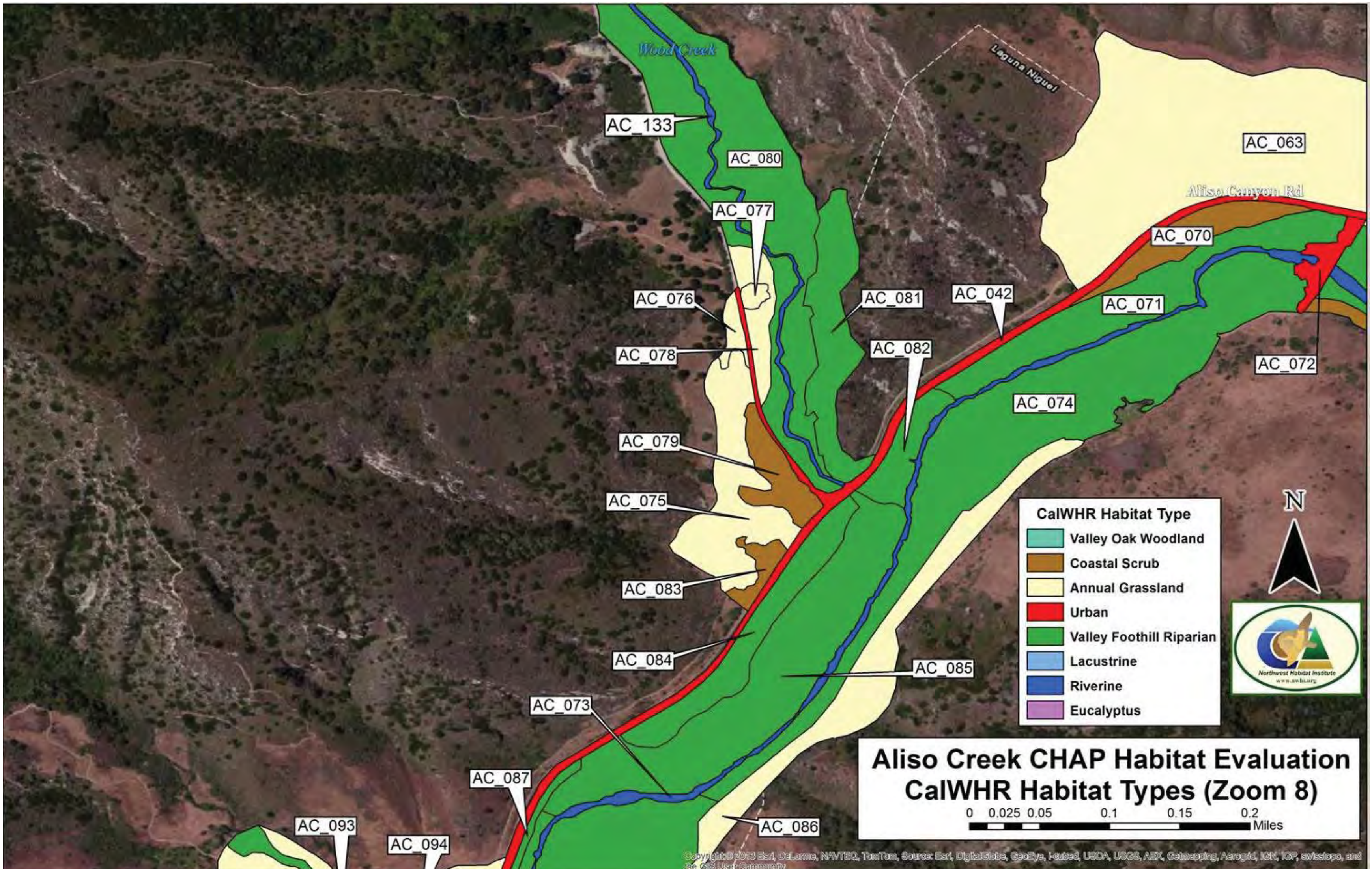


Figure G8. Polygon Identification & Habitat Type – Zoom 8

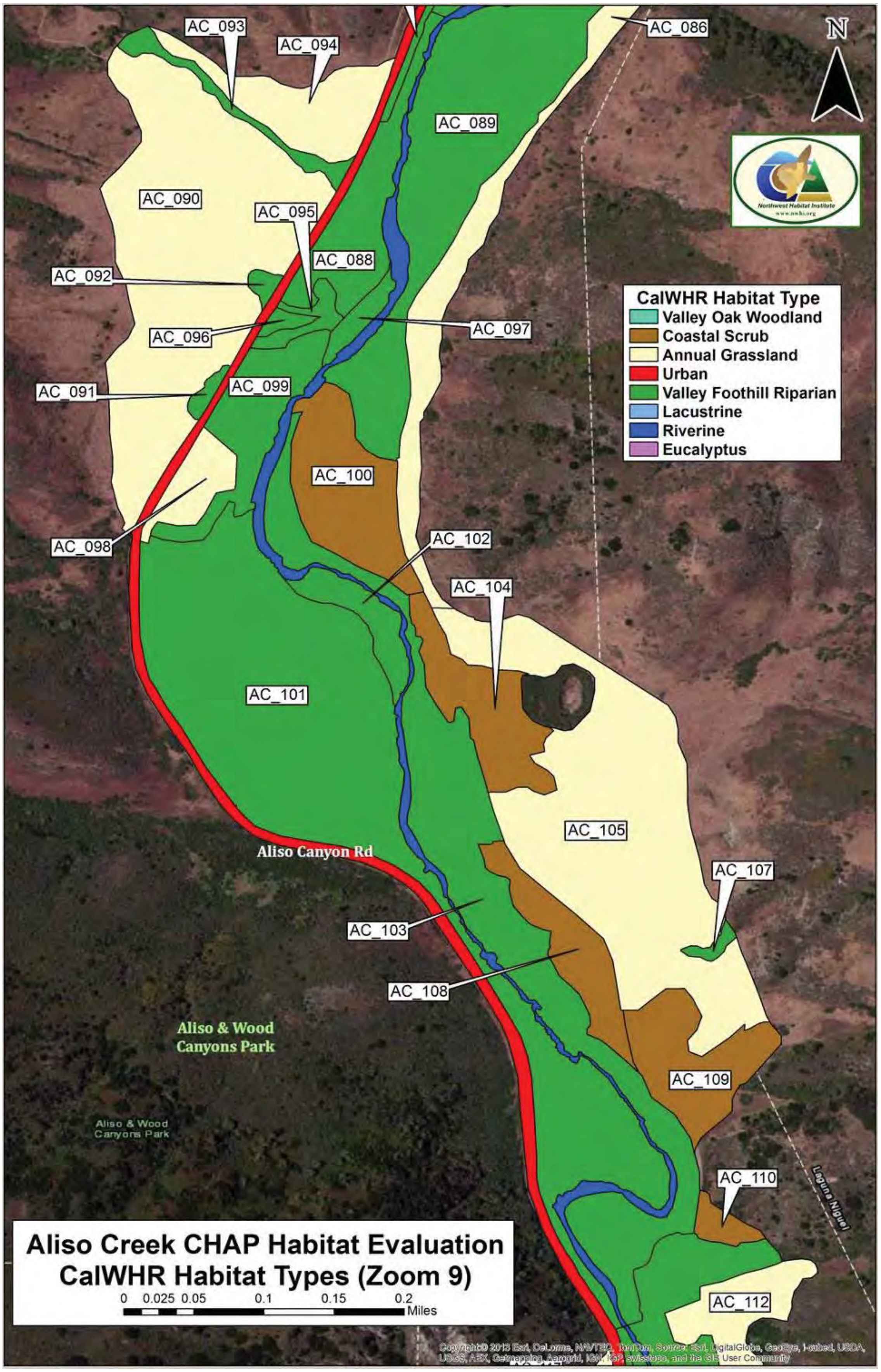


Figure G9. Polygon Identification & Habitat Type – Zoom 9

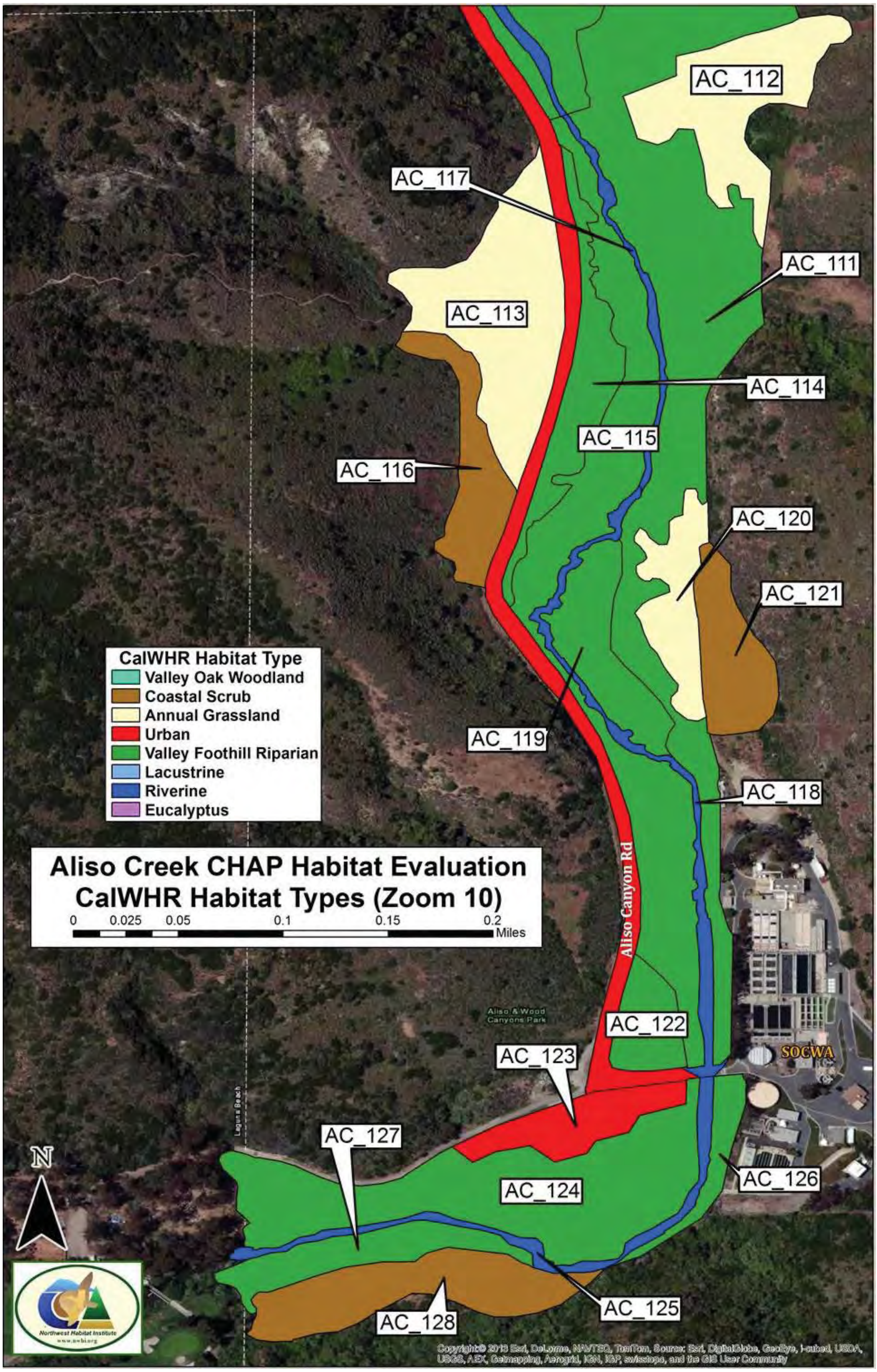


Figure G10. Polygon Identification & Habitat Type – Zoom 10

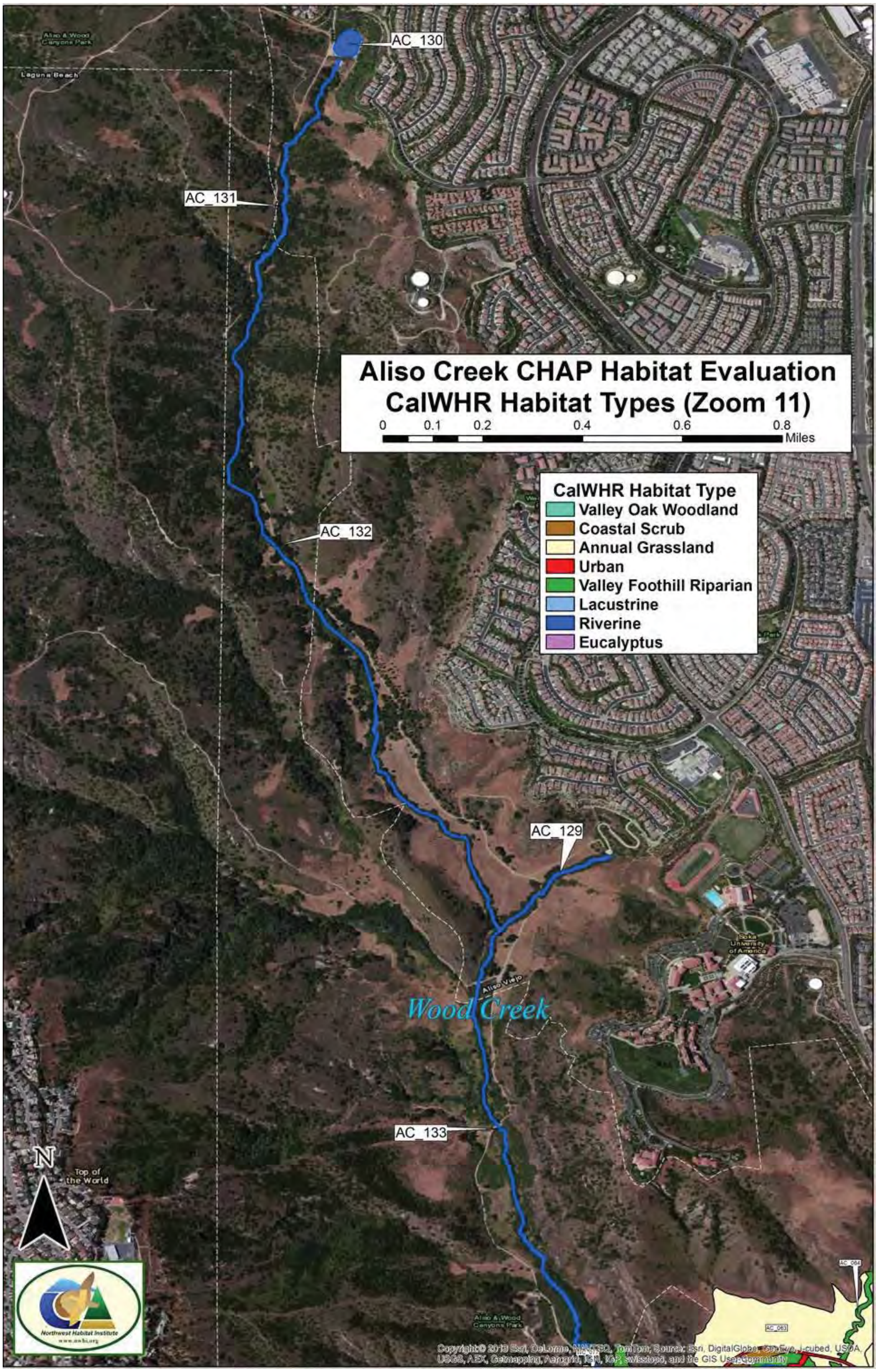


Figure G11. Polygon Identification & Habitat Type – Zoom 11

Figure G12. Polygon Identification & Habitat Type – Zoom 12

Appendix H ~ Example Maps of CHAP's Baseline Condition Outputs for Zoom 7

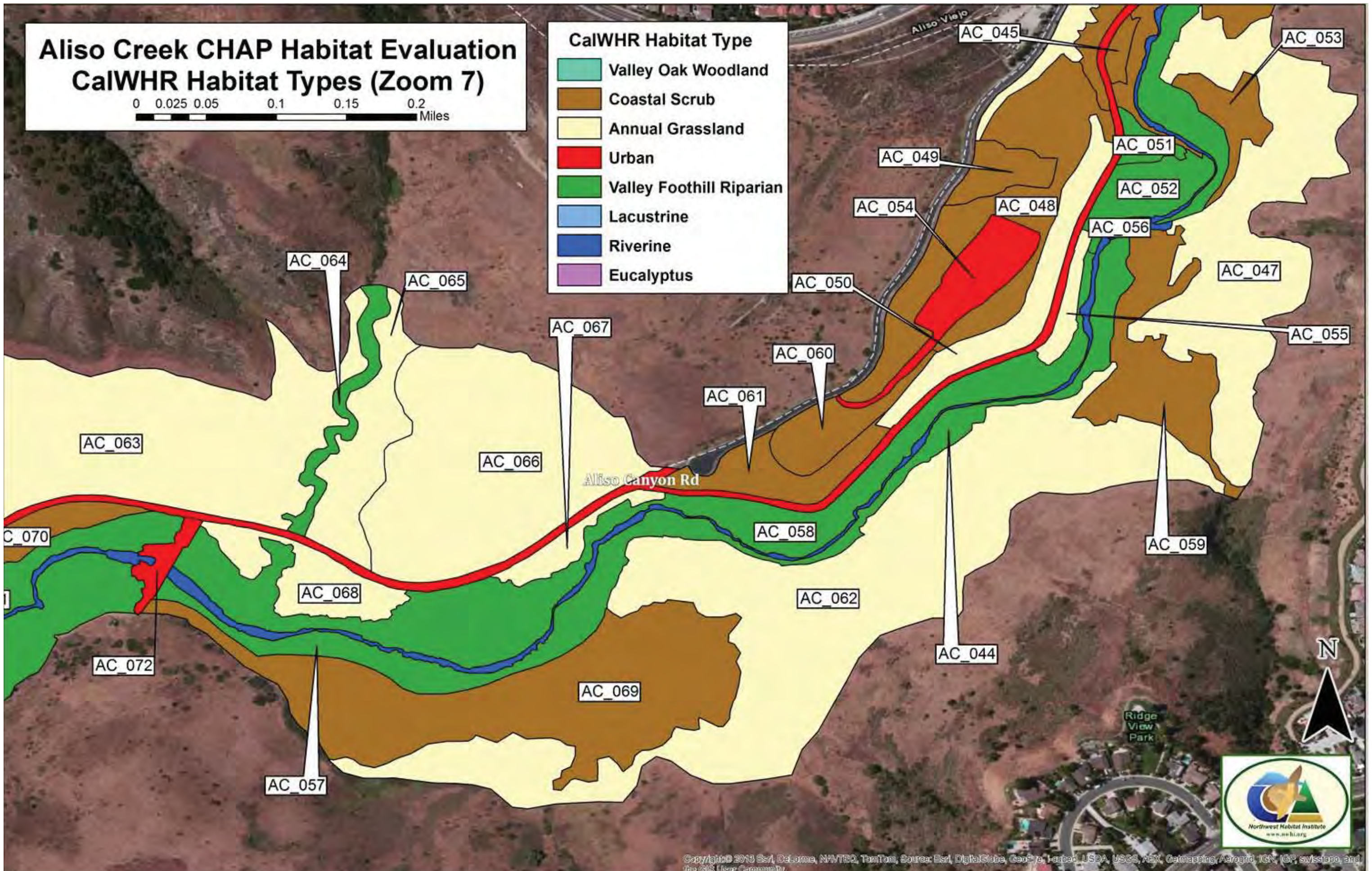


Figure H1. CalWHR Habitat Types

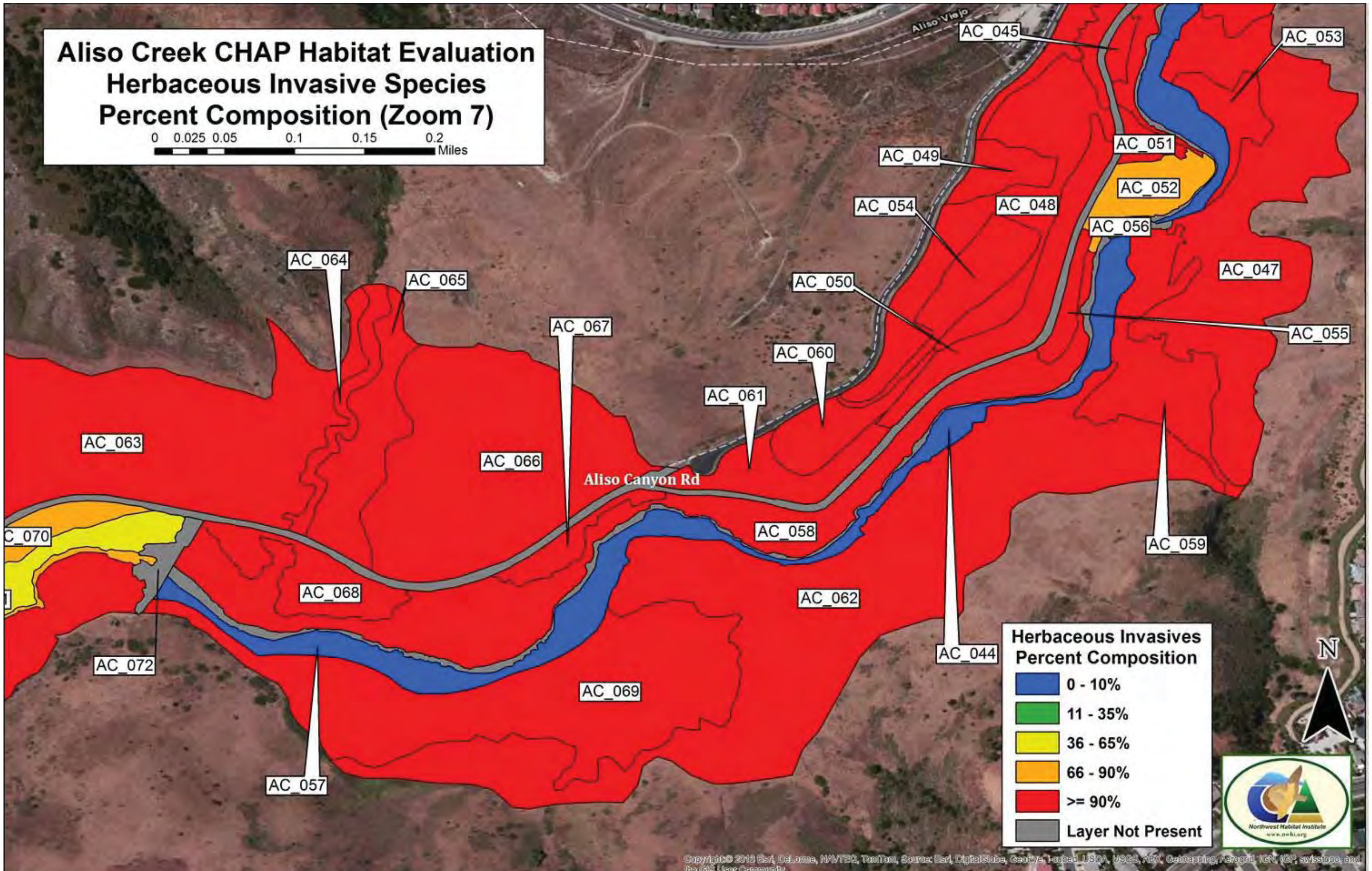


Figure H2. Invasive Species – Herbaceous Layer

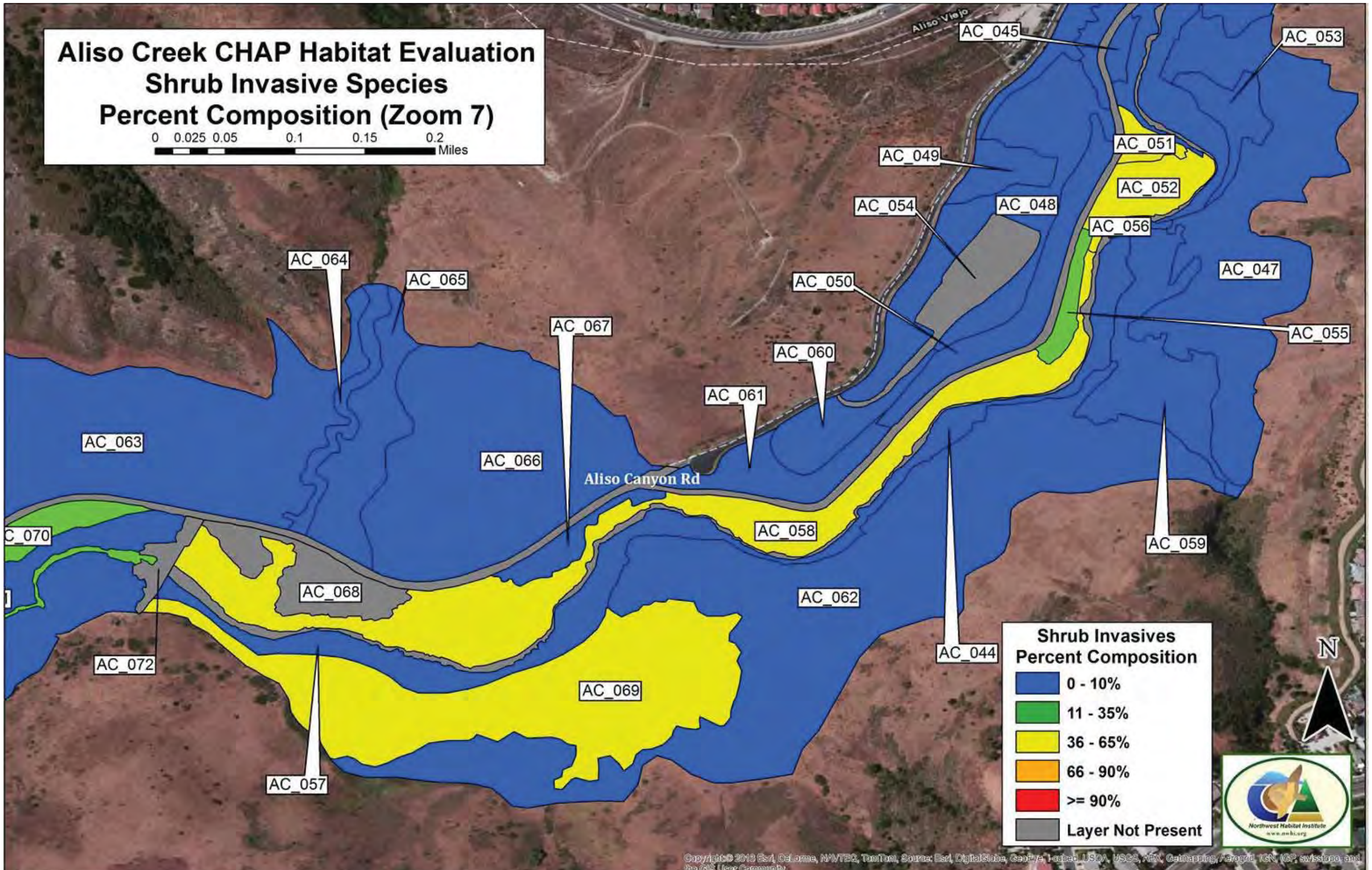


Figure H3. Invasive Species – Shrub Layer

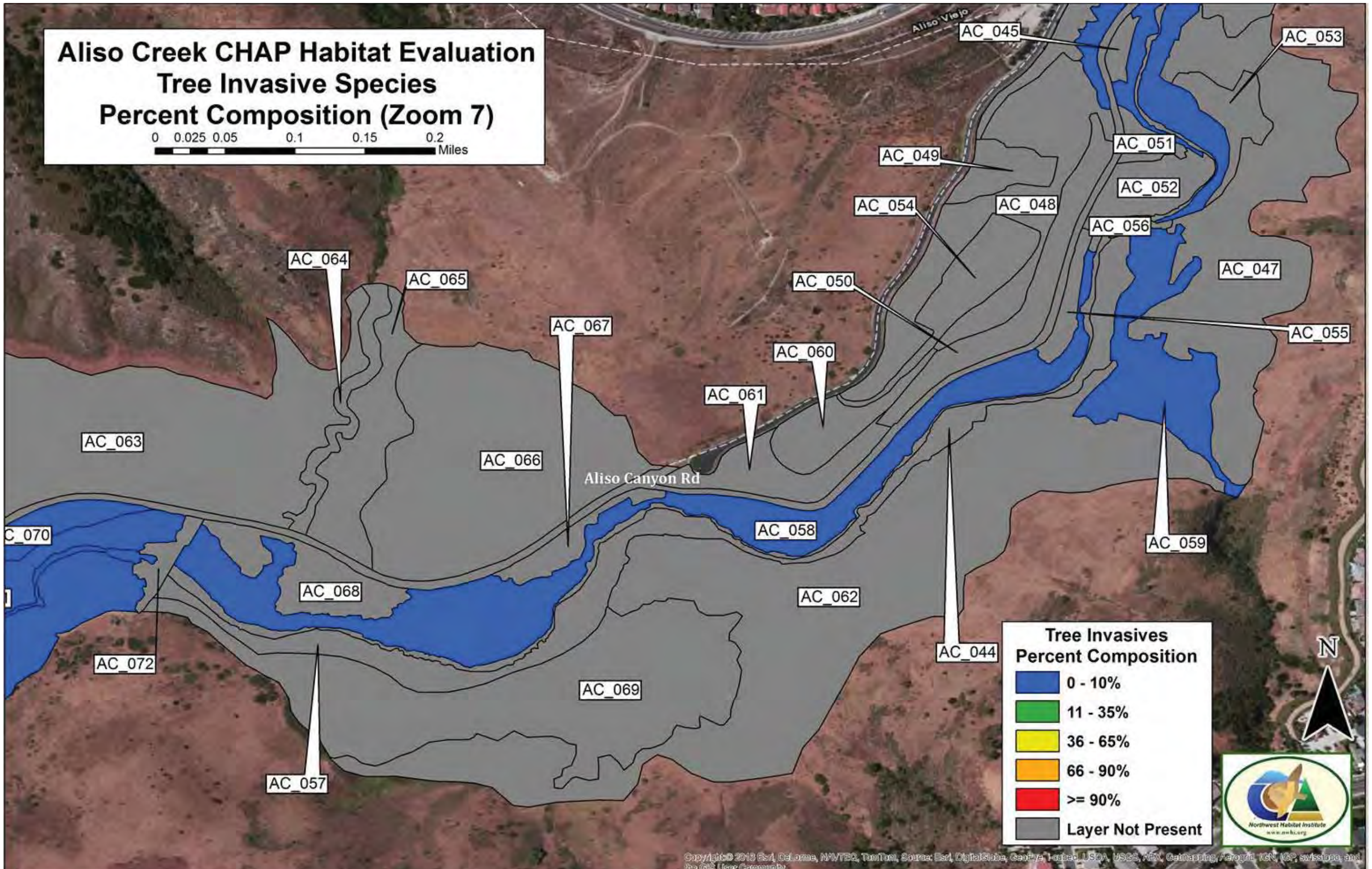


Figure H4. Invasive Species – Tree Layer

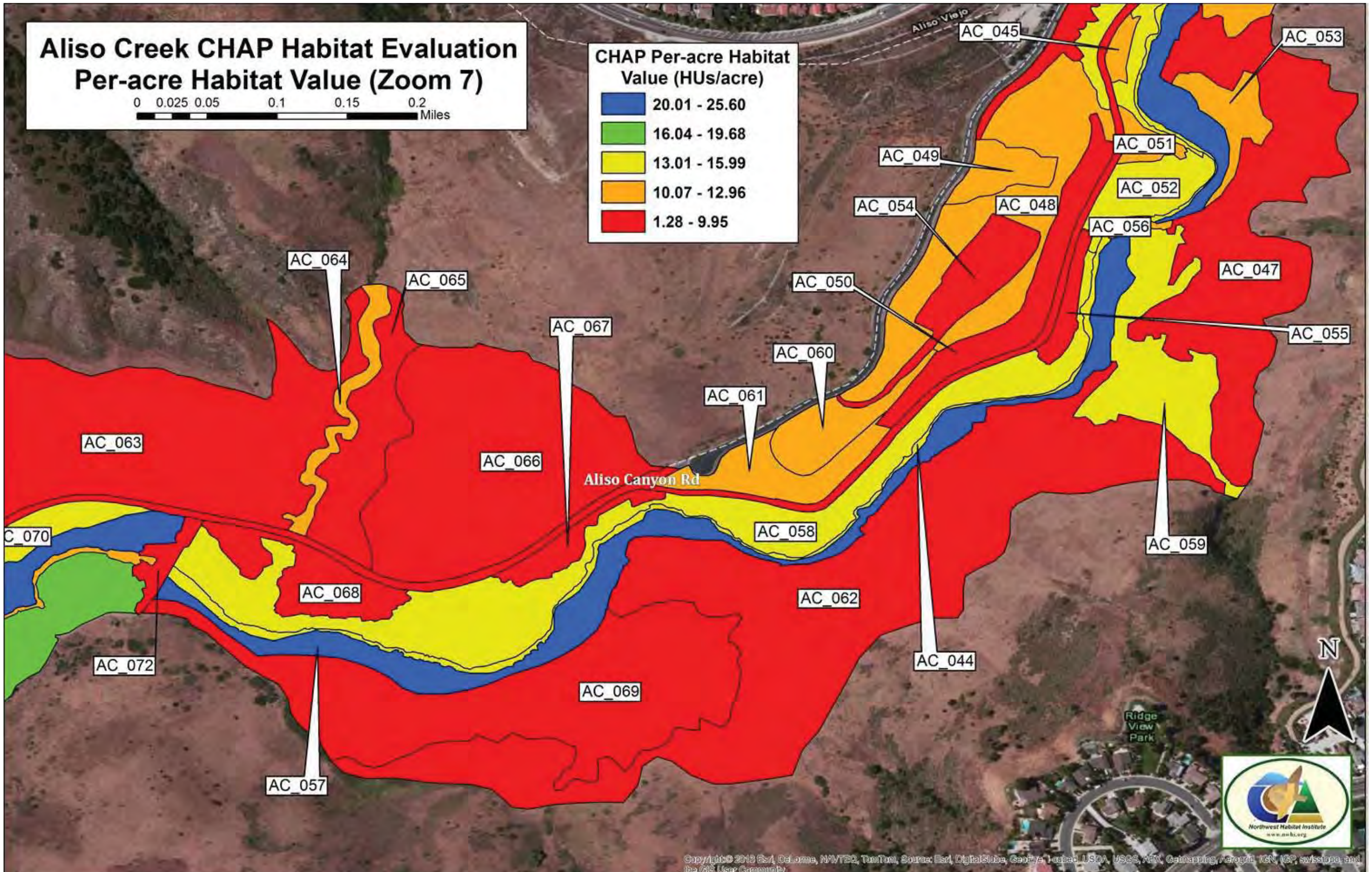


Figure H5. CHAP Per-Acre Habitat Values

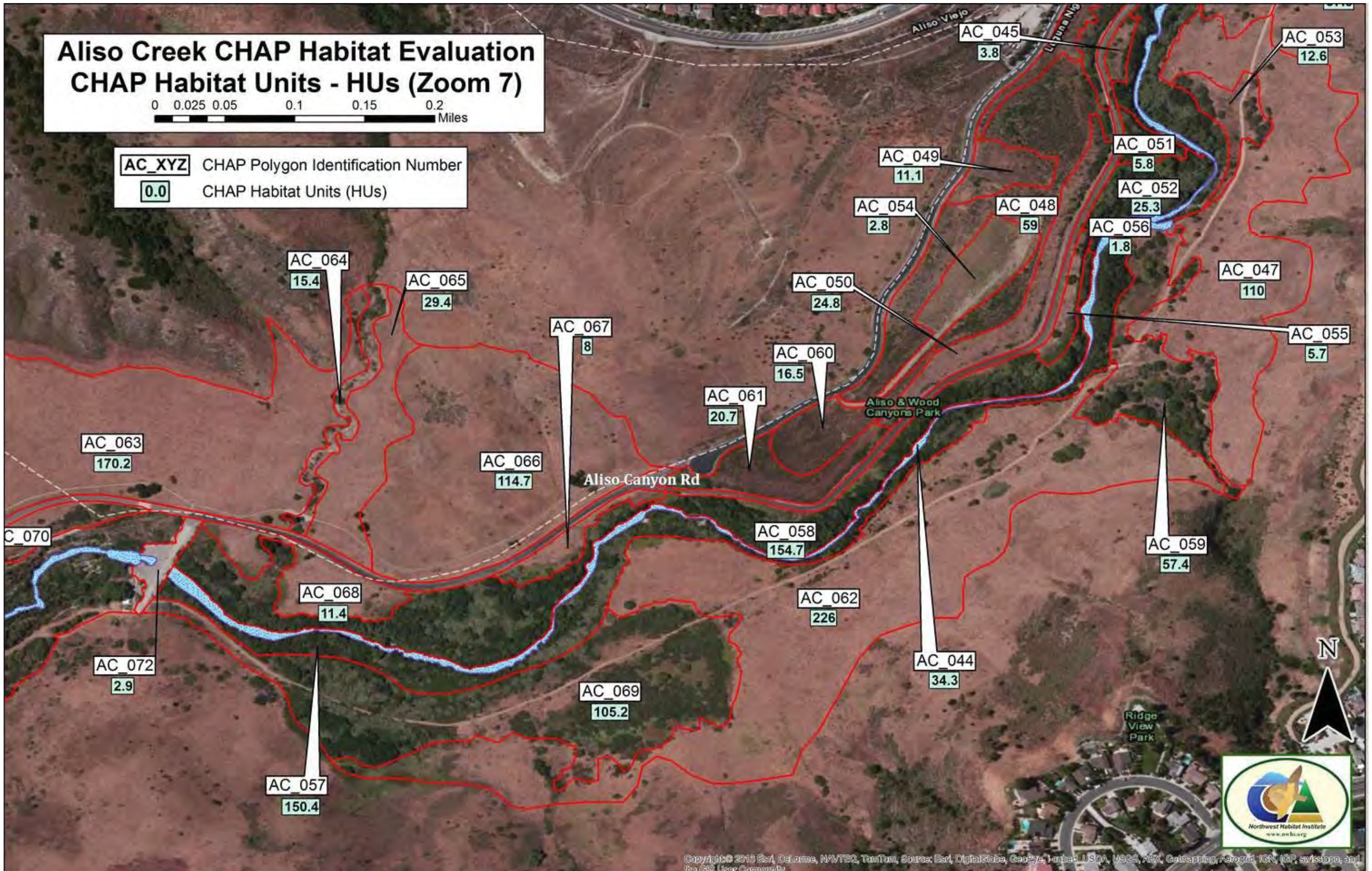


Figure H6. CHAP Habitat Units (HUs)

Combined Habitat Assessment Protocols (CHAP)
Fish & Wildlife Habitat Assessment
Final Report

Aliso Creek

50-year Future Without Project

U.S. Army Corp of Engineers
Los Angeles District

Report and Analysis by
Northwest Habitat Institute

August 31, 2015

Contents

Aliso Creek Wildlife Habitat Assessment

50-year Future Without Project Analysis

Introduction:

A 50-year habitat evaluation assessment was conducted for the Aliso Creek Study Area as part of the baseline ecosystem restoration feasibility study. The purpose of this study was to approximate the conditions of the Aliso Creek Study Area without the implementation of a federal restoration project. This assessment would be equivalent to a “no action” alternative. The baseline assessment was done using 2008 and 2014 imagery and field surveys to depict 2020 baseline conditions, and the 50-year timeframe assesses two future time periods; one at 25 years (2045) and the other at 50-years (2070). To undertake this assessment several projections were made to assess habitats over the 50-year time period. These projections are based on the locales current condition trends. Specifically, realistic predictions include: 1) an increase in presence of invasive plant species, 2) a reduction in the number of fish and wildlife taxa present within the study area over time, 3) several of the in-between reaches of the creek will continue to incise over the next 50 years despite initial hydrology estimates based on streambed profiles in which upstream of the Aliso Creek Wildlife Habitat Enhancement Project (ACWHEP) structure the streambed is expected to remain relatively stable as well as below the South Orange County Wastewater Authority (SOCWA) treatment plant, 4) a greater potential for an increase in wildfire due to the continued drought conditions and a projected likelihood for at least one occurrence of a wildfire within the 50-year period, 5) Aliso Creek’s land use status, as a Wilderness Park, will remain the same, and that future recreation will remain constant with its current level, and 6) the Aliso Creek Inn and Golf Course in the lower reach of the study area will not expand but be maintained in its current state and size. Other points and rationale will be discussed subsequently.

The baseline habitat assessment of the Aliso Creek study area was performed using NHI’s *CHAP,* Combined Habitat Assessment Protocols that utilizes species-habitat-functions to derive current habitat values. To determine a change in these values over time, the above projections were used to alter either the species, habitat, or function parameters. Appling these changes over several time periods, requires some conjecture to deduce the amount of influence that might be expected during each time period. Nonetheless, to display the future condition outcomes the habitat changes are applied to the fine scale habitat map while the species and function changes are applied to their respective data sets to help visualize these changes over time.

The potential influences to California as a whole based on *climate change* are described as: the current distribution, abundance, and vitality of species and habitats are strongly dependent on climatic (and microclimatic) conditions. Climate change is expected to result in warmer temperatures year-round, accompanied by substantially wetter winters. Rising sea level will significantly affect coastal wetlands because they are mostly within a few feet of sea level. As the sea rises, these wetlands will move inland. The overall acreage of wetlands will be reduced due to constraints by existing urban development and steeper slopes immediately inland of existing wetlands. Tidal rivers, estuaries, and relatively flat shoreline habitats will be more subject to damage by flooding and erosion. More severe storm surges from the ocean, due to higher sea levels, combined with higher river runoff could significantly increase flood levels by more than the rise in sea level alone. Erosion of beaches would decrease habitat for beach-dependent species, such as seals, shorebirds, and endangered species (for example, snowy plover and least tern). Aquatic habitats are also likely to be significantly affected by climatic changes. Most fish have limits to how hot or cold the water can be before they must either find more hospitable temperatures or die. As temperatures warm, many fish will have to retreat to cooler waters. The above characterization was taken from California Climate Change Portal (accessed October 7 2009 & May 12, 2015; D. Cayan et al. 2006a and D. Cayan et al. 2006b). A primary emphasis for fish and wildlife in relationship to climate change is to maintain or enhance corridors to allow movement of species through the landscapes (California Natural Resources Agency 2014). Because of climate change uncertainty, there is also a call to employ adaptive management strategies especially when implementing alternative conservation strategies. This approach can provide comparative insights, reduce risk of failure, and aid understanding of system responses to management (e.g. separating policy effects from other causes of ecological change) Keith et al. 2011.

Finally, because some speculation is required to forecast 50-years time frame, the outcomes that are illustrated will generate further discussions with the *Aliso Creek Ecosystem Restoration Habitat Evaluation Team;* thus detailing a consensus approach to the future without project conditions and the assessment in a final draft of this report. Reasonable predictions were made so that plausible scenario for evaluating change over the next 50-year period within the study area could be accomplished.

Methods:

The 25 and 50-year future analysis are built upon the current baseline conditions analysis that illustrates by polygon the California wildlife habitat types. By modifying the species-habitat-functions information based on the perceived future projections for the area, a comparative time series look for 3 time periods (2009, 2034, and 2059) over the 50-year period is generated and assessed.

The rationales for making projections over the 50-years within the study area were the following criteria:

1. **Potential non-viable wildlife populations** –Taxa that may no longer occur or though may have historically occurred in the study environs include: coast range newt (*Taricha torosa torosa)*, arroyo toad (*Bufo microscaphus californicus)*, southwestern pond turtle (Actinemys marmorata pallida), peregrine falcon (*Falco peregrinus),* and mountain lion (*Felis concolor*).

   Historic conditions suggested that other species may be at risk within the study area, evaluation criteria were developed. Criteria used in development of Appendix A included the published and unpublished literature, discussions with expert and knowledgeable ecologist/population biologists from the local scientific community (Nature Reserve of Orange County, California Native Plant Society, Sea and Sage Audubon Society), federal and state fish and wildlife resource agencies (U.S. Fish and Wildlife Service, U.S. Geological Survey/Biological Resources Division, National Marine Fisheries Service, California Department of Fish and Game) as well as local government entities (Orange County Watershed, Orange County Parks).

