



## *Statement of Qualifications*

**2013-14**



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# Professional Services

Tenera Environmental, with offices in Lafayette and San Luis Obispo, California, provides a range of environmental consulting services. Dr. David Mayer, the President of Tenera Environmental, has managed the company since its formation over 30 years ago. Our staff includes marine, freshwater, and terrestrial biologists, marine biofouling experts, mathematical ecologists, GIS analysts, biostatisticians, data analysts, hydroacoustic experts, and programmers.

Tenera Environmental offers expertise in the following areas:

- **Environmental Permitting**
- **Natural Resource Inventories**
- **Regulatory Compliance Review**
- **Impact Assessment and Mitigation Planning**
- **Research and Monitoring**
- **Data Management and Analysis**
- **Instrumentation Systems**

Much of our expertise is focused on the marine environment, in particular community ecology and vertebrate, invertebrate, and algal taxonomy, but we have also completed many terrestrial and freshwater projects. Our staff works with clients in a variety of industry and government sectors, including municipal and public utilities, chemical and petroleum industries, and local, state, and federal agencies.

## Goal

The goal of Tenera Environmental is to provide our clients with high quality environmental science for use in decision making and meeting their regulatory requirements. Our deliverables integrate the technical expertise of our scientists, technicians, and associates, many of whom are recognized experts in their fields, with the latest technologies, including GIS, instrumentation, real-time data acquisition, and advanced techniques in analysis, modeling, and information systems. Tenera's expertise in data management and analysis provides our clients accurate and timely reports with greater insights into their data. Our experience from years of working in environments requiring strict adherence to quality standards and procedures is applied to all of our projects and provides our clients with assurance that all of our deliverables meet similar high quality standards.



## Capabilities

The capabilities of Tenera Environmental can generally be categorized into three main areas:

- **Environmental Permitting and Regulatory Compliance**
- **Natural Resource Inventories**
- **Resource Restoration and Management**

While many of our projects can be categorized into one of these areas, we have also completed projects that require all of these capabilities. The services we have provided our clients in the utility industry have broadened to include other capabilities that are described in a separate section under:

- **Power Generation Support Services**

The three general categories and our power generation support services are discussed in more detail below and are followed by summaries of selected projects.

### ***Environmental Permitting & Regulatory Compliance***

Environmental permitting and regulatory compliance, especially for marine and freshwater habitats, is the core capability of Tenera Environmental. Many of our long-term clients rely on Tenera to provide assistance in NPDES permit renewals and we have been the consultant of choice to a major utility company on one of the largest NPDES marine monitoring studies ever conducted. Tenera principals have participated in workshops and given testimony before the State and Regional Boards on environmental issues related to the Clean Water Act and NPDES permitting. In addition to NPDES permitting at coastal facilities, we have been involved in obtaining permits for projects involving dredging and coastal construction and have worked with agency staff on biological surveys, construction monitoring, listed species, and essential fish habitat issues. Our permitting experience includes U.S. Fish & Wildlife Service Recovery Permits and Habitat Conservation Plans, California Coastal Commission Coastal Development Permit waivers, streambed alteration permits, and U.S. Army Corps of Engineers Section 10, and Section 404 nationwide and individual permits.

Tenera has completed numerous construction monitoring projects including developing monitoring plans and conducting pre-construction training for project personnel. These projects usually involved conducting protocol level surveys for listed species. We have also completed construction monitoring for several large fiber optic drilling projects. One of these projects involved coordinating monitoring activities at four sites in California.

### ***Natural Resource Inventories***

Tenera has over 25 years experience in conducting biological monitoring and assessments. Recognized as one of the leading groups of marine and coastal



ecosystem scientists on the Pacific coast, we provide our clients with experienced field teams, including diving scientists, for resource inventories, impact assessment, and monitoring programs. Although most of our larger projects have been in marine and estuarine environments, we have also completed projects in freshwater and terrestrial habitats, including comprehensive assessments that have included rare plants, special status wildlife, and general habitat descriptions. Many of these surveys have focused on listed species including San Joaquin kit fox, California red-legged frog, tidewater goby, southwestern pond turtle and South-Central California Coast/Southern California ESU steelhead. Other projects have been more focused on specific issues such as the effects of road construction or visitor use on marine intertidal communities. These projects benefit from our experience in designing and conducting field surveys, and in statistical analysis of data for impact analysis.