Potential species or subspecies at risk criteria was identified as those: 1) already a federal or state special status listed taxa , 2) California Department of Fish and Game as a species of special concern, 3) Species Receiving Regulatory coverage under Orange County's Natural Community Conservation Plan and Habitat Conservation Plan (NCCP/HCP), or 4) were large mammals with a large home range are or would be extirpated due to continued urban growth may eventually cut-off access to the Aliso Creek area. Appendix A lists the taxa that are of concern to resources agencies and organizations as potentially being at risk in the study area. The table uses the literature and personal communication to the extent practicable and those who reviewed or were able to discuss their thought process on these taxa of concern. Additionally, landscape connectivity that exists from Aliso Creek to other large tracts of undeveloped land was examined (Figure 1). Besides Laguna Coast Wilderness Park and Crystal Cove State Park, Aliso Creek and Woods Canyon Wilderness Park is disconnected from the nearby large expanses of wilderness due to urban development.

Three species that have the potential for non-viable populations within the study area were identified during the first 25-year period. Additionally, three other species were identified to decrease during this time frame; the effect of losing species contributes to the decline in wildlife habitat values. These species are identified in Table 1.

Non-Viable Populations
Red-Shouldered Hawk
Golden Eagle
Burrowing Owl
Decreasing Populations
Southwestern Pond Turtle
Northern Harrier Hawk
Gray Fox

Table 1. Potential non-viable and decreasing wildlife populations within the study area in the first 25-year period without project.

The three non-viable species identified were removed from the CHAP 25 year future without project species list that feeds into calculating the CHAP Habitat Units (HUs). The functionality of those species is lost from the future without project habitat value.

In the 25-50 year future without project time period, it was determined that two additional species would have the potential of non-viable population within the study area. Additionally, seven other species were identified to decrease during this time frame. The identified species are shown below in Table 2:

Non-Viable Populations
Coast Horned Lizard
White-Tailed Kite
Decreasing Populations
Sharp-Shinned Hawk
Cooper's Hawk
Least Bell’s vireo
Yellow Warbler
Yellow-Breasted Chat
Bobcat
Mule Deer

Table 2. Potential non-viable wildlife populations within the study area between 25 and 50 years without project.

The two non-viable species identified were removed from the CHAP 50 year future without project species list that feeds into calculating the CHAP Habitat Units (HUs). The CHAP 50 year without project species list is developed from the 25 year future without project species list, therefore the species removed from 25 year analysis are also removed from the 50 year analysis. The functionality of all five species projected to be extirpated from the study area is lost from the 50 year future without project habitat value.

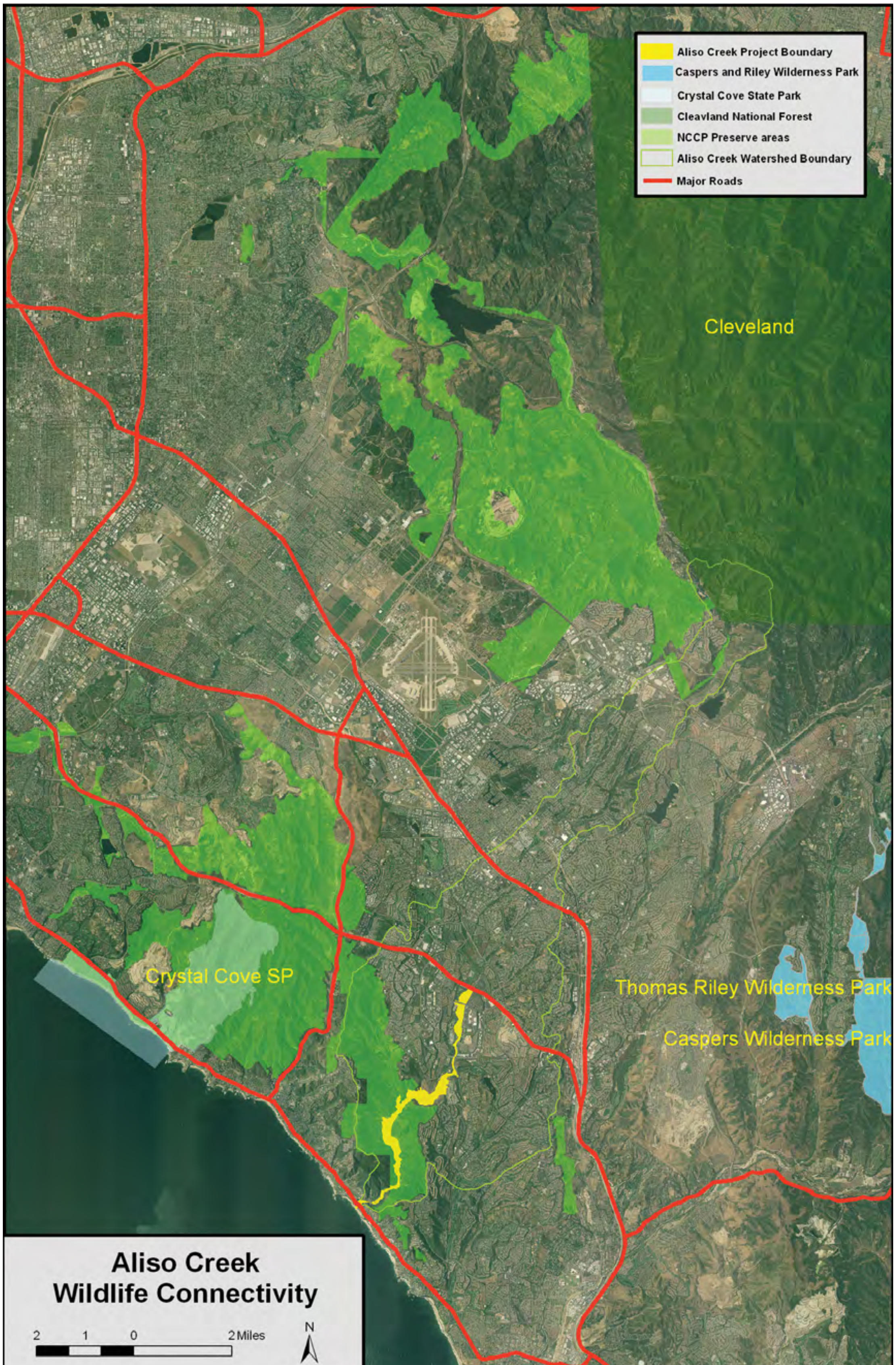


Figure 1. Landscape view of the juxtaposition of Aliso Creek to other large wild area

2. **Fire history interval** – Southern California's Mediterranean climate presents the ideal conditions for fire. The wet, mild winters and dry, hot summers provide a long growing season that produces an abundance of plant fuel. Fire suppression, heavy rains, and seasonal or prolonged drought all result in excessive plant fuel accumulation and the potential for catastrophic wildfire. Throughout history, the San Joaquin Hills have been subjected to repeat burning. The most recent firestorms occurred in October and November of 1993, in which more than 1,000 structures were destroyed or damaged in three major fires: the Stagecoach fire (October 26, 1993), the Laguna Canyon fire (October 27, 1993), and the El Toro fire (November 2, 1993). The Laguna Canyon fire burned more than 16,500 acres and 366 structures (Firewise 2005). The fire burned over 10,000 acres of open space, including 90 percent of the Laguna Coast Wilderness Park (County of Orange Environmental Management Agency 1996). (No portion of AWCWP burned at that time). On June 5, 2009, a 1 acre (.4 ha) fire did burned into Aliso Creek.

   Historically there have been no known fires in AWCWP, although the Moultons apparently did prescribed fires in Aliso Canyon in the 1980s; though they are not found on the fire history maps. Potentially the most threatening fire to the canyon was the Laguna Canyon fire, but a prescribed fire break on the Northwest ridgeline of Woods and Aliso canyons assisted in keeping the fire out of the study area (*AlisoCreekFireHistory.shp*, Orange County Fire Authority). The golf course fire suppression plan includes future construction of fire walls and water cannons which can protect 60-80 feet of upslope vegetation. This is an equivalency plan for the City of Laguna Beach Fire Department's *Landscape/Fuel Modification Guidelines and Maintenance Program* in lieu of thinning to reduce fuel levels due to the potential degradation of sensitive habitats active thinning could cause (*Aliso Creek Area Redevelopment Plan*, The Athens Group 2007).

   Major portions of AWCWP have been designated as high fire classification by the Orange County General Plan and Aliso Creek Corridor Specific Plan. Areas most susceptible to fire have three common characteristics: 1) thirty percent slopes or greater; 2) medium to heavy fuel loading, predominantly coastal sage scrub; and 3) frequent critical fire hazard weather conditions. Canyon slopes meeting these three criteria appear on east facing Laguna Canyon slopes, both sides of lower Aliso Canyon, upper Wood Canyon, portions of Sheep Hills and Upper Aliso Canyon. The greatest potential for fire damage exists at the interface between AWCWP and adjacent residential development.

   We expect to see an increase in the potential of fire over the next 50-years due to climate change, potential vegetation types becoming older, more senescence, and the increasing prevalence of fire prone invasive species such as Giant reed (*Arundo donax)* which burns at intense heats when dry due to its habit of growing in dense monotypic stands. After fires *Arundo* sprouts quickly from a rhizomatous mat up to three feet thick, crowding out other species. Studies show Arundo has the potential to increase intensity, severity, and frequency of fires in riparian areas; ultimately converting the fire regime to that of one found in invasive grassland areas (Dwire and Kauffman 2003). Thus it is projected that there will be at least one occurrence of fire within the study area in the next 50-years without project, and it is estimated it to burn about 1750 acres (708 ha) before being put out (Figure 2). It will be a hot fire, restore the chaparral and coastal sage, but decimate the riparian vegetation habitat, continue to increase the non-native grasslands;

destroy the special status plant taxa and cause the habitat for riverine breeding birds to be lost for up to five years and coastal sage birds (CAGN) for probably 10 years. The diversity of breeding birds for all various vegetation/habitat types would be devastated; loss of reptiles and small mammals as well as large megafuana for at least 50-100 years or more. The wildlife corridor to the Santa Ana Mountains from Aliso Creek to Whiting Ranch to Santiago Canyon is meager at best with several places where Aliso Creek is very narrow, concrete, or incorporates golf courses parks and school grounds. Thus mule deer, mountain lion, and bobcat and others could be extirpated within 50-100 years.

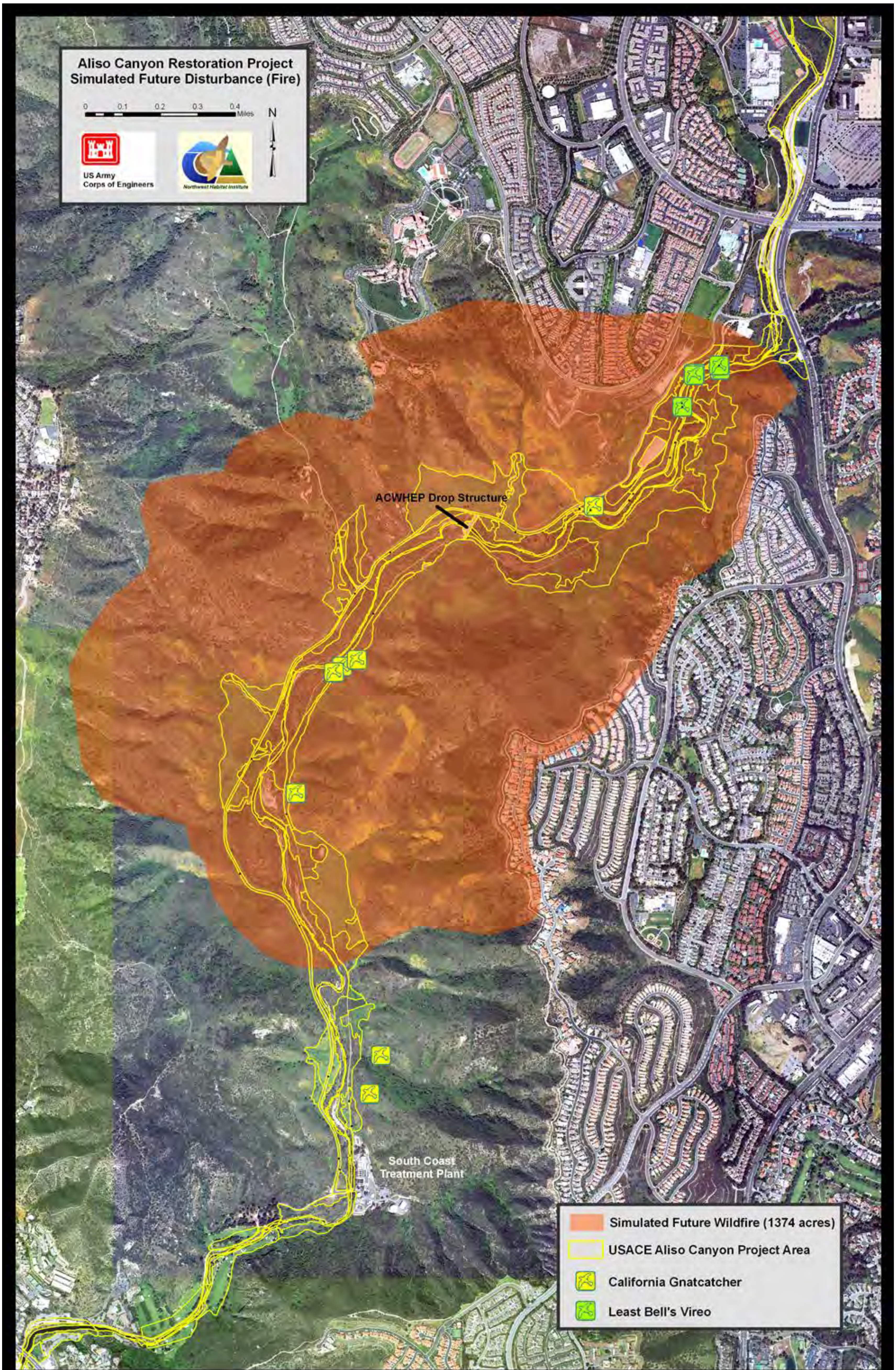


Figure 2. Visual depiction of a simulated potential fire during the 25 to 50 year period future without project.

3. **Spread of Invasive Plant Species** –Invasive plant species information for baseline conditions was originally collected for three structural levels in each polygon; the grass/forb layer/ the shrub layer, and the tree layer. A value was determined and recorded for each layer using the percent breakout in Table 3.

Invasive species cover	*x*
0-10%	1.0
11-35%	0.9
36-65%	0.7
66-90%	0.5
>90%	0.3

Table 3. Invasive plant species deduction factors

Arundo donax comparison from 2006- 2009: Arundo (*Arundo donax*) is the primary invasive plant species within the Aliso Creek study area, although salt cedar, castor bean, fennel, and some pampas grass are present. A key question asked is how fast is *Arundo donax* spreading? To answer this question, a GIS layer was created (*Aliso Arundo* - 2009) defining areas of *Arundo* occurrence within the study area. This layer was then compared to the *Arundo* distribution GIS layer (*AC Invasives* - 2006) created by Dendra Inc (Jason Giessow) for Orange County, California to estimate the rate Arundo spreading within the Aliso Canyon study area.

The *Aliso arundo-2009* was created by digitizing Arundo plants visible on the 2009 Eagle Aerial 6-inch/pixel high-resolution orthophotos provided by Orange County. After reviewing known areas of *Arundo*, photos taken from the field mapping efforts, and Microsoft Maps Live oblique imagery; it became clear that the species was clearly visible on the high-resolution Eagle imagery when zoomed. On screen digitizing was then used to create a polygon layer (*Aliso arundo-2009*) containing all occurrences/distribution of *Arundo* within the Aliso study boundary.

To determine the rate of spread for *Arundo* within the study area, GIS analysis was used with ESRI's ArcMap 9.3 software. Areas of *Arundo* from the Dendra Inc. shapefile "*AC Invasives*-2006" were extracted and clipped to the study boundary. This resulted in a shapefile containing only *Arundo* locations within the study area. For a comparative analysis, the new shapefile, "*Aliso Arundo 2009",* GIS layer was then dissolved from the Dendra Inc. layer to create a shapefile containing areas of *Arundo* identified by the Dendra Inc. study but not identified in the 2009 data collection. These areas were then re-examined against the Eagle imagery to determine if *Arundo* was visible. Areas where *Arundo* was not visible were deleted, and those that could be seen were incorporated into the "*Aliso Arundo-2009"* GIS layer. Correspondently, areas of *Arundo* from the Dendra Inc. study were removed from new 2009 *Arundo* shapefile producing an estimation of the amount of spread of *Arundo* based on the time difference between both sets of aerial photography. The results of this comparison are shown in Figure 3.

There is about two and a half year difference between the source imagery used as the base layer for digitizing the Dendra Inc. study and the 2009 Eagle imagery used in this analysis (area was flown over multiple dates within a time range in both cases). *Arundo* area was found to expand by 5.1 acres during that time frame. It is estimated that current giant reed derived from the 2009 Eagle imagery is 32.7 acres. This suggests that giant reed has spread 18.5% over 2.5 years, or 7.4%/year. This is simply a course estimation of spread rate for *Arundo donax* within the Aliso Canyon Ecosystem Restoration Study area based on the best available data for the site.

Based on these findings, and discussions with other restoration ecologists, it is known that giant reed would continue and advance as an invasive taxa through time. Therefore, study sites that had invasive species on them and were rated for abundance were assumed to advance to the next abundance category. That is, if a site currently had an invasive species value of 11% to 35% then they were adjusted to 36% to 65% in the first 25 years. If the initial values started higher than 11% to 35% then by 50-years out it would progress to > 90%.

Shrub invasive species have a consistent presence, but are sparse compared to the threat of giant reed expansion and tree invasives. Invasive deduction factors were increased by one category over the 50 year future without project analysis for the shrub layer. Eucalyptus and fan palm have great enough presence throughout the study area that the habitat evaluation team chose to increase the invasive adjustment factor for trees by one category per 25 year analysis period.

Figure 3. Time period comparison for *Arundo donax* from 2006 to 2009.

4. **Planned development, mitigation and restoration -** Currently, Orange County is identifying any planned development within or near the project area, however four mitigation sites have been identified within the Aliso Creek project area. These are a turtle pond area immediately above ACWHEP (area above AC_072), an area below ACWHEP but prior to the Aliso Creek oxbow (near polygons AC_076-AC_100), and an area above the South Coast treatment plant (near polygons AC_119-AC_121). For the 50-year without project analysis it is assumed that all prior agreements associated with these mitigation sites will be met. A narrow wildlife corridor connecting the Santa Ana Mountains and the San Joaquin hills has been approved, but crossing the I-5/I-405 interchange (which is 15 lanes of traffic or more) has not been addressed, thus the functionality of such a corridor is assumed currently to have little effect for wildlife at this time.

   Other efforts are focused on invasive species removal (Figure 4). The Orange County Transportation Authority (OCTA) Measure M habitat restoration is assumed to take place in the CHAP calculations. Riparian and Coastal Scrub polygons along the riparian fringe within the OCTA restoration area (Figure 4 yellow box) are assumed to be restored to native vegetative habitats for the 25 year and 50 year future without project habitat value calculations. *Arundo donax* is assumed to be controlled to 0-10% herbaceous layer composition for those analyses.

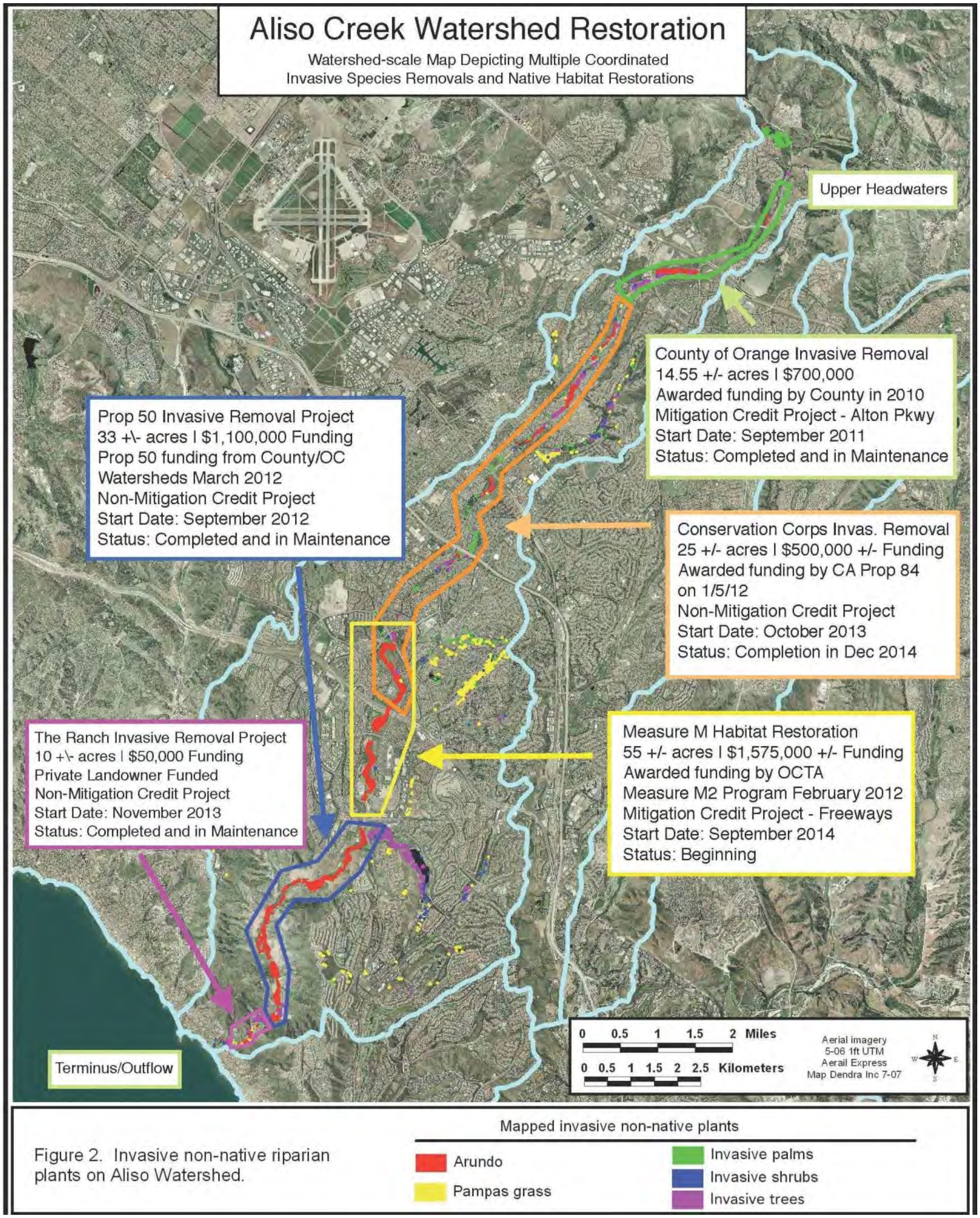


Figure 4. Aliso Creek Invasive Species Removal Projects

5. **Hydro-Geomorphology** – With the federal government (or other entities) taking no action to restore ecosystem functions or values in Aliso Creek, further degradation of the ecological system would continue within the study area. Incision and streambank instability will continue until a dynamic state of equilibrium (stable channel dimension, pattern, and profile) is reached. Some continued incision, on the order of 3 to 4 feet is expected in some reaches both upstream and downstream of the ACWHEP structure. Some further widening is expected episodically, especially from bank slumping due to geotechnical instabilities. Streambank slopes that can stand at near vertical will continue to persist due to the predominately finer-grained soil composition of the alluvial floodplain. The prevalence of steep slopes will degrade the value of riparian structure that can establish. The incised channel will be of a depth that precludes most overbanking from occurring except for less frequent, very large storm events. On the most part however, these breakout areas will be fairly limited and much of the floodplain will be inset within the incised channel. With less overbanking, the opportunity for flood flow infiltration (aquifer recharge) to the historic floodplain and abatement of floodwater energy is repressed, resulting in a changed floodplain habitat. The “S bend” (lower Sub-reach 4b), a distinct geomorphic feature and habitat to freshwater marsh, will be cutoff with time, a fate similar to the abandoned oxbow in the upper portion of the same sub-reach (Figure 5). The effect of this eventual loss will cause additional stream instability (vertically and laterally) for a certain distance both upstream and downstream. The width of the riparian habitat corridor within the incised channel will remain narrow due to the constrained floodplain width. Invasive species will outcompete native riparian species as unstable conditions, including higher flow velocities from confined flows, favor reestablishment of faster growing exotics. The outcome will be a riverine habitat of degraded function and structure, less suitable to support wildlife diversity, including species of special status. Significant barriers created by the ACWHEP structure and the perched tributary at Wood Canyon Creek will remain, promoting isolation of aquatic resources and degradation of aquatic habitat function and value. Flood flows will continue to pose an imminent threat to wastewater infrastructure and public safety, with impacts to the environment and local economy which relies on the recreational use and high aesthetic value of the coastal watershed. SOCWA emergency efforts to protect pipelines at risk will be piecemeal and provide only short-term solutions.

6. **Loss of riparian habitat** – Several reasons suggest that within Aliso Creek there would be a continued loss of riparian habitat within the study boundary, which is the willows/cottonwood vegetation type. They are mostly confined to areas where there is already deep incision of the streambed and bank. Riparian vegetation (trees and shrubs) have died in some spots and continue to show die back from being perched. This suggests that lowering the water table may result in native vegetation root systems being unable to acquire the necessary water for their maintenance and viability. Several factors are occurring synergistically: 1) A review of the literature for several prominent native shrubs show that minimum and maximum rooting depths ranges from 2 feet (0.6 m) to 10.5 feet (3.2 m), [see Table 4]; 2) An initial hydrologic evaluation suggests that the upper and lower portions of Aliso Creek will remain stable but a portion of the middle section will continue to have the streambed down cut as it seeks equilibrium [see Figure 5]; 3) In the future there may be stricter ordinances requiring disconnecting or abating storm flow connections to the stream channel. It is anticipated that less water will be reaching Aliso Creek in the summer than what has occurred in recent past; and 4) Climate change suggests

warmer temperatures year-round, accompanied by substantially wetter winters, thus developing the potential scenario of hotter and drier summers coupled with the potential for increase flooding and erosion in the winter.

Aliso Creek Riparian/Transition Vegetation Rooting Depths						
Common Name	***Binomial Name***	**Minimum Rooting Depth* (m)**	**Maximum Rooting Depth (m) ****	**Native**	**# Occurences in Riparian Polygons**	**Growth form**
Riparian Species						
Arroyo Willow	*Salix lasiolepis*	0.7	2.3* *(SABA)*	y	13	tree/shrub
Goodding's Black Willow	*Salix gooddingii*	0.3	2.1*	y	13	tree/shrub
Elderberry	*Sambucus mexicana*	0.3	1``	y	7	tree
California Sycamore	*Platanus racemosa*	0.9	2.6**	y	6	shrub
Cottonwood	*Populus fremontii*	0.8	3-5``	y	3	shrub/tree
Lemonade Berry	*Rhus integrifolia*	0.6	1.2``	y	2	tree
California Myrtle	*Myrica californica*	0.5	.8 *(MYPE)*``	y	2	tree/shrub
Transition Species						
Mule Fat	*Baccharis salicifolia*	0.3	3.2`` *(BAPI)*	y	15	shrub
Coastal sage	*Artemisia californica*	0.5 *(ARTR)*	1.8-2.3** *(ARTR)*	y	12	shrub
Coyotebrush	*Baccharis pilularis*	0.5	3.2''	y	12	shrub
Black Sage	*Salvia mellifera*	.1``	.6`` *(SAAP)*	y	2	shrub
Rabbit Brush	*Chrysothamnus viscidiflorus*	0.4	.7``	y	2	shrub
Salt Bush	*Atriplex lentiformis*	0.5	6`` *(ATCA)*	y	1	shrub
* Minimum rooting depth according to U.S.D.A Plants website (http://plants.usda.gov/)						
** Canadell et al. 1996. Maximum rooting Depth at a global scale. Oecologia 108: 583-595						
`` Fire Effects Information System (FEIS), (http://www.fs.fed.us/database/feis/)						

Table 4. An example of the minimum and maximum root depth for several native riparian shrubs found within Aliso Creek.

Figure 6 represents a section of Aliso Creek which is projected by the habitat evaluation team to transition habitat types over the 50-years due to streambed incision and the historic oxbow being cut off from adequate water requirements for riparian vegetation. For the corresponding CHAP polygons: the habitat type was changed for the area represented in Figure X as having shifted habitats. KECs were adjusted for the corresponding polygons to represent the structural shift from riparian forest to a shrub dominated environ. Snags and downed wood were attributed to represent the future perched vegetation.

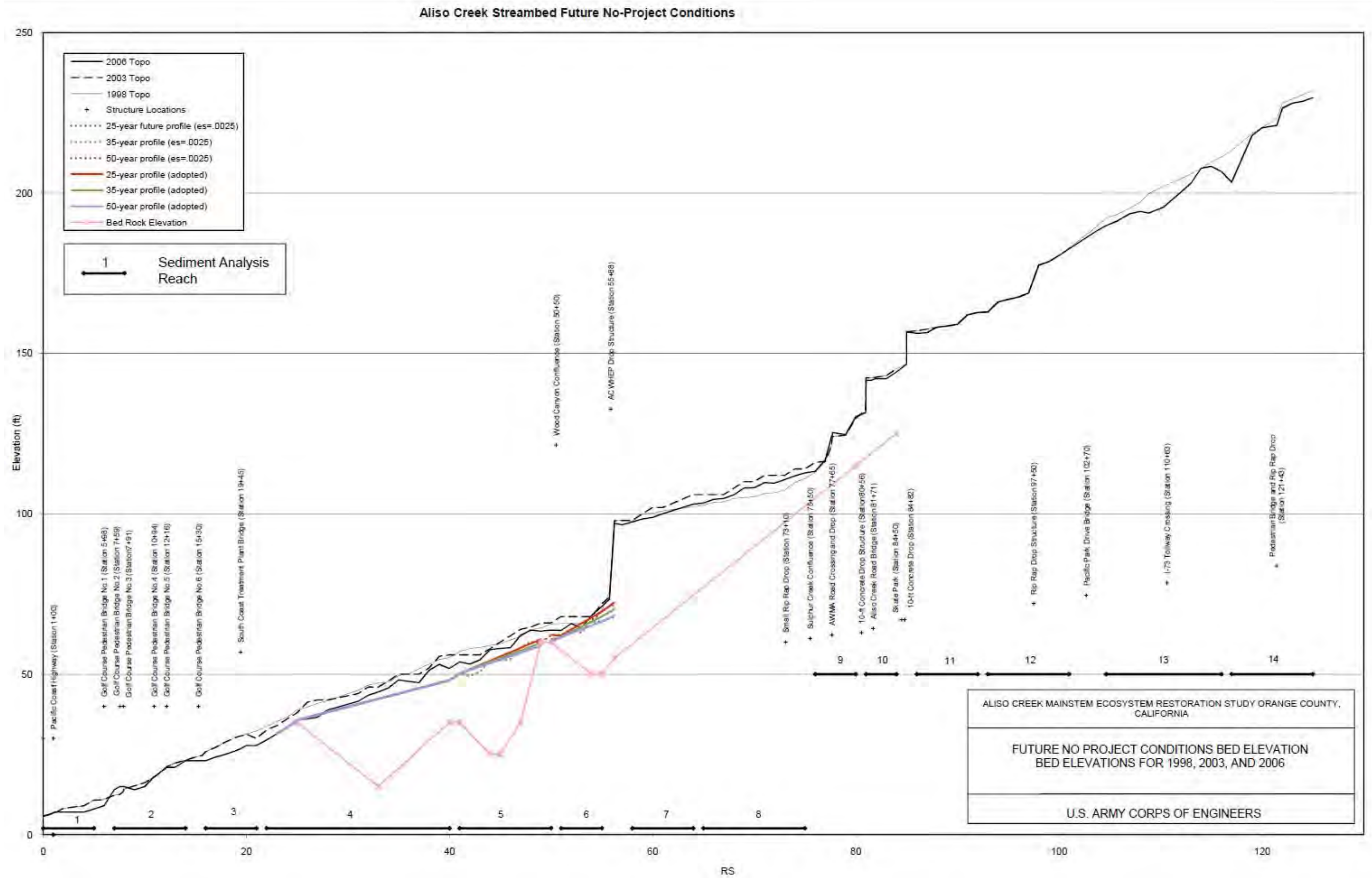


Figure 5. Initial hydrologic profile for Aliso Creek.

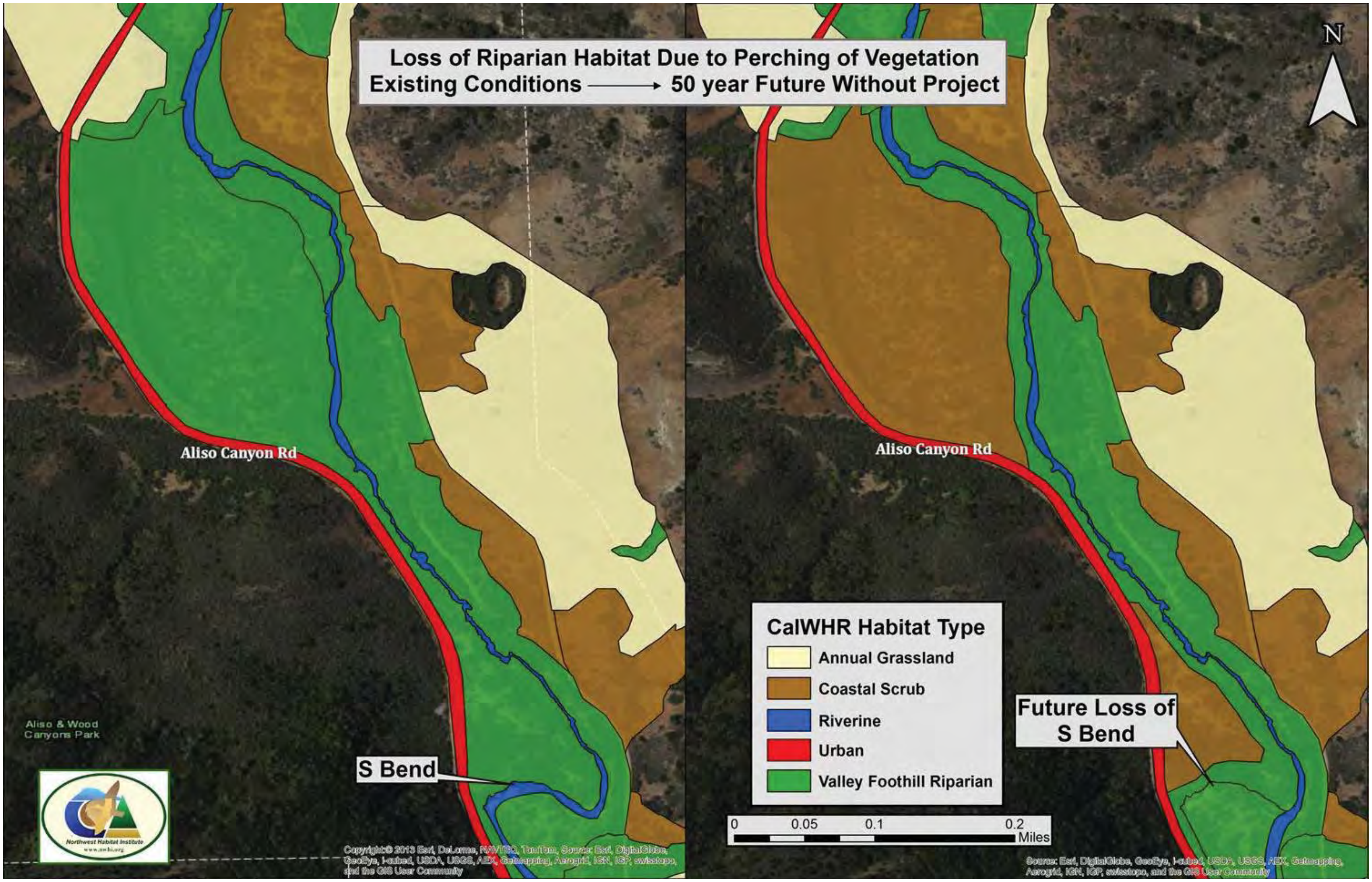


Figure 6. Visual depiction of riparian loss and meander loss over the 50-year period within the Middle section of Aliso Creek.

7. **Connectivity** - Connectivity is cited as an important ecological parameter when evaluating conservation and restoration opportunities (SCAG 2014). Moving across fragmented landscapes can prevent dispersal of animals to other suitable habitat as well as influence species abundance and gene flow. For Aliso Creek, hydro-geomorphologic connectivity is important when considering distribution of aquatic species. Currently, there are three areas that are identified as effecting aquatic species connectivity and they are: Woods Canyon disconnect of 3.5 miles of creek; Suphur Creek disconnect of 1.4 miles of creek; and the ACWEP structure within the mainstem of Aliso Creek. Without project action, then these disconnects would continue to persist and impeding aquatic species connectivity.

8. **Landslides -** Six potential landslide areas have been identified within the Aliso Creek project area. Most are considered ancient or ranging from 10,000-20,000 years old, but there are a few that would be classified as moderately ancient that range from 5,000-10,000 years old. Figure 7 shows the location for the six landslide areas and all are found in association with stream reach 3 to 7. The potential risk and uncertainty is not known, thus there is a possibility for occurrence. For a more detail discussion of landslide potential, please see the Geotechnical report.

Figure 7. Depiction of the six ancient and moderately ancient landslide areas within the aliso Creek project area.

Future Without Project Results:

After adjusting inputs to the appropriate polygons for projected changes to the species, habitats and functions of the site over the without project analysis, CHAP habitat values were calculated for 25 and 50 years to the future of the base year assuming no implementation of a federal project. The 50-year analysis without project illustrates a general trend of declining habitat values given the applied projections that result in a loss in the overall ecological integrity of the area (Table 5). Appendix B contains the baseline without project values for each polygon. Figure 8 illustrates the expected total Habitat Units (HUs) in each time period.

The only polygons within the study area projecting a gain in habitat value without project are those associated with the OCTA restoration project. A credit of 398.7 HUs across 71.8 acres for the restoration of native vegetation and removal of invasive species is associated with the OCTA project.

	CHAP Habitat Units (HUs)
Existing Conditions	8,916.2
25 years Without Project	8,346.3
50 years Without Project	6,862.3

Table 5. Baseline Without Project Habitat Values of the Aliso Creek Study Area

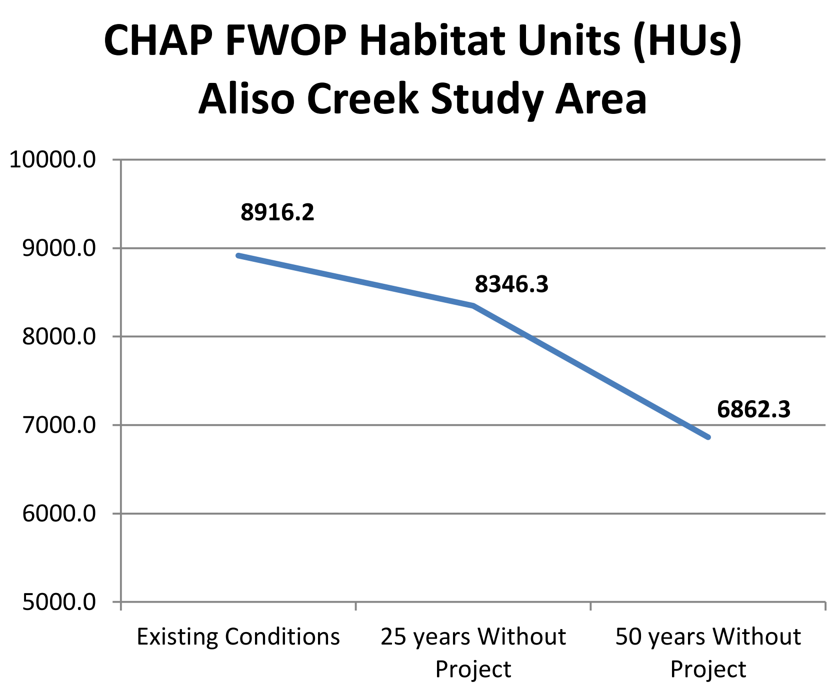


Figure 8. Future Without Project Decline in Habitat Value

Citations

California Natural Resources Agency. 2014 Safeguarding California: Reducing Climate Risk ~ an update to the 2009 California Climate Adaptation Strategy. Sacramento, CA. pp. 343

Cayan, D. (a), P. Bromirski, K. Hayhoe, M. Tyree, M. Dettinger, and R. Flick. 2006. Projecting Future Sea Level ~ A Report from California Climate Change Center. http://www.energy.ca.gov/2005publications/CEC-500-2005-202/CEC-500-2005-202-SF.PDF (accessed 5-12-2015).

Cayan, D. (b), Amy Lynd Luers, Michael Hanemann, Guido Franco, and Bart Croes. 2006. Scenarios of Climate Change in California: An Overview ~ A Report from California Climate Change Center. http://www.energy.ca.gov/2005publications/CEC-500-2005-186/CEC-500-2005-186-SF.PDF (accessed 5-12-2015).

Cayan, D., P. Bromirski, K. Hayhoe, M. Tyree, M. Dettinger, and R. Flick. 2008. Climate change projections of sea level extremes along the California coast. Climatic Change 87:57-73.

Dwire, Kathleen A., and J. Boone Kauffman, 2003. Fire and riparian ecosystems in landscapes of the western USA. In: Young, Michael K.; Gresswell, Robert E.; Luce, Charles H., guest eds. Selected papers from an international symposium on effects of wildland fire on aquatic ecosystems in the western USA; 2002 April 22-24; Boise, ID. In: Forest Ecology and Management. Special Issue: The effects of wildland fire on aquatic ecosystems in the western USA. New York: Elsevier Science B. V; 178(1-2): 61-74. [44923]

Keith, D., Martin, T., McDonald-Madden, E., and Walters, C. 2011. Uncertainty and Adaptive Management for Biodiversity Conservation, Biological Conservation (144) 1175-1178.

Southern California Association of Governments (SCAG). 2014. Conservation Framework and Assessment. Los Angeles, CA. pp. 126.

Appendix A. Species of Concern that potentially may be at risk over the next 50-years as identified by resource agencies, published and unpublished literature.

Common Name	Federal Listed[1]	State Listed	State Species Concern	NCCP Target Species[2]	Future Without Project Status	Comment
Coast Range Newt			yes	yes	**Extirpated**	degradation stream habitat; known to occur (Almanza 1992); populations are localized within study area. Occurs along creeks and streams close to water, especially in rocky areas (Fisher and Case 2003)
Arboreal Salamander				yes	**May not occur**	observed moist oak habitat within area (Almanza 1992); primarily associated with oak and sycamore woodlands, and thick chaparral (Fisher and Case 2003);
Black-bellied slender salamander				yes	**May not occur**	Prefers oak and sycamore woodlands over other habitats (Fisher and Case 2003)
Southwestern Pond Turtle			yes	yes	**Decrease**	observed @Aliso Creek (VST 1991) and LSA (2006); utilizes upland habitat seasonally. They occur in ponds, streams, lakes, ditches, and marshes (Fisher and Case 2003)
Orange-throated Whiptail			yes	yes	**May not occur**	Aliso Viejo Ridge 1992
Coastal Western Whiptail			yes	yes	**As current**	Aliso Creek 2004
Coast horned Lizard			yes	yes	**Extirpated**	Though once common to the entire San Diego area, this species is in decline (Fisher and Case 2003)
California Legless Lizard			yes	yes	**As current**	Only legless lizard in California. A burrowing species seldom seen unless uncovered. Prefers loose soils associated with drainages and valley bottoms, but also occurs on hillsides. Can be nocturnal during summer, but rarely on roads at night (Fisher and Case 2003)

Common Name	Federal Listed[1]	State Listed	State Species Concern	NCCP Target Species[2]	Future Without Project Status	Comment
Two-Striped Garter Snake			yes	yes	**As current**	observed LSA 2004 and 2005 Aliso Ck near Pacific Park Dr
Red Diamond Rattlesnake					**As current**	occasionally observed; A large species often associated with coastal sage scrub, rocky hillsides, and outcrops (Fisher and Case 2003)
San Bernardino Ring-necked Snake				yes	**As current**	
Coastal Rosy Boa				yes	**As current**	Appears to be declining on coast, where it was once common. Difficult to detect, this species is often observed along roads in the late evening or early morning. Genus name for this species has recently been changed to Charina, although most people still use the name Lichanura (Fisher and Case 2003)
Turkey Vulture					**As current**	functional specialist - only performs one function
White-tailed Kite			protected	yes	**Extirpated**	observed by LSA 2006 grasslands of Aliso Ck; declining locally (Gallagher 1997); open native grassland and other grasslands degraded or destroyed
Northern Harrier			yes	yes	**Decreased**	rarest breeding bird in OC (Gallagher 1997); observed foraging Aliso Ck (Almanza 1992) & USACE (2009); further creek incision could produce open freshwater marsh foraging habitat
Sharp-shinned Hawk			yes	yes	**Decrease**	winter visitor only; foraging riparian VST (1991); decreased due to lack of dense cottonwood/willow trees
Copper's Hawk			yes	yes	**Decrease**	suitable nesting habitat available; decreased due to lack of dense cottonwood/willow trees; could move into other park and urban settings with dense trees as well as prey base
Peregrine Falcon		SE		yes	**As current**	Coastal only

Common Name	Federal Listed[1]	State Listed	State Species Concern	NCCP Target Species[2]	Future Without Project Status	Comment
Red-shouldered Hawk				yes	**Extirpated**	Observed near AWCWP 1988-1989 (Dore & Dugan 1989); this raptor should be a breeding bird with the riparian ecosystem (Scott Thomas pers comm. 2009); extirpated due to lack of dense cottonwood/willow trees as well as decrease in prey base
Rough-legged Hawk				yes	**As current**	migrant; grasslands
Golden Eagle			yes	yes	**Extirpated**	former nesting in Aliso Cyn (Almanza 1992)
Burrowing Owl				yes	**Extirpated;**	migration only; declining locally (Gallagher 1997), single pair at UCI, 4-5 pairs at Seal Beach NWS (Hamilton & Willick 1996)
Coastal Cactus Wren			yes	yes	**As current**	detected with appropriate habitat of Aliso Cyn(Almanza 1992); documented in several locations in Aliso Canyon (K. Preston, personal communication, NROC 2009); greatest threat to CAWR is large conflagration wildfire
California Gnatcatcher	**FT**		yes	yes	**As current**	documented breeding bird in coastal sage vegetation type (Dudek 20060 & USCAE (2009); various plant alliances; greatest threat to CAGN is large conflagration wildfire
Loggerhead Shrike			yes	yes	**As current**	grassland habitat exists; no observations or recorded breeding; needs dense vegetation near habitat edge (Hamilton & Willick 1996); decreasing locally (Gallagher 1997); status in OC of great concern (Gallagher 1997).

Common Name	**Federal Listed**[1]	**State Listed**	**State Species Concern**	**NCCP Target Species**[2]	**Future Without Project Status**	**Comment**
Least Bell's Vireo	**FE**	**SE**		yes	**Decrease**	documented few breeding pairs below Sulfur/Aliso confluence; < breeding pairs upstream to Moulton Parkway (USACE 2009 and NROC 2009); riverine breeding habitat will be extirpated if invasive exotic eradication of giant reed is delayed or drawn out over a long period of time; possible extirpated due to degraded riverine habitat and lack of short term intense BHCO management
Yellow Warbler			yes	yes	**Decrease**	regular breeding bird riparian (Almanza 1992); principal migrant and summer resident late March through early October; breeds from April to late July (Shuford & Gardali 2008); breeding birds restricted to deciduous trees of riparian habitats (Gallagher 1997); possible extirpated due to degraded riverine habitat and lack of short term intense BHCO management
Yellow-Breasted Chat			yes	yes	**Decrease**	regular breeding bird riparian (Almanza 1992); principal migrant and summer resident late March through early October; breeds from April to late July (Shuford & Gardali 2008);documented breeding bird in willow-mulefat type (Dudek 2007); population - <10 pairs (USCAE 2009); Shuford & Gardali (2008); early seral stage willow vegetation alliance necessary; possible extirpated due to degraded riverine habitat and lack of short term intense BHCO management
Southern California rufus-crowned sparrow				yes	**As current**	distribution is highly discontinuous (Gallagher 1997); need coastal sage alliances with significant open space (Gallagher 1997); may be affected by large conflagration wildfire

Common Name	Federal Listed[1]	State Listed	State Species Concern	NCCP Target Species[2]	Future Without Project Status	Comment
Grasshopper Sparrow			yes	yes	**As current**	declining taxa in coastal grassland foothills (Gallagher 1997); safe havens remaon at Aliso Park, block 91 (Gallagher 1997); preservation of grasslands necessary.
Brown-Headed Cowbird					**As current**	critical functional link species - only species to perform this function -interspecies host parasite; short term BHCO management program needed
Yuma Myotis					**As current**	feed over water at adjacent lakes
Fringed Myotis					**As current**	feed over water at adjacent lakes
Long-Eared Myotis					**As current**	feed over water at adjacent lakes
Townsend's Big-Eared Bat					**As current**	feed over water at adjacent lakes
San Diego Woodrat				yes	**As current**	
Botta's Pocket Gopher					**As current**	critical functional link species – only species to perform this function - root feeders also may be vulnerable to long-term influence of grass-forbs-shrub removal because of a lack of water to the roots
Black-Tailed Jackrabbit					**As current**	this species may be vulnerable to predators in a closed population and to long-term influence of shrub removal because of a lack of water to the roots.
Coyote				yes	**As current**	can withstand urban pressures
Gray Fox				yes	**Decrease**	island habitat becomes small with decreasing prey base
Bobcat				yes	**Decrease**	island habitat becomes small with decreasing prey base
Mule Deer					**Decrease**	large ranging species – urban development may isolate or exclude this species
Historic Taxa						
Tidewater goby	**FE**			yes	**Extirpated**	restricted to lagoon mouth

Common Name	Federal Listed[1]	State Listed	State Species Concern	NCCP Target Species[2]	Future Without Project Status	Comment
Southern Steelhead	**FE**		yes	yes	**If ever present - extirpated**	occurrence not documented; antidotal evidence
Western Blind Snake - California					**If ever present - extirpated**	
Arroyo Toad	**FE**		yes	yes	**Extirpated**	populations fragmented; prefers sandy or cobble washes and associated upland habitats (Fisher and Case 2003)
Tricolored Blackbird			yes		**Extirpated;**	already extirpated from the locale due to no nearby agriculture or large grassland habitat
Mountain Lion					**Extirpated**	currently extirpated; no wildlife corridors back to the Santa Mountains

1 = USFWS does not have federal candidate or species of species concern. FWS only has Federal Proposed Endangered (FPE), Federal Proposed threatened (FPT) and Federal Proposed Delisted (FPD)

2 = Target and Indentified Species Receiving Regulatory coverage under the NCCP/HCP

Federal or State Listed Species

Appendix B. Existing Conditions and Baseline Future Without Project Habitat Units (HUs) by CHAP Polygon.

CHAP Polygon ID	CalWHR Habitat Type	Acres	CHAP Habitat Units (HUs)	CHAP Habitat Units (HUs) 25 year FWOP	CHAP Habitat Units (HUs) 50 year FWOP
AC_001	Valley Foothill Riparian	16.28	194.7	286.97	262.01
AC_002	Coastal Scrub	3.19	34.7	62.55	58.96
AC_003	Urban	0.34	1.5	1.46	1.46
AC_004	Coastal Scrub	2.55	32.9	48.48	46.49
AC_005	Annual Grassland	1.60	15.3	14.33	12.54
AC_006	Coastal Scrub	8.06	85.6	154.32	145.43
AC_007	Coastal Scrub	7.95	149.3	155.53	146.59
AC_008	Urban	0.78	3.3	2.99	2.33
AC_009	Riverine	3.96	51.5	51.53	51.53
AC_010	Valley Foothill Riparian	0.96	22.4	22.18	20.29
AC_011	Coastal Scrub	6.37	87.6	129.29	124.05
AC_012	Annual Grassland	4.39	69.7	61.77	47.64
AC_013	Annual Grassland	5.31	53.9	37.81	22.48
AC_014	Urban	0.31	1.4	1.22	0.95
AC_015	Valley Foothill Riparian	3.59	84.1	83.24	76.13
AC_016	Coastal Scrub	3.74	59.9	74.61	71.58
AC_017	Valley Foothill Riparian	2.29	52.3	53.63	49.05
AC_018	Annual Grassland	6.32	62.8	58.78	51.46
AC_019	Annual Grassland	8.52	74.1	69.25	60.57
AC_020	Valley Foothill Riparian	8.89	145.8	215.57	207.01
AC_021	Urban	0.25	1.1	0.98	0.76
AC_022	Valley Foothill Riparian	3.92	90.2	89.27	81.64
AC_023	Urban	0.72	2.1	1.96	1.73
AC_024	Urban	4.06	17.3	15.57	12.11
AC_025	Valley Foothill Riparian	0.97	14.0	25.31	23.89
AC_026	Urban	0.82	1.1	1.05	1.05
AC_027	Riverine	0.81	10.9	10.88	10.88
AC_028	Urban	1.98	2.8	2.81	2.81
AC_029	Coastal Scrub	1.22	19.7	24.54	23.55
AC_030	Riverine	0.57	7.9	7.90	7.90
AC_031	Coastal Scrub	0.60	10.0	9.83	8.72
AC_032	Valley Foothill Riparian	0.51	8.9	8.48	6.89
AC_033	Valley Foothill Riparian	0.68	10.3	9.11	6.79
AC_034	Coastal Scrub	1.64	22.5	20.71	17.41
AC_035	Coastal Scrub	3.42	38.1	35.76	31.33
AC_036	Coastal Scrub	2.82	37.8	34.78	29.23
AC_037	Valley Foothill Riparian	4.10	100.4	92.68	69.22
AC_038	Urban	0.76	1.8	1.69	1.49
AC_039	Coastal Scrub	1.06	16.7	12.15	7.68
AC_040	Annual Grassland	2.46	23.7	22.14	19.38
AC_041	Coastal Scrub	1.36	18.1	16.72	14.05
AC_042	Urban	12.15	64.8	64.84	64.84
AC_043	Coastal Scrub	2.02	41.1	37.83	29.25

CHAP Polygon ID	CalWHR Habitat Type	Acres	CHAP Habitat Units (HUs)	CHAP Habitat Units (HUs) 25 year FWOP	CHAP Habitat Units (HUs) 50 year FWOP
AC_044	Riverine	2.28	34.3	34.30	34.30
AC_045	Coastal Scrub	0.35	3.8	3.54	3.11
AC_046	Coastal Scrub	1.00	10.7	9.99	8.75
AC_047	Annual Grassland	11.07	110.0	102.90	90.08
AC_048	Coastal Scrub	5.84	59.0	55.29	48.42
AC_049	Coastal Scrub	1.08	11.1	10.41	9.11
AC_050	Annual Grassland	2.62	24.8	23.18	20.29
AC_051	Valley Foothill Riparian	0.53	5.8	5.75	3.74
AC_052	Valley Foothill Riparian	1.65	25.3	19.40	12.63
AC_053	Coastal Scrub	1.21	12.6	11.79	10.33
AC_054	Urban	2.05	2.8	2.77	2.77
AC_055	Annual Grassland	0.64	5.7	4.94	4.15
AC_056	Riverine	0.15	1.8	1.83	1.28
AC_057	Valley Foothill Riparian	5.99	150.4	141.28	103.70
AC_058	Valley Foothill Riparian	9.84	154.7	147.99	102.10
AC_059	Coastal Scrub	4.09	57.4	52.92	44.48
AC_060	Coastal Scrub	1.55	16.5	15.42	13.51
AC_061	Coastal Scrub	1.95	20.7	19.44	17.03
AC_062	Annual Grassland	22.75	226.0	211.53	185.18
AC_063	Annual Grassland	18.96	178.5	166.89	146.05
AC_064	Valley Foothill Riparian	1.20	15.4	15.24	12.68
AC_065	Annual Grassland	3.12	29.4	27.46	24.03
AC_066	Annual Grassland	12.26	114.7	107.27	93.87
AC_067	Annual Grassland	0.89	8.0	7.48	6.54
AC_068	Annual Grassland	2.33	11.4	11.23	11.14
AC_069	Coastal Scrub	12.26	105.2	87.75	67.50
AC_070	Coastal Scrub	1.47	22.7	16.78	13.70
AC_071	Valley Foothill Riparian	3.82	79.7	68.09	46.63
AC_072	Urban	0.59	2.9	2.85	2.85
AC_073	Riverine	4.83	52.1	42.41	31.32
AC_074	Valley Foothill Riparian	10.39	173.6	165.99	134.82
AC_075	Annual Grassland	3.85	28.9	33.41	29.23
AC_076	Annual Grassland	0.31	2.4	2.78	2.43
AC_077	Annual Grassland	0.16	1.2	1.41	1.24
AC_078	Annual Grassland	0.92	6.9	7.98	6.99
AC_079	Coastal Scrub	1.12	16.6	18.98	14.66
AC_080	Valley Foothill Riparian	9.40	213.1	180.73	135.86
AC_081	Valley Foothill Riparian	5.99	78.4	80.75	67.20
AC_082	Valley Foothill Riparian	1.09	24.0	23.76	16.53
AC_083	Coastal Scrub	0.62	9.3	10.57	8.16
AC_084	Valley Foothill Riparian	2.36	54.7	51.41	33.61
AC_085	Valley Foothill Riparian	7.22	175.1	164.47	107.55
AC_086	Annual Grassland	7.07	98.3	71.35	62.50
AC_087	Valley Foothill Riparian	0.38	8.6	8.47	5.89
AC_088	Valley Foothill Riparian	3.13	49.0	45.24	38.04
AC_089	Valley Foothill Riparian	10.05	141.2	132.71	116.43
AC_090	Annual Grassland	18.01	149.6	139.64	122.07

CHAP Polygon ID	CalWHR Habitat Type	Acres	CHAP Habitat Units (HUs)	CHAP Habitat Units (HUs) 25 year FWOP	CHAP Habitat Units (HUs) 50 year FWOP
AC_091	Valley Foothill Riparian	0.23	3.7	2.80	2.33
AC_092	Valley Foothill Riparian	0.21	3.3	2.51	2.09
AC_093	Valley Foothill Riparian	0.88	10.8	10.64	8.85
AC_094	Annual Grassland	6.59	54.7	51.07	44.64
AC_095	Valley Foothill Riparian	0.57	5.1	5.05	3.89
AC_096	Valley Foothill Riparian	0.23	4.2	3.27	2.75
AC_097	Valley Foothill Riparian	0.56	11.8	9.72	7.20
AC_098	Annual Grassland	1.31	10.9	10.19	8.91
AC_099	Valley Foothill Riparian	2.99	41.9	40.06	27.62
AC_100	Coastal Scrub	4.17	57.7	53.20	44.71
AC_101	Valley Foothill Riparian	21.59	320.5	175.97	135.60
AC_102	Valley Foothill Riparian	1.32	15.3	49.74	38.33
AC_103	Valley Foothill Riparian	11.11	136.2	118.90	104.52
AC_104	Coastal Scrub	3.14	34.0	31.83	27.89
AC_105	Annual Grassland	14.92	171.6	157.71	132.35
AC_107	Valley Foothill Riparian	0.21	2.6	2.61	1.93
AC_108	Coastal Scrub	2.44	46.7	38.64	28.62
AC_109	Coastal Scrub	3.32	68.1	60.62	46.85
AC_110	Coastal Scrub	0.54	5.7	5.33	4.67
AC_111	Valley Foothill Riparian	7.70	107.3	106.27	74.95
AC_112	Annual Grassland	2.39	24.0	22.50	19.70
AC_113	Annual Grassland	3.19	21.3	16.27	16.15
AC_114	Valley Foothill Riparian	1.41	11.9	11.78	9.07
AC_115	Valley Foothill Riparian	4.56	78.6	63.32	43.67
AC_116	Coastal Scrub	1.28	21.7	17.03	11.73
AC_117	Riverine	0.34	4.9	3.96	2.81
AC_118	Riverine	0.79	9.4	8.48	6.60
AC_119	Valley Foothill Riparian	1.37	25.8	24.13	15.76
AC_120	Annual Grassland	1.15	10.7	10.01	8.76
AC_121	Coastal Scrub	1.23	13.3	12.47	10.92
AC_122	Valley Foothill Riparian	0.76	12.0	11.87	5.06
AC_123	Urban	1.03	2.5	2.47	2.06
AC_124	Valley Foothill Riparian	4.53	83.6	67.42	46.51
AC_125	Riverine	0.67	9.0	8.06	6.27
AC_126	Valley Foothill Riparian	0.50	9.9	7.98	6.48
AC_127	Valley Foothill Riparian	1.14	24.2	21.24	13.09
AC_128	Coastal Scrub	2.01	36.7	28.54	24.00
AC_129	Riverine	0.40	4.6	4.59	4.59
AC_130	Riverine	1.04	9.8	9.77	9.77
AC_131	Riverine	0.95	10.3	10.32	10.32
AC_132	Riverine	0.65	7.4	7.39	7.39
AC_133	Riverine	2.10	22.9	22.88	22.88
AC_134	Riverine	0.82	9.8	9.78	9.78
AC_135	Riverine	0.42	3.1	2.22	1.33
AC_136	Riverine	0.35	4.1	4.11	4.11
AC_137	Riverine	0.17	0.5	0.45	0.45
AC_138	Lacustrine	30.29	424.5	382.06	297.16

CHAP Polygon ID	CalWHR Habitat Type	Acres	CHAP Habitat Units (HUs)	CHAP Habitat Units (HUs) 25 year FWOP	CHAP Habitat Units (HUs) 50 year FWOP
AC_139	Riverine	0.47	3.8	2.98	2.19
AC_140	Riverine	0.05	0.5	0.36	0.26
AC_141	Riverine	2.17	27.9	27.91	19.53
AC_142	Riverine	1.22	15.9	14.31	11.13
AC_143	Riverine	0.84	7.4	3.17	3.17
AC_144	Riverine	2.14	19.2	13.71	8.22
AC_145	Riverine	0.90	7.5	5.34	3.21
AC_146	Riverine	0.53	4.3	3.10	1.86
AC_147	Riverine	1.24	10.2	7.32	4.39
AC_148	Annual Grassland	16.75	91.3	90.02	89.36
AC_149	Valley Foothill Riparian	10.37	265.5	236.62	183.08
AC_150	Valley Foothill Riparian	1.27	16.9	14.41	11.11
AC_151	Urban	0.93	4.3	3.25	2.07
AC_152	Annual Grassland	3.59	44.9	41.30	34.68
AC_153	Valley Foothill Riparian	1.12	12.4	7.34	7.30
AC_154	Urban	3.33	12.0	10.09	8.51
AC_155	Urban	5.77	22.0	19.68	12.51
AC_156	Urban	0.23	1.0	0.99	0.99
AC_157	Urban	0.52	2.2	2.22	2.22
AC_158	Urban	0.71	4.2	4.16	4.16
AC_159	Urban	0.19	1.1	1.12	1.12
AC_160	Urban	1.67	7.0	6.45	4.74
AC_161	Urban	0.67	2.0	1.68	1.42
AC_162	Urban	0.05	0.2	0.23	0.23
AC_163	Valley Foothill Riparian	1.45	21.6	18.04	14.34
AC_164	Valley Foothill Riparian	0.25	1.6	1.55	1.54
AC_165	Valley Foothill Riparian	1.70	25.3	21.15	16.81
AC_166	Annual Grassland	0.34	3.2	2.98	2.61
AC_167	Valley Foothill Riparian	0.30	6.2	4.90	3.38
AC_168	Urban	0.93	3.1	2.32	1.48
AC_169	Valley Foothill Riparian	1.27	20.3	18.73	15.75
AC_170	Coastal Scrub	0.61	7.4	6.33	4.88
AC_171	Valley Foothill Riparian	0.33	5.3	4.87	4.10
AC_172	Valley Foothill Riparian	0.19	3.9	3.46	2.67
AC_173	Urban	0.65	2.8	2.76	2.76
AC_174	Coastal Scrub	0.63	6.5	6.09	5.34
AC_175	Coastal Scrub	0.22	2.8	2.60	2.19
AC_176	Valley Foothill Riparian	0.08	1.9	1.84	1.83
AC_177	Valley Foothill Riparian	0.34	6.8	5.60	3.97
AC_178	Coastal Scrub	0.58	9.9	7.56	5.37
AC_179	Valley Foothill Riparian	2.21	44.3	34.05	24.17
AC_180	Annual Grassland	0.29	3.7	3.38	2.84
AC_181	Valley Foothill Riparian	1.18	23.5	18.09	12.84
AC_182	Valley Foothill Riparian	0.10	2.2	1.85	1.39
AC_183	Coastal Scrub	0.56	10.4	8.63	6.39
AC_184	Eucalyptus	0.34	3.8	3.16	2.37
AC_185	Valley Foothill Riparian	3.41	68.3	52.51	37.29

CHAP Polygon ID	CalWHR Habitat Type	Acres	CHAP Habitat Units (HUs)	CHAP Habitat Units (HUs) 25 year FWOP	CHAP Habitat Units (HUs) 50 year FWOP
AC_186	Urban	1.42	6.1	6.07	6.07
AC_187	Urban	0.49	2.3	1.72	1.09
AC_188	Urban	0.15	0.7	0.74	0.74
AC_189	Annual Grassland	0.49	2.1	2.05	2.03
AC_190	Urban	0.98	4.5	3.43	2.18
AC_191	Urban	0.20	0.6	0.70	0.59
AC_192	Urban	0.29	0.9	1.03	0.87
AC_193	Urban	1.17	5.0	5.00	5.00
AC_194	Urban	0.60	1.8	2.13	1.80
AC_195	Urban	0.13	0.6	0.56	0.56
AC_196	Urban	0.34	1.6	1.20	0.77
AC_197	Urban	0.22	1.0	0.77	0.49
AC_198	Urban	0.27	1.3	0.95	0.60
AC_199	Urban	0.19	0.9	0.66	0.42
AC_200	Annual Grassland	2.65	25.2	23.60	20.65
AC_201	Urban	0.23	1.1	1.09	1.09
AC_202	Valley Foothill Riparian	5.28	107.2	82.49	58.57
AC_203	Valley Foothill Riparian	1.03	20.9	16.07	11.41
AC_204	Valley Foothill Riparian	0.20	4.1	3.13	2.23
AC_205	Valley Foothill Riparian	0.94	20.4	16.91	12.53
AC_206	Valley Foothill Riparian	3.31	66.6	49.85	33.41
AC_207	Coastal Scrub	0.61	12.5	11.08	8.57
AC_208	Valley Foothill Riparian	1.55	36.9	32.87	25.42
AC_209	Urban	0.23	1.0	0.99	0.99
AC_210	Valley Foothill Riparian	1.61	38.6	34.35	26.57
AC_211	Coastal Scrub	3.55	65.2	57.95	44.75
AC_212	Valley Foothill Riparian	3.68	80.6	62.08	44.10
AC_213	Coastal Scrub	2.04	19.0	18.09	16.53
AC_214	Valley Foothill Riparian	2.19	47.1	41.87	32.36
AC_215	Annual Grassland	8.80	47.2	46.59	46.24
AC_216	Coastal Scrub	1.62	14.9	14.19	12.97
AC_217	Coastal Scrub	0.69	5.3	4.71	3.95
AC_218	Urban	0.88	1.6	2.09	1.62
AC_219	Urban	0.27	0.9	1.09	0.75
AC_220	Valley Foothill Riparian	0.31	5.1	3.91	2.77
AC_221	Coastal Scrub	0.57	5.6	5.17	4.33
AC_222	Coastal Scrub	0.24	2.4	2.17	1.82
AC_223	Annual Grassland	10.62	79.6	74.15	64.75
AC_224	Urban	0.26	1.1	1.12	1.12
AC_225	Coastal Scrub	0.29	3.3	3.10	2.72
AC_226	Annual Grassland	0.85	15.7	13.95	10.77
AC_227	Coastal Scrub	0.82	11.2	10.30	8.66
AC_228	Valley Foothill Riparian	8.41	181.7	139.87	99.36
AC_229	Urban	1.65	7.1	7.05	7.05
AC_230	Coastal Scrub	1.00	19.5	16.55	12.43
AC_231	Coastal Scrub	2.15	38.7	31.88	22.60
AC_232	Valley Foothill Riparian	1.45	35.0	31.15	24.09

CHAP Polygon ID	CalWHR Habitat Type	Acres	CHAP Habitat Units (HUs)	CHAP Habitat Units (HUs) 25 year FWOP	CHAP Habitat Units (HUs) 50 year FWOP
AC_233	Valley Foothill Riparian	1.10	18.7	13.22	7.89
AC_234	Valley Foothill Riparian	1.45	27.5	21.44	18.03
AC_235	Annual Grassland	3.83	48.1	33.92	20.20
AC_236	Annual Grassland	1.68	19.6	14.16	12.39
AC_237	Valley Foothill Riparian	12.43	207.0	158.86	112.66
AC_238	Urban	2.01	8.8	8.76	8.76
AC_239	Valley Oak Woodland	0.89	12.4	11.87	9.63
AC_240	Urban	2.00	17.9	17.86	17.86

Combined Habitat Assessment Protocols (CHAP)
Fish & Wildlife Habitat Assessment
Final Report

Aliso Creek

Three Ecosystem Restoration Alternatives
U.S. Army Corps of Engineers
Los Angeles District

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CLARIFICATION SHEET

EXPANATORY NOTE FOR DEVELOPMENT OF ALTERNATIVES

Table 1 included in this CHAP appendix contains a list of the base alternatives and various measures. The development of the focused array of alternatives (described in Chapter 3 of the Draft IFR) consisted of assessing measures which could be combined with each base alternative to create variations of the alternatives. Cost effectiveness and incremental cost analysis was utilized to develop cost effective alternatives.

It should be noted some measures listed in Table 1 were subsequently screened out, and not carried forward in the alternatives development. Some of the names appear differently in other reports, and are noted here for clarification, if applicable.

The summary table below summarizes these actions.

Summary Table

Alternatives and Measures	Other Names Used	Screening Retained?
Alternative 2 Base		Yes
❖ **Additional Measures**		Yes
Lower Terrace at Oxbow		No
Channel Lengthen Downstream of Woods Canyon	Sinuosity or Stream Lengthening downstream of Wood Canyon Creek	Yes
Add Newbury Riffles	Newbury Riffle Weir	Yes
Woody Debris Placement		No
Boulder Cluster Placement		No
Alternative 3 Base		Yes
❖ **Additional Measures**		No
Reconnect Oxbow	Reconnection Abandoned Oxbow	Yes
Lower Terrace at Oxbow		No
Channel Lengthen Downstream of Woods Canyon	Sinuosity or Stream Lengthening downstream of Wood Canyon Creek	Yes
Wood Canyon Re-align	Wood Canyon Re-align Trail	Yes
Sulphur Creek Connection		Yes, but added to base
Measure I - Widen in Vicinity of Aliso Creek Road Bridge		Yes
Measure J – Recontour Upstream of Aliso Creek Bridge to Pacific Park Drive		Yes
Measure M – Stream Lengthen Downstream of Pacific Park Drive	Sinuosity downstream of Pacific Park Drive	Yes
Pacific Park Drive Bypass Channel		Yes
Pacific Park Drive Bypass Riparian		No
Floodplain Extension		No
Woody Debris Placement		No
Boulder Cluster Placement		No
Alternative 4 Base		Yes
❖ **Additional Measures**		
Reconnect Oxbow		Yes
Lower Terrace at Oxbow		No
Channel Lengthen Downstream of Woods Canyon	Sinuosity or Stream Lengthening downstream of Wood Canyon Creek	Yes
Sulphur Creek Connection		Yes,but added to base
Measure I - Widen in Vicinity of Aliso Creek Road Bridge		Yes
Measure J – Recontour Upstream of Aliso Creek Bridge to Pacific Park Drive		Yes
Measure M – Stream Lengthen Downstream of Pacific Park Drive		Yes
Pacific Park Drive Bypass Channel		Yes
Pacific Park Drive Bypass Riparian		No
Floodplain Extension		No
Woody Debris Placement		No
Boulder Cluster Placement		No

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Report and Analysis by
Northwest Habitat Institute

November 3, 2015, 2015

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Aliso Creek CHAP Habitat Evaluation Analysis of Three Ecosystem Restoration Alternatives

Executive Summary

Three restoration alternatives (Alternatives 2, 3 and 4) are compared against the no action alternative along with complimentary measures to determine the projected habitat value based on these comparisons. Habitat values were determined by assessing changes to the species, habitats, and functions as well as changes to the hydrology/geomorphology. The resulting values were then compared to the current and future without project baseline values (no action alternative) to determine habitat value gains or losses over 50 years with implementation of the restoration alternative and measures. Checkpoints at 5, 25 and 50 years with project were evaluated, with the intermediate year values coming from annualizing the Habitat Units (HUs). Average Annual Habitat Units (AAHU) for: Alternative 2 Base equals 507.1 (9.24 AAHUs/acre), Alternative 3 Base without Woods Canyon reconnect equals 1,383.1 (10.1 AAHUs/acre) and with Woods Canyon reconnect would give an additional 2,412.7 (17.69 AAHUs/acre), and Alternative 4 Base equals 1,078.3 (9.93 AAHUs/acre).

Introduction

The U.S. Corps of Engineers (Corps) Los Angeles District created three ecosystem restoration alternatives and several optional restoration measures associated with each alternative within their Aliso Creek project assessment. The information used in evaluating and selecting ecosystem restoration alternatives in Corps Civil Works projects includes both quantitative and qualitative information about outputs, costs, significance, acceptability, completeness, effectiveness, and reasonableness of costs. Instead of calculating economic benefits in monetary terms, Corps ecosystem restoration projects calculate the value and benefits of habitat using established habitat assessment methodologies.

Habitat Units (HUs) are one of the currencies the Corps currently uses to rate and compare the value of one ecosystem restoration alternative to another. Combined Habitat Assessment Protocols (CHAP) generates habitat units (HUs) based on an assessment of multiple species (all potential species at a site), habitat features, and functions by habitat type. CHAP is used to calculate baseline HUs, along with projecting 25 and 50 year without project HUs for the Aliso Creek project assessment. Restoration alternative scenarios are then assessed to determine how many HUs are generated by each alternative and associated measure(s). That is, HU benefits are calculated by evaluating specific habitat creation or enhancement actions within the project area. Since CHAP is an accounting and appraisal method that uses geographic information systems (GIS), it is effective evaluating future (with or without project) conditions as long as design specifications and project assumptions are clearly defined spatially. These habitat values are inputted into an economic evaluation, which annualizes them over 50 years to determine environmental benefits and best buy alternative(s) and measure(s).

CHAP analyzes three Aliso Creek ecosystem restoration alternatives that are based on the Corps alternative descriptions, preliminary design cross-sections for each alternative, habitat assumptions by the design team, and habitat decisions made at various Habitat Evaluation Team meetings spanning from 2009 to 2015. Informed predictions of habitat value for each of the three proposed restoration alternatives and their optional measures were calculated by altering the inputs to the CHAP accounting system to match the desired outcomes of the different restoration models. More information on CHAP can be found in the supplemental document *CHAP General Approch.pdf* (O'Neil 2015). Tabled results (also found in this report) can be found in the supplemental worksheets within the digital Excel file labeled as: *Aliso_CHAP_Alternatives_final_10_22_15.xlsx.*

Study Site

The Aliso Creek project boundary falls most within the Aliso and Wood Canyons Wilderness Park, which is a respite for both wildlife and local residents and operated and maintained by Orange County Parks. At the South Coast Water Treatment Plant there is ensuing infrastructure (sewer and water pipes; electrical), which are buried parallel to Aliso Creek on both sides. The Aliso Creek Wilderness Park is surrounded mostly by a dense urban setting in which passive recreation occurs. The primary use of the park is recreation in the forms of bike riding, running, and walking. Past history shows that most (if not all) of the Aliso Creek Wilderness Park was operated as a ranch. Hence, much of the study area shows influences from long-term grazing. The urban setting that surrounds the wilderness park also appears to have had a strongly influence on Aliso Creek; the portion of the creek above the Ranger Station occurs in a very narrow and confined setting with homes, schools, a private university, sports fields, wide highways and other urban settings in immediate proximity. Additionally, the urban setting most likely is contributing to the introduction of exotic plants within the Aliso Creek project area.

The study area for each restoration alternative is based on the footprint of the design (the spatial extent to which the landscape is being altered primarily or secondarily). The footprints were provided by the Corps design team in Environmental Systems Research Institute (ESRI) ArcGIS format. The overall baseline study area (Figure 1) encompasses all areas being evaluated in the alternative analysis (and beyond), therefore a comparison between the alternative and the baseline can be attained by clipping the Geographic Information Systems (GIS) layer for the baseline to the exact extent of each alternative. The individual acreages of each alternative are included in Table 1.

Figure 1. Aliso Creek study area for the CHAP evaluation of the restoration alternatives.

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Table 1. Aliso Creek's Restoration Acreages by Alternative.

	Acres
Alternative 2 Base	**54.88**
❖ **Additional Measures**	
Lower Terrace at Oxbow	14.52
Channel Lengthen Downstream of Woods Canyon	6.04
Add Newbury Riffles	12.49
Woody Debris Placement	12.49
Boulder Cluster Placement	12.49
Alternative 3 Base (includes Wood Canyon Reconnect)	**136.41**
❖ **Additional Measures**	
Reconnect Oxbow	18.69
Lower Terrace at Oxbow	13.83
Channel Lengthen Downstream of Woods Canyon	4.97
Wood Canyon Re-align	7.69
Sulphur Creek Connection	1.75
Measure I - Widen in Vicinity of Aliso Creek Road Bridge	7.38
Measure J – Recontour Upstream of Aliso Creek Bridge to Pacific Park Drive	32.34
Measure M – Stream Lengthen Downstream of Pacific Park Drive	15.68
Pacific Park Drive Bypass Channel	1.01
Pacific Park Drive Bypass Riparian	1.01
Floodplain Extension	21.28
Woody Debris Placement	30.15
Boulder Cluster Placement	30.15
Alternative 4 Base	**108.65**
❖ **Additional Measures**	
Reconnect Oxbow	18.69
Lower Terrace at Oxbow	13.83
Channel Lengthen Downstream of Woods Canyon	4.97
Sulphur Creek Connection	1.75
Measure I - Widen in Vicinity of Aliso Creek Road Bridge	7.38
Measure J – Recontour Upstream of Aliso Creek Bridge to Pacific Park Drive	32.34
Measure M – Stream Lengthen Downstream of Pacific Park Drive	15.68
Pacific Park Drive Bypass Channel	1.01
Pacific Park Drive Bypass Riparian	1.01
Floodplain Extension	8.35
Woody Debris Placement	30.15
Boulder Cluster Placement	30.15
❖ * **Disposal Sites**	**43.12**
Disposal Site 1	2.92
Disposal Site 2	3.82
Disposal Site 3	11.04
Disposal Site 4	4.07
Disposal Site 5	13.09

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- Additional Measures may or may not overlap the Base Alternative, thus combining them do not assumed them to be simply additive
- * All five disposal sites are associated with each of the three Base Alternatives.

Methods

CHAP per acre habitat values for each polygon are derived by summing two matrices: a species/function matrix that relates all potential species at a site to the Key Ecological Functions (KEFs) provided by those species and the ecology of a site; and a habitat/function matrix which relates the Key Environmental Correlates (KECs) to the KEFs. Species/function matrix values are altered when the species list changes or there is a conversion of habitat type. Habitat/function values are altered when KECs are added or removed. This allows analysis of habitat value for all above ground ecology. For Aliso Creek, a third matrix (hydrology/geomorphology) was developed to capture the foundational benefits (below ground) of the project (see hydrology and geomorphology section below). Restoration activities can enhance the values of all matrices within the CHAP accounting system.

By widening the floodplain habitats and converting coastal scrub, annual grassland, or urban habitat types to valley foothill riparian, the subset of species from the potential species list tied to those areas increases greatly. There is also an increase in the number of species performing functions and the number of functions provided by the habitat type. These both lead to increased species/function matrix value for a specific polygon associated with this type of habitat shift. The overall project species list was not altered; thus any change in the species/function value of a polygon for this project is associated with a spatial shift in habitat type.

Adding KECs through planting vegetation; adding hydrologic features such as riffles, pools and in-stream down wood and boulders; enhancing bridges for bat habitat, etc. enhances the habitat/function matrix values by polygon.

To obtain initial and future habitat values representing the benefit of the proposed restoration activities of each alternative, the spatial extent must be analyzed as to the habitat type, structural conditions, and KECs present after restoration. For the purposes of the Aliso Creek feasibility study, habitat values were projected at 5, 10, 25, and 50 years with project. This provides a direct comparison to the baseline without project analysis.

Comparison to Baseline Habitat Value

CHAP is spatially based, and ties to GIS. California Wildlife Habitat Relationships (CalWHR) habitat type GIS coverages were provided by the Corps design team for each alternative. In some cases those polygons were further split to reflect variance in structural conditions. KECs were applied to the habitat types after restoration based on the proposed designs. Species/function matrix and Habitat/function matrix values can then be calculated for each polygon, allowing the calculation of CHAP HUs for the spatial extent of each alternative or measure. These values are further enhanced by any associated Hydrology/geomorphology benefits.

Now that with project Habitat Units have been calculated, comparing those values to the baseline values is a simple exercise in ArcGIS. The *Clip* analysis tool is used to cut the baseline GIS layer to the exact extent of the alternative layer. Once that is complete the acres field is recalculated for each polygon within the baseline layer. Finally the acres field is multiplied by the per-acre value field to obtain updated baseline habitat values based on the exact extent of the restoration alternative being evaluated.

Adjustment Value for Invasive Species

Prior to conversion to HUs, the per-acre baseline value of each polygon was adjusted based on the presence of invasive species. Each polygon was assigned an invasive plant value for each of three structural layers (grass/forb, shrub, and tree) based on the percent composition of invasive species in that layer, as documented in the field inventory. Because invasive species generally negatively influence ecosystem function, the per-acre values were then discounted for the presence of invasives, to arrive at a corrected per-acre value for each polygon. The value of discount applied for each layer based on presence of invasive species is described in Table 2. A deduction factor is then determined for the polygon by taking the geo-mean of the deduction factors for each of the three vegetative layers. A geo-mean is used to account for the possibility that a layer does not exist within a polygon (e.g. a polygon containing no trees). The polygon deduction factor was multiplied by the per-acre value to reach the corrected value. In sum, per-acre value x deduction factor = corrected per-acre value.

Table 2. Invasive species adjustment factors.

Invasive species cover	*x*
0-10%	1.0
11-35%	0.9
36-65%	0.7
66-90%	0.5
>90%	0.3

In the case of all restoration alternatives and measures, the design assumption is that invasive species would be controlled to the 0-10% level for the duration of the 50 year analysis period. Therefore each with project polygon receives an invasive deduction factor of 1.0 (no habitat value loss associated with invasive plant species).

Assessing Riparian within the Floodplain

The valley foothill riparian habitat type can contain various different vegetative communities and communities of various age classes. The Aliso Creek system's valley foothill riparian with project will contain a variety of successional stages based on their spatial relationship to the floodplain and main channel. It was a concern of the Habitat Evaluation Team to capture this diversity in the CHAP habitat evaluation. The projected channel location, 2-year floodplain, 10-year floodplain, and 100-year floodplain for each alternative were spatially defined by the Corps design team. With this data, the spatial context of the floodplains within the riparian polygons could be established within ArcGIS. By appending the floodplain polygons into the overarching riparian polygon and erasing the channel polygon, the riparian areas could be further refined into multiple polygons based on their floodplain. Valley foothill riparian KECs were developed representing early successional, mid successional and late successional communities. Which KECs were applied to each polygon was determined using the spatial relationships described below (Table 3). An example is illustrated in Figure 2. Also see Appendix A for assumptions about restoration.

Table 3   Valley foothill riparian KECs based on floodplain relationship

Floodplain Zone	Valley Foothill Riparian KECs
Channel - 2 year	Early Successional
2 year - 10 year	Mid Successional
10 year - 100 year	Late Successional

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Figure 2. Example of successional stage polygons within valley foothill riparian habitat

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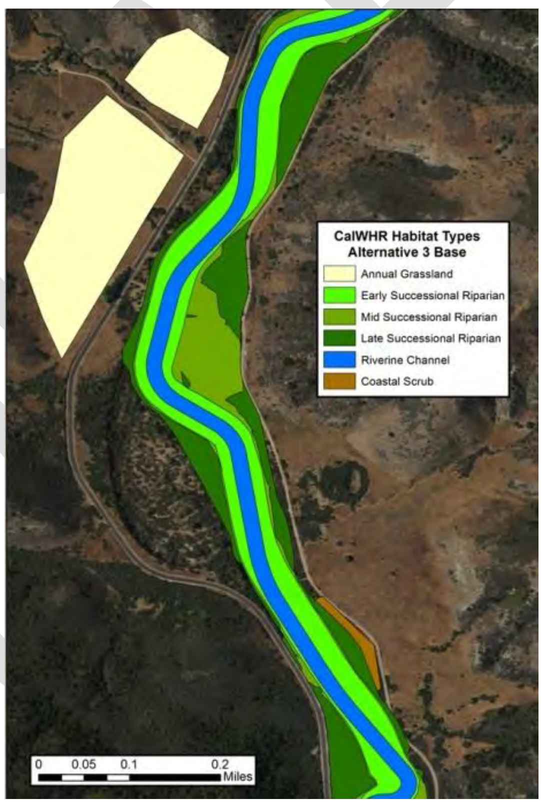

Valuing Hydrology-Geomorphology

In evaluating Aliso Creek's habitat, there was a desire to develop and account for the principal building blocks that serve as a foundation for stream restoration. To meet this desire, a review was done, and we identified an approach by Harman et al (2006), which was funded by the Environmental Protection Agency and US Fish and Wildlife Service and built on prior work by the US Army Corps of Engineers (Corps). This approach provided us with a desired framework that could be applied at Aliso Creek. However, because of the Corps required management needs in implementing Ecosystem Restoration the alternative assessments need to be prescriptive to evaluate alternatives and their measures as well as report the results in Habitat Units (HUs). Additionally, since the Corps was using the Combined Habitat Assessment Protocols (CHAP) to address the biology/ecology some clarifications of terms within the framework were needed (please see Glossary). Further, we needed to clearly depict what restoration principles need to be transformed that would affect KECs (or the fine featured elements) to produce a positive influence on the hydro-geomorphic Key Ecological Functions (KEFs). Once this module was determined then the matrix could simply be scored in a similar manner as done for CHAP's biology/ecology assessment.

Harman et al. (2006) gives a framework for approaching stream assessment and restoration from a function perspective called, *A Function-Based Framework for Stream Assessment and Restoration Projects.* The goal of this framework was to understand the different functions work together and which restoration techniques influence a given function. This document was inspired by Fischenich (2006), where the Corps and a group of scientists and practitioners developed functional objectives for stream restoration projects. However, Harman et al. (2006) document uses different terminology than the Fischenich (2006) in an attempt to tie stream functions to common parameters and they do not delineate between parameters that are functions versus those that are structural measures. Rather, the parameters are called function-based because each parameter can be used to help understand the overall function for a given level. These levels and abridge parameters are shown in Figure 3 below. Stream functions are separated into a hierarchy of levels with: Level 1 – Hydrology, Level 2 – Hydraulic, Level 3 – Geomorphology, Level 4 – Physicochemical, and Level 5 – Biology. Within this hierarchical framework, lower-levels support higher-level, like a pyramid. For example, hydraulic is supported by hydrology, and so on.