### ***Resource Restoration and Management***

Tenera has developed and assisted in the development of restoration plans at Morro and Toro creeks in San Luis Obispo County. These projects involved numerous agencies and stakeholders in the permitting process and coordinating the activities of several contractors working on the restorations. We have also been involved in monitoring restoration efforts at these and several other sites. Additionally, we have played major roles in developing large habitat restoration and enhancement programs related to mitigation for water withdrawals along the American River and impacts related to the power plant operations. These were large programs that included numerous components related to restoration, research, monitoring, and education. We have also been involved in similar efforts related to the Morro Bay National Estuary that included modeling efforts using Natural Resource Damage Assessment Habitat Equivalency Analysis (HEA) and ACOE Hydrogeomorphic Assessment (HGM).

Our long-term consulting agreement with a large West Coast utility has resulted in our involvement in their land stewardship and environmental education programs and that expertise has resulted in similar projects with other clients.



## Power Generation Support

Tenera Environmental has provided environmental support to the electric power industry for over 25 years. In addition to providing support in the areas listed previously, Tenera has completed projects and provided operational support to this industry in the following areas:

- **Study Design and Development**
- **Permitting Assistance**
- **Data Acquisition and Monitoring**
- **Thermal and Chemical Tolerance Studies**
- **Biofouling Investigations and Solutions**
- **Mitigation and Remedial Action Plans**
- **Kelp Control and Debris Management**
- **Intake Screening Technology**
- **Pump Performance Dye Testing**
- **Water Quality and Water Resource Studies**
- **Meteorological Forecasting and Reporting**
- **Land Stewardship**
- **GIS Management and Support**
- **Environmental Education**



## Technical Capabilities

Tenera Environmental has expertise in the following areas:

- **Coastal, Estuarine and Terrestrial Community Ecology**
- **Endangered Species Surveys, Habitat Conservation Plans, and Consultations**
- **Biological and Fishery Survey Design**
- **Larval Fish/Eggs, Zooplankton and Phytoplankton Sampling and Sample Processing**
- **Larval Fish/Eggs, Zooplankton and Phytoplankton Taxonomy**
- **Scientific Diving Operations**
- **Nearshore Vessel Operations and Support**
- **Instrumentation**
- **Hydroacoustics for Fishery and Hydrographic Surveys**
- **Geographic Information Systems (GIS)**
- **Computer Programming**
- **Database Analysis and Administration**
- **Statistical Analysis**
- **Mathematical Modeling**



## Staff Summaries

The capabilities of senior staff scientists, including the President of Tenera Environmental, Dr. David L. Mayer, are summarized below. Complete resumes of these and other Tenera employees are available upon request.

**David L. Mayer, Ph.D.** *President / Principal Scientist* — Dr. Mayer has over 35 years of experience in environmental consulting specializing in studies of marine and freshwater systems. He has extensive experience in the areas of aquatic temperature and flow regimes, and their effects on ecological systems, beginning with his doctoral research analyzing and modeling the relationships of water temperatures and hydrodynamics on aquatic communities. He has also provided similar expertise and experience in research and problem solving to freshwater issues associated with water intake location, screening technology, and discharge effects. He has provided expert witness testimony in formal agency hearings and workshops on the results of water quality, thermal and ecological modeling. Dr. Mayer has been involved in a number of Natural Resources Damages Assessment (NRDA) actions in both marine and freshwater settings. Dr. Mayer presently directs a group of scientists and staff who provide contract services of environmental monitoring and assessments for power plants, desalination facilities, water districts, and coastal resource agencies.

**John R. Steinbeck** *Vice President / Principal Scientist* — Mr. Steinbeck has over 20 years experience as a professional environmental scientist. For the past 10 years he has been the principal investigator and manager for the environmental monitoring conducted at the Diablo Canyon Nuclear Power Plant by Tenera under contract to Pacific Gas and Electric Company. This program is one of the largest long-term environmental monitoring programs ever conducted in the United States. Mr. Steinbeck combines a broad background of involvement in field and laboratory biology with extensive experience in data analysis and data management. He is also involved in biological and oceanographic field monitoring, and maintains primary responsibility for the maintenance and design of all data management, analysis and reporting. He also provides study design and statistical analysis support for many of Tenera's projects. He has testified in formal agency hearings and workshops on water quality issues, study design, and thermal and ecological modeling.

**John B. Hedgepeth, Ph.D.** *Project Scientist / Fisheries Biologist* — Dr. Hedgepeth has been involved in fisheries and acoustics studies worldwide. He joined Tenera Environmental in 1998 to assist in statistical and fish population dynamics analyses, and fisheries population and hydroacoustic studies. Recent projects include design and implementation of an acoustical salmon feeding monitor for the Chilean aquaculture industry and active tracking sonar for assessing juvenile salmon behavior in the approaches to dam bypass structures on the Snake and Columbia rivers. Dr. Hedgepeth has designed automated acoustical systems for measuring fish passage and for robotically controlling bypass gates at hydroelectric dams. Recent work includes acoustic surveys of fishes near power plant intakes, population inventories using split-beam hydroacoustics, and modeling thermal discharge plumes from coastal power plants.