Therefore, using the above framework we were able to produce a module for CHAP assessments that would allow a hydro-geomorphic evaluation to be completed. Since the current CHAP method already captures Level 1 - Biology/Ecology, our main objective was to capture Levels 2 thru 5. By doing so, we would be able to provide a functional assessment that covers all Levels identified in the Pyramid (Figure 3), and thereby offer a more complete functional based habitat valuation of the Aliso Creek alternatives. To populate the hydro-geomorphic matrix, a step down logic was applied that identified: 1) Pyramid Level, 2) Restoration Category of Interest, 3) Restoration Principle to Transform, 4) Key Environmental Correlate (KEC) Feature that would be affected by management actions, and 5) Key Ecological Functions (KEFs) that could be positively affected. This information was developed in coordination with project engineer, hydrologist, and ecologist. The Principal Project Engineer gave clarity to the Restoration Category and Restoration Principles that need to be transformed and also to the KEC Features that would be affected by management action(s). Finally, a list of alternatives that are associated with each management actions was identified along with a related metric attribute.

Regarding scoring within the matrix, there was discussion on how to value the different Levels of the Pyramid. The main consensus was that the Pyramid concept offered building blocks whereby one Level supports the next and therefore the lower Levels or foundation pieces should receive a higher value or weight than upper Levels. Therefore, it was decided that values would be weighted based on inverting the Pyramid Levels; that is Level 1 - Hydrology parameters would have a weight of 5, Level 2

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- Hydraulic parameters would have a weight of 4 and so on with Level 5- Biology receiving a weight of 1. Please see Table 4 for an example of a Hydro-Geomorphic matrix; a complete set of matrices for each Alternative and individual measures can be found in the digital files labeled: Alt2 (10-16-2015).xlsx; Alt3 (10-16-2015).xlsx; and Alt4 (10-16-2015).xlsx.

Figure 3. A stream pyramid framework for designing and assessing a functional prescription for ecosystem restoration. [Harman, W., R. Starr, M. Carter, K. Tweedy, M. Clemmons, K. Suggs, C. Miller. 2012. *A Function-Based Framework for Stream Assessment and Restoration Projects.* US Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Washington, DC EPA 843-K-12-006].

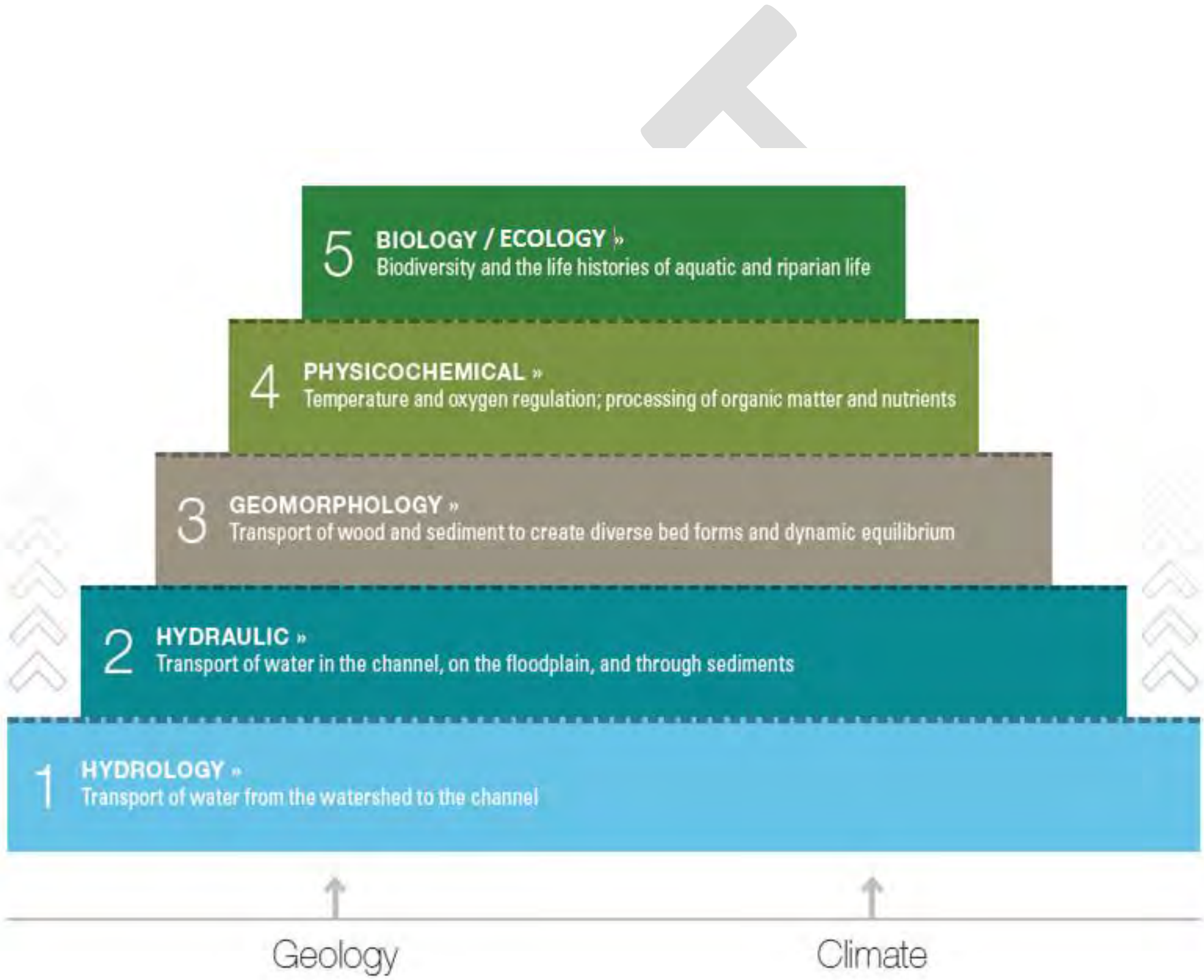

Table 4. A hydro-geomorphic matrix for Base Alternative 3 to value key ecological functions. Highlight areas show the key environmental correlate features that were identified as base measures for this alternative along with their weighted value.

						Alternative 3 Base Measures											
						Hydro-Geomorphic Key Ecological Function											
Pyramid Level	Restoration Category	Restoration Objective	Key Environmental Corrleate Feature	Relav't Alt	Metric Attribute	Stores, Supplies, Enhances Water Flow	Slows Water	Aerates Water	Emolliates Water Temperature	BioFilters Water	Supports Groundwtr Recharge	Expands Floodplain	Abates Floodwater Energy	Creates Diversity & Complexity Instream	Supports Habitat Development	Supports Aquatic Species Connectivity	Makes New Point Bar Formation
Biology/Ecology	Landscape Pathways	Longitudinal Aquatic Species Connectivity	Wood Canyon connection barrier	3	add 3.5 mi											1	
			Removal/Modify ACWHEP	3,4	7,700 ft to 10-ft drops											1	
			Sulphur Creek connection barrier	3,4	remove barrier												
			Remove (2) 10-ft drop structures	3,4	5,280 ft												
			Remove 8-ft drop below Pacific Park Dr.	3,4	1,400 ft												
			Create Pacific Park Dr. Bypass	3,4	Pac Park Dr to I-5												
Physiochemical	Water Quality	Revegetate Riparian	Enhance Canopy	2,3,4	decrease temperature				2	2					2		
Geomorphology	Channel stability	Dynamic Equilibrium	Regime channel construction (SOCWA to ACWHEP or AWMA rd)	2,3,4	create a more stable channel size	3							3		3		
			Recontour channel below Pacific Park Dr	3,4	more stable channel size												
			Streambank grading	2,3,4	flatter side slope than existing										3	3	
		Channel Stability	Riparian slopes	2,3,4					3				3				
	Channel Pattern	Stream lengthen (re-meander)	Reconnect Oxbow	3,4	830 ft added												
			Stream lengthen downstream Woods Canyon	2,,3,4	53 ft (alt 2); 59 ft (alt 3,4)												
			Stream lengthen downstream Pacific Park Dr.	3,4	33 ft (alt 2); 32 ft (alt 3,4)												
	Channel Structure	Bed-form Diversity	Rock Riffles	3,4	length varies: 55, 70 or 170 ft			3		3			3	3	3	3	
			Pool Formation	2,3,4	create 1 pool per riffle	3	3		3	3	3			3	3	3	
			Woody Debris Placement	2,3,4	place woody debris with pools												
			Boulder Cluster Placement	2,3,4	place boulder clusters with pools												
Hydraulics	Hydrodynamic	Floodplain connectivity	Widen channel revegate strip ar Aliso Creek Rd	3,4	in-channel floodprone width (2,10-yr)												
			In-channel floodprone width creation (2, 10-yr)	2,3,4	in-channel floodprone width (2,10-yr)	4				4	4		4		4		
			Raise streambed	3,4	overbank floodpl area (10, 100 yr)	4	4			4	4		4		4		
			Lower perched terrace at oxbow	2, 3,4	expanded 10-yr floodpl												
			Overbank floodplain grading for extension	3,4	excavated 10-yr floodpln area												
		Surface/subsurface water connection	Raise streambed - groundwater influence	3,4	groundwater rise to new invert	4									4		
		Surface Water and Groundwater Exchange	Create Surface & Groundwater Exchange in Pond Turtle Refugia	2,3,4	create turtle habitat area												

Results

By comparing the total habitat value with project to the baseline value, it is possible to isolate the benefits of the ecosystem restoration to fish and wildlife habitat. Because the baseline evaluation did not include the 5-year analysis; the existing, 25-year without project and 50-year without project values were annualized to produce the value at 5 years. In addition, Hydro-Geomorphic values were developed for each Base Alternative and a subset of measures (Table 5-7). The acreage and total CHAP habitat units for both with and without project at each time period for each alternative and sub-measure are summarized in Tables 8-10. Note that the values reported in Tables 8-10 include not only the biology/ecology evaluation but also the hydro-geomorphic assessment, which can be found in Tables 5-7. Further, please be aware that the additional measures for each alternative can spatially overlap the Base Alternative in some instances. In those instances, the areas overlapping are compared to the Base Alternative footprint and the areas not included in the Base Alternative are then compared to the baseline condition value(s). This is done because of the assumption that the Base Alternative is being performed regardless of application of any of its additional measures.

Hydro-Geomorphology Values by Alternative

Alternative 2 – South Orange County Wastewater Authority (SOCWA) Facility to ACWHEP

Base Alternative 2 consists of: Single trapezoidal channel (with no benches) at similar existing streambed elevations, using a constant 0.4% slope; some reconnection to 10 & 100-yr floodplain. No excavated overbank 10-yr floodplain expansion; graded slopes. No Aliso Creek Wildlife Habitat Enhancement Project (ACWHEP) or Wood Canyon tributary aquatic connection. However, it does include exotic plants removal. The hydro-geomorphic values were applied to Measures 1, 2, & 4. As for Measure 5 & 6, these values were calculated based on the biology and ecology benefits because no pools or associated riffles locations were identified, as was done with the Newbury Riffles.

Table 5. Hydro-Geomorphic scores used to determine Alternative 2 values.

Alternative 2				Scores	Scores	Means	Means
Base & Additional Measures	Excel Spreadsheet		# Functions	weighted	unweighted	weighted	unweighted
	Base		9	71	23	7.89	2.56
Lower Terrace at Oxbow (Main channel remains)	Measure 1		9	95	29	10.56	3.22
Channel Lengthen Downstream of Woods Canyon	Measure 2		11	98	32	8.91	2.91
Add Newbury Riffles	Measure 4		10	89	29	8.90	2.90
Woody Debris Placement	Measure 5		Handled on the Biology/Ecology side of Ledger				
Boulder Cluster Placement	Measure 6		Handled on the Biology/Ecology side of Ledger				
	All		12	156	48	13.00	4.00

Alternative 3 – SOCWA to AWMA Bridge

Base Alternative 3 consists of: Compound channel (includes 2-yr floodplain benches) with raised streambed invert; channel slope is 0.25% between riffles. Some reconnection will occur to 10 & 100-yr floodplain. ACWHEP and Woods Canyon tributary aquatic connection achieved. It does include exotic plant removal. Riffles: from SOCWA to ACWHEP there would be 23 riffles structures (70 ft. long each) at 5% slope; from ACWHEP to AWMA Bridge there would be 11 riffles structures (all 70 ft. long, except two @ 55ft.) at 5% slope. The hydro-geomorphic values were applied to Measures 1, 2, 3, 5, & 6 to 13. As for Measure 14 & 15, these values were calculated based on the biology and ecology because 11 riffles were calculated part of the base alternative and counting woody debris and boulder cluster placement would have double counted those areas. It is assumed that the woody debris and boulder clusters were to be placed in association with the riffles.

Table 6. Hydro-Geomorphic scores used to determine Alternative 3 values.

	Alternative 3				Scores	Scores	Means	Means
	Base & Additional Measures	Excel Spreadsheet		# Functions	weighted	unweighted	weighted	unweighted
		Base		10	123	39	12.30	3.90
or	Reconnect Oxbow (Fill main channel)	Measure 1		12	150	48	12.50	4.00
	Lower Terrace at Oxbow (Main channel remains)	Measure 2		10	147	45	14.70	4.50
	Channel Lengthen Downstream of Woods Canyon	Measure 3		12	150	48	12.50	4.00
	Woods Canyon Confluence Trail Realign		Handled on the Biology/Ecology side of Ledger					
	Sulphur Creek Connection	Measure 5		10	127	43	12.70	4.30
and	Measure I - Widen in Vicinity of Aliso Creek Rd. Bridge	Measure 6		10	148	46	14.80	4.60
	Measure J- Recontour Upstream of Aliso Creek Rd. Bridge to Pacific Park Drive	Measure 7		11	139	45	12.64	4.09
	Measure I - Widen in Vicinity of Aliso Creek Rd. Bridge	Measure 8		10	148	46	14.80	4.60
or	Reconfigure channel (short segment 32 ft.)	Measure 9		10	126	40	12.60	4.00
	Measure M - Stream Lengthen Downstream of Pacific Park Drive	Measure 10		12	150	48	12.50	4.00
	Measure J- Recontour Upstream of Aliso Creek Rd. Bridge to Pacific Park Drive	Measure 11		10	127	41	12.70	4.10
	Pacific Park Drive Bypass - Aquatic & Riparian Extensions	Measure 12		10	125	41	12.50	4.10
	Floodplain Extension	Measure 13		10	147	45	14.70	4.50
	Woody Debris Placement	Measure 14	Handled on the Biology/Ecology side of Ledger					
	Boulder Cluster Placement	Measure 15	Handled on the Biology/Ecology side of Ledger					
		All		12	336	105	28.00	8.75

# Functions	Score weighted	Score unweighted	Mean weighted	Mean unweighted
11	164	52	14.91	4.73
Green - Combining Measures 6 & 7.				
Blue Combining Measures 8, 9, 10 & 11.				
# Functions	Score weighted	Score unweighted	Mean weighted	Mean unweighted
12	179	57	14.92	4.75

Alternative 4 – SOCWA to AWMA Bridge

Base Alternative 4 consists of: Compound channel (includes 2-yr floodplain benches) with intermediate raised streambed invert; channel slope is 0.25% between riffles. Some reconnection will occur to 10 & 100-yr floodplain. Only ACWHEP aquatic connection achieved (not the Woods Canyon tributary). It does include exotic plant removal. Riffles: from SOCWA to ACWHEP there would be 23 riffles structures (70 ft long each) at 5% slope; from ACWHEP to AWMA Bridge there would be 14 riffles structures (all 70 ft long) at 5% slope. The hydro-geomorphic values were applied to Measures 1, 2, 3, 5, & 6 to 13. As for Measure 14 & 15, these values were calculated based on the biology and ecology because 14 riffles were calculated part of the base alternative and counting woody debris and boulder cluster placement would have double counted those areas. That is the woody debris and boulder clusters were to be placed in association with the riffles.

Table 7. Hydro-Geomorphic scores used to determine Alternative 4 values.

	Alternative 4				Scores	Scores	Means	Means
	Base & Additional Measures	Excel Spreadsheet		# Functions	weighted	unweighted	weighted	unweighted
		Base		10	122	38	12.20	3.80
or	Reconnect Oxbow (Fill main channel).	Measure 1		12	149	47	12.42	3.92
	Lower Terrace at Oxbow (Main channel remains)	Measure 2		10	146	44	14.60	4.40
	Channel Lengthen Downstream Woods Canyon	Measure 3		12	149	47	12.42	3.92
	Sulphur Creek Connection	Measure 5		10	126	42	12.60	4.20
and	Measure I - Widen in Vicinity of Aliso Creek Rd. Bridge	Measure 6		10	147	45	14.70	4.50
	Measure J - Recontour Upstream of Aliso Creek Rd. Bridge to Pacific Park Drive	Measure 7		11	138	44	12.55	4.00
	Measure I - Widen in Vicinity of Aliso Creek Rd. Bridge	Measure 8		10	147	45	14.70	4.50
or	Reconfigure channel (short segment 32 ft.)	Measure 9		10	125	39	12.50	3.90
	Measure M - Stream Lengthen Downstream of Pacific Park Drive	Measure 10		12	149	47	12.42	3.92
	Measure J - Recontour Upstream of Aliso Creek Rd. Bridge to Pacific Park Drive	Measure 11		10	126	40	12.60	4.00
	Pacific Park Drive Bypass - Aquatic & Riparian Extensions	Measure 12		10	124	40	12.40	4.00
	Floodplain Extension	Measure 13		10	146	44	14.60	4.40
	Woody Debris Placement	Measure 14	Handled on the Biology/Ecology side of Ledger					
	Boulder Cluster Placement	Measure 15	Handled on the Biology/Ecology side of Ledger					
		All		12	334	104	27.83	8.67

# Functions	Score weighted	Score unweighted	Mean weighted	Mean unweighted
11	163	51	14.82	4.64
Green - Combining Measures 6 & 7. Blue Combining Measures 8, 9, 10 & 11.				
# Functions	Score weighted	Score unweighted	Mean weighted	Mean unweighted
12	178	56	14.83	4.67

Combining Biology/Ecology & Hydro-Geomorphic Values by Alternative and Measure

The CHAP approach assesses species, habitats, and functions to derive a value for each alternative and measure over a 50 year time period. These assessments fit well into the stream function pyramid at the Biology/Ecology Level, which is at the top of the pyramid (see Figure 3). The Hydro-Geomorphology covers the remaining Levels that are Physiochemical, Geomorphology and Hydraulics. There were no values assessed for Hydrology (see glossary definition) for this project.

Below are examples of only the base 2, 3, & 4 alternatives (see Table 8, 9, & 10) to give the reader an understanding of how the biology/ecology and hydro-geomorphology values are applied. That is, the Biology/Ecology HUs are combined with the Hydro-Geomorphic HUs to obtain a Total Base Alternative value. This value is then compared to the Without Project HUs to obtain a net Environmental Benefit in HUs. For a complete list of all alternatives and their measures see the worksheets in the digital file: AC_CHAP_Alternatives_final_10_22_2015.xlsx.

All of this information is then combined into one table for each base alternative and measure to depict: 1) total acres, 2) baseline year with project and without project HUs, 3) 5-year later with and without project HUs, 4) 25-years later with and without project HUs, 5) 50-years later with and without project HUs, and 6) the value of restoring disposal sites that are associated with each alternative (see Tables 11, 12, 13, and 14).

Table 15 shows the change in Habitat Units (HUs) by alternative and additional measures, which are then inputted into an economic evaluation to determine environmental benefits for each scenario.

Table 8. Alternative 2 – SOCWA to ACWHEP

CHAP Polygon ID	Acres	HUs Base yr	HUs 10 yr	HUs 25yr	HUs 50yr
AC2B_01	12.49	148.9	153.6	165.5	156.9
AC2B_02	13.18	270.8	281.4	331.4	342.2
AC2B_03	9.54	193.5	210.1	220.3	228.2
AC2B_04	19.67	400.8	446.9	514.1	524.9
Biology/Ecology HUs	54.88	1013.9	1091.9	1231.3	1252.2
Hydro-Geomorphic HUs	12.49*	98.52	98.52	98.52	98.52
Total Base Alternative HUs	54.88	1112.4	1190.4	1329.8	1350.7
Total Without Project HUs	54.88	834.0	820.6	737.7	562.7
Environmental Benefit HUs		278.4	369.8	592.1	788.1

* Of the 54.88 total acres, 12.49 acres received added value for hydro-geomorphology Improvements.

Table 9. Alternative 3 – SOCWA to Pacific Park Drive.

CHAP Polygon ID	Acres	HUs Base yr	HUs 5 yr	HUs 25yr	HUs 50yr
AC3B_1	30.15	359.4	370.8	399.6	399.6
AC3B_2	45.33	931.5	968.1	1140.1	1168.5
AC3B_3	19.22	389.8	423.2	491.8	495.2
AC3B_4	41.71	841.7	963.2	1071.1	1093.9
Biology/Ecology HUs	136.41	2522.5	2725.3	3102.6	3157.1
Hydro-Geomorphic HUs	30.15	370.80	370.80	370.80	370.80
Total Base Alternative HUs	136.41	2893.3	3096.1	3473.4	3527.9
Total Without Project HUs	136.41	2087.6	2034.3	1882.9	1453.3
Environmental Benefit HUs		805.7	1061.8	1590.5	2074.5

* Of the 136.41 total acres, 30.15 acres received added value for hydro-geomorphology Improvements.

Table 10. Alternative 4 – SOCWA to Pacific Park Drive.

CHAP Polygon ID	Acres	HUs Base yr	HUs 5 yr	HUs 25yr	HUs 50yr
AC3B_1	30.15	359.4	370.8	399.6	399.6
AC3B_2	45.56	936.2	972.9	1145.8	1174.2
AC3B_3	14.12	286.3	310.9	361.3	363.7
AC3B_4	18.82	380.0	434.6	483.3	493.6
Biology/Ecology HUs	108.65	1961.9	2089.2	2389.9	2431.1
Hydro-Geomorphic HUs	30.15	367.8	367.8	367.8	367.8
Total Base Alternative HUs	108.65	2329.7	2457.0	2757.7	2798.9
Total Without Project HUs	108.65	1686.5	1644.8	1526.6	1172.2
Environmental Benefit HUs		643.3	812.2	1231.1	1626.8

* Of the 108.65 total acres, 30.15 acres received added value for hydro-geomorphology Improvements.

Table 11. These Five Disposal Sites* are Associated with Each Alternative.

(Each Alternative's Acreages and Habitat Units (HUs) would thereby Increase Accordingly)

Disposal Sites	Acres	Base Year With Project HUs	Base Year FWOP* HUs	Year 5 With Project HUs	Year 5 FWOP HUs	Year 25 With Project HUs	Year 25 FWOP HUs	Year 50 With Project HUs	Year 50 FWOP HUs
Disposal Site 1	2.92	0.2	11.5	18.3	29.1	86.7	73.2	88.7	62.5
Disposal Site 2	3.82	23.1	36.9	42.2	48.4	77.6	35.5	79.5	31.0
Disposal Site 3	11.04	72.4	117.2	127.5	144.9	224.8	97.2	230.0	85.1
Disposal Site 4	4.07	31.2	64.0	51.3	57.2	82.8	31.6	84.8	27.6
Disposal Site 5	13.09	100.1	164.2	164.7	183.7	266.3	101.6	272.5	88.8

* Values shown are for converting all disposal sites from grassland to coastal sage habitat.

Table 12. Alternative 2 and Additional Measures Total Habitat Units (HUs).

Alternative 2	Acres	Base Year With Project HUs	Base Year FWOP* HUs	Year 5 With Project HUs	Year 5 FWOP HUs	Year 25 With Project HUs	Year 25 FWOP HUs	Year 50 With Project HUs	Year 50 FWOP HUs
Base Alternative	54.88	1,112.4	834.0	1,190.4	820.6	1,329.8	737.7	1,350.7	562.7
Alternative 2 Additional Measures	Values represented for the additional measures assume completion of the base alternative. Habitat Units are in addition to the base alternative. Year 5-50 FWOP HUs are taken from either or a combination of the base year HUs or the future without project HUs depending on their spatial overlap of the base alternative.								
Lower Terrace at Oxbow	14.52	377.7	219.4	406.8	201.2	450.9	152.0	450.9	120.8
Channel Lengthen Downstream of Woods Canyon	6.04	132.7	127.0	142.2	131.3	156.2	138.6	158.3	124.3
Add Newbury Riffles	12.49	111.1	98.5	111.1	98.5	111.1	98.5	111.1	98.5
Woody Debris Placement	12.49	254.7	247.4	259.4	252.1	271.3	264.0	262.7	255.4
Boulder Cluster Placement	12.49	249.6	247.4	254.3	252.1	266.2	264.0	257.6	255.4

*FWOP = Future Without Project

Table 13. Alternative 3 and Additional Measures Total Habitat Units (HUs).

Alternative 3	Acres	Base Year With Project HUs	Base Year FWOP* HUs	Year 5 With Project HUs	Year 5 FWOP HUs	Year 25 With Project HUs	Year 25 FWOP HUs	Year 50 With Project HUs	Year 50 FWOP HUs
Base Alternative	136.41	2,893.3	2,087.6	3,096.1	2,034.3	3,473.4	1,882.9	3,527.9	1,453.3
Base Alternative with Wood Canyon Creek Landscape Reconnect	136.41	3,922.9	2,087.6	4,125.7	2,034.3	4,503.0	1,882.9	4,557.5	1,453.3
Alternative 3 Additional Measures	Values represented for the additional measures assume completion of the base alternative. Habitat Units are in addition to the base alternative. Year 5-50 FWOP HUs are taken from either or a combination of the base year HUs or the future without project HUs depending on their spatial overlap of the base alternative.								
	Base Alternative with Wood Canyon Reconnect and Pacific Park Drive Bypass Channel "With Project HUs" include uplift from upstream riverine and riparian areas that are connected by the measure.								
Reconnect Oxbow	18.69	394.9	299.3	421.9	296.5	478.0	285.0	482.5	265.6
Lower Terrace at Oxbow	13.83	450.6	218.0	478.0	208.1	520.2	173.2	520.2	148.4
Channel Lengthen Downstream of Woods Canyon	4.97	113.9	107.4	121.7	112.6	132.8	125.6	134.6	126.0
Wood Canyon Re-align	7.69	131.1	107.1	151.5	107.1	160.6	107.2	166.9	86.9
Sulphur Creek Connection	1.75	57.5	35.3	62.4	40.3	67.1	44.9	68.0	45.8
Measure I- Widen in Vicinity of Aliso Creek Rd Bridge	7.38	156.4	67.9	163.2	69.7	175.9	75.2	176.8	71.3
Measure J- Recontour Upstream of Alisco Creek Rd Bridge to Pacific Park Drive	32.34	718.3	422.3	765.4	437.1	846.1	496.2	853.9	462.7
Measure M- Stream Lengthen Downstream of Pacfic Park Drive (Measure J Included in FWOP HUs)	15.68	348.1	300.1	371.0	317.1	410.1	349.4	413.9	347.5
Pacific Park Drive Bypass Channel	1.01	1,222.2	9.9	1,222.6	10.2	1,223.6	11.2	1,223.6	10.3
Pacific Park Drive Bypass Riparian	1.01	20.4	9.9	22.2	10.2	25.8	11.2	25.9	10.3
Floodplain Extension	21.28	606.8	294.0	598.0	285.3	577.9	265.1	518.4	205.6
Woody Debris Placement	30.15	747.3	730.2	758.7	741.6	787.5	770.4	787.5	770.4
Boulder Cluster Placement	30.15	735.6	730.2	746.9	741.6	775.8	770.4	775.8	770.4
		*FWOP = Future Without Project							

Table 14. Alternative 4 and Additional Measures Total Habitat Units (HUs).

Alternative 4	Acres	Year With Project HUs	Base Year FWOP* HUs	Year 5 With Project HUs	Year 5 FWOP HUs	Year 25 With Project HUs	Year 25 FWOP HUs	Year 50 With Project HUs	Year 50 FWOP HUs
Base Alternative	108.65	2,329.7	1,686.5	2,457.0	1,644.8	2,757.7	1,526.6	2,798.9	1,172.2
Alternative 4 Additional Measures	Habitat Units are in addition to the base alternative. Year 5-50 FWOP HUs are taken from either or a combination of the base year HUs or the future without project HUs depending on their spatial overlap of the base alternative.								
	Pacific Park Drive Bypass Channel "With Project HUs" include uplift from upstream riverine and riparian areas that are connected by the measure.								
Reconnect Oxbow	18.69	394.5	293.1	421.5	285.4	477.6	266.7	482.1	244.0
Lower Terrace at Oxbow	13.83	449.5	211.0	476.8	195.6	519.1	152.5	519.1	124.0
Channel Lengthen Downstream of Woods Canyon	4.97	113.7	109.0	121.6	112.5	132.6	123.5	134.4	119.3
Sulphur Creek Connection	1.75	57.3	35.3	62.3	40.3	66.9	44.9	67.8	45.8
Measure I- Widen in Vicinity of Aliso Creek Rd Bridge	7.38	156.2	67.9	162.9	69.7	175.6	75.2	176.5	71.3
Measure J- Recontour Upstream of Alisco Creek Rd Bridge to Pacific Park Drive	32.34	717.6	422.3	764.8	437.1	845.4	496.2	853.3	462.7
Measure M- Stream Lengthen Downstream of Pacfic Park Drive (Measure J Included in FWOP HUs)	15.68	347.8	299.8	370.7	316.8	409.8	349.1	413.6	347.2
Pacific Park Drive Bypass Channel	1.01	1,222.2	9.9	1,222.6	10.2	1,223.6	11.2	1,223.6	10.3
Pacific Park Drive Bypass Riparian	1.01	20.4	9.9	22.2	10.2	25.8	11.2	25.9	10.3
Floodplain Extension	8.35	240.0	117.3	238.4	115.6	233.5	110.8	213.1	90.3
Woody Debris Placement	30.15	744.3	727.2	755.7	738.6	784.5	767.4	784.5	767.4
Boulder Cluster Placement	30.15	732.5	727.2	743.9	738.6	772.7	767.4	772.7	767.4

*FWOP = Future Without Project

Table 15. Change in Habitat Units (HUs) by Alternative and Additional Measures.

Inputs into Economic Evaluation for Environmental Benefits

		Delta CHAP Habitat Units (HUs)			
Alternative 2	**Acres**	**Base Yr**	**Year 5**	**Year 25**	**Year 50**
Base Alternative	54.88	278.4	369.8	592.1	788.1
Lower Terrace at Oxbow	14.52	158.3	205.6	298.9	330.1
Channel Lengthen Downstream of Woods Canyon	6.04	5.7	11.0	17.6	34.0
Add Newbury Riffles	12.49	12.6	12.6	12.6	12.6
Woody Debris Placement	12.49	7.3	7.3	7.3	7.3
Boulder Cluster Placement	12.49	2.2	2.2	2.2	2.2
		Delta CHAP Habitat Units (HUs)			
Alternative 3	**Acres**	**Base Yr**	**Year 5**	**Year 25**	**Year 50**
Base Alternative	136.41	805.7	1,061.8	1,590.5	2,074.5
Base Alternative with Wood Canyon Creek Landscape Reconnect	136.41	1,835.3	2,091.4	2,620.1	3,104.2
Reconnect Oxbow	18.69	95.6	125.4	193.0	216.9
Lower Terrace at Oxbow	13.83	232.6	269.8	347.0	371.8
Channel Lengthen Downstream of Woods Canyon	4.97	6.5	9.1	7.1	8.6
Wood Canyon Re-align	7.69	24.0	44.3	53.5	80.0
Sulphur Creek Connection	1.75	22.2	22.2	22.2	22.2
Measure I- Widen in Vicinity of Aliso Creek Rd Bridge	7.38	88.5	93.4	100.7	105.5
Measure J- Recontour Upstream off Aliso Creek Rd Bridge to Pacific Park Dri	32.34	295.9	328.3	349.8	391.2
Measure M- Stream Lengthen downstream of Pacfic Park Drive (Assumes Completion of Measure J)	15.68	48.0	54.0	60.7	66.5
Pacific Park Drive Bypass Channel (Includes Hydro-Geomorphic Values for Aquatic and Riparian up to I-5 Crossing)	1.01	1,212.4	1,212.4	1,212.4	1,213.3
Pacific Park Drive Bypass Riparian	1.01	10.6	12.0	14.6	15.7
Floodplain Extension	21.28	312.8	312.8	312.8	312.8
Woody Debris Placement	30.15	17.1	17.1	17.1	17.1
Boulder Cluster Placement	30.15	5.4	5.4	5.4	5.4
		Delta CHAP Habitat Units (HUs)			
Alternative 4	**Acres**	**Base Yr**	**Year 5**	**Year 25**	**Year 50**
Base Alternative	108.65	643.3	812.2	1,231.1	1,626.8
Reconnect Oxbow	18.69	101.3	136.1	210.9	238.1
Lower Terrace at Oxbow	13.83	238.5	281.3	366.6	395.1
Channel Lengthen Downstream of Woods Canyon	4.97	4.7	9.1	9.2	15.1
Sulphur Creek Connection	1.75	22.0	22.0	22.0	22.0
Measure I- Widen in Vicinity of Aliso Creek Rd Bridge	7.38	88.2	93.2	100.4	105.2
Measure J- Recontour Upstream off Aliso Creek Rd Bridge to Pacific Park Dri	32.34	295.3	327.7	349.2	390.6
Measure M- Stream Lengthen downstream of Pacfic Park Drive (Assumes Completion of Measure J)	15.68	48.0	53.9	60.7	66.4
Pacific Park Drive Bypass Channel (Includes Hydro-Geomorphic Values for Aquatic and Riparian up to I-5 Crossing)	1.01	1,212.4	1,212.4	1,212.4	1,213.3
Pacific Park Drive Bypass Riparian	1.01	10.6	12.0	14.6	15.7
Floodplain Extension	8.35	122.8	122.8	122.8	122.8
Woody Debris Placement	30.15	17.1	17.1	17.1	17.1
Boulder Cluster Placement	30.15	5.4	5.4	5.4	5.4
		Delta CHAP Habitat Units (HUs)			
Disposal Sites	**Acres**	**Base Yr**	**Year 5**	**Year 25**	**Year 50**
Disposal Site 1	2.92	0.2	11.5	18.3	29.1
Disposal Site 2	3.82	23.1	36.9	42.2	48.4
Disposal Site 3	11.04	72.4	117.2	127.5	144.9
Disposal Site 4	4.07	31.2	64.0	51.3	57.2
Disposal Site 5	13.09	100.1	164.2	164.7	183.7

Citations

Johnson, D. H., and T.A. O'Neil, (managing directors). 2001. Wildlife-Habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis, OR. pp. 736

Mayer, K.E., W. Laudenslayer (editors). 1988. A guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection. Sacramento, CA. pp.166.

O'Neil, T. 2015. General Documentation Combined Habitat Assessment Protocols (CHAP) – A Biodiversity Accounting & Valuing System. Northwest Habitat Institute, Corvallis, OR. 50 pp.

O'Neil, T., and J. Bohannon. 2014. Conservation Framework and Assessment. Southern California Association of Governments. Los Angeles, CA. 126 pp.

O'Neil, T.A., C. Langhoff, and A. Johnson. 2008. Mapping with a Consistent Wildlife Habitat Classification to Improve Transportation & Conservation Planning. Transportation Research Record: Journal of the Transportation Research Board, No. 2058 - Environment and Energy, Transportation Research Board of the National Academies, Washington D.C. pp. 115-124.

O'Neil, T., B.G. Marcot, and P. Paquet. 2005. The habitat-species-function triad: a planning framework for ecoprovinces and subbasins. Northwestern Naturalist, 86(2): 111.

Perkins, J.P. Like a cool drink of water. Conservation Biology, 16(3):852-853.

Appendix A – Assumptions

Assumptions for all Alternatives and Measures

- Restoration footprints, floodplains, and habitat types within those footprints will be consistent with ArcGIS design layers provided by Corps;
- Target invasive species in the herbaceous, shrub and tree layers will be controlled and maintained in the 0-10% composition range, meaning there will be no Habitat Unit deduction for invasive species for any “with project” polygon;
- The species list will remain consistent with existing conditions (i.e. no species will be gained or lost from the project potential species list);
- Re-connection of topographic and aquatic features will provide adequate connectivity for aquatic species;
- Five disposal sites are associated with each alternative because each alternative has excess excavated material that needs to be reclaimed. All disposal sites will be replanted to coastal sage habitat so that invasive grasses and weeds can be more readily controlled. When the capacity of the disposal sites are exceeded the remaining material will either be removed off-site to a landfill or to other work sites that need the material;
- Staging areas are not included in any alternative assessment; and
- The base alternative will be completed regardless of implementation of additional measures, and any implementation of a measure will tie in with the base alternative.

- Woody debris and boulder clusters were to be placed in association with the riffles.

Assumptions about Restoration

- Aliso Creek’s existing vegetation will undergo clearing and grubbing and will result in complete removal in many areas within the project boundary. There may be some riparian habitat left intact that is within the project boundary;
- Therefore we anticipate that the restoration sites will have 1 gallon container plants as well as pole cuttings from the genetic stock vegetation found on-site. The vegetation will succeed in various stages depending on the growth form - trees or shrubs or herbaceous vegetation, an example for trees follows: sapling, (1-5 years), pole (5-10 years), mature (10-25 years), and old growth (50+ years);
- Next, we believe that fluvial processes will be acting on the vegetation as soon as construction is complete, therefore activating normal flood cycles that periodically remove vegetation, keeping vegetation within the lower floodplains from reaching the same level of maturity as the upper floodplains. That is – in the long term, the 2-year floodplain might be dominated by vegetation less than 5 years old, while the 10-year floodplain might be dominated by vegetation less than 15 years old. That is, we would see the return of an active floodplain cycle of removal

and regeneration of the vegetation. The hydrology will be immediately restored as it will be bypassed through the site during construction;

- We anticipate that large mammals will start using the restoration sites at will while reptiles and small mammals will start reinvading the area from the surrounding habitats when conditions allow. Birds that prefer barren soil will utilize the site, such as a newly burned or silviculture treated area for insects and seeds in the soil. Least Bell's vireo and other obligate riparian birds should commence breeding activities in year 5, but it is common for vireos to use a restore riparian habitat in year 2 or year 3. Riparian bird research indicates that birds return to restored riparian habitat within 2-3 years of initial planting. The guild of riparian birds necessary to illustrate a complete and successful restoration is in the range of 10-15 years; and
- To successfully remove giant reed (*Arundo donax*), which includes preventing reestablishment, giant reed needs to be eradicated starting at the top of the watershed (which is out of the project boundary) then progressively moving down through the watershed. This approach would prevent seeds from reestablishing from an upstream source.

Assumptions for Hydrology-Geomorphology Assessment

- Hydrology-Geomorphology (Hydro-Geo) matrices are filled out based on best professional judgement, which is support by years of experience in engineering, hydrology, geomorphology, or ecology. No empirical data was used;

- The list of functions shown in the matrices should be viewed as an incomplete representation;

- The findings in the matrices should be viewed as repeatable, testable working hypotheses and can be validated and refined through research;

- Hydro-Geo matrices were also designed to capture connectivity, specifically longitudinal, lateral, and vertical
    - Longitudinal (linear) –hydraulic connections to expand up and downstream movement for aquatic species by removal of barrier(s) or by lengthening streams (reconnection oxbow; expanding stream length);

    - Lateral – expanding or enhancing floodplain connectivity (lowering terrace) & adding or increasing sinuosity; and

    - Vertical – raising groundwater to the new invert, enhancing or increasing surface and groundwater exchange;

- For the function supporting aquatic species connectivity, it was assumed that when the barrier(s) is removed aquatic species will have free movement up and downstream and will have increase access to additional habitat. Further, the increase in stream access also allows access to adjacent habitat;

- For the function supporting habitat development, identifies the KEC features that were thought by restoration would enhance or develop additional habitat or its structure;

- Hydro-geo metric is a weighted value as determined based on the inverted order of the stream pyramid framework for designing and assessing a functional prescription for ecosystem restoration. The values range from 1 to 4, please see Hydro-geo excel matrices;

- Hydro-Geo metric values are applied to the wetted perimeter and remain static over the time periods. We understand that these values are dynamic and would change over time, but elected to show them as steady and persistent over time;

- Key ecological functions that have been identified for each alternative are thought to depict ecological services by viewing these processes over time; and

- Functional web concept supports the species, habitat, and hydrology-geomorphic function. It represents a set of KEFs within a community and their connections among species and to habitat elements or KECs.

Appendix B - Methods for Calculating Habitat Units (HUs)

In conducting an initial review of the draft, several comments kept surfacing that required explanation; therefore we assumed the reader would have similar questions. These points needing clarification stemmed from: 1) several measures having the same acreages, but when compared between alternatives, the values differed, 2) what was the general method to calculate Habitat Units (HUs), and 3) what was the rationale for giving secondary benefits to the Woods Canyon Creek reconnection and Pacific Drive Bypass. A discussion of each point follows.

Comparing a Measure to a Base Alternative

When comparing a measure to a Base Alternative, the reader may wonder why the value isn't simply additive. The value is not always additive because we need to avoid the double counting the additional area provided by the measure(s). Thus, we have to first account for the Base Alternative's footprint. Each of the Base Alternative has a different spatial coverage, with varying per- acre value(s). Since Alternative 3 Base covered the largest area, it also had the highest HU value. However, the *Delta* or changes in CHAP HUs were lower for several measures that had the same acreages when compared to Alternative 4. For examples, see the Reconnect Oxbow and Lower Terrace at Oxbow measures and the more detailed explanation below. The reason for this is because Base Alternative 3 footprint is larger and those measures overlap it, and thus the area of overlap was accounted for in the base and not within the measure itself. The opposite is true for the Channel Lengthening down stream of Woods Canyon measure when it is compared amongst alternatives. Although Alternative 2 has the highest value for this measure it is because the base alternative covers the smallest area. Therefore, Alternative 2 had no overlap and the measure actual increased by 1.07 acres because of it.

To determine the *Delta* CHAP HU value for all of the additional measures, we determine the difference between the measure value and the without project value, if it does not spatially overlap the Base Alternative. If it did, then we accounted for the difference between the measure value and the Base Alternative value. The sum of these two is the *Delta* or change in CHAP HU value for the alternative.

Detailed Explanation of Reconnect Oxbow Measure:

To walk through this explanation, one needs to look at the digital file: AC_CHAP_Alternatives_final_10_22_15.xlsx and go to worksheet Alt3 &Alt4 Reconnect Oxbow measures. There one would see that Alternative 4 adds 1.16 more restored acres than Alternative 3 when comparing without project values (Alt 4 - 11.29 and Alt 3 – 10.13, respectively). This is because the Base Alternative 4 floodplain does not extend as wide to the west as Alternative 3 does. Although the initial comparison gives the impression that alternative 4 is scoring higher. In actuality, Alternative 3 produces slightly more with project habitat units (HUs), but shows lower net habitat units for this measure.

So in conclusion, the reader needs to remember that when looking at the different measure's value the measure is in addition to the Base Alternative actions.

General Approach to Calculating Habitat Units (HUs)

- Create a CHAP geodatabase for each alternative, sub-measure and time. Example: Alternative 3 Base would have a geodatabase for base year, 5-years with project, 25-years with project, and 50-years with project (4 geodatabases per alternative or measure). Each alternative or sub-measure has 4 geodatabases, one for each of the above time periods;

- Projected habitat types, invasive values and KECs are entered into each geodatabase providing the required information to produce with project CHAP values;

- The methodology for calculating HUs is discussed earlier in this report and the same methodology is used for the 'with project' calculations;

- In order to have accurate accounting between 'with project' and 'without project' it is necessary that they both have the same total acreage and have the same spatial coverage;

- With project values are compared to without project values by using the Clip ArcGIS geoprocessing tool to clip the baseline layer to the exact footprint of the 'with project' layer, thus creating a corresponding without project layer for every with project layer. Corresponding time periods are matched for comparison (i.e. 25-year without project layer is clipped to the extent of the 25-year with project layer for comparative analysis). Acreage for the clipped layer is recalculated in ArcGIS using "calculate geometry" on the acres field. Finally "calculate field" is performed on the CHAP HU field by multiplying the acres by the per-acre HU value (Cor_per field), calculating updated without project HUs for direct comparison to with project HUs;

- To calculated Delta CHAP HUs, 'without project' is subtracted from 'with project' HUs; and

- Some of the polygons created by the clip process are very small and are smaller than the minimum spatial resolution of CHAP. They are however still included because the initial polygon size prior to the clip was above the minimum size.