**Christopher P. Ehrler** *Project Scientist / Manager* — Mr. Ehrler has worked as an environmental consultant for the past 35 years, conducting a variety of ecological studies in the intertidal and subtidal zones of marine, estuarine, fresh water, and terrestrial habitats. The majority of his work experience relates to the impacts caused by thermal discharges and the operation of power plant cooling water intake systems. He has been involved with all aspects of study design, field sampling, laboratory processing, data interpretation, and reporting. He has worked with the taxonomy of larval fishes all along the California coast for the last 21 years and on the island of Oahu for the past 6 years. He has worked extensively with larval rockfish (*Sebastes*) identification including a study using DNA analysis to confirm larval rockfish identity and a study of larval fish aging based on increments on larval otolith. He also helped implement TENERA Environmental's laboratory QA/QC program. As Project Manager, he has managed a large number of personnel and worked directly with a variety of federal, state, and local agencies, and public interest groups. He has also completed a number of projects related to NPDES stormwater issues including development of Stormwater Management Plans (SWMP) under the Municipal Stormwater General Permit and Storm Water Pollution Prevention Plans (SWPPP) under the Industrial Permit. He is a member of the Central Coast Partners for Water Quality and the San Luis Obispo Countywide Hydromodification Technical Advisory Committee. These and other experiences have given him an understanding of regulatory processes, compliance issues, and agency protocols.

**R. Scott Kimura** *Project Scientist / Manager* — Mr. Kimura has a broad base of experience as a marine ecologist conducting applied studies in the environmental sciences. His roles and responsibilities range from principal investigator and program manager to assisting in the field studies. In addition to his knowledge and background in project planning and implementation, his educational and practical experience in writing, technical editing, graphics, and report production add to the skills necessary to ensure projects are completed effectively, from planning phases to submittal of deliverables. Besides being an authority on the marine algae of the West Coast, Mr. Kimura specializes in assessments of visitor use and construction impacts on shoreline resources, invasive species surveys, and coastal resource mapping. He works closely with local agencies to apply research findings to improve resource management.

**Fredric L. Steinert** *Senior Scientist / Biofouling Control Specialist* — Mr. Steinert has more than 30 years of experience in the environmental field as a Marine Biologist and Biofouling Control Specialist. His responsibilities have included the development, implementation and management of programs for the control of macrofouling and microfouling organisms at several power production facilities including P.G. & E.'s Diablo Canyon Power Plant and Duke Energy's Moss Landing Power Plant. He is recognized as an expert in this field. Mr. Steinert has also conducted laboratory research into the physiological and ecological responses of marine organisms to power plant influences. He has extensive field experience as an Ichthyologist and Ecologist. His qualifications include a thorough knowledge of power plant and seawater system design and operation, and comprehensive experience in dealing with the federal, state and local agencies and the regulations that govern a facility's interaction with the environment.



**Jay C. Carroll** *Senior Marine Biologist* — Mr. Carroll has over 30 years of professional experience as a consulting biologist and has participated in several environmental monitoring programs for Pacific Coast utility companies, state and federal agencies, and various industrial clients. His responsibilities in these studies have included project management, marine and estuarine quantitative surveys of benthic invertebrates and fish populations, water quality sampling, larval fish and invertebrate identification, and associated data analysis and reporting. Mr. Carroll has performed over 3,500 hours of underwater scientific observations during these field studies and serves as diving officer for Tena Environmental. He has participated in intertidal biological surveys in support of studies on visitor use impacts, shoreline discharges, and potential oil spills at numerous locations throughout central and southern California. Mr. Carroll has authored and edited environmental reports and has served as a reviewer for journal publications and grant applications.

**Daniel S. Dugan** *Aquatic Biologist / Senior Scientist* — Mr. Dugan has more than 17 years experience in the field of environmental sciences, serving as both an environmental consultant and a representative of state and federal agencies. He has a diverse background that includes training and experience in the fields of aquatic and terrestrial biology, environmental law, and research/commercial diving. Mr. Dugan has participated in scientific studies of populations of marine mammals, seabirds, fishes (offshore, nearshore, estuarine, and anadromous), reptiles, amphibians, marine invertebrates, and terrestrial mollusks. His recent projects include biological surveys of coastal stream and riparian systems, estuaries, marine habitats (intertidal, subtidal, and pelagic), sandy beaches, terrestrial habitats, and offshore oil platforms. Mr. Dugan focuses on services related to compliance with NEPA, the Federal Endangered Species Act, Clean Water Act, CEQA, and other state and local environmental regulations. Mr. Dugan currently serves as a project manager and lead Tena biologist for a variety of projects involving endangered species surveys, habitat assessments, wildlife surveys, and wetland delineations.

**Barbie Dugan** *Wildlife Biologist / Senior Scientist* — Ms. Dugan has a broad educational background including significant course work in Business Management, Biological Sciences, Wildlife Conservation, and Biochemistry. She has worked in the environmental field for over ten years, including eight years in California's anadromous salmonid fishery. Her experience encompasses conducting biological assessments, surveys, and monitoring in coastal stream and riparian systems, estuaries, marine habitats, sandy beaches, and offshore island habitats. She has participated in a range of projects (censusing, tagging, surveying, care and rehabilitation, training) involving a diversity of wildlife species (e.g., terrestrial and marine mammals, shorebirds and seabirds, raptors, amphibians, reptiles, mollusks, and salmonids) including work with rare, threatened, and endangered species. Ms. Dugan has several years of Project Management experience involving multi-agency interactions with private firms, non-profits organizations, government agencies, and academia. She has authored a variety of environmental documents and technical reports.



## Tenera Environmental – Partial Client List

AES Corporation  
Avila Beach Community Services District  
Balearic Government Spain/TRAGSA  
Battelle, Pacific Northwest Division  
Bureau of Ocean Energy Management (formerly MMS)  
California Department of Fish and Game  
California State Coastal Conservancy  
California Department of Transportation  
Cambria Community Services District  
Chevron, U.S.A.  
City of Arroyo Grande  
City of Morro Bay  
City of San Luis Obispo  
Contra Costa Water District  
County of Santa Barbara Energy Division  
County of San Mateo Parks and Recreation Division  
Duke Energy Services  
Dynegy  
East Bay Municipal Utilities District  
Electric Power Research Institute (EPRI)  
Guam Power Authority  
Gulf of the Farallones National Marine Sanctuary  
Hawaiian Electric Company  
Los Osos Community Services District  
Mirant Corporation  
Monterey Bay National Marine Sanctuary  
Morro Bay Harbor District  
Morro Bay National Estuary Program  
National Marine Fisheries Service  
NRG Energy, Inc.  
Pacific Gas and Electric Company  
Poseidon Resources  
Port San Luis Harbor District  
Port of Oakland  
Santa Barbara Flood Control District  
Science Applications International Corporation (SAIC)  
TetraTech, Inc.  
The Nature Conservancy  
URS Corporation  
U.S. Coast Guard  
U.S. Fish and Wildlife Service  
U.S. Generating Company  
U.S. Geological Survey  
Utilities Water Act Group



# Permitting and Regulatory Compliance

## 316(a) Thermal Effluent Exemption Studies – Diablo Canyon Power Plant

*Pacific Gas and Electric Company  
Avila Beach, California*

Tenera Environmental has completed studies required to obtain a Federal Clean Water Act 316(a) exemption from thermal effluent limitations for the Diablo Canyon Power Plant. To support the successful application for a National Pollutant Discharge Elimination System (NPDES) permit, Tenera designed and implemented a program of comprehensive marine biological and oceanographic studies that remains one of the most extensive on the West Coast. The program included both subtidal and intertidal field studies to identify and enumerate fishes, invertebrates, surfgrasses, and algae to detect changes in their distribution and abundance in areas influenced by the thermal effluent. Tenera provides project management and support on a variety of associated tasks including database management, quality assurance and quality control, laboratory research on thermal effects, reporting and negotiations with the Regional Water Quality Control Board, and expert witness testimony. The final report submitted in 1997 evaluated discharge effects on hundreds of species of marine algae, invertebrates, and fishes. The report also summarized abundance data for over 800 taxa observed during the 21-year study period.



## Larval Entrainment – Pittsburg and Contra Costa Power Plants

*Pacific Gas and Electric Company  
Pittsburg and Antioch, California*

Tenera designed and conducted a real-time monitoring program to estimate the entrainment of larval and juvenile striped bass at Pittsburg and Contra Costa steam generation power plants. This work was required by the two plants' NPDES permits and under agreement with the California Department of Fish and Game. Plankton samples were collected at the discharges of the power plants either twice weekly or daily. Larval fishes were sorted and identified, and these data were combined with daily power plant operations data to optimize plant operations for minimizing fish losses. The entrainment density data were also used in a striped bass mortality model that was designed to estimate the losses of equivalent adult striped bass. An extensive quality assurance/quality control program was also an important component of the monitoring program. Tenera prepared the plant's yearly monitoring reports that were submitted to the administering agency.