Reconnection of Woods Canyon

There are three action measures associated with the reconnection of Woods Canyon to Aliso Creek, and they are: 1) Woods Canyon Connection, Woods Canyon Creek Trailhead Realignment, and Woods Canyon Landscape Reconnect.

Wood Canyon Connection- this measure is associated primarily with stream protection against erosion rather than restoration. Riprap stone would be placed in the streambed and the side slopes of Wood Canyon Creek in the segment just downstream of the AWMA Road crossing to the confluence with Aliso Creek. It would act as an energy dissipater as Wood Canyon flows are transitioning to Aliso Creek. It would apply to Alts 2, 3, and 4, but does <u>not</u> receive an associated CHAP value.

Wood Canyon Creek Trailhead Realignment- Wood Canyon trailhead at AWMA Road would be realigned to create more riparian area just upstream of the confluence and the AWMA Road crossing. The trail would be moved farther to the southwest. Because this measure would only convert habitat types or enhance habitat features only biology/ecology values are determined. Further, this measure only applies to Alternative 3 Base, which is the only action to receive a CHAP value.

Wood Canyon Creek Landscape Reconnect- This measure considers the primary connection along with secondary effects resulting from synergy/connectivity of including an additional 3.5 miles of Wood Canyon Creek. This measure also includes the replacement of the culverts at AWMA Road crossing with a bridge where the road crosses Wood Canyon Creek. This measure would only apply to Alternative 3 Base that receives a CHAP value. Because the primary action raises the invert, removes culverts, and replaces those with a bridge would result in improved aquatic access to Woods Canyon Creek for the aquatic species that occur in Aliso Creek (Figure 1). The southwestern pond turtle (*Actinemys marmorata pallida*) occurs in Aliso Creek within the project boundary and is considered a "State Species of Special Concern" by the California Department of Fish and Wildlife. Since this restoration action has the potential to benefit this primary aquatic species of interest, hydro-geomorphic credit was given for this restoration action.

Because of reconnecting woods canyon, hydro-geomorphic benefits were applied as a primary benefit to the reconnection site within the wetted perimeter in Aliso (30.15 ac); secondary benefit were given to the upstream riverine in Woods Canyon Creek (5.14 ac) and the riparian areas associated with Woods Canyon Creek (78.56 ac). The rationale for this is because pond turtle movements have been shown to be influenced by hydrological flow. A study in southern California showed that females in an intermittent river had significantly larger linear aquatic home ranges then those inhabiting a dammed river where water levels were more stable (Goodman and Stewart 2000). Pond turtle in the intermittent reach of the Mad River in Northern California moved to terrestrial sites earlier than those in the perennial reach, apparently in response to declines in surface water area (Bondi 2009). In southern California, linear aquatic home ranges range up to 14,000 ft (4,263 m) Goodman and Stewart 2000, Bettelheim 2005).

Further, pond turtle's over-wintering can be aquatic or terrestrial (Holland 1994). Pond turtles often hibernate underwater, in the muddy bottom of a pool and may estivate during summer droughts by burying in soft bottom mud. They can survive even when streams dry out in most years, by moving onto land and hibernating under dense brush or in wood rat nests (Lemm 2006). Overwintering and estivation sites are typically located in upland areas; in southern California they may be over 197 feet (60 m) from water (Goodman 1997a). Overwintering site characteristics are highly variable, but the microsite usually consists of burrows in leaf litter or soil (Holland 1994). Holland and Goodman (1996) reported an aggregation of 19 southwestern pond turtles in a crevice of granitic rock near a stream in San Luis Obispo County, California on September 26. The availability of suitable terrestrial shelter sites is necessary to provide protection from predators and thermal extremes.

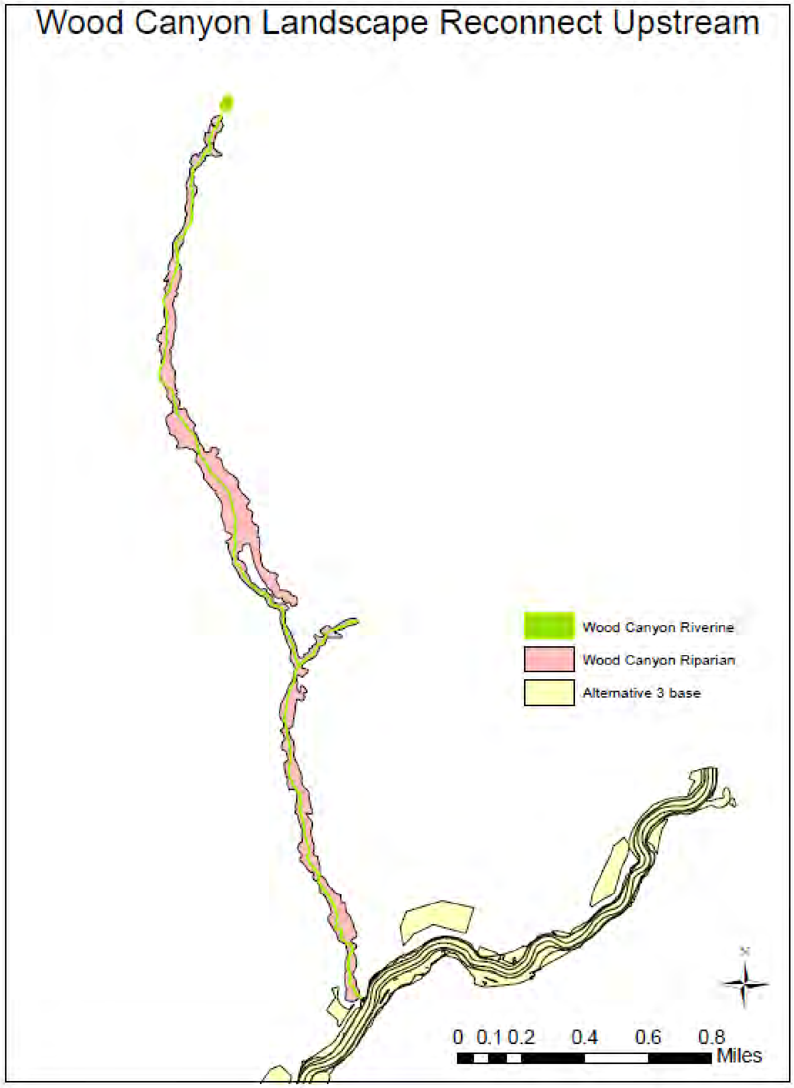

Figure 1. An illustration of the area influenced by Woods Canyon Creek reconnection to Aliso Creek.

Pacific Park Drive Bypass

Pacific Park Drive Bypass evaluates to measures an aquatic and a riparian restoration action. Several of the Habitat Evaluation Team members viewed the Pacific Park Drive Bypass as a bottleneck that is blocking some aquatic and terrestrial connectivity to the upstream portions of Aliso Creek. There is a 600 ft. long culvert under Pacific Park Drive but there is not a consensus among team members on the viability of the culvert for aquatic and mammal species connectivity. Therefore, an assessment of both measures was done.

The primary area of influence is the riverine connection at the bypass (1.01 ac) and secondary uplift for the upstream riverine (9.04 ac) and upstream riparian (86.77 ac). The rationale for giving hydro-geomorphic credit to the primary and secondary areas is the same as was stated for reconnection of Woods Canyon Creek above. Additionally, the southwestern pond turtle may occur in in this upper stretch of Aliso Creek as reported by USGS pass surveys done within the project boundary (Robert Fisher pers. communications). Further, turtles (species identification could not be determined) were observed within and near the top of the project boundary just below the I-5 crossing. Figure 2 shows the areas of influence by the Pacific Park Bypass reconnection measure.

Figure 2. An illustration of the area influenced by Pacific Park Drive Bypass.

Citations

Bettelheim, Matthew P. 2005. The Western Pond Turtle, Clemmys marmorata: A Natural History of the Species. Privately Published. 30 pp.

Bondi, C. A. 2009 A comparison of western pond turtle (Actinemys marmorata) movements in perennial and intermittent portions of a Northwestern California river system. Master's thesis, Humboldt State University, Arcata, California, USA.

Goodman, R. H., Jr., and G. R. Stewart. 2000. Aquatic home ranges of female Western Pond Turtles, Clemmys marmorata, at two sites in Southern California. Chelonian Conservation and Biology, Vol 3, No. 4, pp. 743-745.

Goodman, R.H., Jr. 1997a. The biology of the southwestern pond turtle (Clemmys marmorata pallida) in the Chino Hills State Park and the West Fork of the San Gabriel River. Master's Thesis, California State Polytechnic University, Pomona.

Holland, D.C. 1994. The western pond turtle: habitat and history. U.S. Department of Energy, Bonneville Power Administration, Portland, Oregon. 11 chapters + appendices.

Holland, D.C. and R. H. Goodman, Jr. 1996. Clemmys marmorata (western pond turtle). Terrestrial habitat use. Herpetol. Rev. 27:198-199.

Lemm, J. 2006. Field Guide to Amphibians and Reptiles of the San Diego Region. California Natural History Guides. University of California Press.

Appendix D – Glossary of Terms

Abates Floodwater Energy: Ability to decrease or diminish the power of floodwaters against its bed or banks.

Aerates Water: Ability to expose to action or effect of air or to cause air to circulate through water.

Bed-form Diversity: Creating pool & riffle sequencing, pool depth variability and variability in streambed gradation size.

Biofilters Water: Ability for natural biological process to filter water.

Supports Groundwater Recharge: Ability to reinforce the replenishment of an aquifer by the absorption of water.

Biology Function: Involves the biodiversity and the life histories of aquatic, marine, and terrestrial organisms. These functions are determined by how organisms influence their environment (Key Ecological Functions). These functions are found at the top of the Pyramid because the lower level processes support or influence the habitats that support these organisms.

Channel Pattern: Fluvial processes that form river or streams as straight, sinuous, meandering, or braided.

Channel Structure: Underlying framework that can include the number of channel levels, the number and types of intermediaries, and the linkages among channel members.

Channel Stability: A stream that is in equilibrium by balance between erosion and deposition usually attained in mature systems (Davis 1902). It is the ability of a stream over time to transport the sediment and flows in a manner that maintains its dimension, pattern, and profile without either aggrading or degrading (Rosgen 1996). Additionally, streams described to be "in regime" are synonymous with "stable channels"

Creates Diversity & Complexity Instream: Ability to generate a variety of involved instream structure(s) and habitat(s).

Dynamic Equilibrium: A state of balance between continuing processes or by two forces in motion. It is an open system in a steady state in which there is continuous inflow of material while the form or character of the system remains unchanged.

Ecology: Science that deals with the relationships between living organisms with their physical environment and with each other.

Emolliates Water Temperature: Ability to weaken, reduce, or block the effect of temperature on water.

Floodplain Connectivity: A stream or river linked or joined to a naturally occurring plain that is subject to flooding. The linkage or connection allows for variable flow regimes to occur.

Floodplain Expansion: Ability to enlarge a stream or river floodplain.

Functions: The physical, chemical and biological processes that occur in ecosystems.

Functional Resilience – The capacity of a community to return to a starting pattern of total functional diversity, richness, and redundancy following a disturbance event.

Functional Web - The set of all Key Ecological Functions within a community and their connections among species and thence to habitat elements or Key Environmental Correlates. The functional web concept supports the developing of the species, habitat, and hydro-geomorphic function matrices (see calculation section).

Geomorphology: Study of the physical features of the surface of the earth and their relation to its geological structures. In the evaluation context it involves channel stability, stream lengthen (re-meander), bed form diversity and dynamic equilibrium (Level 3).

Hydraulics: Deals with the moving force or mechanical properties of liquids or fluids. In the evaluation context it involves floodplain connectivity, which is the transport of water in the channel onto the floodplain, surface/subsurface water connection, and surface water and groundwater exchange (Level 2).

Hydrodynamic: Forces acting on or exerted by fluids (especially liquids) which include such parameters are viscosity, turbulence, and friction. Viscosity is one of the most important factors effecting flow.

Hydrology: Study of the properties, distribution, and circulation of water on and below the earth's surface and in the atmosphere. In the evaluation context it involves the transport of water from the watershed to the channel (Level 1). No actions to evaluate were identified.

In Regime: Channel construction that establishes a channel width, which allows it to carry its design flow without significant degradation or aggradation.

Key Ecological Functions – The principal ways organisms use, influence, and alter their biotic and abiotic environments.

Key Environmental Correlates – Fine feature habitat elements physical or biological thought to support ecological functions and/or influence a species distribution, abundance, fitness, and viability.

Landscape Pathways: Courses, routes, tracks or ways that allows for movement through the topography or terrain.

Makes New Point Bar Formation: Ability to create a low curved ridge of sand or gravel along the inside bend of a stream or river.

Performance Standards: Observable or measurable physical (including hydrological), chemical and/or biological attributes that are used to determine if the mitigation project meets its objectives.

Physiochemical: Parameters include temperature and oxygen regulation, and processing of organic matter and nutrients. These elements are generally more affected by underlying levels like geomorphology because restoration practitioners typically address these parameters to see improvements in physicochemical parameters.

Pyramid Level Category: The term for each level of the Stream Functions Pyramid that includes five categories: Hydrology (Level 1), Hydraulics (Level 2), Geomorphology (Level 3), Physicochemical (Level 4), and Biology (Level 5).

Restoration: The manipulation of the physical, chemical and biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic or terrestrial resource

Sediment Continuity: Accounts for sediment budget, and relation between inflow (supply), storage, and yield.

Slows Water: Ability to reduce the speed of water.

Stream Functions Pyramid: The hierarchical representation of stream functions with five levels: Hydrology, Hydraulics, Geomorphology, Physicochemical and Biology.

Stream Lengthen (re-meander): Expanding a stream extent by creating or reestablish bends and/or turns.

Stores, Supplies, Enhances Water Flow: Ability to accumulate, make available, or improve the flow of water.

Supports Habitat Development: Ability to reinforce the development of aquatic and terrestrial habitat.

Supports Aquatic Species Connectivity: Includes removing or modifying natural or artificial features that are usually hard and fixed within or along a stream channel or habitat features that assist with the ability to allow aquatic species movement both up and downstream.

Water Quality: Related to the chemical, physical, and biological and radiological characteristics of water.

Watershed – An area or a region that is bordered by a divide and from which water drains to a particular watercourse or body of water.

Citations

Davis, W.M., 1902. Base-Level Grade and Peneplain. Jounral of Geology, Vol. X, pp.77-109.

Rosgen, David L. 1996. Applied River Morphology. Wildland Hydrology Books, Pagosa Springs, Colorado.

Appendix E - Relationship Matrix Descriptions

MATRIX 1: Potential Species by Function Matrix

The potential species list generated by IBIS (see Baseline Condition Report) is aligned with Key Ecological Functions (KEFs) that could potentially be performed in the habitat type and structural condition represented by the polygon. For example, if the polygon represents a "shrub-steppe" habitat type, the KEFs thought to be performed in that habitat type by the potential species are included in the relationship matrix. This information is acquired from IBIS. The result of this matrix is the number of potential species performing key functions in that habitat type. Example follows:

Lowland Mixed Conifer <u>Habitat Type</u> *Species Value (Potential)*	**Function 1** ***Secondary Consumer***	**Function 2** ***Breaks up Down Wood***	**Function 3** ***Primary Excavator***	**Function 4** ***Eats Terrestrial Insects***
Downey Woodpecker	**0**	**1**	**1 (tree)**	**1**
Bobcat	**1**	**0**	**0**	**0**
Belted Kingfisher	**1**	**0**	**1 (burrows)**	**1**
Great Blue Heron	**1**	**0**	**0**	**1**

MATRIX 2: Actual Key Environmental Correlates by Function Matrix

In this matrix, the functions, or KEFs, are again related to Key Environmental Correlates (KECs), but this time the KECs are those actually present at the site (based on field data inventory). Because this is an actual account, those KEFs not correlated to an actual KEC are then removed. The result of this matrix is the number of KEFs characterized by KECs specific to that polygon. Example follows:

Lowland Mixed Conifer <u>Habitat Type</u> *KEC Value (Potential)*	**Function 1** ***Creates Snags***	**Function 2** ***Breaks up Down Wood***	**Function 3** ***Primary Excavator***	**Function 4** ***Eats Terrestrial Insects***
KEC 1 down wood	**0**	**1**	**0**	**1**
KEC 2 snags	**1**	**0**	**1**	**1**
KEC 3 tree cavities	**1**	**1**	**1**	**1**
KEC 4 hollow living trees	**0**	**1**	**0**	**1**

MATRIX 3: Hydro-Geomorphic Key Environmental Correlates by Function Matrix

To populate the hydro-geomorphic matrix, a step down logic was applied that identified: 1) Pyramid Level, 2) Restoration Category of Interest, 3) Restoration Principle to Transform, 4) Key Environmental Correlate (KEC) Feature that would be affected by management actions, and 5) Key Ecological Functions (KEFs) that would be positively affected. This information was developed in coordination with project engineer, hydrologist, and ecologist. The Principal Project Engineer gave clarity to the Restoration Category and Restoration Principles that need to be transformed and also to the KEC Feature that would be affected by management action(s). Finally, a list of alternatives that are associated with each management actions was identified along with a related metric attribute.

Regarding scoring within the matrix, there was discussion on how to value the different Levels of the Pyramid. The main consensus was that the Pyramid concept offered building blocks whereby one Level supports the next and therefore the lower Levels or foundation pieces should receive a higher value or weight than upper Levels. Thus, it was decided that values would be weighted based on inverting the Pyramid Levels; that is Level 1 - Hydrology parameters would have a weight of 5, Level 2 - Hydraulic parameters would have a weight of 4 and so on with Level 5 - Biology receiving a weight of 1. Examples matrices can be found in tables B-2, B-3, and B-4.

						Alternative 2 - Base Measures											
						Hydro-Geomorphic Key Ecological Function											
Pyramid Level	**Restoration Category**	**Restoration Objective**	**Key Environmental Correlate Feature**	**Relav't Alt**	**Metric Attribute**	**Stores, Supplies, Enhances Water Flow**	**Slows Water**	**Aerates Water**	**Emolliates Water Temperature**	**BioFilters Water**	**Supports Groundwtr Recharge**	**Expands Floodplain**	**Abates Floodwater Energy**	**Creates Diversity & Complexity Instream**	**Supports Habitat Development**	**Supports Aquatic Species Connectivity**	**Makes New Point Bar Formation**
Biology	Landscape Pathways	Longitudinal Aquatic Species Connectivity	Wood Canyon connection barrier	3	add 3.5 mi												
			Removal/Modify ACWHEP	3, 4	7,700 ft to 10-ft drops												
			Sulphur Creek connection barrier	3,4	remove barrier												
			Remove (2) 10-ft drop structures	3,4	5,280 ft												
			Remove 8-ft drop below Pacific Park Dr.	3,4	1,400 ft												
			Create Pacific Park Dr. Bypass	3,4	Pac Park Dr to I-5												
Physiochemical	Water Quality	Revegetate Riparian	Enhance Canopy	2,3,4	decrease temperature				2	2					2		
Geomorphology	Channel stability	Dynamic Equilibrium	Regime channel construction (SOCWA to ACWHEP or AWMA rd)	2,3,4	create a more stable channel size	3							3		3		
			Recontour channel below Pacific Park Dr	3,4	more stable channel size												
			Streambank grading	2,3,4	flatter side slope than										3	3	
		Channel Stability	Riparian slopes	2,3,4					3				3				
	Channel Pattern	Stream lengthen (re-meander)	Reconnect Oxbow	3,4	830 ft added												
			Stream lengthen downstream Woods Canyon	2,3,4	53 ft (alt 2); 59 ft (alt 3,4)												
			Stream lengthen downstream Pacific Park Dr.	3,4	33 ft (alt 2); 32 ft (alt 3,4)												
	Channel Structure	Bed-form Diversity	Rock Riffles	3,4	length varies: 55, 70 or 170 ft												
			Newbury Riffles	2	create 32 ft long												
			Pool Formation	2,3,4	create 1 pool per riffle	3	3		3	3	3			3	3	3	
			Woody Debris Placement	2,3,4	place woody debris with												
			Boulder Cluster Placement	2,3,4	place boulder clusters with pools												
Hydraulics	Hydrodynamic	Floodplain connectivity	Widen channel revegetate strip ar Aliso Creek Rd	3,4	in-channel floodprone width (2,10-yr)												
			In-channel floodprone width creation (2, 10-yr)	2,3,4	in-channel floodprone width (2,10-yr)	4				4	4		4		4		
			Raise streambed	3,4	overbank floodpl area (10,												
			Lower perched terrace at oxbow	2, 3,4	expanded 10-yr floodpl												
			Overbank floodplain grading for extension	3,4	excavated 10-yr floodpln area												
		Surface/subsurface water connection	Raise streambed - groundwater influence	3,4	groundwater rise to new invert												
		Surface Water and Groundwater Exchange	Create Surface & Groundwater Exchange in Pond Turtle Refugia	2,3,4	create turtle habitat area												

Table B-2. A hydro-geomorphic matrix for the Alternative 2 Base to value key ecological functions. Highlight areas show the key environmental correlate features that were identified as base measures for this alternative.

						Alternative 3 Base Measures											
						Hydro-Geomorphic Key Ecological Function											
Pyramid Level	Restoration Category	Restoration Objective	Key Environmental Corrleate Feature	Relav' t Alt	Metric Attribute	Stores, Supplies, Enhances Water Flow	Slows Water	Aerates Water	Emolliates Water Temperature	BioFilters Water	Supports Groundwater Recharge	Expands Floodplain	Abates Floodwater Energy	Creates Diversity & Complexity Instream	Supports Habitat Development	Supports Aquatic Species Connectivity	Makes New Point Bar Formation
			Wood Canyon connection barrier	3	add 3.5 mi											1	
			Removal/Modify ACWHEP	3, 4	7,700 ft to 10-ft drops											1	
Biology/Ecology	Landscape Pathways	Longitudinal Aquatic Species Connectivity	Sulphur Creek connection barrier	3,4	remove barrier												
			Remove (2) 10-ft drop structures	3,4	5,280 ft												
			Remove 8-ft drop below Pacific Park Dr.	3,4	1,400 ft												
			Create Pacific Park Dr. Bypass	3,4	Pac Park Dr to I-5												
Physiochemical	Water Quality	Revegetate Riparian	Enhance Canopy	2,3,4	decrease temperature				2	2					2		
			Regime channel construction (SOCWA to ACWHEP or AWMA rd)	2,3,4	create a more stable channel size	3							3		3		
	Channel stability	Dynamic Equilibrium	Recontour channel below Pacific Park Dr	3,4	more stable channel size												
			Streambank grading	2,3,4	flatter side slope than existing										3	3	
		Channel Stability	Riparian slopes	2,3,4					3				3				
			Reconnect Oxbow	3,4	830 ft added												
Geomorphology	Channel Pattern	Stream lengthen (re-meander)	Stream lengthen downstream Woods Canyon	2,,3,4	53 ft (alt 2); 59 ft (alt 3,4)												
			Stream lengthen downstream Pacific Park Dr.	3,4	33 ft (alt 2); 32 ft (alt 3,4)												
			Rock Riffles	3,4	length varies: 55, 70 or 170 ft			3		3			3	3	3	3	
			Pool Formation	2,3,4	create 1 pool per riffle	3	3		3	3	3			3	3	3	
	Channel Structure	Bed-form Diversity	Woody Debris Placement	2,3,4	place woody debris with pools												
			Boulder Cluster Placement	2,3,4	place boulder clusters with pools												
			Widen channel revegate strip ar Aliso Creek Rd	3,4	in-channel floodprone width (2,10-yr)												
		Floodplain connectivity	In-channel floodprone width creation (2, 10-yr)	2,3,4	in-channel floodprone width (2,10-yr)	4				4	4		4		4		
			Raise streambed	3,4	overbank floodpl area (10,	4	4			4	4		4		4		
Hydraulics	Hydrodynamic		Lower perched terrace at oxbow	2, 3,4	expanded 10-yr floodpl												
			Overbank floodplain grading for extension	3,4	excavated 10-yr floodpln area												
		Surface/subsurface water connection	Raise streambed - groundwater influence	3,4	groundwater rise to new invert	4									4		
		Surface Water and Groundwater Exchange	Create Surface & Groundwater Exchange in Pond Turtle Refugia	2,3,4	create turtle habitat area												

Table B-3. A hydro-geomorphic matrix for the Alternative 3 Base to value key ecological functions. Highlight areas show the key environmental correlate features that were identified as base measures for this alternative.

						Alternative 4 -Base Measures Hydro-Geomorphic Key Ecological Function											
Pyramid Level	**Restoration Category**	**Restoration Objective**	**Key Environmental Corrleate Feature**	**Relav't Alt**	**Metric Attribute**	**Stores, Supplies, Enhances Water Flow**	**Slows Water**	**Aerates Water**	**Emolliates Water Temperature**	**BioFilters Water**	**Supports Groundwtr Recharge**	**Expands Floodplain**	**Abates Floodwater Energy**	**Creates Diversity & Complexity Instream**	**Supports Habitat Development**	**Supports Aquatic Species Connectivity**	**Makes New Point Bar Formation**
Biology/Ecology	Landscape Pathways	Longitudinal Aquatic Species Connectivity	Removal/Modify ACWHEP	3, 4	7,700 ft to 10-ft drops											1	
			Remove (2) 10-ft drop structures	3,4	5,280 ft												
			Remove 8-ft drop below Pacific Park Dr.	3,4	1,400 ft												
			Create Pacific Park Dr. Bypass	3,4	Pac Park Dr to I-5												
Physiochemical	Water Quality	Revegetate Riparian	Enhance Canopy	2,3,4	decrease temperature				2	2					2		
Geomorphology	Channel stability	Dynamic Equilibrium	Regime channel construction (SOCWA to ACWHEP or AWMA rd)	2,3,4	create a more stable channel size	3							3		3		
			Recontour channel below Pacific Park Dr	3,4	more stable channel size												
			Streambank grading	2,3,4	flatter side slope than existing										3	3	
		Channel Stability	Riparian slopes	2,3,4					3				3				
	Channel Pattern	Stream lengthen (re-meander)	Reconnect Oxbow	3,4	830 ft added												
			Stream lengthen downstream Woods Canyon	2,,3,4	53 ft (alt 2); 59 ft (alt 3,4)												
			Pacific Park Dr Stream lengthen	3,4	33 ft (alt 2); 32 ft (alt 3,4)												
	Channel Structure	Bed-form Diversity	Rock Riffles	3,4	length varies: 55, 70 or 170 ft			3		3			3	3	3	3	
			Pool Formation	2,3,4	create 1 pool per riffle	3	3		3	3	3			3	3	3	
			Woody Debris Placement	2,3,4	place woody debris with pools												
			Boulder Cluster Placement	2,3,4	place boulder clusters with												
Hydraulics	Hydrodynamic	Floodplain connectivity	Widen channel revegate strip ar Aliso Creek Rd	3,4	in-channel floodprone width (2,10-yr)												
			In-channel floodprone width creation (2, 10-yr)	2,3,4	in-channel floodprone width (2,10-yr)	4				4	4		4		4		
			Raise streambed	3,4	overbank floodpl area (10, 100 yr)	4	4			4	4		4		4		
			Lower perched terrace at Oxbow	2, 3,4	expanded 10-yr floodpl												
			Overbank floodplain grading for extension	3,4	excavated 10-yr floodpln area												
		Surface/subsurface water connection	Raise streambed - groundwater influence	3,4	groundwater rise to new invert	4									4		
		Surface Water and Groundwater Exchange	Create Surface & Groundwater Exchange in Pond Turtle Refugia	2,3,4	create turtle habitat area												

Table B-4. A hydro-geomorphic matrix for the Alternative 4 Base to value key ecological functions. Highlight areas show the key environmental correlate features that were identified as base measures for this alternative.

Appendix B-2d Crosswalk of Aliso Creek Ecosystem Restoration Vegetation/Habitat Type between Sawyer, Keeler-Wolf, and Evens, CNDDB/Holland, and CWHR (1988)		
2011 Vegetation Mapping Alliances (Corps 2013a) (MCV2; Sawyer et al. 2009)	CNDDB/ Holland (1986)	California Wildlife Habitat Relationships (Mayer and Laudenslayer 1988)
Artemisia californica–Eriogonum fasciculatum Alliance	Coastal scrub (32000)	Coastal Scrub
Baccharis pilularis Alliance	Coastal scrub (32000)	Coastal Scrub
Baccharis salicifolia Alliance	Riparian scrub (63000)	Valley Foothill Riparian
Eriogonum fasciculatum Alliance*	Coastal scrub (32000)	Coastal Scrub
Isocoma menziesii Alliance	Coastal scrub (32000)	Coastal Scrub
Populus fremontii Alliance	Riparian forest (61000); marsh and swamp (52000); riparian scrub (63000)	Valley Foothill Riparian
Quercus agrifolia Alliance	Riparian forest (61000); marsh and swamp (52000); riparian scrub (63000)	Coastal Oak Woodland
Rhus integrifolia Alliance	Coastal scrub (32000)	Coastal Sage Scrub, Chamise Chaparral
Salix exigua Alliance	Riparian forest (61000); marsh and swamp (52000); riparian scrub (63000)	Valley Foothill Riparian
Salix gooddingii Alliance	Riparian forest (61000); marsh and swamp (52000); riparian scrub (63000)	Valley Foothill Riparian
Salix laevigata Alliance	Riparian forest (61000); marsh and swamp (52000); riparian scrub (63000)	Valley Foothill Riparian
Salix lasiolepis Alliance	Riparian forest (61000); marsh and swamp (52000); riparian scrub (63000)	Valley Foothill Riparian
Schoenoplectus americanus Alliance	Marsh and swamp (52000); riparian scrub (63000)	Freshwater Emergent Wetland
Typha domingensis Alliance	Marsh and swamp (52000)	Freshwater Emergent Wetland
Xanthium strumarium Provisional Herbaceous Alliance	No corresponding type	No corresponding type
Semi-natural Stands	No corresponding type	No corresponding type
Other Land Cover Types	Developed/Disturbed/ Graded	No corresponding type

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APPENDIX B-3: Restoration Review

ALISO CREEK MAINSTEM
ECOSYSTEM RESTORATION STUDY
Orange County, California

September 2017

US Army Corps
of Engineers

Orange County Public Works
Environmental Resources
Department

Ecosystem Restoration Review: Aliso Creek Ecosystem Restoration Project, Orange County, California

Prepared for
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April 13, 2016

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Executive Summary

As specified in the Tentatively Selected Plan Draft Design Appendix (Corps 2015), the purpose of the Aliso Creek Ecosystem Restoration Project is to improve the existing stream bank and invert stability, provide riparian habitat, protect existing infrastructure, and provide aquatic wildlife connectivity within the project limits. Successful ecological restoration of Aliso Creek will depend largely on the size of floodplains provided. Floodplain delineations (2-year, 10-year, and 100-year) are used as the primary determinant of project success in Aliso Creek. Of the four alternatives evaluated in this review, Alternative 3 provides the largest and most well-connected floodplain area overall, and is therefore the alternative most likely to result in successful ecological restoration of Aliso Creek.

Methods of giant reed removal described in Explanation/Details of Arundo Treatment Methods in South Orange County (San Juan Hydrologic Unit) (Finch 2008) should generally be effective at eradicating giant reed populations. However, a conclusive review of eradication success in Aliso Creek is not possible at this time due to lack of information about current condition and how eradication methods described in the Arundo Treatment Methods document have been applied at Aliso Creek.

1.0 Introduction

The U.S. Army Corps of Engineers (Corps) is developing alternatives for the Aliso Creek Ecosystem Restoration Project (project) within the lower reaches of Aliso Creek, located in Orange County, California. Aliso Creek flows approximately 19 miles (30 kilometers) from its headwaters in the Cleveland National Forest southward to the Pacific Ocean at Aliso Beach Park in the City of Laguna Beach (County of Orange 2009). The proposed stream restoration area includes Aliso Creek from Pacific Park Drive (upstream limit) to the South Orange County Wastewater Authority (SOCWA) Coastal Treatment Plant (CTP) (downstream limit) and the lower reaches of Wood Canyon Creek and Sulphur Creek tributaries. The purpose of this ecosystem restoration review is to provide an impartial review of the Corps approach to ecosystem restoration at Aliso Creek that will support completion of the Tentatively Selected Plan (TSP) milestone, as outlined in SMART[1] Planning guidelines for Corps feasibility studies.

The primary documents reviewed in this report are the TSP Draft Design Appendix for the Aliso Creek Ecosystem Restoration Study (Corps 2015) that outlines primary civil engineering design elements for Alternatives 2, 3, and 4; and Explanation/Details of Arundo Treatment Methods in South Orange County (San Juan Hydrologic Unit) (Finch 2008). Additional resources were Aliso Creek Mainstem Ecosystem Restoration Baseline Environmental Conditions and Future without Project Conditions (Corps 2009a); Aliso and Wood Canyons Wilderness Park Resource Management Plan (County of Orange 2009); Habitat Restoration and Enhancement Plan (Nature Reserve of Orange County 2003); and civil engineering computer-aided design (CAD)/geographic information system (GIS) data provided by the Corps.

As specified in the TSP Draft Design Appendix (Corps 2015), the purpose of the Aliso Creek Ecosystem Restoration Project is to improve the existing stream bank and invert stability, provide riparian habitat, protect existing infrastructure, and provide aquatic wildlife connectivity within the project limits. In particular, successful restoration will include habitat for the southwestern pond turtle (*Actinemys marmorata pallida*) and potentially the California red-legged frog (*Rana aurora draytonii*).

This review will focus on elements of geomorphology and hydrology that directly affect the likelihood of success for each alternative presented in the TSP Draft Design Appendix (Corps 2015). The review will also evaluate the giant reed (*Arundo donax*) removal methodology outlined by Orange County. It will consider potential limitations of the design and highlight knowledge gaps. Analysis and conclusions provided in the project documents will be assessed for feasibility by RECON, with reference to related research literature and documents.

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[1] SMART: specific, measurable, attainable, risk informed, timely.

2.0 Project Area and Background

The Aliso Creek watershed drains 34.6 square miles of what primarily comprises urban development, including portions of Lake Forest, Aliso Viejo, Mission Viejo, Laguna Niguel, Laguna Hills, and Laguna Beach (Corps 2015). Undeveloped areas of the watershed include the upper headwaters that lie within the Cleveland National Forest and the areas immediately adjacent to Aliso Creek south of State Route 73 (SR-73), located within the Aliso and Wood Canyons Wilderness Park.

The proposed stream restoration area is contained between Pacific Park Drive (upstream limit) and SOCWA CTP (downstream limit), a reach of Aliso Creek that is contained almost entirely within the Aliso and Woods Canyons Wilderness Park. The channel is in mostly natural condition except between the skate park (just north of the Aliso Creek Road bridge) and the Awma Road bridge, where the channel is fully engineered with riprap bank protection and a soft bottom (Corps 2015). Downstream of the Awma Road bridge, Aliso Creek enters the Aliso and Wood Canyons Wilderness Park, where the channel meanders through mostly undeveloped canyons. This portion of the reach contains wide alluvial terraces and abandoned floodplains. However, Aliso Creek channel is highly incised along this reach and disconnected from its historic floodplains. Current conditions are worsening, causing increased incision and erosion along banks, decrease of channel sinuosity, higher stream flow velocities, and sediment deposition downstream. Adverse effects to vegetation include reduced access to water by way of reduced flood frequency and reduced access to ground water reserves (i.e., lowering of the water table).

The Aliso Creek Wetland Habitat Enhancement Project (ACWHEP) constructed a grouted rock overflow dam on Aliso Creek within Aliso and Wood Canyons Wilderness Park, between the confluences of Sulphur Creek and Wood Canyon Creek. The purpose of the ACWHEP was to provide habitat along the creek banks by diverting stream flow into the adjacent floodplains. Due to damage caused by high flows in 1997–98, erosion has been accelerated at the base of the structure and downstream. Upstream of the structure, Aliso Creek is generally stable, with balanced aggradation/degradation and good connectivity between the channel and the floodplains.

Removal of giant reed in Aliso Creek is underway in Aliso Creek watershed as part of a watershed-scale removal effort by the County of Orange. Removal methods are outlined in *Explanation and Details of Arundo Treatment Methods in South Orange County* (Finch 2008). The methodology presented in this document is reviewed in Section 5.

3.0 Current Conditions

As stated in the Habitat Restoration and Enhancement Plan (Nature Reserve of Orange County 2003, pp. 15), the general condition of vegetation and habitat within Aliso Creek and the surrounding areas, within Aliso and Wood Canyons Wilderness Park, is as follows:

> Aliso/Wood Canyons Wilderness Park supports healthy native habitats, including CSS [coastal sage scrub], riparian woodland, oak woodland and chaparral habitats, as well as degraded native grasslands and extensive non-native grassland. Italian thistle, artichoke thistle, and black mustard are the dominant exotic plants of concern in Aliso and Wood Canyons Wilderness Park, occupying large grassland areas. Secondary weeds of concern in the park include giant reed, tree tobacco, poison hemlock, and pampas grass. Disturbances that are promoting weeds in the park include erosion, adjacent development, drainage infrastructure and trails/roads.
>
> Sensitive plants and wildlife species that have been documented in the park include big-leaved crown-beard (*Verbesina dissita*), thread-leaved brodiaea (*Brodiaea filifolia*), coastal California gnatchatcher, coastal cactus wren, southwestern pond turtle, western spadefoot toad, garter snake, grasshopper sparrow and least Bell's vireo.

As stated in the Aliso and Wood Canyons Wilderness Park (AWCWP) Resource Management Plan (RMP) (County of Orange 2009) Section 4.3.3, the general condition of Aliso Creek watershed and channel is as follows:

> The Aliso Creek watershed, like other watersheds in Orange County, has been significantly affected by development. Aliso Creek, once an intermittent stream before the region became heavily urbanized, now flows year-round through the eastern and southern sections of AWCWP, augmented in recent years by significant increases in upstream urban runoff. Specific watershed concerns include channelization, poor surface water quality from discharge of non-point sources, loss of habitat in the floodplain, loss of riparian habitat, paving of the flood plain, decline of water supply and flows, biodiversity loss, invasive plant and animal species, surface erosion, and over use of existing resources (California Coastal Conservancy 2001).

The condition of Aliso Creek has been declining in recent years, as further explained in Section 4.3.3 of the AWCWP RMP:

> River geomorphology conditions within AWCWP have been degrading for several decades. Degradation within AWCWP is caused by several factors including past cattle grazing, current goat grazing and dry farming, urbanization of the upper watershed, improper fuel zone management, natural and artificial fluctuations of the water levels in the channel, and human activities such as impeding the channel at trail, spillway, and road crossings.

Urbanization is a very significant stress on the geomorphology of the Aliso Creek watershed. Due to high proportion of paved surfaces in an urban setting, infiltration rates are low and travel time of storm runoff to the channel is very fast. Therefore highly urbanized watersheds experience an acceleration of both volume and speed of runoff reaching a channel, which increases the volume of peak flows. Increased volume of peak flows increases rates of erosion in a stream, often causing bank failure and channel incision.

Also low flows on Aliso Creek have increased. Aliso Creek, which was historically an ephemeral stream, has become perennial due to consistent sources of urban runoff. Aliso Creek is also fed by year-round discharge of effluent into Sulphur Creek from the Sulphur Creek Regional Treatment Plant.

A study of geomorphological degradation in the channel from 1998 to present is discussed in the Aliso Creek Mainstem Ecosystem Restoration Baseline Environmental Conditions and Future without Project Conditions (Corps 2009a) Section 2.3.1.1:

> A comparison of profiles of the water surfaces was conducted based on 1998, 2003, and 2006 topographies for the 2-year and 100-year events. Upstream of Awma Road, the channel invert and water surface elevation level (WSEL) have remained consistent. Between ACWHEP and Awma Road the channel invert shows some variation with the 2003 invert at the highest elevation and the 2006 invert usually between the 1998 and 2003 elevation. The WSEL reflects the change in channel profile. Between the South Coast Treatment Plant bridge and ACWHEP the more significant channel erosion is evident and is again reflected in the WSEL. Downstream of the treatment plan and through the golf course, the channel invert has stayed largely constant with a few fluctuations.

Channel incision has caused disconnection from historic floodplains, as described further in Section 2.3.1.1 (Corps 2009a):

> The hydraulic analysis indicates that a 10-year event is contained within the natural channel through the Aliso and Wood Canyon Wilderness Park; in some locations an event as large as a 25-year event is contained. This is well above most estimates of the bankfull discharge associated with a natural stream…

Channel incision is also discussed in the Aliso Creek Ecosystem Restoration Study (Corps 2015):

> A significant structure within the project limits is the Aliso Creek Wetland Habitat Enhancement Project (ACWHEP), which was built to provide habitat along the creek banks by diverting water into the floodplain to support growth of riparian vegetation. The grouted rock structure is currently being damaged by erosion in the downstream toe area. However, the structure is apparently providing stability to the upstream channel.

The ACWHEP facility was determined to offer limited benefit to the park in terms of function (County of Orange 2009) and:

> This structure has exacerbated downstream erosion and created a large drop in the downstream channel, thereby segmenting the creek and causing substantial habitat degradation.

Erosion and degradation downstream of the ACWHEP structure is severe, as described in Section 2.6.1 of the in the Aliso Creek Mainstem Ecosystem Restoration Baseline Environmental Conditions and Future without Project Conditions (Corps 2009a):

> A grade control structure known as the Aliso Creek Wildlife Habitat Enhancement Project (ACWHEP) structure is located on Aliso Creek in the upstream locale of the AWCWP structure no longer functions as intended and severe erosion and incision of the stream is occurring downstream…

The structure interrupts aquatic habitat connectivity, as stated in Section 2.6.1:

> In addition, the ACWHEP structure blocks access for aquatic, amphibious, and terrestrial wildlife through the riverine and aquatic corridor.

Vegetation communities in and around Aliso Creek proposed project area are described in the Aliso and Wood Canyons Wilderness Park Resource Management Plan (County of Orange 2009) Section 4.4.1:

> AWCWP contains seven unique habitat types: coastal scrub; chaparral; grassland; vernal pools, seeps, and meadow habitats; marsh; riparian; and woodland habitats. Rock and cliff habitat also comprises a limited portion of the park, and disturbed habitat – characterized by non-native plant species – is also present in areas.

Additional information about the existing vegetation communities is provided in the Aliso Creek Mainstem Ecosystem Restoration Baseline Environmental Conditions and Future without Project Conditions Report (Corps 2009a).

4.0 Successful Ecological Restoration at Aliso Creek

The policy objectives of ecological restoration for the Aliso Creek Ecosystem Restoration Project are to re-establish proper ecosystem structure, function, and dynamic processes so that the region will mimic, as closely as possible, conditions that would occur in the absence of human intervention (Corps 2009b). Achieving this objective requires successful restoration of the geomorphological and hydrological function of Aliso Creek, such that there would be no dams and few levees or water diversions (RHJV 2009), the primary channel would be permitted to meander, floodplains would be active and connected to the main channel, and erosion and sedimentation would be in balance. Once these hydrological processes are established, native riparian vegetation communities would be established by active ecological restoration and sustained by adequate water supply and natural cycles of recruitment. Self-sustaining native riparian vegetation communities would provide high-quality habitat for wildlife.

By definition, a riparian area is composed of a river channel and its current or potential floodplain; it is a transitional area between terrestrial and aquatic ecosystems (RHJV 2009). If the area does not flood, then river processes are not in operation and the area will not function as riparian habitat (RHJV 2009). Vegetation community types vary within a riparian area, usually forming bands along the river edge, and are determined almost entirely by the plants' access to water. For the purposes of this review, vegetation communities will be grouped into riparian zones defined by floodplains outlined in the Draft Design Appendix (Corps 2015). Specifically, these are the 2-year (Q2), 10-year (Q10), and 100-year (Q100) floodplains.

As a component of ecological restoration, habitat restoration at Aliso Creek should include planting and seeding of riparian vegetation. One possible planting plan for riparian vegetation communities, along with associated riparian zone and preferred water requirements, is provided in Table 1. Primary threats to long term establishment and sustainability of riparian vegetation communities are summarized in Table 2.