### 316(b) Demonstration Study – Diablo Canyon Power Plant

*Pacific Gas and Electric Company, Avila Beach, California*

Tenera conducted entrainment and impingement studies to fulfill requirements of the Federal Clean Water Act Section 316(b) for determining whether the design of the intake structure represented the best technology available for minimizing adverse environmental impacts. This project consisted of collecting, identifying, and enumerating larval fishes and selected invertebrates to estimate their losses in the cooling water intake system. Tenera collaborated with the client, the Regional Water Quality Control Board, the California Department of Fish and Game, and a panel of experts from the scientific and academic community to design the study and sampling protocols and to review the statistical approaches for assessing impacts.



Tenera designed and implemented an innovative proportional withdrawal modeling approach to assess entrainment losses while also applying more traditional adult equivalent loss approaches. The application of this approach to an open ocean system and its intensive scrutiny by the panel made this a unique foray into the field of assessing entrainment losses. Tenera staff conducted all:

- Field sampling operations
- Laboratory processing
- Taxonomic identification of larval fishes and invertebrates
- Data management
- Statistical analyses
- Report preparation

### Impingement Monitoring – Morro Bay and South Bay Power Plants

*Duke Energy North America*

*Morro Bay and San Diego, California*

Tenera designed and conducted an impingement study at the Morro Bay and South Bay Power Plant's intake structure. Sampling was conducted once per week over a continuous 24-hour period for a period of one year. All impinged organisms were removed from the debris and identified. All fishes, crabs, shrimps, and cephalopods were measured and weighed. The data collected in these surveys were used to estimate the annual losses of impinged organisms.



## Impingement Monitoring – Pittsburg and Contra Costa Power Plants

*Pacific Gas and Electric Company  
Pittsburg and Antioch, California*

Tenera conducted NPDES required impingement studies at two Sacramento-San Joaquin Delta steam generation plants. Impingement monitoring occurred at least once per month over a continuous 24-hour period for several years. All fishes were removed from the impinged material and were identified, measured, and weighed. The data were used in combination with the plants' operating data to estimate annual losses of fishes resulting from impingement.

## Desalination Plant – Permitting, Impingement and Entrainment Monitoring

*Poseidon Resources, Inc.  
Encina Power Station, Carlsbad, California*

*West Basin Municipal Water District  
Carson, California*

California's ever increasing need for drinking water is rapidly outstripping the limited freshwater resources that are available. This has led to the consideration of alternative freshwater sources including the use of desalination to extract freshwater from brackish or saltwater sources. Tenera has conducted environmental studies associated with the permitting and operation of such facilities including Poseidon Resources' project at the Encina Power Station in Carlsbad California, and West Basin Demonstration Desalination Project in Redondo Beach California.

*Santa Cruz Water Department and Soquel Creek Water District  
Santa Cruz, California*

*DeepWater Desal  
Moss Landing, California*

Tenera designed and implemented a sampling program to model potential impacts from a proposed desalination facility seawater intake, and tested the effectiveness of a narrow-slot wedgewire screening device to minimize entrainment and impingement impacts. Operational characteristics of the screening system and fish behavior in relation to screen flows were studied using an underwater video system. Tenera worked closely with a technical advisory panel to address agency concerns about potential marine resource impacts.



## Application for Certification Studies – Morro Bay Power Plant Sand Beach Faunal Characterization and Impact Analysis

*Duke Energy North America  
Morro Bay, California*

Tenera conducted a habitat characterization of the Morro Strand State Beach in support of the California Energy Commission’s Application for Certification studies for Morro Bay Power Plant. Over 200 core samples were collected in an orthogonal sampling design covering the entire range of intertidal levels up to 3,000 m from the thermal discharge. Sediment samples were also collected at each station to correlate grain size distribution with infaunal community characteristics. In accordance with Tenera laboratory procedures, samples were preserved, invertebrates sorted and identified, and quality control checks were implemented. The analysis, in combination with thermal plume modeling studies, provided evidence the power plant discharge did not significantly affect sand beach faunal resources.

## Subtidal Benthic Faunal Characterization, Sediment and Water Quality

*Chevron, Gaviota, California; and  
Duke Energy North America,  
Morro Bay and San Diego Bay, California*

Tenera Environmental designed and implemented soft-bottom subtidal benthic surveys to assess the distribution and population characteristics of benthic invertebrate populations. Both diver-operated and shipboard sampling devices were used, depending on depths, sediment characteristics, and other conditions. In one study, Tenera conducted a receiving water monitoring study to comply with an



oil processing plant’s NPDES permit requirements. Investigations included diver-collected sediment and benthic infauna samples at the refinery’s diffuser outfall stations. Benthic sediments were analyzed for heavy metal contamination and benthic infaunal invertebrates were identified and quantified. In another study, benthic core samples were collected in the shallow subtidal zone in support of the California Energy Commission’s Application for Certification process for the Morro Bay Power Plant. Benthic faunal samples from both studies were processed in Tenera’s benthic sorting and identification laboratory using stringent quality control procedures.



## **Biological Surveys and Monitoring of the Shell/SEPCO Flowline Abandonment Project at Arroyo Hondo Creek (Santa Barbara Co.)**

*Padre Associates, Inc.  
Santa Barbara, California*

Tenera conducted biological surveys and construction monitoring for a natural gas pipeline removal project located adjacent to and within a small estuarine lagoon at the mouth of Arroyo Hondo Creek, Santa Barbara County. Tenera performed pre-activity surveys of the lagoon for special status species prior to initiation of construction activities. Two federally listed endangered fish species, southern California ESU steelhead and tidewater goby, were documented in the lagoon during pre-construction surveys. California red-legged frogs and two-striped garter snakes were identified during daily pre-activity surveys of the lagoon. Tenera biologists were authorized by the USFWS to capture and move California red-legged frogs and their larvae to ensure no individuals were harmed or otherwise adversely impacted.

## **Fish Monitoring and Consulting Support for Contra Costa Water District**

*Contra Costa Water District  
Concord, California*

Since 2003 Tenera has been conducting fish monitoring at the Rock Slough Headworks, Pumping Plant #1, Old River Intake, and Mallard Slough Intake for the Contra Costa Water District as required by the U.S. Fish and Wildlife Service in their 1993 Biological Opinion on the Formal Consultation on Effects of the Proposed Los Vaqueros Reservoir Project on Delta Smelt. Tenera has collected nearly 1,400 sieve net and plankton samples during the study, and submitted biweekly and annual reports for review by water district staff before submittal to federal and state agencies. As a result of the study, Tenera scientists have developed solid working relationships with key staff members of the California Department of Fish and Game (CDFG), U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), as well as with other state and federal entities such as Bureau of Reclamation (Reclamation) and Department of Water Resources (DWR).

In addition to our fish monitoring, we have also provided consulting services for many other CCWD projects. We assisted CCWD by writing a Biological Resources Report (2005) that was used to begin discussions with the agencies during the initial phases of the Canal Replacement Project. We conducted surveys of the birds utilizing the entire 4-mile section of the unlined Canal. We provided descriptions of the special status fish species that may occur in the Canal, which included legal status, current population information, and information regarding designated critical habitat and essential fish habitat, and an assessment of the effects of the project on fishes and their habitat. We developed and described a fish moving and fish rescue plan to be implemented prior to dewatering sections of the Canal. This project was approved by CDFG, NMFS, and USFWS; Tenera completed the first phase of fish moving in the section of the Canal from Marsh Creek to Pumping Plant #1 prior to postponement of the project. In 2008, Tenera recently completed a California Environmental Quality Act (CEQA) Mitigated Negative Declaration report for CCWD's aquatic weed

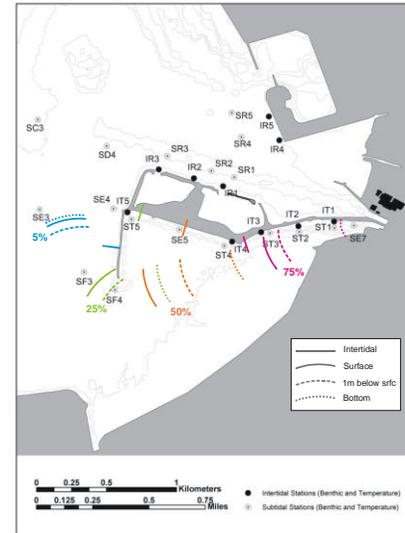


control program for the application of a fluridone-based herbicide. A draft Biological Assessment for CCWD’s aquatic weed control program, prepared largely by Tenera, is currently under review.

### 316(a) Thermal Discharge Modeling – South Bay Power Plant

*Duke Energy  
San Diego, California*

As part of a 316(a) EPA study in South San Diego Bay in 2003, Tenera monitored water temperatures to describe the dispersal, and model the extent, of the thermal plume originating from the South Bay Power Plant. Warm water from the power plant, which is less dense than the receiving water, generally floats to the bay surface, except in the discharge channel area where turbulent mixing and flow volumes can cause it to contact the bottom. Tenera used 21 subtidal and 10 intertidal temperature monitoring stations near SBPP to provide a detailed description of plume characteristics under various conditions. Temperature excursion modeling analyzed temperature as a function of distance from the discharge. The duration and frequency of temperature exposure was studied using the accumulated temperature data from each station for a variety of elevated temperatures ranging from 79–100°F.