Table 1
Riparian Vegetation Communities

Vegetation Community	Dominant Species	Vegetation Structure	Vegetation Zone	Hydric Conditions
Coastal sage scrub; chaparral; grassland	Sagebrush, buckwheat, manzanita, coffeeberry, toyon, native and non-native grasses	Shrub overstory with herbaceous understory dominated by grasses	Upland	No inundation
Coast live oak woodland	Coast live oak, coyote brush, elderberry, buckwheat	Medium/tall open overstory with moderately dense shrub/herbaceous understory	Upper Riparian (Q100)	Rare to extremely rare inundation; roots do not reach water table (~30 feet)
Mixed riparian forest	Cottonwood, black willow, arroyo willow, white alder, sycamore	Medium/tall closed overstory with occasional openings and dense shrub/ herbaceous understory	Middle Riparian (Q10)	Occasional to Infrequent inundation; tap roots can access water table (~20 feet)
Willow scrub	Cottonwood, sandbar willow, mule fat, mugwort	Medium/short overstory that is interspersed and dense on sandbars; vegetation is generally young, willows multi-stemmed; understory sparse	Lower Riparian (Q2)	Frequent to occasional inundation; roots have easy access to water
Freshwater marsh/aquatic	Sandbar willow; mule fat	Short, open understory layer; partially/ seasonally submerged	Riverine	Inundated

Table 2 Common Threats to Riparian Vegetation		
Threat to Riparian Vegetation Communities	Cause	Result
Lack of access to groundwater	Incised channel that drains the area and lowers the water table	Vegetation in the middle and lower riparian areas cannot access the water table and are lost/reduced.
High velocity flows	Limited access to lateral expansion during peak flows (i.e., disconnection from floodplains); low channel sinuosity; lack of riffle/pool sequences in channel; lack of vegetation/debris in channel.	Accelerated rates of erosion and reduced rates of deposition; loss of channel meanders, loss of riffle/pool sequences; loss of lower riparian vegetation and aquatic wildlife; loss off vegetation/debris in channel; loss of aquatic wildlife habitat.
Non-native invasive species	Direct transport; local disturbance that provides an opportunity/advantage.	Loss of native vegetation communities, biodiversity, and wildlife habitat.

4.1 Summary of Alternatives

Four restoration alternatives were evaluated as part of the Aliso Creek Ecosystem Restoration Study (Corps 2015). The first alternative was a No Action alternative; three others provide engineered solutions to issues of channel incision, lowered water table, and threats to surrounding infrastructure. The ability of each alternative to provide a foundation for successful establishment of riparian vegetation communities depends primarily on (1) area suitability for planting, (2) system stability, and (3) adequate water supply. These three elements lay the foundation for how well each alternative will meet overall project goals; a summary of alternatives is provided in Table 3.

Table 3 Summary of Alternatives				
Element	Alt 1	Alt 2	Alt 3	Alt 4
System stability	VP	P	G	G
Maximize access to water (all zones)	VP	VP	VG	G
Maximize groundwater recharge	VP	P	VG	G
Minimize in-channel velocity	VP	VP	G	G
Minimize non-native invasive species	NE	NE	NE	NE
Maximize area for coastal sage scrub; chaparral; grassland	VG	G	G	G
Maximize area for coast live oak woodland	G	G	G	G
Maximize area for mixed riparian forest	VP	P	VG	G
Maximize area for willow scrub	VP	G	VG	VG
Maximize area for freshwater marsh and aquatic habitat (for red-legged frog and pond turtle)	VP	P	G	G
VP = Very Poor; P = Poor; G = Good; VG = Very Good; NE = No Effect				

Most areas in the construction plan (Corps 2015) for all alternatives are considered suitable for planting. The channel banks will be constructed with a slope of 3:1 (run:rise), which is very good for establishing riparian vegetation.

System stability in riparian areas is a state of dynamic equilibrium where natural geomorphological processes are in effect (such as cutting of stream banks, bed scour, and in-channel deposition) but are generally balanced so that the general trend of the system is neither aggradation nor degradation. System stability is necessary for long-term establishment of riparian vegetation communities, because excessive movement of soil will either undercut or bury plants and roots.

Riparian vegetation communities are highly dependent upon water supply, therefore planning vegetation communities with an understanding of water availability is critical to restoration success. Adequate water supply, for the purposes of this evaluation, is one required to sustain a particular vegetation community (e.g., coast live oak woodland or willow scrub). Water supply is provided by a combination of sources, namely: groundwater, inundation (i.e., flooding), and surface infiltration from precipitation and runoff. Floodplain delineations can be used to estimate water availability, because two of the three primary water sources are known (approximately): access to groundwater and frequency of inundation. The third source – surface infiltration – will be approximately the same for all alternatives.

Floodplain areas per alternative are summarized in Table 4 and also provided in Figures 1a to 1d. These floodplain area data were provided by the Corps to RECON in March 2016. Areas do not include additional planning measures that may or may not be applied to each alternative; therefore the completed restoration floodplain areas may vary from information provided here.

Table 4 Summary of Floodplain Acreages					
	Floodplain	Northern Section	Southern Section	Total Acreage	Rank[2]
Alternative 1	2-year (Q2)	30.53	25.05	55.58	4
	10-year (Q10)	45.56	32.32	77.88	4
	100-year (Q100)	62.19	44.07	106.26	4
Total Acreage for Alternative 1 Floodplains				**239.72**	**4**
Alternative 2	2-year (Q2)	30.53[1]	24.43	54.96	3
	10-year (Q10)	45.56[1]	34.92	80.48	3
	100-year (Q100)	62.19[1]	50.55	112.74	3
Total Acreage for Alternative 2 Floodplains				**248.17**	**3**
Alternative 3	2-year (Q2)	57.81	47.25	105.06	2
	10-year (Q10)	62.63	63.05	125.67	1
	100-year (Q100)	72.70	82.19	154.89	1
Total Acreage for Alternative 3 Floodplains				**385.63**	**1**
Alternative 4	2-year (Q2)	57.51	48.21	105.72	1
	10-year (Q10)	61.26	53.06	114.32	2
	100-year (Q100)	48.55	64.39	112.95	2
Total Acreage for Alternative 4 Floodplains				**332.99**	**2**

[1] Since no work is planned for the northern section of Alternative 2, acreages provided here were taken from Alternative 1 (the No Action Alternative).
[2] Acreages are ranked with Rank = 1 given to the alternative with the largest acreage.

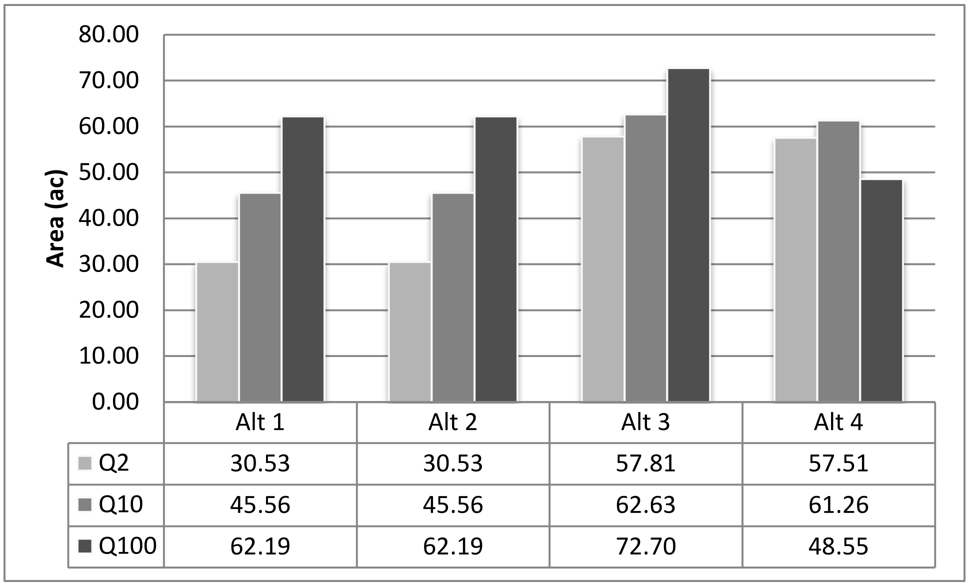

Figure 1a. Comparison of Floodplain Acreages for Alternatives 1–4, Northern Section (Pacific Park Drive to ACWHEP). Since no work is planned for Alternative 2 in this section, areas have been set equal to Alternative 1 (No Action Alternative).

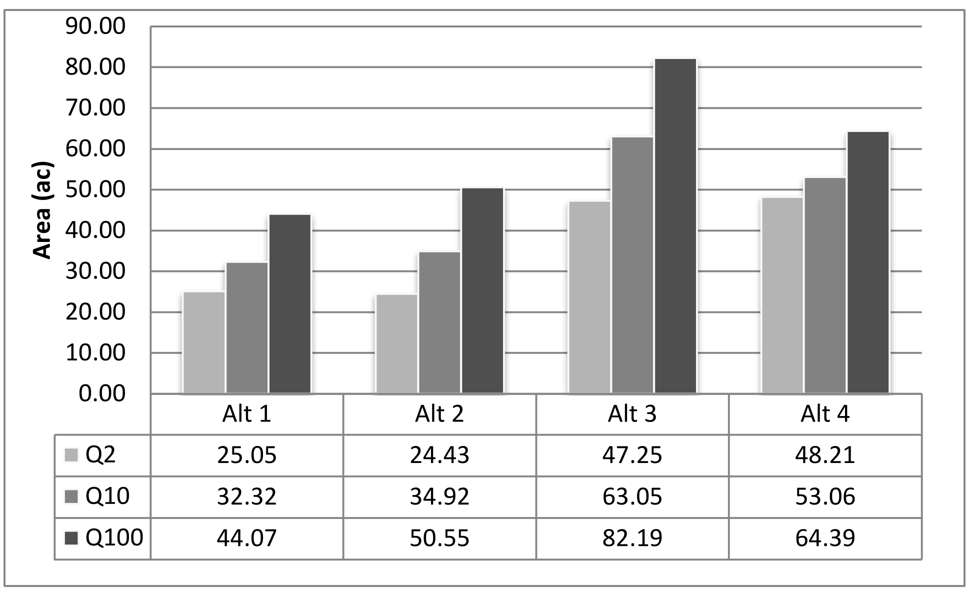

Figure 1b. Comparison of Floodplain Acreages for Alternatives 1–4, Southern Section (ACWHEP to SOCWA)

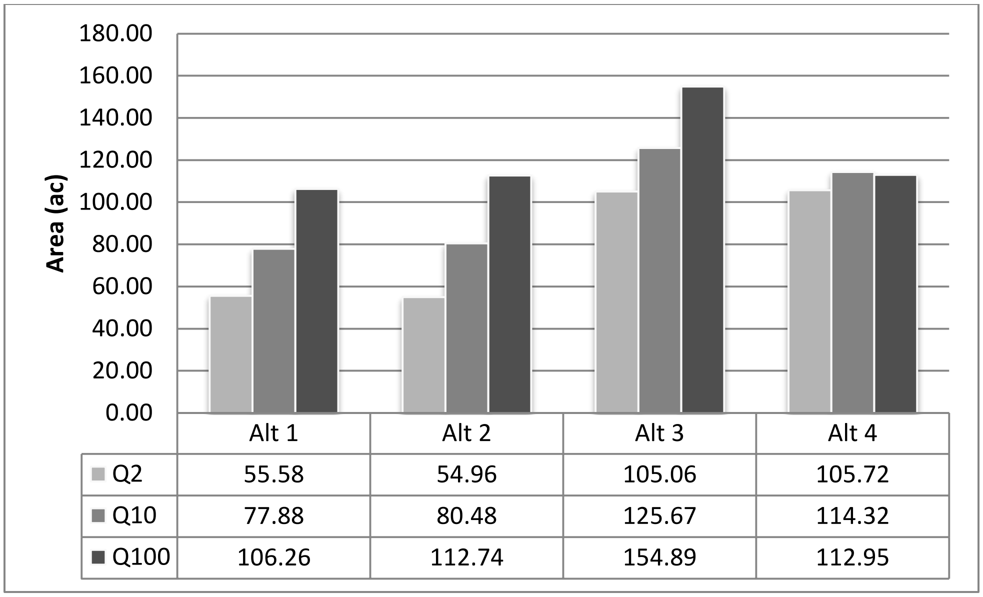

Figure 1c. Total Floodplain Acreage for Alternatives 1–4 (Combined for Northern and Southern Sections)

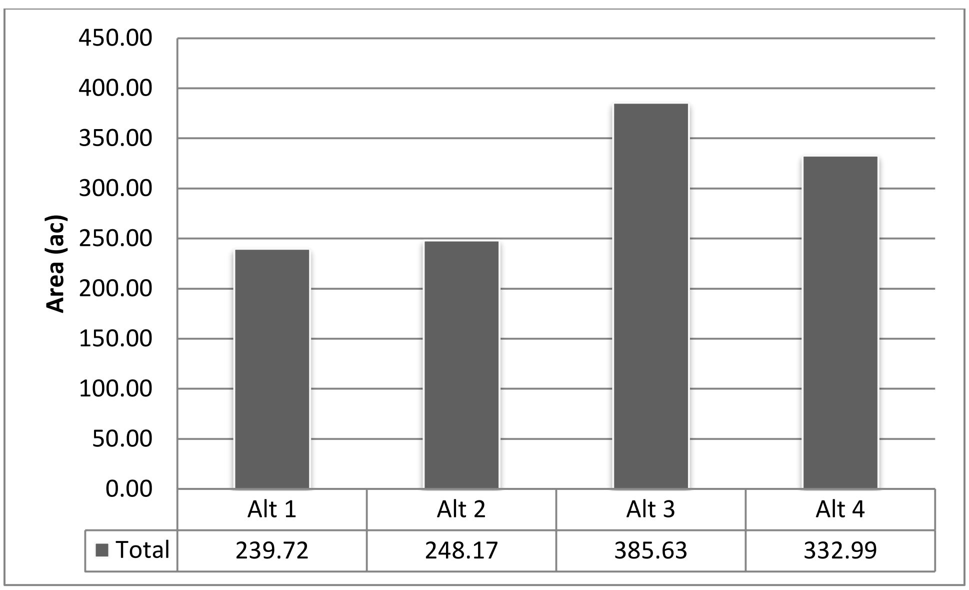

Figure 1d. Total Combined 2-year, 10-year, and 100-year Floodplain Acreage for Alternatives 1–4 (Combined for Northern and Southern Sections)

Alternative 1

Alternative 1 is the No Action alternative that would allow the existing condition of Aliso Creek to persist. No design improvements would be applied. The benefits of the No Action alternative are that no project disturbances would occur; mature vegetation would be left in place, leaving the riparian vegetation communities and habitat intact. Existing processes would also be left unchanged, therefore the Aliso Creek channel would probably continue to incise and degrade, further eroding the channel banks and dropping groundwater levels throughout the Aliso Creek system. The system is adjusting to hydrology that has been altered by urbanization of the watershed and development within the channel (and possibly additional stressors).

Aliso Creek will continue to erode until it establishes an equilibrium that accommodates the new (current) hydrological regime. Rebalancing of the Aliso Creek system could require 50 to 100 years. While this is occurring, channel degradation would continue, cutting the bed and banks throughout the project area and causing heavy sediment deposition at the far downstream end, likely at the creek mouth. The channel invert would continue to drop and disconnect from old floodplains. Disconnection from broad floodplains will cause the channel to sustain very high velocities during peak stormflow. High velocities could threaten habitat for aquatic species and be destructive to in-channel vegetation (i.e., prevent stands from reaching maturity).

The water table would continue to lower with the channel invert, challenging the root systems to reach the water and threatening the persistence of existing riparian vegetation communities. Where access to ground water was reduced, the riparian vegetation would follow a natural conversion to upland vegetation. Persistence of riparian vegetation communities would be restricted to areas that still have sufficient access to water, such as within and directly adjacent to the incised channel.

Alternative 1 provides the smallest combined floodplain area (at or below the Q100) of all alternatives and is therefore ranked last of the four alternatives (see Table 4 and Figures 1c and 1d). The planting area for middle, lower, and riverine riparian vegetation communities would be limited to small, narrow floodplains that are relatively small in area. High stream flow velocities during peak stormflow events would threaten the stability of the channel, channel banks, and survival of the aquatic and riparian vegetation communities.

Alternative 2

The purpose of Alternative 2 is to stabilize the existing streambed and construct associated floodplain within incised channel margins. It does not apply design improvements to Aliso Creek above the ACWHEP structure and allows it to remain in place. The benefits of Alterative 2 are that project disturbances would be limited to below the ACWHEP structure, therefore all existing mature vegetation above ACWHEP would be left in place.

Although Alternative 2 design improvements claim to create a stable channel below ACWHEP, this will not necessarily create overall system stability, which requires connection to floodplains. Because Alternative 2 provides limited connection to the floodplains, peak stream flow volumes would be confined to a relatively narrow channel and small floodplains (similar to current condition). High stream flow velocities during peak stormflow would cause bank and channel erosion, threaten aquatic species and aquatic habitats, and be destructive to vegetation in the channel and on the floodplains.

Alternative 2 provides the second smallest combined floodplain area (at or below the Q100) of all alternatives and is therefore ranked third of the four alternatives (see Table 4 and Figures 1c and 1d). The planting area for middle, lower, and riverine riparian vegetation communities would be limited to small, narrow floodplains that are relatively small in area. High stream flow velocities during peak stormflow events would threaten the stability of the channel, channel banks, and survival of the aquatic and riparian vegetation communities.

Alternative 3

The purpose of Alternative 3 is to reconnect the stream channel to the historic floodplain by lifting the elevation of the streambed as high as possible. Alternative 3 provides the largest 10-year and 100-year floodplain areas (Table 4, Figure 1c) as well as the largest combined floodplain area (Table 4 and Figure 1d). It provides the second largest 2-year floodplain area, but only so by 0.66 acre (less than 1 percent), and is therefore nearly equal in size with the floodplain area provided by Alternative 4. This connection to large floodplains creates the most balanced system overall, and provides the largest areas for restoring riparian vegetation in Aliso Creek.

Of the four alternatives, Alternative 3 provides the best opportunity for system stability because it allows peak stream flow to expand laterally onto the floodplains, where stream flow velocity is reduced by contact with soil and vegetation in the floodplains. This reduced flow velocity would minimize channel incision and bank erosion. Lower in-channel stream flow velocities would help preserve aquatic wildlife and habitats. Frequent inundation of the floodplains would increase water supply to riparian vegetation communities on the floodplains and help recharge groundwater reservoirs.

Alternative 3 provides the largest combined floodplain area (at or below the Q100) of all alternatives that will be appropriate for riparian vegetation community establishment and is therefore ranked first among the four alternatives. The planting area elevations for middle, lower, and riverine riparian vegetation communities are all highest (or nearly the highest) of the alternatives. Because of the raised channel invert and connection to the floodplains, Alternative 3 also provides the greatest access to surface and ground water supply, which provides the best opportunity for long-term persistence of these communities.

Alternative 4

The purpose of Alternative 4 is to reconnect the stream channel to the historic floodplain by lifting the streambed to an intermediate elevation. Alternative 4 provides the largest 2-year floodplain area, but only so by 0.66 acre (less than 1 percent), and is therefore nearly equal in size with the floodplain area provided by Alternative 3 (Table 4, Figure 1c). It provides the second largest floodplain area in all other categories (10-year, 100-year and combined; Table 4, Figure 1c, and Figure 1d).

Alternative 4 provides improved connection to floodplains compared to current condition, which will support system stability. Peak streamflow will be allowed to expand laterally onto the floodplains, where stream flow velocity is reduced by contact with soil and vegetation. This reduced flow velocity would reduce channel incision and bank erosion. Lower in-channel stream flow velocities would help preserve aquatic wildlife and habitats. Frequent inundation of the floodplains would increase water supply to riparian vegetation communities on the floodplains and help recharge groundwater reservoirs.

Alternative 4 provides the second largest combined floodplain area (at or below the Q100) of all alternatives and is therefore ranked second of the alternatives, next to Alternative 3. Alternative 4 provides access to surface and ground water supply, which would support long-term persistence of riparian vegetation communities.

4.2 Discussion

Successful ecological restoration of Aliso Creek will depend largely on whether the design alternative can provide system stability and adequate water supply. This review uses floodplain area as the primary determinant of both of these factors, since large, available floodplains decrease channel and bank degradation during peak storm events and are the areas that will be used for establishment of lower, middle, and upper riparian vegetation communities. Large, connected floodplains are generally preferred. Of the four alternatives evaluated in this review, Alternative 3 provides the largest and most well-connected floodplain area overall, and each of the three floodplains (2-year, 10-year, and 100-year) are of sufficient size. These large floodplains give Alternative 3 the largest area of riparian vegetation of all alternatives and make it the most likely to sustain these vegetation communities for long term. Alternative 3 gives Aliso Creek the greatest ability to accommodate and adjust to changes in hydrology caused by variations in climate and weather as well as to local stressors such as infrastructure and urban development in the watershed.

4.3 Potential Limitations

The flood frequency data used as the basis of engineering had a period of record of 1932 to present, a period of time when the Aliso Creek watershed was much less urbanized than it is now. This could be a limiting factor in accurately predicting peak streamflow events for the current and future hydrology of Aliso Creek. Based on a general understanding of how urbanized watersheds affect hydrological regimes, it can be expected that the actual magnitude of peak streamflow events (e.g., the 10-year and 100-year floods) will be higher than predicted from the historical data. The low flow magnitudes will likely be higher as well.

Predictions for altered rainfall patterns in the arid Southwest due to climate change include stronger, heavier storms and longer, drier drought periods. If this is the case, the flood frequency of the system will be further pushed past the current 2-year, 10-year, and 100-year capacity. Additionally, the upper and middle riparian vegetation communities will be stressed during drought periods. The lower riparian and aquatic communities will likely survive drought well, since the urbanized watershed provides consistent low flow (from urban sources) even during dry periods.

Urban streams tend to erode at higher rates than natural streams due to lack of sediment in urban stormflow that arrives in the channel over pavement and through culverts (rather than surface flow and ground flow through soil). For this reason, Aliso Creek will still be vulnerable to erosion even if all other factors are optimally balanced.

4.4 Knowledge Gaps

Information about the micro-topography of the 100-year flood plain (above the engineered 10-year channel) is not available. Therefore this review cannot evaluate the lateral extent of inundation that might occur during intermediate (20-, 30-, 50-year) flood events. Furthermore, micro-topography on this floodplain directly affects access to groundwater, which will determine which vegetation community is best suited for that area. For purposes of this review, planting composition of the 100-year floodplain is summarized as primarily upper riparian (oak woodland), but depending on actual topography it could include extensive planting area for mixed riparian forest.

Exact location and size of the side channels for extended marsh and aquatic habitat are not defined, therefore analysis of form and function for the purposes of this review are not included.

5.0 Giant Reed Removal at Aliso Creek

Giant reed removal is being conducted within the Aliso Creek project area in a cooperative effort led by the County of Orange. This section provides a review of treatment methods outlined in *Explanation/Details of Arundo Treatment Methods that will be used by the County of Orange on Arundo Control and Revegetation Projects in South Orange County* (Finch 2008), herein referred to as the Arundo Treatment Methods document.

5.1 Methodology

The methodology outlined in the Arundo Treatment Methods document will be effective at reducing the growth of giant reed in the treatment areas if regrowth is treated for several years following initial treatment; however, the methodology, as it stands, does not specify duration of treatment. The methodology outlined will be effective at eradicating giant reed in the project area if a few minor adjustments are made, as discussed below, and the following items are added to the current treatment scope: (1) regrowth is aggressively treated for several years until no regrowth is sustained for several consecutive years and (2) native vegetation is successfully established in treatment areas thereby prohibiting opportunities for the same or other invasive species to occupy the vacant space, and (3) sources of infestations for reinvasion are controlled and/or eliminated (e.g., upstream populations).

Some strategies outlined in the Arundo Treatment Methods document that will be effective (if they are being applied as described) are highlighted here:

1. Treatment begins with foliar herbicide treatment and is followed by mowing several months later.
2. Foliar applications of herbicide (glyphosate) will be conducted in fall, which is the most effective time to treat giant reed.
3. Regrowth will be treated with herbicide at appropriate time periods.
4. Herbicide will be applied using backpack sprayers or hand-held power sprayers.
5. Risk of accidental contamination is minimized by restricting refueling and herbicide mixing to designated staging areas.
6. Cleared areas will be planted with native vegetation appropriate for the region.
7. Mowing and cutting of giant reed will be conducted outside avian nesting seasons.
8. Only herbicides approved for aquatic areas will be used near open water.
9. Crew sizes are limited to 12 to 16 people in order to minimize adverse impacts and disturbance within one treatment area.
10. No more than three crews will work within the watershed at any given time to minimize stress on the system (i.e., to not exceed the capacity of the flora, fauna, and stream channel to accommodate the disturbance).
11. Designated staging areas will be limited to previously impacted and/or developed areas, whenever possible.
12. Native vegetation is protected and preserved whenever possible.
13. The plant pallets provided are appropriate for the local area.
14. Treatment methods are adjusted to work within existing conditions, such as use of hand tools and backpack sprayers in confined areas where large equipment and all-terrain vehicles cannot reach.
15. Adequate precautions are taken to minimize adverse impacts to native flora, fauna, and water quality.

5.2 Results

The giant reed removal methodology (Finch 2008) has been applied to giant reed infestations in Aliso Creek since as early as September 2011. Five reaches of Aliso Creek have been treated separately for giant reed (and other species) under individual contracts with varied scopes of work. A summary of these efforts is provided in a map of unknown origin provided by the Corps, titled *Invasive Non-Native Riparian Plants on Aliso Watershed*. This map shows that eradication implementation in four of the five reaches has been completed and is in maintenance phase; the reach that is still possibly active is Aliso Creek north (upstream) of the Awma Road bridge, where implementation began in September 2014. This reach is within the Aliso Creek Ecosystem Restoration Project area.

Results of giant reed eradication in Aliso Creek Ecosystem Restoration Project were observed during visits to the project site and through personal communication. During the site visit in May 2015, most of the project area had been cleared of giant reed although there were some large patches of giant reed found untreated upstream of the areas that had been treated. Open areas where giant reed had been removed were common. A few small stands of living giant reed were observed, with no obvious reason as to why they were untreated (i.e., they were not always surrounded by native vegetation or in areas difficult to access and in some cases were situated along access roads).

Stalks of some or entire patches of giant reed were cut and painted with herbicide, then left in place. Stockpiles of cut and stacked giant reed were observed in at least two locations, situated within previously impacted areas well outside the lower riparian floodplain. These stockpiles were relatively fresh (probably less than one year old). The stacked canes were not chipped, as described in the removal methodology. Other areas within the lower floodplain had obvious signs of soil disturbance as if areas were cleared with a skip loader or similar small earthmoving equipment.

There were no signs of active restoration (e.g., container plants) in the areas treated for giant reed nor was there any evidence to suggest that native species were naturally recruiting into the area.

Several stands of untreated invasive exotic weeds, other than giant reed, were observed throughout the treatment areas. These species included salt cedar (*Tamarix* sp.), pampas grass (*Cortaderia* sp.), castor bean (*Ricinus communis*), fennel (*Foeniculum vulgare*), tree tobacco (*Nicotiana glauca*), and several species of palm.

5.3 Discussion

A general assessment of eradication success, based on information above, is that initial removal has generally been successful; the project area has been cleared almost completely of giant reed. However successful eradication will depend on treatment of the scattered patches of giant reed, including all upstream populations, and diligent maintenance of the sites that will prevent giant reed from re-establishing. Strategies presented in the removal methodology that will be important to follow are timely treatment of regrowth (item 3 in the listed strategies above) and replanting of treated areas (item 6 in the listed strategies above). In addition, the invasive species removal strategy must incorporate all non-native and invasive species, because, if left unchecked, they will quickly invade into the newly cleared areas and present similar, if not more problematic, obstacles for recovery to a native riparian system.

The removal methodology specifies that reports will be provided each year that document maintenance activities and site progress. These documents should be acquired and reviewed, with actual work compared to that described in the methodology, in order to properly evaluate the likelihood of successful eradication of giant reed in Aliso Creek watershed. These reports were not available at the time of this evaluation.

5.4 Potential Limitations

The following are specific elements of the giant reed removal methodology (Finch 2008) that may pose limitations to successful eradication in the project area.

Project Phasing

Since some giant reed had not been treated at the time of visiting (May 2015), it is assumed that this project is being implemented in phases. In phasing an invasive species eradication project, work should begin at the upstream end, or the upper limits off the watershed first, then move treatment areas downstream as species are controlled. Untreated invasive weeds upstream have the ability to move downstream and become established.

Target species

The methodology targets giant reed for removal but does not address eradication and removal of other non-native invasive species within the project area. Non-native species observed during a site visit in May 2015 were salt cedar, pampas grass, castor bean, fennel, tree tobacco, and several species of palm. Although removal of giant reed will greatly improve form and function of the system, best results will be seen if methods are expanded to include eradication of all/other problem species. If left unchecked, these highly invasive species will recruit into the cleared areas and create a new set of invasive species issues. Eradication efforts should focus on species designated as invasive by the California Invasive Plant Council (Cal-IPC).

Biomass Removal

Methodology for biomass reduction states "Hand-cut [giant reed] is stacked and mowed, chipped, or left to decompose naturally." This method will be effective if the stacks are kept small (approximate size of wood rat piles) and if the material is completely dead so that it cannot root again from nodes and regrow. Mulched living material can resprout if it is not mulched fine enough to fracture/damage all nodes.

It further describes leaving a mulch layer as deep as 4 inches to reduce weed cover. The mulch can be deeper than this (as deep as 12 inches) and still provide benefit to the site. However a mulch layer will limit the ability of native plants to establish naturally in these areas, therefore native vegetation will have to be planted and maintained (i.e., passive restoration is less likely to be successful).

Scattered Stands Left in Place

Methodology for biomass reduction states that "Scattered smaller stands are left to decompose naturally (they are left standing)." This approach is effective only if stands are small and interspersed with native species such that the native species will fill in over time.

Inadequate Irrigation to Planted Vegetation

Methodology for revegetation of treatment areas states that "…supplemental watering may be needed but occurs by hand and only two or three cycles maximum." The methodology goes on to claim "Sites that have dense [giant reed] and pampas grass have functional hydrology – if they did not then the stands would not typically require vegetation reduction (mowing)." This statement seems to imply that treatment areas will naturally supply newly installed plants with water sufficient to sustain them; however, this is not the case. Newly installed plants will not have a root system mature enough to access groundwater and will therefore be temporarily reliant upon supplemental watering. In order to achieve 70 percent survival (as outlined in methodology), the project should be prepared to supply as-needed water to all newly installed plants for one to two years following installation. All supplemental irrigation should focus on supplying water at depth in order to encourage roots to grow toward the water table, and not near the surface. This can be achieved by deep-pipe watering or intermittent heavy application of surface irrigation that allows soil to saturate at depth.

Planting Design

The stated planting density of 300 to 400 plants per acre is low for a riparian area; best results would be achieved with a planting density closer to 1,200 to 1,800 plants per acre. With a success criterion of 250 surviving individuals per acre, the proposed density of planting may yield only 50 percent vegetative cover after 5 years, at best. Proposed plant diversity is also low and should be increased to levels found in adjacent well-balanced native vegetation communities. Further, the planting palette should focus on integration of species with a diversity of height classes to provide physical structure (i.e., tree canopy with understory of herbs and shrubs).

Work during Breeding Season

The methodology assumes that potential for nesting birds will be minimal or not existent in treatment areas. However cleared and newly planted areas could provide habitat for listed species and should therefore be included in all nest surveys (and work might have to be adjusted in these areas). For example, the least Bell's vireo (*Vireo bellii pusillus*) is able to nest and forage in newly established willow shrubland and woodland communities, especially areas with supplemental irrigation.

Planning and Coordination

Production of annual work plans and progress reports (as stated) should be coordinated with on-site meetings to update agencies on status and determine if adjustments need to be made.

Compliance with Regulatory Requirements

The methodology does not specifically address compliance with specific regulatory or wildlife agency and/or permit requirements. Relevant regulatory agencies might include the

Corps, California Department of Fish and Wildlife, Regional Water Quality Control Board, and U.S. Fish and Wildlife Service. For example, the Corps' RGB-41 permit sets limitations on debris stockpiling near the channel, requires less than 5 percent relative cover of the treated species for at least two years following implementation, and requires photo documentation before and after treatment. The methodology described should be adapted to RGB-41 and other relevant permit requirements for use in Aliso Creek.

5.5 Knowledge Gaps

Although the methodology provides detail on certain aspects of removal, it is not comprehensive. The purpose of the document (Finch 2008) might have been to coordinate efforts of different teams, or to share information, or to gain approval for particular methods. However as a planning document it is inadequate and leaves many questions unanswered. This section summarizes some of the primary knowledge gaps that need to be addressed in order to evaluate efficacy of the approach being used in Aliso Creek.

What are the measures of success for this treatment?

The methodology does not provide clear project goals, objectives, or success criteria. Clearly defined goals and objectives are necessary in order to make sound recommendations about how to achieve project success, also on how to measure progress and determine when success has been achieved or if a different approach is warranted. The approach that is appropriate for weed control is different than what is required for establishing self-sustaining native vegetation communities and/or enhancing habitat for least Bell's vireo.

What is the broad-scale approach to eradication?

The methodology fails to address some broad-scale fundamental concepts of eradication. It does not define how to identify treatment areas or how to prioritize them. For example, source areas upstream should be treated first, whenever possible, to increase the opportunity for project success. It also does not explicitly state that all populations within the project area will be treated; especially with the mention of "scattered stands left in place", the methodology as outlined leaves some questions about the thoroughness of approach within the project area.

How have these methods been applied to the Aliso Creek project area, and what are the results?

The methodology states that project work plans will be prepared annually (by July 15) outlining planned plant control and revegetation efforts; that progress reports will be prepared annually (May 15) detailing the work that was completed; and that photographs will be used to document the effectiveness of treatments. However, attempts to locate these annual reports were unsuccessful; they do not exist for Aliso Creek. Without these documents, it is not possible to assess success of the methodology as it was applied to Aliso Creek.

Is the planting design appropriate for Aliso Creek?

Although the plant pallet provided is appropriate for the local area, it may not be ideal for Aliso Creek in particular. Information about the history of Aliso Creek, Aliso Creek watershed, and the adjacent areas is necessary to determine if the specified plants are appropriate. In addition, the planting design does not specify locations where the plants will be installed, such as upland or lower floodplain; this information is needed in order to determine long-term success of the installations.

6.0 Conclusion

The documents reviewed here outline methods and alternatives for habitat restoration in Aliso Creek watershed that are likely to bring positive change to the system. From the information provided, the restoration approach that will best support establishment of self-sustaining native vegetation communities and riparian habitat for native animal species is Alternative 3, because it will provide the widest floodplain area and best connectivity from the channel to the floodplains. These large floodplain areas will (1) provide the greatest area for lower and middle riparian vegetation communities; (2) provide the lowest in-channel streamflow velocity during peak flows, thereby reducing incision and channel erosion rates, (3) provide the most reliable and hospitable aquatic habitats by reducing water velocity and rates of erosion/sedimentation, and (4) provide the best protection for adjacent infrastructure by minimizing bank erosion.

The No Action alternative would beneficial in the short term, because it will allow present vegetation communities and wildlife to remain in Aliso Creek. The channel is adjusting to current stressors (primarily the AWCHEP structure and urbanization of the watershed) and will eventually find a new equilibrium. However, this alternative is not ideal, because until the channel reaches equilibrium it will be difficult to maintain healthy riparian vegetation and adjacent infrastructure such as roads, pipelines, and utility structures. Erosion rates will be high, degrading water quality and discharging heavy sediment loads downstream.

Although removal of giant reed in the project area seems to have been effective, long-term eradication is not certain based on available information. Furthermore, no active restoration (container planting) appears to have been initiated within the treatment areas and therefore recovery to a native habitat seems unlikely given the site conditions and presence of other untreated invasive exotic weeds. Further review of key elements would be possible if knowledge gaps described in this report were addressed.

7.0 References

County of Orange 2009

Aliso and Wood Canyons Wilderness Park Resource Management Plan. Prepared by LSA Associates, Inc. August 2009.

Finch, Zoila 2008

Explanation/Details of Arundo treatment methods that will be used by the County of Orange on Arundo control and re-vegetation projects in South Orange County (San Juan Hydrologic Unit). County of Orange, Public Works Department. May 16, 2008.

Nature Reserve of Orange County 2003

Habitat Restoration and Enhancement Plan; Nature Reserve of Orange County, Central Coastal Subregion. Prepared by LSA Associates, Inc. Revised August 2003.

Riparian Habitat Joint Venture (RHJV) 2009

California Riparian Habitat Restoration Handbook. Griggs, F. Thomas. River Partners. 2nd Ed. July 2009.

United States Army Corps of Engineers (Corps) 2009a

Aliso Creek Mainstem Ecosystem Restoration Baseline Environmental Conditions and Future without Project Conditions.

United States Army Corps of Engineers (Corps) 2009b

Aliso Creek Ecosystem Restoration Feasibility Study; Orange County, California; An Introductory Baseline Focus. Jon Vivanti, Debbie Lamb, Tom ONeil, and Thomas Keeney. United States Army Corps of Engineers and Northwest Habitat Institute. Powerpoint presentation. May 7, 2009.

United States Army Corps of Engineers (Corps) 2015

TSP Draft Design Appendix for the Aliso Creek Ecosystem Restoration Study, Orange County, California; TSP Draft Design Appendix, Alternatives 2, 3, and 4. Prepared by Tetra Tech, Inc. February 2015.

APPENDIX B-4: Air Quality

ALISO CREEK MAINSTEM
ECOSYSTEM RESTORATION STUDY
Orange County, California

September 2017

US Army Corps of Engineers

Orange County Public Works
Environmental Resources
Department

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AIR QUALITY ANALYSIS

Significance Threshold

Impacts would be considered significant if the alternative:

- Exceeds SCAQMD daily emissions thresholds
- Exceeds General Conformity Rule *de minimis* thresholds.

Alternative 3.3

Under Alternative 3.3, an area of approximately 5 miles long and approximately 200 ft. wide, raises the existing streambed to approach the historic pre-incised stream elevation for channel stability, installs 47 rock riffles, with on-site disposal of 130,000 cubic yards of creek substrate on slopes, and plants native vegetation.

Assumptions:

Construction Phase - Over a 4 year work period the total construction duration would be 780 days. Daily construction assumed an 8 hour work and 5 days a week.
Site Preparation and Grading - Site Preparation work is approximately 23.39216024 acres, and Demolition - Demolition of ACWHEP structure and the two large concrete drop structures, approximately 9,224 tons to be removed.
Construction Personnel: Approximately 50 laborers would be at the construction work site daily.

Air Quality Program Model for air emission criteria pollutants: CalEEMod 2013. 2 program calculates emissions for proposed project, calculating daily maximum and annual average criteria pollutants as well as total or annual greenhouse gas (GHG) emission. CalEEMod uses sources such as the United States Environmental Protection Agency (USEPA) AP-42 emission factors and California Air Resources Board (ARB) vehicle emission models. The winter lbs/day emissions are typically higher in air pollutant air emissions when compared to the summer lbs/day and therefore, the winter lbs/day are referenced as the maximum lbs/day instead of the summer lbs/day.

Alternative 3.3 would result in air quality construction impacts daily and during each year of construction. See Table X.X and X.X below for comparison of estimated daily emissions (maximum daily construction lbs/day) to SCAQMD threshold and comparison of estimated annual emissions (maximum construction tons/year) to Federal threshold.

Table X.X Comparison of Alternative 3.3 Daily Construction Emissions to SCAQMD Lbs/Day

Construction	ROG/VOC	NOx	CO	SO2	PM10	PM2.5	GHG/CO2e
Alt. 3.3 Maximum	19.1275	126.4463	200.5864	0.6099	38.5269	12.5731	51,955.5499

Daily lb/day							
SCAQMD Daily lb/day	75	100	550	150	150	55	No criteria unless industrial facilities; 10,000 MT/yr CO2eq for industrial facilities

Daily construction emissions are shown in Table X.X above. Estimated construction emissions are below the SCAQMD thresholds except for NOx.

Table X.X Comparison of Alternative 3.3 Annual Construction Emissions to General Conformity de minimis Thresholds

Construction	ROG/ VOC	NOx	CO	SO2	PM10	PM2.5	GHG (MT/yr)
Alt. 3.3 Average Ton/Year	0.8619	5.2765	10.7957	0.0303	1.9058	0.6563	2,247.1278
Federal Ton/Year	100	100	100	100	70	100	Recommends that agencies quantify a proposed agency action’s projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools that are suitable for the proposed agency action

Annual construction emissions are shown in Table X.X above. Estimated construction emissions are below General Conformity de minimis Thresholds.

Based on the above, Alternative 3.3 construction daily emissions would be significant for NOx while ROG/VOC, CO, SO2, PM10, PM 2.5, and GHG would result in less than significant impacts. Furthermore, Alternative 3.3 construction annual emissions are below General Conformity de minimis thresholds. With the implementation of air quality (AQ) Environmental Commitments AQ-1 through AQ-18 and Best Management Practices (BMPs) potential daily and annual air construction emission impacts would be reduced. Impacts from emissions would be temporary and would return to pre-project conditions following completion of construction. Based on the above, impacts to daily and annual construction emissions would be less than significant.

Regarding operation and maintenance (O&M) work for Alternative 3.3, O&M would more than likely occur only after a major storm and/or major flood event. The restoration would be established through self-sustainability and would more than likely not require recurring restoration O&M. Based on the above, Alternative 3.3 would result in air quality O&M impacts daily and during each year of O&M. See Table X.X and X.X below for comparison of estimated daily emissions (maximum daily operation lbs/day) to SCAQMD threshold and comparison of estimated annual emissions (maximum operation tons/year) to Federal threshold.

Table X.X Comparison of Alternative 3.3 Daily O&M Emissions to SCAQMD Lbs/Day

O&M	ROG/ VOC	NOx	CO	SO2	PM10	PM2.5	GHG/CO2e
Alt. 3.3 Maximum Daily lb/day	102.5380	negligible	negligible	negligible	Negligible	negligible	negligible
SCAQMD Daily lb/day	55	55	550	150	150	55	No criteria unless industrial facilities; 10,000 MT/yr CO2eq for industrial facilities

Daily O&M emissions are shown in Table X.X above. Estimated O&M emissions are below the SCAQMD thresholds for all air emission criteria pollutants listed except for ROG/VOC. With the implementation of air quality (AQ) Environmental Commitments AQ-1 through AQ-18 and Best Management Practices (BMPs) potential daily air O&M emission impacts would be reduced. Impacts from emissions would be temporary and would return to pre-project conditions following completion of O&M. Based on the above, impacts to daily O&M emissions would be less than significant.

Based on the above, Alternative 3.3 would have annual O&M emissions, as summarized below in Table X.X Comparison of Alternative 3.3 Annual O&M Emissions to General Conformity de minimis Thresholds.

Table X.X Comparison of Alternative 3.3 Annual O&M Emissions to General Conformity de minimis Thresholds

O&M	ROG/ VOC	NOx	CO	SO2	PM10	PM2.5	GHG (MT/yr)
Alt. 3.3 Average Ton/Year	18.7132	negligible	Negligible	negligible	Negligible	negligible	negligible
Federal Ton/Year	100	100	100	100	70	100	Recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools that are suitable for the proposed agency action

Estimated annual O&M emissions are below General Conformity de minimis Thresholds. With the implementation of air quality (AQ) Environmental Commitments AQ-1 through AQ-18 and

Best Management Practices (BMPs) potential annual air O&M emission impacts would be reduced. Impacts from emissions would be temporary and would return to pre-project conditions following completion of O&M. Based on the above, impacts to annual O&M emissions would be less than significant.

Based on the above, Alternative 3.3 O&M daily emissions, and O&M annual emissions, would be less than significant.

Alternative 3.6

Under Alternative 3.6, the Tentatively Selected Plan (TSP), an area of approximately 5 miles long & 200 ft. wide, reconnects 850 ft. of length in an abandoned oxbow, installs 46 rock riffles, on-site disposal of 300,000 cubic yards of creek substrate onto channels slopes, and plants native vegetation.

Assumptions:
Construction Phase - Over a 4 year work period the total construction duration would be 876 days. Daily construction assumed an 8 hour work and 5 days a week.
Demolition - Demolition of ACWHEP structure and the two large concrete drop structures, approximately 9,224 tons to be removed.
Construction Personnel: Approximately 50 laborers would be at the construction work site daily.
Air Quality Program Model for air emission criteria pollutants: CalEEMod 2013. 2 program calculates emissions for proposed project, calculating daily maximum and annual average criteria pollutants as well as total or annual greenhouse gas (GHG) emission. CalEEMod uses sources such as the United States Environmental Protection Agency (USEPA) AP-42 emission factors and California Air Resources Board (ARB) vehicle emission models. The winter lbs/day emissions are typically higher in air pollutant air emissions when compared to the summer lbs/day and therefore, the winter lbs/day are referenced as the maximum lbs/day instead of the summer lbs/day.

Alternative 3.6 would result in air quality construction impacts daily and during each year of construction. See Table X.X and X.X below for comparison of estimated daily emissions (maximum daily construction lbs/day) to SCAQMD threshold and comparison of estimated annual emissions (maximum construction tons/year) to Federal threshold.

Table X.X Comparison of Alternative 3.6 Daily Construction Emissions to SCAQMD Lbs/Day

Construction	ROG/ VOC	NOx	CO	SO2	PM10	PM2.5	GHG/CO2e
Alt. 3.6 Maximum Daily lb/day	19.5064	127.8164	206.0224	0.6268	39.6497	12.8964	53,278.3100
SCAQMD Daily lb/day	75	100	550	150	150	55	No criteria unless industrial facilities; 10,000 MT/yr CO2eq for industrial

facilities

Daily construction emissions are shown in Table X.X above. Estimated construction emissions are below the SCAQMD thresholds except for NOx.

Table X.X Comparison of Alternative 3.6 Annual Construction Emissions to General Conformity de minimis Thresholds

Construction	ROG/ VOC	NOx	CO	SO2	PM10	PM2.5	GHG (MT/yr)
Alt. 3.6 Average Ton/Year	0.9231	5.7168	11.5042	0.0319	2.0192	0.7053	2,373.3738
Federal Ton/Year	100	100	100	100	70	100	Recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools that are suitable for the proposed agency action

Annual construction emissions are shown in Table X.X above. Estimated construction emissions are below General Conformity de minimis Thresholds.

Based on the above, Alternative 3.6 construction daily emissions would be significant for NOx while ROG/VOC, CO, SO2, PM10, PM 2.5, and GHG would result in less than significant impacts. Furthermore, Alternative 3.6 construction annual emissions are below General Conformity de minimis thresholds. With the implementation of air quality (AQ) Environmental Commitments AQ-1 through AQ-18 and Best Management Practices (BMPs) potential daily and annual air construction emission impacts would be reduced. Impacts from emissions would be temporary and would return to pre-project conditions following completion of construction. Based on the above, impacts to daily and annual construction emissions would be less than significant.

Regarding operation and maintenance (O&M) work for Alternative 3.6, O&M would more than likely occur only after a major storm and/or major flood event. The restoration would be established through self-sustainability and would more than likely not require recurring restoration O&M. Based on the above, Alternative 3.6 would result in air quality O&M impacts daily and during each year of O&M. See Table X.X and X.X below for comparison of estimated daily emissions (maximum daily operation lbs/day) to SCAQMD threshold and comparison of estimated annual emissions (maximum operation tons/year) to Federal threshold.

Table X.X Comparison of Alternative 3.6 Daily O&M Emissions to SCAQMD Lbs/Day

O&M	ROG/ VOC	NOx	CO	SO2	PM10	PM2.5	GHG/CO2e
Alt. 3.6 Maximum Daily lb/day	107.5391	negligible	negligible	Negligible	negligible	negligibl e	negligible

SCAQMD Daily lb/day	55	55	550	150	150	55	No criteria unless industrial facilities; 10,000 MT/yr CO2eq for industrial facilities

Daily O&M emissions are shown in Table X.X above. Estimated O&M emissions are below the SCAQMD thresholds for all air emission criteria pollutants listed except for ROG/VOC.
With the implementation of air quality (AQ) Environmental Commitments AQ-1 through AQ-18 and Best Management Practices (BMPs) potential daily air O&M emission impacts would be reduced. Impacts from emissions would be temporary and would return to pre-project conditions following completion of O&M. Based on the above, impacts to daily O&M emissions would be less than significant.

Based on the above, Alternative 3.6 would have annual O&M emissions, as summarized below in Table X.X Comparison of Alternative 3.6 Annual O&M Emissions to General Conformity de minimis Thresholds.

Table X.X Comparison of Alternative 3.6 Annual O&M Emissions to General Conformity de minimis Thresholds

O&M	ROG/VOC	NOx	CO	SO2	PM10	PM2.5	GHG (MT/yr)
Alt. 3.6 Average Ton/Year	19.6259	negligible	negligible	negligible	negligible	negligible	negligible
Federal Ton/Year	100	100	100	100	70	100	Recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools that are suitable for the proposed agency action

Estimated annual O&M emissions are below General Conformity de minimis Thresholds. With the implementation of air quality (AQ) Environmental Commitments AQ-1 through AQ-18 and Best Management Practices (BMPs) potential annual air O&M emission impacts would be reduced. Impacts from emissions would be temporary and would return to pre-project conditions following completion of O&M. Based on the above, impacts to annual O&M emissions would be less than significant.

Based on the above, Alternative 3.6 O&M daily emissions, and O&M annual emissions, would be less than significant.

Alternative 3.7
Under Alternative 3.7, an area of approximately 5 miles long & 200 ft. wide, approximately covering 4,124,275 SF, reconnects 850 ft. of length in an abandoned oxbow, adds sinuosity of 32 ft. length, installs 46 rock riffles, on-site disposal of 340,000 cy of creek substrate on slopes, & plants native veg.

Assumptions:
Approximate Area - approximately covering 4,112,500 SF.
Grading - Excavation of material is approximately 340,000 cubic yards.
Construction Phase - Over a 4 year work period (2021 through 2024) the total construction duration would be 901 days. Daily construction assumed an 8 hour work and 5 days a week.
Site Preparation and Grading - Site Preparation work is approximately 23.54281451 acres, and Grading work is approximately 22.38005051 acres. The project would be completely in place and completely operational in 2025.
Demolition - Demolition of ACWHEP structure and the two large concrete drop structures, approximately 9,224 tons to be removed.
Construction Personnel: Approximately 50 laborers would be at the construction work site daily.
Air Quality Program Model for air emission criteria pollutants: CalEEMod 2013. 2 program calculates emissions for proposed project, calculating daily maximum and annual average criteria pollutants as well as total or annual greenhouse gas (GHG) emission. CalEEMod uses sources such as the United States Environmental Protection Agency (USEPA) AP-42 emission factors and California Air Resources Board (ARB) vehicle emission models. The winter lbs/day emissions are typically higher in air pollutant air emissions when compared to the summer lbs/day and therefore, the winter lbs/day are referenced as the maximum lbs/day instead of the summer lbs/day.

Alternative 3.7 would result in air quality construction impacts daily and during each year of construction. See Table X.X and X.X below for comparison of estimated daily emissions (maximum daily construction lbs/day) to SCAQMD threshold and comparison of estimated annual emissions (maximum construction tons/year) to Federal threshold.

Table X.X Comparison of Alternative 3.7 Daily Construction Emissions to SCAQMD Lbs/Day

Construction	ROG/VOC	NOx	CO	SO2	PM10	PM2.5	GHG/CO2e
Alt. 3.7 Maximum Daily lb/day	19.5305	127.9043	206.3680	0.6279	39.6497	12.9168	53,362.2270
SCAQMD Daily lb/day	75	100	550	150	150	55	No criteria unless industrial facilities;

10,000 MT/yr CO2eq
for industrial facilities

Daily construction emissions are shown in Table X.X above. Estimated construction emissions are below the SCAQMD thresholds except for NOx.

Table X.X Comparison of Alternative 3.7 Annual Construction Emissions to General Conformity de minimis Thresholds

Construction	ROG/VOC	NOx	CO	SO2	PM10	PM2.5	GHG (MT/yr)
Alt. 3.7 Average Ton/Year	1.0189	6.1399	12.8919	0.0362	2.2909	0.7864	2,680.4325
Federal Ton/Year	100	100	100	100	70	100	Recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools that are suitable for the proposed agency action

Annual construction emissions are shown in Table X.X above. Estimated construction emissions are below General Conformity de minimis Thresholds.

Based on the above, Alternative 3.7 construction daily emissions would be significant for NOx while ROG/VOC, CO, SO2, PM10, PM 2.5, and GHG would result in less than significant impacts. Furthermore, Alternative 3.7 construction annual emissions are below General Conformity de minimis thresholds. With the implementation of air quality (AQ) Environmental Commitments AQ-1 through AQ-18 and Best Management Practices (BMPs) potential daily and annual air construction emission impacts would be reduced. Impacts from emissions would be temporary and would return to pre-project conditions following completion of construction. Based on the above, impacts to daily and annual construction emissions would be less than significant.

Regarding operation and maintenance (O&M) work for Alternative 3.7, O&M would more than likely occur only after a major storm and/or major flood event. The restoration would be established through self-sustainability and would more than likely not require recurring restoration O&M. Based on the above, Alternative 3.7 would result in air quality O&M impacts daily and during each year of O&M. See Table X.X and X.X below for comparison of estimated daily emissions (maximum daily operation lbs/day) to SCAQMD threshold and comparison of estimated annual emissions (maximum operation tons/year) to Federal threshold.

Table X.X Comparison of Alternative 3.7 Daily O&M Emissions to SCAQMD Lbs/Day

O&M	ROG/ VOC	NOx	CO	SO2	PM10	PM2.5	GHG/CO2e
Alt. 3.7 Maximum Daily lb/day	107.539 1	negligible	negligible	negligible	negligible	negligible	negligible
SCAQMD Daily lb/day	55	55	550	150	150	55	No criteria unless industrial facilities; 10,000 MT/yr CO2eq for industrial facilities

Daily O&M emissions are shown in Table X.X above. Estimated O&M emissions are below the SCAQMD thresholds for all air emission criteria pollutants listed except for ROG/VOC. With the implementation of air quality (AQ) Environmental Commitments AQ-1 through AQ-18 and Best Management Practices (BMPs) potential daily air O&M emission impacts would be reduced. Impacts from emissions would be temporary and would return to pre-project conditions following completion of O&M. Based on the above, impacts to daily O&M emissions would be less than significant.

Based on the above, Alternative 3.7 would have annual O&M emissions, as summarized below in Table X.X Comparison of Alternative 3.7 Annual O&M Emissions to General Conformity de minimis Thresholds.

Table X.X Comparison of Alternative 3.7 Annual O&M Emissions to General Conformity de minimis Thresholds

O&M	ROG/ VOC	NOx	CO	SO2	PM10	PM2.5	GHG (MT/yr)
Alt. 3.7 Average Ton/Year	19.6821	negligible	negligible	negligible	negligible	negligible	negligible
Federal Ton/Year	100	100	100	100	70	100	Recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools that are suitable for the proposed agency action

Estimated annual O&M emissions are below General Conformity de minimis Thresholds. With the implementation of air quality (AQ) Environmental Commitments AQ-1 through AQ-18 and Best Management Practices (BMPs) potential annual air O&M emission impacts would be reduced. Impacts from emissions would be temporary and would return to pre-project conditions following completion of O&M. Based on the above, impacts to annual O&M emissions would be less than significant.

Based on the above, Alternative 3.7 O&M daily emissions, and O&M annual emissions, would be less than significant.

Alternative 3.8

Under Alternative 3.8, an area of approximately 5 miles long & 200 ft. wide, reconnects 850 ft. of length in an abandoned oxbow, adds sinuosity of 32 ft. length and 59 feet length at 2 locations, installs 46 rock riffles, on-site disposal of 340,000 cy of creek substrate on slopes, and plants native veg.

Assumptions:

Construction Phase - Over a 4 year work period the total construction duration would be 916 days. Daily construction assumed an 8 hour work and 5 days a week.

Demolition - Demolition of ACWHEP structure and the two large concrete drop structures, approximately 9,224 tons to be removed.

Construction Personnel: Approximately 50 laborers would be at the construction work site daily.

Air Quality Program Model for air emission criteria pollutants: CalEEMod 2013. 2 program calculates emissions for proposed project, calculating daily maximum and annual average criteria pollutants as well as total or annual greenhouse gas (GHG) emission. CalEEMod uses sources such as the United States Environmental Protection Agency (USEPA) AP-42 emission factors and California Air Resources Board (ARB) vehicle emission models. The winter lbs/day emissions are typically higher in air pollutant air emissions when compared to the summer lbs/day and therefore, the winter lbs/day are referenced as the maximum lbs/day instead of the summer lbs/day.

Alternative 3.8 would result in air quality construction impacts daily and during each year of construction. See Table X.X and X.X below for comparison of estimated daily emissions (maximum daily construction lbs/day) to SCAQMD threshold and comparison of estimated annual emissions (maximum construction tons/year) to Federal threshold.

Table X.X Comparison of Alternative 3.8 Daily Construction Emissions to SCAQMD Lbs/Day

Construction	ROG/VOC	NOx	CO	SO2	PM10	PM2.5	GHG/CO2e
Alt. 3.8 Maximum Daily lb/day	19.5569	127.9952	206.7453	0.6291	39.8021	12.9402	53,454.9628
SCAQMD Daily lb/day	75	100	550	150	150	55	No criteria unless industrial facilities; 10,000 MT/yr CO2eq for industrial facilities

Daily construction emissions are shown in Table X.X above. Estimated construction emissions are below the SCAQMD thresholds except for NOx.

Table X.X Comparison of Alternative 3.8 Annual Construction Emissions to General

Conformity de minimis Thresholds

Construction	ROG/ VOC	NOx	CO	SO2	PM10	PM2.5	GHG (MT/yr)
Alt. 3.8 Average Ton/Year	1.0844	6.4240	13.8470	0.0392	2.4793	0.8423	2,892.5961
Federal Ton/Year	100	100	100	100	70	100	Recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools that are suitable for the proposed agency action

Annual construction emissions are shown in Table X.X above. Estimated construction emissions are below General Conformity de minimis Thresholds.

Based on the above, Alternative 3.8 construction daily emissions would be significant for NOx while ROG/VOC, CO, SO2, PM10, PM 2.5, and GHG would result in less than significant impacts. Furthermore, Alternative 3.8 construction annual emissions are below General Conformity de minimis thresholds. With the implementation of air quality (AQ) Environmental Commitments AQ-1 through AQ-18 and Best Management Practices (BMPs) potential daily and annual air construction emission impacts would be reduced. Impacts from emissions would be temporary and would return to pre-project conditions following completion of construction. Based on the above, impacts to daily and annual construction emissions would be less than significant.

Regarding operation and maintenance (O&M) work for Alternative 3.8, O&M would more than likely occur only after a major storm and/or major flood event. The restoration would be established through self-sustainability and would more than likely not require recurring restoration O&M. Based on the above, Alternative 3.8 would result in air quality O&M impacts daily and during each year of O&M. See Table X.X and X.X below for comparison of estimated daily emissions (maximum daily operation lbs/day) to SCAQMD threshold and comparison of estimated annual emissions (maximum operation tons/year) to Federal threshold.

Table X.X Comparison of Alternative 3.8 Daily O&M Emissions to SCAQMD Lbs/Day

O&M	ROG/ VOC	NOx	CO	SO2	PM10	PM2.5	GHG/CO2e
Alt. 3.8 Maximum Daily lb/day	108.1771	negligible	negligible	negligible	negligible	negligible	negligible
SCAQMD Daily lb/day	55	55	550	150	150	55	No criteria unless industrial facilities; 10,000 MT/yr CO2eq for

industrial
facilities

Daily O&M emissions are shown in Table X.X above. Estimated O&M emissions are below the SCAQMD thresholds for all air emission criteria pollutants listed except for ROG/VOC. With the implementation of air quality (AQ) Environmental Commitments AQ-1 through AQ-18 and Best Management Practices (BMPs) potential daily air O&M emission impacts would be reduced. Impacts from emissions would be temporary and would return to pre-project conditions following completion of O&M. Based on the above, impacts to daily O&M emissions would be less than significant.

Based on the above, Alternative 3.8 would have annual O&M emissions, as summarized below in Table X.X Comparison of Alternative 3.8 Annual O&M Emissions to General Conformity de minimis Thresholds.

Table X.X Comparison of Alternative 3.8 Annual O&M Emissions to General Conformity de minimis Thresholds

O&M	ROG/ VOC	NOx	CO	SO2	PM10	PM2.5	GHG (MT/yr)
Alt. 3.8 Average Ton/Year	19.7423	negligible	negligible	negligible	negligible	negligible	negligible
Federal Ton/Year	100	100	100	100	70	100	Recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools that are suitable for the proposed agency action

Estimated annual O&M emissions are below General Conformity de minimis Thresholds. With the implementation of air quality (AQ) Environmental Commitments AQ-1 through AQ-18 and Best Management Practices (BMPs) potential annual air O&M emission impacts would be reduced. Impacts from emissions would be temporary and would return to pre-project conditions following completion of O&M. Based on the above, impacts to annual O&M emissions would be less than significant.

Based on the above, Alternative 3.8 O&M daily emissions, and O&M annual emissions, would be less than significant.

No Federal Action Alternative

The No Federal Action Alternative would avoid impacts to air quality since there would be no ecosystem restoration. Since there would be no construction equipment, there would be air emissions.

Aliso Creek Mainstem Ecosystem Restoration Alternative 3.3

Orange County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
	0.00		0.00	3,921,250.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	30
Climate Zone	8			**Operational Year**	2025
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Aliso Creek Mainstem Ecosystem Restoration Alternative 3.3 is located in southern Orange County, California.

Land Use - Alt. 3.3, an area of 5 miles long & 200 ft. wide, raise streambed for channel stability to approach the historic pre-incised stream elevation, install 47 rock riffles, on-site disposal of 130,000 cubic yards creek substrate on slopes, & plants native veg.

Construction Phase - Over a 4 year period work the total construction duration would be 780 days.

Grading - Site Preparation work is approximately 23.39216024 acres, and Grading work is approximately 18.32673324 acres.

Demolition - Demolition of ACWHEP structure and the two large concrete drop structures.

Energy Use -

Off-road Equipment - 50 laborers would be at the construction work site daily.

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	0.00	130.00
tblConstructionPhase	NumDays	0.00	24.00
tblConstructionPhase	NumDays	0.00	216.00
tblConstructionPhase	NumDays	0.00	229.00

tblConstructionPhase	NumDays	0.00	181.00
tblConstructionPhase	PhaseEndDate	5/1/2023	6/30/2023
tblConstructionPhase	PhaseEndDate	8/15/2022	10/31/2022
tblConstructionPhase	PhaseEndDate	5/16/2024	11/14/2024
tblConstructionPhase	PhaseEndDate	10/14/2021	10/15/2021
tblConstructionPhase	PhaseStartDate	11/1/2022	1/1/2023
tblConstructionPhase	PhaseStartDate	10/16/2021	1/1/2022
tblConstructionPhase	PhaseStartDate	7/1/2023	1/1/2024
tblConstructionPhase	PhaseStartDate	2/4/2021	2/5/2021
tblGrading	AcresOfGrading	0.00	18.33
tblGrading	AcresOfGrading	90.50	23.39
tblOffRoadEquipment	LoadFactor	0.38	0.38
tblOffRoadEquipment	OffRoadEquipmentType		Off-Highway Trucks
tblProjectCharacteristics	OperationalYear	2014	2025

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2021	0.1869	1.6862	1.4096	3.5700e-003	0.1417	0.0764	0.2180	0.0245	0.0704	0.0949	0.0000	306.5303	306.5303	0.0836	0.0000	308.2853
2022	0.0793	0.6942	0.8899	1.4400e-003	0.1029	0.0362	0.1391	0.0489	0.0346	0.0835	0.0000	121.7954	121.7954	0.0213	0.0000	122.2423
2023	0.5246	2.2980	7.6389	0.0237	1.4327	0.0657	1.4983	0.3856	0.0605	0.4461	0.0000	1,692.0906	1,692.0906	0.0625	0.0000	1,693.4025
2024	0.0711	0.5980	0.8573	1.5400e-003	0.0226	0.0277	0.0503	6.0100e-003	0.0258	0.0319	0.0000	122.5360	122.5360	0.0315	0.0000	123.1978
Total	**0.8619**	**5.2765**	**10.7957**	**0.0303**	**1.6998**	**0.2059**	**1.9058**	**0.4650**	**0.1914**	**0.6563**	**0.0000**	**2,242.9522**	**2,242.9522**	**0.1988**	**0.0000**	**2,247.1278**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2021	0.1869	1.6862	1.4096	3.5700e-003	0.1417	0.0764	0.2180	0.0245	0.0704	0.0949	0.0000	306.5300	306.5300	0.0836	0.0000	308.2850
2022	0.0793	0.6942	0.8899	1.4400e-003	0.1029	0.0362	0.1391	0.0489	0.0346	0.0835	0.0000	121.7952	121.7952	0.0213	0.0000	122.2421
2023	0.5246	2.2980	7.6389	0.0237	1.4327	0.0657	1.4983	0.3856	0.0605	0.4461	0.0000	1,692.0905	1,692.0905	0.0625	0.0000	1,693.4024
2024	0.0711	0.5980	0.8573	1.5400e-003	0.0226	0.0277	0.0503	6.0100e-003	0.0258	0.0319	0.0000	122.5359	122.5359	0.0315	0.0000	123.1977
Total	**0.8619**	**5.2765**	**10.7957**	**0.0303**	**1.6998**	**0.2059**	**1.9058**	**0.4650**	**0.1914**	**0.6563**	**0.0000**	**2,242.9516**	**2,242.9516**	**0.1988**	**0.0000**	**2,247.1272**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio- CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	18.7132	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**18.7132**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	18.7132	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**18.7132**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description

1	Demolition	Demolition	1/1/2021	2/3/2021	5	24	
2	Site Preparation	Site Preparation	2/5/2021	10/15/2021	5	181	
3	Grading	Grading	1/1/2022	10/31/2022	5	216	
4	Building Construction	Building Construction	1/1/2023	6/30/2023	5	130	
5	Paving	Paving	1/1/2024	11/14/2024	5	229	

Acres of Grading (Site Preparation Phase): 23.39

Acres of Grading (Grading Phase): 18.33

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Off-Highway Trucks	50	2.00	400	0.38
Paving	Cement and Mortar Mixers	4	6.00	9	0.56
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Grading	Concrete/Industrial Saws	1	8.00	81	0.73
Building Construction	Cranes	1	4.00	226	0.29
Building Construction	Forklifts	2	6.00	89	0.20
Site Preparation	Graders	1	8.00	174	0.41
Paving	Pavers	1	7.00	125	0.42
Paving	Rollers	1	7.00	80	0.38
Demolition	Rubber Tired Dozers	1	1.00	255	0.40
Grading	Rubber Tired Dozers	1	1.00	255	0.40
Building Construction	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Demolition	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Grading	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Paving	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Site Preparation	Tractors/Loaders/Backhoes	1	8.00	97	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	54	135.00	0.00	912.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	2	5.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Grading	4	10.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	5	1,647.00	643.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving	7	18.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0987	0.0000	0.0987	0.0149	0.0000	0.0149	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1002	0.8738	0.6363	2.1300e-003		0.0337	0.0337		0.0312	0.0312	0.0000	186.5164	186.5164	0.0586	0.0000	187.7473
Total	**0.1002**	**0.8738**	**0.6363**	**2.1300e-003**	**0.0987**	**0.0337**	**0.1324**	**0.0149**	**0.0312**	**0.0461**	**0.0000**	**186.5164**	**186.5164**	**0.0586**	**0.0000**	**187.7473**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	7.2600e-003	0.0827	0.0884	3.3000e-004	7.8200e-003	1.6700e-003	9.4900e-003	2.1500e-003	1.5300e-003	3.6800e-003	0.0000	28.5217	28.5217	2.3000e-004	0.0000	28.5265
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.8500e-003	5.5200e-003	0.0586	2.1000e-004	0.0178	1.2000e-004	0.0179	4.7200e-003	1.2000e-004	4.8400e-003	0.0000	13.5666	13.5666	5.9000e-004	0.0000	13.5790

Total	**0.0111**	**0.0882**	**0.1470**	**5.4000e-004**	**0.0256**	**1.7900e-003**	**0.0274**	**6.8700e-003**	**1.6500e-003**	**8.5200e-003**	**0.0000**	**42.0883**	**42.0883**	**8.2000e-004**	**0.0000**	**42.1055**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0987	0.0000	0.0987	0.0149	0.0000	0.0149	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1002	0.8738	0.6363	2.1300e-003		0.0337	0.0337		0.0312	0.0312	0.0000	186.5162	186.5162	0.0586	0.0000	187.7470
Total	**0.1002**	**0.8738**	**0.6363**	**2.1300e-003**	**0.0987**	**0.0337**	**0.1324**	**0.0149**	**0.0312**	**0.0461**	**0.0000**	**186.5162**	**186.5162**	**0.0586**	**0.0000**	**187.7470**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	7.2600e-003	0.0827	0.0884	3.3000e-004	7.8200e-003	1.6700e-003	9.4900e-003	2.1500e-003	1.5300e-003	3.6800e-003	0.0000	28.5217	28.5217	2.3000e-004	0.0000	28.5265
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.8500e-003	5.5200e-003	0.0586	2.1000e-004	0.0178	1.2000e-004	0.0179	4.7200e-003	1.2000e-004	4.8400e-003	0.0000	13.5666	13.5666	5.9000e-004	0.0000	13.5790
Total	**0.0111**	**0.0882**	**0.1470**	**5.4000e-004**	**0.0256**	**1.7900e-003**	**0.0274**	**6.8700e-003**	**1.6500e-003**	**8.5200e-003**	**0.0000**	**42.0883**	**42.0883**	**8.2000e-004**	**0.0000**	**42.1055**

3.3 Site Preparation - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0124	0.0000	0.0124	1.3400e-003	0.0000	1.3400e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0745	0.7226	0.6098	8.4000e-004		0.0409	0.0409		0.0376	0.0376	0.0000	74.1362	74.1362	0.0240	0.0000	74.6397
Total	**0.0745**	**0.7226**	**0.6098**	**8.4000e-004**	**0.0124**	**0.0409**	**0.0533**	**1.3400e-003**	**0.0376**	**0.0389**	**0.0000**	**74.1362**	**74.1362**	**0.0240**	**0.0000**	**74.6397**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0700e-003	1.5400e-003	0.0164	6.0000e-005	4.9700e-003	3.0000e-005	5.0000e-003	1.3200e-003	3.0000e-005	1.3500e-003	0.0000	3.7894	3.7894	1.7000e-004	0.0000	3.7929
Total	**1.0700e-003**	**1.5400e-003**	**0.0164**	**6.0000e-005**	**4.9700e-003**	**3.0000e-005**	**5.0000e-003**	**1.3200e-003**	**3.0000e-005**	**1.3500e-003**	**0.0000**	**3.7894**	**3.7894**	**1.7000e-004**	**0.0000**	**3.7929**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0124	0.0000	0.0124	1.3400e-003	0.0000	1.3400e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0745	0.7226	0.6098	8.4000e-004		0.0409	0.0409		0.0376	0.0376	0.0000	74.1361	74.1361	0.0240	0.0000	74.6396
Total	**0.0745**	**0.7226**	**0.6098**	**8.4000e-004**	**0.0124**	**0.0409**	**0.0533**	**1.3400e-003**	**0.0376**	**0.0389**	**0.0000**	**74.1361**	**74.1361**	**0.0240**	**0.0000**	**74.6396**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0700e-003	1.5400e-003	0.0164	6.0000e-005	4.9700e-003	3.0000e-005	5.0000e-003	1.3200e-003	3.0000e-005	1.3500e-003	0.0000	3.7894	3.7894	1.7000e-004	0.0000	3.7929
Total	**1.0700e-003**	**1.5400e-003**	**0.0164**	**6.0000e-005**	**4.9700e-003**	**3.0000e-005**	**5.0000e-003**	**1.3200e-003**	**3.0000e-005**	**1.3500e-003**	**0.0000**	**3.7894**	**3.7894**	**1.7000e-004**	**0.0000**	**3.7929**

3.4 Grading - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0910	0.0000	0.0910	0.0457	0.0000	0.0457	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0769	0.6907	0.8529	1.3000e-003		0.0362	0.0362		0.0346	0.0346	0.0000	112.8983	112.8983	0.0209	0.0000	113.3372
Total	**0.0769**	**0.6907**	**0.8529**	**1.3000e-003**	**0.0910**	**0.0362**	**0.1272**	**0.0457**	**0.0346**	**0.0803**	**0.0000**	**112.8983**	**112.8983**	**0.0209**	**0.0000**	**113.3372**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.4400e-003	3.4700e-003	0.0370	1.4000e-004	0.0119	8.0000e-005	0.0119	3.1500e-003	8.0000e-005	3.2300e-003	0.0000	8.8971	8.8971	3.8000e-004	0.0000	8.9050
Total	**2.4400e-003**	**3.4700e-003**	**0.0370**	**1.4000e-004**	**0.0119**	**8.0000e-005**	**0.0119**	**3.1500e-003**	**8.0000e-005**	**3.2300e-003**	**0.0000**	**8.8971**	**8.8971**	**3.8000e-004**	**0.0000**	**8.9050**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0910	0.0000	0.0910	0.0457	0.0000	0.0457	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0769	0.6907	0.8529	1.3000e-003		0.0362	0.0362		0.0346	0.0346	0.0000	112.8982	112.8982	0.0209	0.0000	113.3371
Total	**0.0769**	**0.6907**	**0.8529**	**1.3000e-003**	**0.0910**	**0.0362**	**0.1272**	**0.0457**	**0.0346**	**0.0803**	**0.0000**	**112.8982**	**112.8982**	**0.0209**	**0.0000**	**113.3371**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.4400e-003	3.4700e-003	0.0370	1.4000e-004	0.0119	8.0000e-005	0.0119	3.1500e-003	8.0000e-005	3.2300e-003	0.0000	8.8971	8.8971	3.8000e-004	0.0000	8.9050
Total	**2.4400e-003**	**3.4700e-003**	**0.0370**	**1.4000e-004**	**0.0119**	**8.0000e-005**	**0.0119**	**3.1500e-003**	**8.0000e-005**	**3.2300e-003**	**0.0000**	**8.8971**	**8.8971**	**3.8000e-004**	**0.0000**	**8.9050**

3.5 Building Construction - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0409	0.4145	0.4600	7.4000e-004		0.0207	0.0207		0.0191	0.0191	0.0000	64.7789	64.7789	0.0210	0.0000	65.2188
Total	**0.0409**	**0.4145**	**0.4600**	**7.4000e-004**		**0.0207**	**0.0207**		**0.0191**	**0.0191**	**0.0000**	**64.7789**	**64.7789**	**0.0210**	**0.0000**	**65.2188**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.2528	1.5574	3.7032	8.9300e-003	0.2574	0.0366	0.2940	0.0735	0.0337	0.1071	0.0000	758.6208	758.6208	5.2100e-003	0.0000	758.7303
Worker	0.2309	0.3261	3.4757	0.0140	1.1753	8.3900e-003	1.1836	0.3121	7.7800e-003	0.3199	0.0000	868.6909	868.6909	0.0363	0.0000	869.4534
Total	**0.4837**	**1.8835**	**7.1789**	**0.0230**	**1.4327**	**0.0450**	**1.4776**	**0.3856**	**0.0414**	**0.4270**	**0.0000**	**1,627.3117**	**1,627.3117**	**0.0415**	**0.0000**	**1,628.1836**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0409	0.4145	0.4600	7.4000e-004		0.0207	0.0207		0.0191	0.0191	0.0000	64.7788	64.7788	0.0210	0.0000	65.2188
Total	**0.0409**	**0.4145**	**0.4600**	**7.4000e-004**		**0.0207**	**0.0207**		**0.0191**	**0.0191**	**0.0000**	**64.7788**	**64.7788**	**0.0210**	**0.0000**	**65.2188**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.2528	1.5574	3.7032	8.9300e-003	0.2574	0.0366	0.2940	0.0735	0.0337	0.1071	0.0000	758.6208	758.6208	5.2100e-003	0.0000	758.7303
Worker	0.2309	0.3261	3.4757	0.0140	1.1753	8.3900e-003	1.1836	0.3121	7.7800e-003	0.3199	0.0000	868.6909	868.6909	0.0363	0.0000	869.4534
Total	**0.4837**	**1.8835**	**7.1789**	**0.0230**	**1.4327**	**0.0450**	**1.4776**	**0.3856**	**0.0414**	**0.4270**	**0.0000**	**1,627.3117**	**1,627.3117**	**0.0415**	**0.0000**	**1,628.1836**

3.6 Paving - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0669	0.5921	0.7940	1.2700e-003		0.0275	0.0275		0.0257	0.0257	0.0000	106.0458	106.0458	0.0308	0.0000	106.6935
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0669**	**0.5921**	**0.7940**	**1.2700e-003**		**0.0275**	**0.0275**		**0.0257**	**0.0257**	**0.0000**	**106.0458**	**106.0458**	**0.0308**	**0.0000**	**106.6935**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.2400e-003	5.9600e-003	0.0634	2.7000e-004	0.0226	1.6000e-004	0.0228	6.0100e-003	1.5000e-004	6.1600e-003	0.0000	16.4902	16.4902	6.8000e-004	0.0000	16.5044
Total	**4.2400e-003**	**5.9600e-003**	**0.0634**	**2.7000e-004**	**0.0226**	**1.6000e-004**	**0.0228**	**6.0100e-003**	**1.5000e-004**	**6.1600e-003**	**0.0000**	**16.4902**	**16.4902**	**6.8000e-004**	**0.0000**	**16.5044**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0669	0.5921	0.7940	1.2700e-003		0.0275	0.0275		0.0257	0.0257	0.0000	106.0457	106.0457	0.0308	0.0000	106.6933
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0669**	**0.5921**	**0.7940**	**1.2700e-003**		**0.0275**	**0.0275**		**0.0257**	**0.0257**	**0.0000**	**106.0457**	**106.0457**	**0.0308**	**0.0000**	**106.6933**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.2400e-003	5.9600e-003	0.0634	2.7000e-004	0.0226	1.6000e-004	0.0228	6.0100e-003	1.5000e-004	6.1600e-003	0.0000	16.4902	16.4902	6.8000e-004	0.0000	16.5044
Total	**4.2400e-003**	**5.9600e-003**	**0.0634**	**2.7000e-004**	**0.0226**	**1.6000e-004**	**0.0228**	**6.0100e-003**	**1.5000e-004**	**6.1600e-003**	**0.0000**	**16.4902**	**16.4902**	**6.8000e-004**	**0.0000**	**16.5044**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Total					

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.500282	0.057001	0.196753	0.152945	0.042333	0.006070	0.016337	0.017415	0.001474	0.002202	0.004129	0.000486	0.002572

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	18.7132	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	18.7132	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	4.5438					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	14.1694					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**18.7132**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	4.5438					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	14.1694					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**18.7132**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Aliso Creek Mainstem Ecosystem Restoration Alternative 3.3

Orange County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
	0.00		0.00	3,921,250.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	30
Climate Zone	8			**Operational Year**	2025
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Aliso Creek Mainstem Ecosystem Restoration Alternative 3.3 is located in southern Orange County, California.

Land Use - Alt. 3.3, an area of 5 miles long & 200 ft. wide, raise streambed for channel stability to approach the historic pre-incised stream elevation, install 47 rock riffles, on-site disposal of 130,000 cubic yards creek substrate on slopes, & plants native veg.

Construction Phase - Over a 4 year period work the total construction duration would be 780 days.

Grading - Site Preparation work is approximately 23.39216024 acres, and Grading work is approximately 18.32673324 acres.

Demolition - Demolition of ACWHEP structure and the two large concrete drop structures.

Energy Use -

Off-road Equipment - 50 laborers would be at the construction work site daily.

Aliso Creek Mainstem Ecosystem Restoration Alternative 3.6 Tentatively Selected Plan (TSP)

Orange County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
	0.00		0.00	4,112,500.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	30
Climate Zone	8			**Operational Year**	2025
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Aliso Creek Ecosystem Restoration Alternative 3.6 is the Tentatively Selected Plan (TSP), and is located in southern Orange County, California.

Land Use - Alt. 3.6 TSP, an area of approx. 5 miles long & 200 ft. wide, reconnects 850 ft. of length in an abandoned oxbow, installs 46 rock riffles, on-site disposal of 300,000 cubic yards of creek substrate onto channels slopes, & plant native vegetation.

Construction Phase - Over a 4 year period work the total construction duration would be 876 days.

Off-road Equipment - 50 laborers would be at the construction work site daily.

Grading - Site Preparation work is approximately 23.51411846 acres, and Grading work is approximately 22.35135445 acres.

Demolition - Demolition of ACWHEP structure and the two large concrete drop structures.

Energy Use -

Aliso Creek Mainstem Ecosystem Restoration Alternative 3.6 Tentatively Selected Plan (TSP)

Orange County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
	0.00		0.00	4,112,500.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	30
Climate Zone	8			**Operational Year**	2025
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Aliso Creek Ecosystem Restoration Alternative 3.6 is the Tentatively Selected Plan (TSP), and is located in southern Orange County, California.

Land Use - Alt. 3.6 TSP, an area of approx. 5 miles long & 200 ft. wide, reconnects 850 ft. of length in an abandoned oxbow, installs 46 rock riffles, on-site disposal of 300,000 cubic yards of creek substrate onto channels slopes, & plant native vegetation.

Construction Phase - Over a 4 year period work the total construction duration would be 876 days.

Off-road Equipment - 50 laborers would be at the construction work site daily.

Grading - Site Preparation work is approximately 23.51411846 acres, and Grading work is approximately 22.35135445 acres.

Demolition - Demolition of ACWHEP structure and the two large concrete drop structures.