### Coastal Construction Permitting

*DeGarimore Properties, Inc.  
Morro Bay, California*

Tenera acted as the client’s agent in obtaining a Coastal Development Permit waiver from the California Coastal Commission for the reconstruction of a wharf in Morro Bay. We interfaced with numerous agencies including the City of Morro Bay, Morro Bay Harbor Office, Fish and Game, California Coastal Commission, RWQCB, U.S. Army Corps of Engineers (ACOE), U.S. Fish and Wildlife, and National Marine Fisheries Service in obtaining ACOE permits for the project and addressing concerns related to Section 10 of the Rivers and Harbor Act, and Section 404 of the Clean Water Act.

### Environmental Monitoring at AT&T’s Manchester Beach / Japan — U.S. Fiber Optic Cable Project

*Science Applications International Corporation  
Manchester Beach, California*



Tenera Environmental fielded a team of scientists to conduct environmental monitoring at Manchester State Beach, California of horizontal direction drilling operations for landing fiber optic cables. The land-based rig drilled a continuous hole under the beach that exited the ocean bottom in approximately 10 meters water depth. Tenera was responsible for acquisition, mobilization, and maintenance of an array of equipment for the purpose of detecting accidental drilling mud release. Tenera scientists simultaneously conducted shoreline and ship-based monitoring using state-of-the-art fluorometry and water sampling techniques.

## Initial Biological Report and Wetland Delineation

*Albright Ranch  
Morro Bay, California*

This study was conducted by Tenera biologists to provide planners and responsible agencies with the biological information they require to make determinations about the feasibility and potential impacts of the proposed construction activities. Both a literature review and field surveys were conducted to determine the habitat types and wildlife species either present or potentially present on this 20-acre parcel. The report discussed the assemblages of plant and wildlife species typical of annual grassland, ruderal habitats (disturbed), and ephemeral and disturbed aquatic habitats on the project site in Chorro Valley. The report also included an assessment of the condition of the existing in-stream and riparian habitats and a delineation of wetland areas (using methods outlined in the 1987 U.S. Army Corps of Engineers Wetlands Delineation Manual) adjacent to the proposed creek crossing. Potential mitigation measures for this project were also discussed, including enhancements to wetland habitats and improving habitat value for California red-legged frogs.

## Global West Network, Inc. Fiber Optic Cable Landings

*Science Applications International Corporation  
Four sites in California*

The Global West Network, Inc. landed six cables at four sites in central and southern California. Tenera Environmental, under sub-contract to SAIC worked together with the construction design firm, the independent third party monitors representing state and regulatory agencies, and the drillers to complete this expansive project. Tenera Environmental fielded several complete monitoring teams, simultaneously staffing up to three boring sites across the state. Tenera used state-of-the-art fluorometry and water sampling techniques from shore and from a ship-based platform to detect Rhodamine WT in the water in the case of accidental drilling mud releases. During accidental drilling mud releases, Tenera SCUBA divers were employed to map the extent of the spill, document it using underwater video, and assess any impacts to the habitat near the point of release.



## Coastal Stream, Riparian Habitat, Endangered Species Surveys & Construction Monitoring Services

### *Various Clients*

*San Luis Obispo County and Santa Barbara County, California*

Tenera has provided a number of services to clients who are in need of biological consultation on a variety of issues. These have included field surveys to assess habitat quality and utilization by listed and special status species such as the California red-legged frog, steelhead, tidewater goby, southwestern pond turtle, two-striped garter snake, brown pelican, gray whales, sea otters, and peregrine falcons. Tenera has also provided clients with qualified biological monitors, training for work crews in endangered species awareness and procedures, and assistance with project permitting. Final survey reports include an extensive literature review, an analysis of the potential biological impacts of a project, and suggestions for alternatives and mitigation when required. Projects have included stream bank erosion control, in-stream and riparian habitat restoration, pipeline removal and replacement, road improvement and repair, development of housing subdivisions and commercial properties, and NPDES permitting, monitoring, and reporting.



## Striped Bass Monitoring Program at Pittsburg and Contra Costa Power Plants

### *Pittsburg, California*

*Pacific Gas & Electric Company & Mirant Delta LLC*

Tenera designed and conducted a real-time monitoring program to estimate the entrainment of larval and juvenile striped bass at Pittsburg and Contra Costa steam generation power plants located on the Sacramento-San Joaquin Delta. This work was required by the plants' NPDES permits and under agreement with the California Department of Fish and Game. Plankton samples were collected, sorted and identified, and these data were combined with daily power plant operations data to optimize plant operations for minimizing fish losses. The entrainment density data were used in a model to estimate the losses of equivalent adult striped bass. Tenera prepares the plants' yearly monitoring reports that are submitted to the Regional Water Quality Control Boards.