Energy Use -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	0.00	130.00
tblConstructionPhase	NumDays	0.00	24.00

tblConstructionPhase	NumDays	0.00	260.00
tblConstructionPhase	NumDays	0.00	229.00
tblConstructionPhase	NumDays	0.00	233.00
tblConstructionPhase	PhaseEndDate	12/26/2022	12/31/2022
tblConstructionPhase	PhaseEndDate	5/16/2024	11/14/2024
tblConstructionPhase	PhaseStartDate	12/28/2021	1/1/2022
tblConstructionPhase	PhaseStartDate	7/1/2023	1/1/2024
tblGrading	AcresOfGrading	0.00	22.35
tblGrading	AcresOfGrading	116.50	23.51
tblOffRoadEquipment	LoadFactor	0.38	0.38
tblOffRoadEquipment	OffRoadEquipmentType		Off-Highway Trucks
tblProjectCharacteristics	OperationalYear	2014	2025

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2021	9.2663	79.7761	64.6591	0.2234	10.3956	2.9553	13.3509	1.8268	2.7328	4.5596	0.0000	21,052.4599	21,052.4599	5.4591	0.0000	21,167.1018
2022	0.7347	6.4242	8.2572	0.0134	0.9557	0.3356	1.2913	0.4533	0.3208	0.7740	0.0000	1,246.7885	1,246.7885	0.2172	0.0000	1,251.3498
2023	8.3117	35.2519	116.3723	0.3914	23.5181	1.0417	24.5598	6.3198	0.9594	7.2792	0.0000	30,705.4213	30,705.4213	1.0920	0.0000	30,728.3535
2024	0.6221	5.2172	7.5168	0.0136	0.2012	0.2415	0.4427	0.0534	0.2257	0.2790	0.0000	1,186.1155	1,186.1155	0.3034	0.0000	1,192.4870
Total	**18.9347**	**126.6693**	**196.8054**	**0.6418**	**35.0706**	**4.5741**	**39.6447**	**8.6533**	**4.2386**	**12.8918**	**0.0000**	**54,190.7851**	**54,190.7851**	**7.0718**	**0.0000**	**54,339.2921**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2021	9.2663	79.7761	64.6591	0.2234	10.3956	2.9553	13.3509	1.8268	2.7328	4.5596	0.0000	21,052.4599	21,052.4599	5.4591	0.0000	21,167.1018
2022	0.7347	6.4242	8.2572	0.0134	0.9557	0.3356	1.2913	0.4533	0.3208	0.7740	0.0000	1,246.7885	1,246.7885	0.2172	0.0000	1,251.3498
2023	8.3117	35.2519	116.3723	0.3914	23.5181	1.0417	24.5598	6.3198	0.9594	7.2792	0.0000	30,705.4213	30,705.4213	1.0920	0.0000	30,728.3535
2024	0.6221	5.2172	7.5168	0.0136	0.2012	0.2415	0.4427	0.0534	0.2257	0.2790	0.0000	1,186.1155	1,186.1155	0.3034	0.0000	1,192.4870
Total	**18.9347**	**126.6693**	**196.8054**	**0.6418**	**35.0706**	**4.5741**	**39.6447**	**8.6533**	**4.2386**	**12.8918**	**0.0000**	**54,190.7850**	**54,190.7850**	**7.0718**	**0.0000**	**54,339.2921**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	107.5391	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**107.5391**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	107.5391	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**107.5391**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description

1	Demolition	Demolition	1/1/2021	2/3/2021	5	24	
2	Site Preparation	Site Preparation	2/4/2021	12/27/2021	5	233	
3	Grading	Grading	1/1/2022	12/31/2022	5	260	
4	Building Construction	Building Construction	1/1/2023	6/30/2023	5	130	
5	Paving	Paving	1/1/2024	11/14/2024	5	229	

Acres of Grading (Site Preparation Phase): 23.51411846

Acres of Grading (Grading Phase): 22.35135445

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Off-Highway Trucks	50	2.00	400	0.38
Paving	Cement and Mortar Mixers	4	6.00	9	0.56
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Grading	Concrete/Industrial Saws	1	8.00	81	0.73
Building Construction	Cranes	1	4.00	226	0.29
Building Construction	Forklifts	2	6.00	89	0.20
Site Preparation	Graders	1	8.00	174	0.41
Paving	Pavers	1	7.00	125	0.42
Paving	Rollers	1	7.00	80	0.38
Demolition	Rubber Tired Dozers	1	1.00	255	0.40
Grading	Rubber Tired Dozers	1	1.00	255	0.40
Building Construction	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Demolition	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Grading	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Paving	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Site Preparation	Tractors/Loaders/Backhoes	1	8.00	97	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	54	135.00	0.00	912.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	2	5.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Grading	4	10.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	5	1,727.00	674.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving	7	18.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.2244	0.0000	8.2244	1.2452	0.0000	1.2452			0.0000			0.0000
Off-Road	8.3502	72.8163	53.0275	0.1771		2.8062	2.8062		2.5956	2.5956		17,133.2627	17,133.2627	5.3840		17,246.3263
Total	**8.3502**	**72.8163**	**53.0275**	**0.1771**	**8.2244**	**2.8062**	**11.0305**	**1.2452**	**2.5956**	**3.8408**		**17,133.2627**	**17,133.2627**	**5.3840**		**17,246.3263**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.5883	6.5521	6.5031	0.0279	0.6623	0.1387	0.8010	0.1814	0.1276	0.3090		2,622.6133	2,622.6133	0.0207		2,623.0488
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.3278	0.4077	5.1285	0.0184	1.5090	0.0104	1.5194	0.4002	9.6600e-003	0.4099		1,296.5839	1,296.5839	0.0544		1,297.7268

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Total	**0.9161**	**6.9598**	**11.6316**	**0.0463**	**2.1713**	**0.1491**	**2.3204**	**0.5816**	**0.1373**	**0.7188**		**3,919.1972**	**3,919.1972**	**0.0752**		**3,920.7756**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.2244	0.0000	8.2244	1.2452	0.0000	1.2452			0.0000			0.0000
Off-Road	8.3502	72.8163	53.0275	0.1771		2.8062	2.8062		2.5956	2.5956	0.0000	17,133.2627	17,133.2627	5.3840		17,246.3262
Total	**8.3502**	**72.8163**	**53.0275**	**0.1771**	**8.2244**	**2.8062**	**11.0305**	**1.2452**	**2.5956**	**3.8408**	**0.0000**	**17,133.2627**	**17,133.2627**	**5.3840**		**17,246.3262**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.5883	6.5521	6.5031	0.0279	0.6623	0.1387	0.8010	0.1814	0.1276	0.3090		2,622.6133	2,622.6133	0.0207		2,623.0488
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.3278	0.4077	5.1285	0.0184	1.5090	0.0104	1.5194	0.4002	9.6600e-003	0.4099		1,296.5839	1,296.5839	0.0544		1,297.7268
Total	**0.9161**	**6.9598**	**11.6316**	**0.0463**	**2.1713**	**0.1491**	**2.3204**	**0.5816**	**0.1373**	**0.7188**		**3,919.1972**	**3,919.1972**	**0.0752**		**3,920.7756**

3.3 Site Preparation - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.1070	0.0000	0.1070	0.0116	0.0000	0.0116			0.0000			0.0000
Off-Road	0.8231	7.9849	6.7382	9.3200e-003		0.4515	0.4515		0.4154	0.4154		902.9958	902.9958	0.2921		909.1288
Total	**0.8231**	**7.9849**	**6.7382**	**9.3200e-003**	**0.1070**	**0.4515**	**0.5585**	**0.0116**	**0.4154**	**0.4269**		**902.9958**	**902.9958**	**0.2921**		**909.1288**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0121	0.0151	0.1899	6.8000e-004	0.0559	3.9000e-004	0.0563	0.0148	3.6000e-004	0.0152		48.0216	48.0216	2.0200e-003		48.0640
Total	**0.0121**	**0.0151**	**0.1899**	**6.8000e-004**	**0.0559**	**3.9000e-004**	**0.0563**	**0.0148**	**3.6000e-004**	**0.0152**		**48.0216**	**48.0216**	**2.0200e-003**		**48.0640**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.1070	0.0000	0.1070	0.0116	0.0000	0.0116			0.0000			0.0000
Off-Road	0.8231	7.9849	6.7382	9.3200e-003		0.4515	0.4515		0.4154	0.4154	0.0000	902.9958	902.9958	0.2921		909.1288
Total	**0.8231**	**7.9849**	**6.7382**	**9.3200e-003**	**0.1070**	**0.4515**	**0.5585**	**0.0116**	**0.4154**	**0.4269**	**0.0000**	**902.9958**	**902.9958**	**0.2921**		**909.1288**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0121	0.0151	0.1899	6.8000e-004	0.0559	3.9000e-004	0.0563	0.0148	3.6000e-004	0.0152		48.0216	48.0216	2.0200e-003		48.0640
Total	**0.0121**	**0.0151**	**0.1899**	**6.8000e-004**	**0.0559**	**3.9000e-004**	**0.0563**	**0.0148**	**3.6000e-004**	**0.0152**		**48.0216**	**48.0216**	**2.0200e-003**		**48.0640**

3.4 Grading - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.8439	0.0000	0.8439	0.4236	0.0000	0.4236			0.0000			0.0000
Off-Road	0.7115	6.3958	7.8974	0.0120		0.3348	0.3348		0.3200	0.3200		1,152.3064	1,152.3064	0.2133		1,156.7863
Total	**0.7115**	**6.3958**	**7.8974**	**0.0120**	**0.8439**	**0.3348**	**1.1787**	**0.4236**	**0.3200**	**0.7437**		**1,152.3064**	**1,152.3064**	**0.2133**		**1,156.7863**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0231	0.0285	0.3597	1.3600e-003	0.1118	7.8000e-004	0.1126	0.0296	7.2000e-004	0.0304		94.4821	94.4821	3.8800e-003		94.5635
Total	**0.0231**	**0.0285**	**0.3597**	**1.3600e-003**	**0.1118**	**7.8000e-004**	**0.1126**	**0.0296**	**7.2000e-004**	**0.0304**		**94.4821**	**94.4821**	**3.8800e-003**		**94.5635**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.8439	0.0000	0.8439	0.4236	0.0000	0.4236			0.0000			0.0000
Off-Road	0.7115	6.3958	7.8974	0.0120		0.3348	0.3348		0.3200	0.3200	0.0000	1,152.3064	1,152.3064	0.2133		1,156.7863
Total	**0.7115**	**6.3958**	**7.8974**	**0.0120**	**0.8439**	**0.3348**	**1.1787**	**0.4236**	**0.3200**	**0.7437**	**0.0000**	**1,152.3064**	**1,152.3064**	**0.2133**		**1,156.7863**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0231	0.0285	0.3597	1.3600e-003	0.1118	7.8000e-004	0.1126	0.0296	7.2000e-004	0.0304		94.4821	94.4821	3.8800e-003		94.5635
Total	**0.0231**	**0.0285**	**0.3597**	**1.3600e-003**	**0.1118**	**7.8000e-004**	**0.1126**	**0.0296**	**7.2000e-004**	**0.0304**		**94.4821**	**94.4821**	**3.8800e-003**		**94.5635**

3.5 Building Construction - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.6284	6.3773	7.0772	0.0114		0.3185	0.3185		0.2930	0.2930		1,098.5610	1,098.5610	0.3553		1,106.0223
Total	**0.6284**	**6.3773**	**7.0772**	**0.0114**		**0.3185**	**0.3185**		**0.2930**	**0.2930**		**1,098.5610**	**1,098.5610**	**0.3553**		**1,106.0223**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	3.8723	24.2137	50.3092	0.1445	4.2143	0.5878	4.8021	1.2004	0.5408	1.7412		13,533.9703	13,533.9703	0.0911		13,535.8830
Worker	3.8110	4.6608	58.9859	0.2356	19.3038	0.1353	19.4391	5.1195	0.1256	5.2450		16,072.8899	16,072.8899	0.6456		16,086.4483
Total	**7.6833**	**28.8745**	**109.2951**	**0.3800**	**23.5181**	**0.7231**	**24.2412**	**6.3198**	**0.6663**	**6.9862**		**29,606.8602**	**29,606.8602**	**0.7367**		**29,622.3313**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.6284	6.3773	7.0772	0.0114		0.3185	0.3185		0.2930	0.2930	0.0000	1,098.5610	1,098.5610	0.3553		1,106.0223
Total	**0.6284**	**6.3773**	**7.0772**	**0.0114**		**0.3185**	**0.3185**		**0.2930**	**0.2930**	**0.0000**	**1,098.5610**	**1,098.5610**	**0.3553**		**1,106.0223**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	3.8723	24.2137	50.3092	0.1445	4.2143	0.5878	4.8021	1.2004	0.5408	1.7412		13,533.9703	13,533.9703	0.0911		13,535.8830
Worker	3.8110	4.6608	58.9859	0.2356	19.3038	0.1353	19.4391	5.1195	0.1256	5.2450		16,072.8899	16,072.8899	0.6456		16,086.4483
Total	**7.6833**	**28.8745**	**109.2951**	**0.3800**	**23.5181**	**0.7231**	**24.2412**	**6.3198**	**0.6663**	**6.9862**		**29,606.8602**	**29,606.8602**	**0.7367**		**29,622.3313**

3.6 Paving - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.5842	5.1711	6.9340	0.0111		0.2401	0.2401		0.2243	0.2243		1,020.9213	1,020.9213	0.2969		1,027.1563
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.5842**	**5.1711**	**6.9340**	**0.0111**		**0.2401**	**0.2401**		**0.2243**	**0.2243**		**1,020.9213**	**1,020.9213**	**0.2969**		**1,027.1563**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0379	0.0461	0.5828	2.4500e-003	0.2012	1.4200e-003	0.2026	0.0534	1.3200e-003	0.0547		165.1942	165.1942	6.5000e-003		165.3306
Total	**0.0379**	**0.0461**	**0.5828**	**2.4500e-003**	**0.2012**	**1.4200e-003**	**0.2026**	**0.0534**	**1.3200e-003**	**0.0547**		**165.1942**	**165.1942**	**6.5000e-003**		**165.3306**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.5842	5.1711	6.9340	0.0111		0.2401	0.2401		0.2243	0.2243	0.0000	1,020.9213	1,020.9213	0.2969		1,027.1563
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.5842**	**5.1711**	**6.9340**	**0.0111**		**0.2401**	**0.2401**		**0.2243**	**0.2243**	**0.0000**	**1,020.9213**	**1,020.9213**	**0.2969**		**1,027.1563**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0379	0.0461	0.5828	2.4500e-003	0.2012	1.4200e-003	0.2026	0.0534	1.3200e-003	0.0547		165.1942	165.1942	6.5000e-003		165.3306
Total	**0.0379**	**0.0461**	**0.5828**	**2.4500e-003**	**0.2012**	**1.4200e-003**	**0.2026**	**0.0534**	**1.3200e-003**	**0.0547**		**165.1942**	**165.1942**	**6.5000e-003**		**165.3306**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Total					

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.500282	0.057001	0.196753	0.152945	0.042333	0.006070	0.016337	0.017415	0.001474	0.002202	0.004129	0.000486	0.002572

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

6.0 Area Detail

6.1 Mitigation Measures Area

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Mitigated	107.5391	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	107.5391	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

6.2 Area by SubCategory

Unmitigated

SubCategory	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Architectural Coating	26.1116					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	81.4275					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**107.5391**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Consumer Products	81.4275					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Architectural Coating	26.1116					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**107.5391**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Aliso Creek Mainstem Ecosystem Restoration Alternative 3.7

Orange County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
	0.00		0.00	4,124,275.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	30
Climate Zone	8			**Operational Year**	2025
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Aliso Creek Mainstem Ecosystem Restoration Alternative 3.7, and is located in southern Orange County, California.

Land Use - Alt. 3.7 an area of approx.. 5 miles long & 200 ft. wide, reconnects abandoned oxbow of 850 ft. of length, adds sinuosity of 32 ft length, installs 46 rock riffles, on-site disposal of 340,000 cy of creek substrate on slopes, & plant native veg.

Construction Phase - Over a 4 year period work the total construction duration would be 901 days.

Off-road Equipment - 50 laborers would be at the construction work site daily.

Grading - Site Preparation work is approximately 23.54281451 acres, and Grading work is approximately 22.38005051 acres.

Demolition - Demolition of ACWHEP structure and the two large concrete drop structures.

Energy Use -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	0.00	152.00
tblConstructionPhase	NumDays	0.00	24.00

tblConstructionPhase	NumDays	0.00	260.00
tblConstructionPhase	NumDays	0.00	229.00
tblConstructionPhase	NumDays	0.00	236.00
tblConstructionPhase	PhaseEndDate	12/29/2022	12/31/2022
tblConstructionPhase	PhaseEndDate	6/17/2024	11/14/2024
tblConstructionPhase	PhaseStartDate	12/31/2021	1/2/2022
tblConstructionPhase	PhaseStartDate	8/2/2023	1/1/2024
tblGrading	AcresOfGrading	0.00	22.38
tblGrading	AcresOfGrading	118.00	23.54
tblOffRoadEquipment	LoadFactor	0.38	0.38
tblOffRoadEquipment	OffRoadEquipmentType		Off-Highway Trucks
tblProjectCharacteristics	OperationalYear	2014	2025

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2021	0.2098	1.9062	1.5998	3.8500e-003	0.1433	0.0888	0.2320	0.0249	0.0819	0.1067	0.0000	330.2093	330.2093	0.0909	0.0000	332.1184
2022	0.0954	0.8356	1.0712	1.7400e-003	0.1240	0.0436	0.1676	0.0589	0.0417	0.1006	0.0000	146.6055	146.6055	0.0256	0.0000	147.1435
2023	0.6425	2.8000	9.3636	0.0291	1.7615	0.0795	1.8410	0.4741	0.0732	0.5473	0.0000	2,076.3863	2,076.3863	0.0756	0.0000	2,077.9728
2024	0.0711	0.5980	0.8573	1.5400e-003	0.0226	0.0277	0.0503	6.0100e-003	0.0258	0.0319	0.0000	122.5360	122.5360	0.0315	0.0000	123.1978
Total	**1.0189**	**6.1399**	**12.8919**	**0.0362**	**2.0514**	**0.2396**	**2.2909**	**0.5638**	**0.2226**	**0.7864**	**0.0000**	**2,675.7372**	**2,675.7372**	**0.2236**	**0.0000**	**2,680.4325**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2021	0.2098	1.9062	1.5998	3.8500e-003	0.1433	0.0888	0.2320	0.0249	0.0819	0.1067	0.0000	330.2090	330.2090	0.0909	0.0000	332.1181
2022	0.0954	0.8356	1.0712	1.7400e-003	0.1240	0.0436	0.1676	0.0589	0.0417	0.1006	0.0000	146.6054	146.6054	0.0256	0.0000	147.1433
2023	0.6425	2.8000	9.3636	0.0291	1.7615	0.0795	1.8410	0.4741	0.0732	0.5473	0.0000	2,076.3863	2,076.3863	0.0756	0.0000	2,077.9727
2024	0.0711	0.5980	0.8573	1.5400e-003	0.0226	0.0277	0.0503	6.0100e-003	0.0258	0.0319	0.0000	122.5359	122.5359	0.0315	0.0000	123.1977
Total	**1.0189**	**6.1399**	**12.8919**	**0.0362**	**2.0514**	**0.2396**	**2.2909**	**0.5638**	**0.2226**	**0.7864**	**0.0000**	**2,675.7364**	**2,675.7364**	**0.2236**	**0.0000**	**2,680.4317**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	19.6821	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**19.6821**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	19.6821	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**19.6821**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description

1	Demolition	Demolition	1/1/2021	2/3/2021	5	24	
2	Site Preparation	Site Preparation	2/4/2021	12/30/2021	5	236	
3	Grading	Grading	1/2/2022	12/31/2022	5	260	
4	Building Construction	Building Construction	1/1/2023	8/1/2023	5	152	
5	Paving	Paving	1/1/2024	11/14/2024	5	229	

Acres of Grading (Site Preparation Phase): 23.54281451

Acres of Grading (Grading Phase): 22.38005051

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Off-Highway Trucks	50	2.00	400	0.38
Paving	Cement and Mortar Mixers	4	6.00	9	0.56
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Grading	Concrete/Industrial Saws	1	8.00	81	0.73
Building Construction	Cranes	1	4.00	226	0.29
Building Construction	Forklifts	2	6.00	89	0.20
Site Preparation	Graders	1	8.00	174	0.41
Paving	Pavers	1	7.00	125	0.42
Paving	Rollers	1	7.00	80	0.38
Demolition	Rubber Tired Dozers	1	1.00	255	0.40
Grading	Rubber Tired Dozers	1	1.00	255	0.40
Building Construction	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Demolition	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Grading	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Paving	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Site Preparation	Tractors/Loaders/Backhoes	1	8.00	97	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	54	135.00	0.00	912.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	2	5.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Grading	4	10.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	5	1,732.00	676.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving	7	18.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0987	0.0000	0.0987	0.0149	0.0000	0.0149	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1002	0.8738	0.6363	2.1300e-003		0.0337	0.0337		0.0312	0.0312	0.0000	186.5164	186.5164	0.0586	0.0000	187.7473
Total	**0.1002**	**0.8738**	**0.6363**	**2.1300e-003**	**0.0987**	**0.0337**	**0.1324**	**0.0149**	**0.0312**	**0.0461**	**0.0000**	**186.5164**	**186.5164**	**0.0586**	**0.0000**	**187.7473**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	7.2600e-003	0.0827	0.0884	3.3000e-004	7.8200e-003	1.6700e-003	9.4900e-003	2.1500e-003	1.5300e-003	3.6800e-003	0.0000	28.5217	28.5217	2.3000e-004	0.0000	28.5265
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.8500e-003	5.5200e-003	0.0586	2.1000e-004	0.0178	1.2000e-004	0.0179	4.7200e-003	1.2000e-004	4.8400e-003	0.0000	13.5666	13.5666	5.9000e-004	0.0000	13.5790

Total		0.0111	0.0882	0.147 0	5.4000 e-004	0.0256	1.7900 e-003	0.0274	6.8700 e-003	1.6500 e-003	8.5200 e-003	0.000 0	42.088 3	42.088 3	8.2000 e-004	0.000 0	42.105 5

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0987	0.0000	0.098 7	0.0149	0.0000	0.014 9	0.000 0	0.0000	0.0000	0.000 0	0.000 0	0.0000
Off-Road	0.100 2	0.873 8	0.636 3	2.1300e -003		0.0337	0.033 7		0.0312	0.031 2	0.000 0	186.516 2	186.516 2	0.058 6	0.000 0	187.747 0
Total	**0.100 2**	**0.873 8**	**0.636 3**	**2.1300e -003**	**0.0987**	**0.0337**	**0.132 4**	**0.0149**	**0.0312**	**0.046 1**	**0.000 0**	**186.516 2**	**186.516 2**	**0.058 6**	**0.000 0**	**187.747 0**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	7.2600e-003	0.0827	0.0884	3.3000e-004	7.8200e-003	1.6700e-003	9.4900e-003	2.1500e-003	1.5300e-003	3.6800e-003	0.0000	28.5217	28.5217	2.3000e-004	0.0000	28.5265
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.8500e-003	5.5200e-003	0.0586	2.1000e-004	0.0178	1.2000e-004	0.0179	4.7200e-003	1.2000e-004	4.8400e-003	0.0000	13.5666	13.5666	5.9000e-004	0.0000	13.5790
Total	**0.0111**	**0.0882**	**0.1470**	**5.4000e-004**	**0.0256**	**1.7900e-003**	**0.0274**	**6.8700e-003**	**1.6500e-003**	**8.5200e-003**	**0.0000**	**42.0883**	**42.0883**	**8.2000e-004**	**0.0000**	**42.1055**

3.3 Site Preparation - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0125	0.0000	0.0125	1.3500e-003	0.0000	1.3500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0971	0.9422	0.7951	1.1000e-003		0.0533	0.0533		0.0490	0.0490	0.0000	96.6637	96.6637	0.0313	0.0000	97.3202
Total	**0.0971**	**0.9422**	**0.7951**	**1.1000e-003**	**0.0125**	**0.0533**	**0.0658**	**1.3500e-003**	**0.0490**	**0.0504**	**0.0000**	**96.6637**	**96.6637**	**0.0313**	**0.0000**	**97.3202**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4000e-003	2.0100e-003	0.0214	8.0000e-005	6.4800e-003	5.0000e-005	6.5200e-003	1.7200e-003	4.0000e-005	1.7600e-003	0.0000	4.9409	4.9409	2.2000e-004	0.0000	4.9454
Total	**1.4000e-003**	**2.0100e-003**	**0.0214**	**8.0000e-005**	**6.4800e-003**	**5.0000e-005**	**6.5200e-003**	**1.7200e-003**	**4.0000e-005**	**1.7600e-003**	**0.0000**	**4.9409**	**4.9409**	**2.2000e-004**	**0.0000**	**4.9454**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0125	0.0000	0.0125	1.3500e-003	0.0000	1.3500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0971	0.9422	0.7951	1.1000e-003		0.0533	0.0533		0.0490	0.0490	0.0000	96.6636	96.6636	0.0313	0.0000	97.3201
Total	**0.0971**	**0.9422**	**0.7951**	**1.1000e-003**	**0.0125**	**0.0533**	**0.0658**	**1.3500e-003**	**0.0490**	**0.0504**	**0.0000**	**96.6636**	**96.6636**	**0.0313**	**0.0000**	**97.3201**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4000e-003	2.0100e-003	0.0214	8.0000e-005	6.4800e-003	5.0000e-005	6.5200e-003	1.7200e-003	4.0000e-005	1.7600e-003	0.0000	4.9409	4.9409	2.2000e-004	0.0000	4.9454
Total	**1.4000e-003**	**2.0100e-003**	**0.0214**	**8.0000e-005**	**6.4800e-003**	**5.0000e-005**	**6.5200e-003**	**1.7200e-003**	**4.0000e-005**	**1.7600e-003**	**0.0000**	**4.9409**	**4.9409**	**2.2000e-004**	**0.0000**	**4.9454**

3.4 Grading - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1097	0.0000	0.1097	0.0551	0.0000	0.0551	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0925	0.8315	1.0267	1.5600e-003		0.0435	0.0435		0.0416	0.0416	0.0000	135.8961	135.8961	0.0252	0.0000	136.4245
Total	**0.0925**	**0.8315**	**1.0267**	**1.5600e-003**	**0.1097**	**0.0435**	**0.1533**	**0.0551**	**0.0416**	**0.0967**	**0.0000**	**135.8961**	**135.8961**	**0.0252**	**0.0000**	**136.4245**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.9400e-003	4.1800e-003	0.0445	1.7000e-004	0.0143	1.0000e-004	0.0144	3.7900e-003	9.0000e-005	3.8800e-003	0.0000	10.7094	10.7094	4.6000e-004	0.0000	10.7190
Total	**2.9400e-003**	**4.1800e-003**	**0.0445**	**1.7000e-004**	**0.0143**	**1.0000e-004**	**0.0144**	**3.7900e-003**	**9.0000e-005**	**3.8800e-003**	**0.0000**	**10.7094**	**10.7094**	**4.6000e-004**	**0.0000**	**10.7190**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1097	0.0000	0.1097	0.0551	0.0000	0.0551	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0925	0.8315	1.0267	1.5600e-003		0.0435	0.0435		0.0416	0.0416	0.0000	135.8960	135.8960	0.0252	0.0000	136.4243
Total	**0.0925**	**0.8315**	**1.0267**	**1.5600e-003**	**0.1097**	**0.0435**	**0.1533**	**0.0551**	**0.0416**	**0.0967**	**0.0000**	**135.8960**	**135.8960**	**0.0252**	**0.0000**	**136.4243**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.9400e-003	4.1800e-003	0.0445	1.7000e-004	0.0143	1.0000e-004	0.0144	3.7900e-003	9.0000e-005	3.8800e-003	0.0000	10.7094	10.7094	4.6000e-004	0.0000	10.7190
Total	**2.9400e-003**	**4.1800e-003**	**0.0445**	**1.7000e-004**	**0.0143**	**1.0000e-004**	**0.0144**	**3.7900e-003**	**9.0000e-005**	**3.8800e-003**	**0.0000**	**10.7094**	**10.7094**	**4.6000e-004**	**0.0000**	**10.7190**

3.5 Building Construction - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0478	0.4847	0.5379	8.6000e-004		0.0242	0.0242		0.0223	0.0223	0.0000	75.7414	75.7414	0.0245	0.0000	76.2559
Total	**0.0478**	**0.4847**	**0.5379**	**8.6000e-004**		**0.0242**	**0.0242**		**0.0223**	**0.0223**	**0.0000**	**75.7414**	**75.7414**	**0.0245**	**0.0000**	**76.2559**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.3108	1.9144	4.5522	0.0110	0.3164	0.0450	0.3614	0.0903	0.0414	0.1317	0.0000	932.5255	932.5255	6.4100e-003	0.0000	932.6600
Worker	0.2839	0.4009	4.2736	0.0173	1.4451	0.0103	1.4554	0.3838	9.5700e-003	0.3933	0.0000	1,068.1194	1,068.1194	0.0446	0.0000	1,069.0569
Total	**0.5947**	**2.3154**	**8.8258**	**0.0282**	**1.7615**	**0.0553**	**1.8168**	**0.4741**	**0.0509**	**0.5250**	**0.0000**	**2,000.6449**	**2,000.6449**	**0.0511**	**0.0000**	**2,001.7169**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0478	0.4847	0.5379	8.6000e-004		0.0242	0.0242		0.0223	0.0223	0.0000	75.7413	75.7413	0.0245	0.0000	76.2558
Total	**0.0478**	**0.4847**	**0.5379**	**8.6000e-004**		**0.0242**	**0.0242**		**0.0223**	**0.0223**	**0.0000**	**75.7413**	**75.7413**	**0.0245**	**0.0000**	**76.2558**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.3108	1.9144	4.5522	0.0110	0.3164	0.0450	0.3614	0.0903	0.0414	0.1317	0.0000	932.5255	932.5255	6.4100e-003	0.0000	932.6600
Worker	0.2839	0.4009	4.2736	0.0173	1.4451	0.0103	1.4554	0.3838	9.5700e-003	0.3933	0.0000	1,068.1194	1,068.1194	0.0446	0.0000	1,069.0569
Total	**0.5947**	**2.3154**	**8.8258**	**0.0282**	**1.7615**	**0.0553**	**1.8168**	**0.4741**	**0.0509**	**0.5250**	**0.0000**	**2,000.6449**	**2,000.6449**	**0.0511**	**0.0000**	**2,001.7169**

3.6 Paving - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0669	0.5921	0.7940	1.2700e-003		0.0275	0.0275		0.0257	0.0257	0.0000	106.0458	106.0458	0.0308	0.0000	106.6935
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0669**	**0.5921**	**0.7940**	**1.2700e-003**		**0.0275**	**0.0275**		**0.0257**	**0.0257**	**0.0000**	**106.0458**	**106.0458**	**0.0308**	**0.0000**	**106.6935**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.2400e-003	5.9600e-003	0.0634	2.7000e-004	0.0226	1.6000e-004	0.0228	6.0100e-003	1.5000e-004	6.1600e-003	0.0000	16.4902	16.4902	6.8000e-004	0.0000	16.5044
Total	**4.2400e-003**	**5.9600e-003**	**0.0634**	**2.7000e-004**	**0.0226**	**1.6000e-004**	**0.0228**	**6.0100e-003**	**1.5000e-004**	**6.1600e-003**	**0.0000**	**16.4902**	**16.4902**	**6.8000e-004**	**0.0000**	**16.5044**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0669	0.5921	0.7940	1.2700e-003		0.0275	0.0275		0.0257	0.0257	0.0000	106.0457	106.0457	0.0308	0.0000	106.6933
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0669**	**0.5921**	**0.7940**	**1.2700e-003**		**0.0275**	**0.0275**		**0.0257**	**0.0257**	**0.0000**	**106.0457**	**106.0457**	**0.0308**	**0.0000**	**106.6933**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.2400e-003	5.9600e-003	0.0634	2.7000e-004	0.0226	1.6000e-004	0.0228	6.0100e-003	1.5000e-004	6.1600e-003	0.0000	16.4902	16.4902	6.8000e-004	0.0000	16.5044
Total	**4.2400e-003**	**5.9600e-003**	**0.0634**	**2.7000e-004**	**0.0226**	**1.6000e-004**	**0.0228**	**6.0100e-003**	**1.5000e-004**	**6.1600e-003**	**0.0000**	**16.4902**	**16.4902**	**6.8000e-004**	**0.0000**	**16.5044**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Total					

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.500282	0.057001	0.196753	0.152945	0.042333	0.006070	0.016337	0.017415	0.001474	0.002202	0.004129	0.000486	0.002572

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	19.6821	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	19.6821	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	4.7790					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	14.9031					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**19.6821**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	4.7790					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	14.9031					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**19.6821**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Aliso Creek Mainstem Ecosystem Restoration Alternative 3.8

Orange County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
	0.00		0.00	4,136,900.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	30
Climate Zone	8			**Operational Year**	2025
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Aliso Creek Mainstem Ecosystem Restoration Alternative 3.8, and is located in southern Orange County, California.

Land Use - Alt. 3.8, an area of 5 miles long & 200 ft. wide, reconnects abandoned oxbow of 850 ft. of length, adds sinuosity of 32 ft. & 59 ft. at 2 locations, installs 46 rock riffles, on-site disposal of 350,000 cy of creek substrate on slopes, & plant native veg.

Construction Phase - Over a 4 year period work the total construction duration would be 916 days.

Off-road Equipment - 50 laborers would be at the construction work site daily.

Grading - Site Preparation work is approximately 23.54998852 acres, and Grading work is approximately 22.38722452 acres.

Demolition - Demolition of ACWHEP structure and the two large concrete drop structures.

Energy Use -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	0.00	167.00
tblConstructionPhase	NumDays	0.00	24.00

tblConstructionPhase	NumDays	0.00	260.00
tblConstructionPhase	NumDays	0.00	229.00
tblConstructionPhase	NumDays	0.00	236.00
tblConstructionPhase	PhaseEndDate	12/29/2022	12/31/2022
tblConstructionPhase	PhaseEndDate	7/8/2024	11/14/2024
tblConstructionPhase	PhaseStartDate	12/31/2021	1/1/2022
tblConstructionPhase	PhaseStartDate	8/23/2023	1/1/2024
tblGrading	AcresOfGrading	0.00	22.39
tblGrading	AcresOfGrading	118.00	23.55
tblOffRoadEquipment	LoadFactor	0.38	0.38
tblOffRoadEquipment	OffRoadEquipmentType		Off-Highway Trucks
tblProjectCharacteristics	OperationalYear	2014	2025

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2021	0.2098	1.9062	1.5998	3.8500e-003	0.1433	0.0888	0.2321	0.0249	0.0819	0.1067	0.0000	330.2093	330.2093	0.0909	0.0000	332.1184
2022	0.0954	0.8356	1.0712	1.7400e-003	0.1240	0.0436	0.1676	0.0589	0.0417	0.1006	0.0000	146.6055	146.6055	0.0256	0.0000	147.1435
2023	0.7079	3.0841	10.3187	0.0321	1.9418	0.0875	2.0293	0.5226	0.0806	0.6032	0.0000	2,288.3894	2,288.3894	0.0832	0.0000	2,290.1365
2024	0.0711	0.5980	0.8573	1.5400e-003	0.0226	0.0277	0.0503	6.0100e-003	0.0258	0.0319	0.0000	122.5360	122.5360	0.0315	0.0000	123.1978
Total	**1.0844**	**6.4240**	**13.8470**	**0.0392**	**2.2317**	**0.2476**	**2.4793**	**0.6124**	**0.2300**	**0.8423**	**0.0000**	**2,887.7403**	**2,887.7403**	**0.2312**	**0.0000**	**2,892.5961**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2021	0.2098	1.9062	1.5998	3.8500e-003	0.1433	0.0888	0.2321	0.0249	0.0819	0.1067	0.0000	330.2090	330.2090	0.0909	0.0000	332.1181
2022	0.0954	0.8356	1.0712	1.7400e-003	0.1240	0.0436	0.1676	0.0589	0.0417	0.1006	0.0000	146.6054	146.6054	0.0256	0.0000	147.1433
2023	0.7079	3.0841	10.3187	0.0321	1.9418	0.0875	2.0293	0.5226	0.0806	0.6032	0.0000	2,288.3893	2,288.3893	0.0832	0.0000	2,290.1364
2024	0.0711	0.5980	0.8573	1.5400e-003	0.0226	0.0277	0.0503	6.0100e-003	0.0258	0.0319	0.0000	122.5359	122.5359	0.0315	0.0000	123.1977
Total	**1.0844**	**6.4240**	**13.8470**	**0.0392**	**2.2317**	**0.2476**	**2.4793**	**0.6124**	**0.2300**	**0.8423**	**0.0000**	**2,887.7395**	**2,887.7395**	**0.2312**	**0.0000**	**2,892.5954**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	19.7423	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**19.7423**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	19.7423	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**19.7423**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio-CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description

1	Demolition	Demolition	1/1/2021	2/3/2021	5	24	
2	Site Preparation	Site Preparation	2/4/2021	12/30/2021	5	236	
3	Grading	Grading	1/1/2022	12/31/2022	5	260	
4	Building Construction	Building Construction	1/1/2023	8/22/2023	5	167	
5	Paving	Paving	1/1/2024	11/14/2024	5	229	

Acres of Grading (Site Preparation Phase): 23.54998852

Acres of Grading (Grading Phase): 22.38722452

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Off-Highway Trucks	50	2.00	400	0.38
Paving	Cement and Mortar Mixers	4	6.00	9	0.56
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Grading	Concrete/Industrial Saws	1	8.00	81	0.73
Building Construction	Cranes	1	4.00	226	0.29
Building Construction	Forklifts	2	6.00	89	0.20
Site Preparation	Graders	1	8.00	174	0.41
Paving	Pavers	1	7.00	125	0.42
Paving	Rollers	1	7.00	80	0.38
Demolition	Rubber Tired Dozers	1	1.00	255	0.40
Grading	Rubber Tired Dozers	1	1.00	255	0.40
Building Construction	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Demolition	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Grading	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Paving	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Site Preparation	Tractors/Loaders/Backhoes	1	8.00	97	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	54	135.00	0.00	912.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	2	5.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Grading	4	10.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	5	1,738.00	678.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving	7	18.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0987	0.0000	0.0987	0.0149	0.0000	0.0149	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1002	0.8738	0.6363	2.1300e-003		0.0337	0.0337		0.0312	0.0312	0.0000	186.5164	186.5164	0.0586	0.0000	187.7473
Total	**0.1002**	**0.8738**	**0.6363**	**2.1300e-003**	**0.0987**	**0.0337**	**0.1324**	**0.0149**	**0.0312**	**0.0461**	**0.0000**	**186.5164**	**186.5164**	**0.0586**	**0.0000**	**187.7473**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	7.2600e-003	0.0827	0.0884	3.3000e-004	7.8200e-003	1.6700e-003	9.4900e-003	2.1500e-003	1.5300e-003	3.6800e-003	0.0000	28.5217	28.5217	2.3000e-004	0.0000	28.5265
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.8500e-003	5.5200e-003	0.0586	2.1000e-004	0.0178	1.2000e-004	0.0179	4.7200e-003	1.2000e-004	4.8400e-003	0.0000	13.5666	13.5666	5.9000e-004	0.0000	13.5790

Total	**0.0111**	**0.0882**	**0.1470**	**5.4000e-004**	**0.0256**	**1.7900e-003**	**0.0274**	**6.8700e-003**	**1.6500e-003**	**8.5200e-003**	**0.0000**	**42.0883**	**42.0883**	**8.2000e-004**	**0.0000**	**42.1055**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0987	0.0000	0.0987	0.0149	0.0000	0.0149	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1002	0.8738	0.6363	2.1300e-003		0.0337	0.0337		0.0312	0.0312	0.0000	186.5162	186.5162	0.0586	0.0000	187.7470
Total	**0.1002**	**0.8738**	**0.6363**	**2.1300e-003**	**0.0987**	**0.0337**	**0.1324**	**0.0149**	**0.0312**	**0.0461**	**0.0000**	**186.5162**	**186.5162**	**0.0586**	**0.0000**	**187.7470**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	7.2600e-003	0.0827	0.0884	3.3000e-004	7.8200e-003	1.6700e-003	9.4900e-003	2.1500e-003	1.5300e-003	3.6800e-003	0.0000	28.5217	28.5217	2.3000e-004	0.0000	28.5265
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.8500e-003	5.5200e-003	0.0586	2.1000e-004	0.0178	1.2000e-004	0.0179	4.7200e-003	1.2000e-004	4.8400e-003	0.0000	13.5666	13.5666	5.9000e-004	0.0000	13.5790
Total	**0.0111**	**0.0882**	**0.1470**	**5.4000e-004**	**0.0256**	**1.7900e-003**	**0.0274**	**6.8700e-003**	**1.6500e-003**	**8.5200e-003**	**0.0000**	**42.0883**	**42.0883**	**8.2000e-004**	**0.0000**	**42.1055**

3.3 Site Preparation - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0125	0.0000	0.0125	1.3500e-003	0.0000	1.3500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0971	0.9422	0.7951	1.1000e-003		0.0533	0.0533		0.0490	0.0490	0.0000	96.6637	96.6637	0.0313	0.0000	97.3202
Total	**0.0971**	**0.9422**	**0.7951**	**1.1000e-003**	**0.0125**	**0.0533**	**0.0658**	**1.3500e-003**	**0.0490**	**0.0504**	**0.0000**	**96.6637**	**96.6637**	**0.0313**	**0.0000**	**97.3202**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4000e-003	2.0100e-003	0.0214	8.0000e-005	6.4800e-003	5.0000e-005	6.5200e-003	1.7200e-003	4.0000e-005	1.7600e-003	0.0000	4.9409	4.9409	2.2000e-004	0.0000	4.9454
Total	**1.4000e-003**	**2.0100e-003**	**0.0214**	**8.0000e-005**	**6.4800e-003**	**5.0000e-005**	**6.5200e-003**	**1.7200e-003**	**4.0000e-005**	**1.7600e-003**	**0.0000**	**4.9409**	**4.9409**	**2.2000e-004**	**0.0000**	**4.9454**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0125	0.0000	0.0125	1.3500e-003	0.0000	1.3500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0971	0.9422	0.7951	1.1000e-003		0.0533	0.0533		0.0490	0.0490	0.0000	96.6636	96.6636	0.0313	0.0000	97.3201
Total	**0.0971**	**0.9422**	**0.7951**	**1.1000e-003**	**0.0125**	**0.0533**	**0.0658**	**1.3500e-003**	**0.0490**	**0.0504**	**0.0000**	**96.6636**	**96.6636**	**0.0313**	**0.0000**	**97.3201**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4000e-003	2.0100e-003	0.0214	8.0000e-005	6.4800e-003	5.0000e-005	6.5200e-003	1.7200e-003	4.0000e-005	1.7600e-003	0.0000	4.9409	4.9409	2.2000e-004	0.0000	4.9454
Total	**1.4000e-003**	**2.0100e-003**	**0.0214**	**8.0000e-005**	**6.4800e-003**	**5.0000e-005**	**6.5200e-003**	**1.7200e-003**	**4.0000e-005**	**1.7600e-003**	**0.0000**	**4.9409**	**4.9409**	**2.2000e-004**	**0.0000**	**4.9454**

3.4 Grading - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1097	0.0000	0.1097	0.0551	0.0000	0.0551	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0925	0.8315	1.0267	1.5600e-003		0.0435	0.0435		0.0416	0.0416	0.0000	135.8961	135.8961	0.0252	0.0000	136.4245
Total	**0.0925**	**0.8315**	**1.0267**	**1.5600e-003**	**0.1097**	**0.0435**	**0.1533**	**0.0551**	**0.0416**	**0.0967**	**0.0000**	**135.8961**	**135.8961**	**0.0252**	**0.0000**	**136.4245**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.9400e-003	4.1800e-003	0.0445	1.7000e-004	0.0143	1.0000e-004	0.0144	3.7900e-003	9.0000e-005	3.8800e-003	0.0000	10.7094	10.7094	4.6000e-004	0.0000	10.7190
Total	**2.9400e-003**	**4.1800e-003**	**0.0445**	**1.7000e-004**	**0.0143**	**1.0000e-004**	**0.0144**	**3.7900e-003**	**9.0000e-005**	**3.8800e-003**	**0.0000**	**10.7094**	**10.7094**	**4.6000e-004**	**0.0000**	**10.7190**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1097	0.0000	0.1097	0.0551	0.0000	0.0551	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0925	0.8315	1.0267	1.5600e-003		0.0435	0.0435		0.0416	0.0416	0.0000	135.8960	135.8960	0.0252	0.0000	136.4243
Total	**0.0925**	**0.8315**	**1.0267**	**1.5600e-003**	**0.1097**	**0.0435**	**0.1533**	**0.0551**	**0.0416**	**0.0967**	**0.0000**	**135.8960**	**135.8960**	**0.0252**	**0.0000**	**136.4243**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.9400e-003	4.1800e-003	0.0445	1.7000e-004	0.0143	1.0000e-004	0.0144	3.7900e-003	9.0000e-005	3.8800e-003	0.0000	10.7094	10.7094	4.6000e-004	0.0000	10.7190
Total	**2.9400e-003**	**4.1800e-003**	**0.0445**	**1.7000e-004**	**0.0143**	**1.0000e-004**	**0.0144**	**3.7900e-003**	**9.0000e-005**	**3.8800e-003**	**0.0000**	**10.7094**	**10.7094**	**4.6000e-004**	**0.0000**	**10.7190**

3.5 Building Construction - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0525	0.5325	0.5909	9.5000e-004		0.0266	0.0266		0.0245	0.0245	0.0000	83.2159	83.2159	0.0269	0.0000	83.7811
Total	**0.0525**	**0.5325**	**0.5909**	**9.5000e-004**		**0.0266**	**0.0266**		**0.0245**	**0.0245**	**0.0000**	**83.2159**	**83.2159**	**0.0269**	**0.0000**	**83.7811**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.3424	2.1096	5.0162	0.0121	0.3487	0.0495	0.3982	0.0995	0.0456	0.1451	0.0000	1,027.5823	1,027.5823	7.0600e-003	0.0000	1,027.7305
Worker	0.3130	0.4420	4.7116	0.0190	1.5932	0.0114	1.6045	0.4231	0.0106	0.4336	0.0000	1,177.5913	1,177.5913	0.0492	0.0000	1,178.6249
Total	**0.6555**	**2.5516**	**9.7278**	**0.0311**	**1.9418**	**0.0609**	**2.0027**	**0.5226**	**0.0561**	**0.5787**	**0.0000**	**2,205.1735**	**2,205.1735**	**0.0563**	**0.0000**	**2,206.3553**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0525	0.5325	0.5909	9.5000e-004		0.0266	0.0266		0.0245	0.0245	0.0000	83.2158	83.2158	0.0269	0.0000	83.7810
Total	**0.0525**	**0.5325**	**0.5909**	**9.5000e-004**		**0.0266**	**0.0266**		**0.0245**	**0.0245**	**0.0000**	**83.2158**	**83.2158**	**0.0269**	**0.0000**	**83.7810**

Mitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.3424	2.1096	5.0162	0.0121	0.3487	0.0495	0.3982	0.0995	0.0456	0.1451	0.0000	1,027.5823	1,027.5823	7.0600e-003	0.0000	1,027.7305
Worker	0.3130	0.4420	4.7116	0.0190	1.5932	0.0114	1.6045	0.4231	0.0106	0.4336	0.0000	1,177.5913	1,177.5913	0.0492	0.0000	1,178.6249
Total	**0.6555**	**2.5516**	**9.7278**	**0.0311**	**1.9418**	**0.0609**	**2.0027**	**0.5226**	**0.0561**	**0.5787**	**0.0000**	**2,205.1735**	**2,205.1735**	**0.0563**	**0.0000**	**2,206.3553**

3.6 Paving - 2024

Unmitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Off-Road	0.0669	0.5921	0.7940	1.2700e-003		0.0275	0.0275		0.0257	0.0257	0.0000	106.0458	106.0458	0.0308	0.0000	106.6935
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0669**	**0.5921**	**0.7940**	**1.2700e-003**		**0.0275**	**0.0275**		**0.0257**	**0.0257**	**0.0000**	**106.0458**	**106.0458**	**0.0308**	**0.0000**	**106.6935**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.2400e-003	5.9600e-003	0.0634	2.7000e-004	0.0226	1.6000e-004	0.0228	6.0100e-003	1.5000e-004	6.1600e-003	0.0000	16.4902	16.4902	6.8000e-004	0.0000	16.5044
Total	**4.2400e-003**	**5.9600e-003**	**0.0634**	**2.7000e-004**	**0.0226**	**1.6000e-004**	**0.0228**	**6.0100e-003**	**1.5000e-004**	**6.1600e-003**	**0.0000**	**16.4902**	**16.4902**	**6.8000e-004**	**0.0000**	**16.5044**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0669	0.5921	0.7940	1.2700e-003		0.0275	0.0275		0.0257	0.0257	0.0000	106.0457	106.0457	0.0308	0.0000	106.6933
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0669**	**0.5921**	**0.7940**	**1.2700e-003**		**0.0275**	**0.0275**		**0.0257**	**0.0257**	**0.0000**	**106.0457**	**106.0457**	**0.0308**	**0.0000**	**106.6933**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.2400e-003	5.9600e-003	0.0634	2.7000e-004	0.0226	1.6000e-004	0.0228	6.0100e-003	1.5000e-004	6.1600e-003	0.0000	16.4902	16.4902	6.8000e-004	0.0000	16.5044
Total	**4.2400e-003**	**5.9600e-003**	**0.0634**	**2.7000e-004**	**0.0226**	**1.6000e-004**	**0.0228**	**6.0100e-003**	**1.5000e-004**	**6.1600e-003**	**0.0000**	**16.4902**	**16.4902**	**6.8000e-004**	**0.0000**	**16.5044**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Total					

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.500282	0.057001	0.196753	0.152945	0.042333	0.006070	0.016337	0.017415	0.001474	0.002202	0.004129	0.000486	0.002572

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	19.7423	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	19.7423	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	4.7936					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	14.9487					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**19.7423**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	4.7936					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	14.9487					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**19.7423**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

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