**Additional Permitting and Regulatory Compliance Studies include:**

- **Dredge Spoil Monitoring** – Port San Luis Harbor District – *Avila Beach, California*
- **NPDES Sediment Sampling and Analysis** – *Duke Energy Morro Bay, LLC. – Morro Bay, California*
- **Thermal Plume Modeling Verification and Mapping** – *Duke Energy Moss Landing, LLC – Moss Landing, California*
- **Water Quality Modeling, Analysis, and Expert Witness Testimony** – *East Bay Municipal Utilities District – Oakland, California*
- **Member of the Interagency Ecological Program’s Estuarine Ecological Team** – *San Francisco, California*



# Natural Resource Inventories

## Biological Impacts of Oil Spill Beach Clean-up Technologies

*National Oceanic and Atmospheric Administration  
Seattle, Washington*

Oil released from the grounded tanker Exxon Valdez in 1989 covered more than 400 miles of shoreline in Prince William Sound, Alaska. Tenera has been involved in projects associated with the initial spill assessment and various aspects of recovery. We conducted field studies to determine the nature of additional impacts on marine shoreline biological communities that resulted from the various beach treatment clean-up methods utilized in the oil spill remediation. Changes in the condition of the marine communities resulting from hot and cold water beach washes were studied by sampling representative plots permanently sited on rocky and cobble shores in wave exposed and protected sites.



## Natural Resource Damage Assessments: Data Management and Logistics

*California Department of Fish and Wildlife  
Sacramento, California*

Responding to oil spills can become an overwhelming task that can overburden resource agency staff and office capabilities. Accordingly, Tenera recently contracted with the California Department of Fish and Wildlife (formerly Fish & Game) Office of Spill Prevention and Response (OSPR) to provide on-call assistance in Natural Resource Damage Assessments for oil spills affecting the nearshore marine environment. Responsibilities and services include assisting OSPR in coordinating through the Incident Command Unit the deployment of qualified field teams for data collections, helping to provide the sampling equipment and logistics support, managing the data and analysis, assisting in preparing report deliverables, managing subcontractors that are brought onto the team, and overseeing all of the associated administrative duties of tracking the labor and equipment for project invoicing and accounting.



## Resource Assessments of Nearshore Ecosystems in California

*California Department of Fish and Game  
Monterey, California*

Tenera participated in surveys and analyzed all fish and invertebrate data from 88 sampling sites in central and southern California kelp forests. The data were collected by 75 research divers at six institutions in support of the Marine Life Management Act administered by the Resources Agency of the State of California. Tenera validated the data, developed analysis programs



in SAS, and produced a report of analysis results describing spatial distributions and multivariate relationships for 83 species of fishes and 60 species of invertebrates. The information is used to evaluate the effectiveness of marine protected areas, and adds to a growing database of information on nearshore species that has been developed by other long-term ecological studies such as the Channel Islands NPS kelp forest monitoring study.

## Impacts to Intertidal Communities from Cliff Sedimentation and Coastal Landslides

*California Department of Transportation  
San Luis Obispo, California*

The shoreline along Highway 1 on the Big Sur coast is at constant risk of damage from cliff erosion and landslides. Tenera worked with Caltrans to determine the potential impacts to marine intertidal and subtidal communities in these areas from sedimentation and to assess their recovery potential once they have been



affected. We have completed studies of biological communities in areas where the intertidal zone can be subjected to side casting of slide material. We are also conducting subtidal surveys that utilize side-scan sonar and hydroacoustics to map the distribution of subtidal habitats that could be affected by sedimentation from the slide material. These mapping techniques are especially useful on projects where the size of the area or diving conditions limit our ability to use standard underwater survey methods. They also allow us to focus more detailed survey efforts using SCUBA to areas and habitats at highest risk.



## Arroyo Burro Lagoon Aquatic Survey

*URS Corporation  
Santa Barbara, California*

The objective of this study was to characterize the aquatic habitat and assess the fish species present in the vicinity of a proposed restoration site in the Arroyo Burro Lagoon. The lagoon was surveyed using stream bank and underwater fish sampling techniques adapted from the *California Salmonid Stream Habitat Restoration Manual*. The soil and rip-rap composition and the species of vegetation around the perimeter of the lagoon were documented as were the water temperature and salinity throughout the lagoon. Although larval and adult tidewater gobies were found during the surveys of the lagoon, no steelhead were observed. The final report presented suggestions for improvements to the lagoon habitat that would enhance or restore features of the upper estuary for steelhead. These included efforts to limit erosion, reduction of barriers to fish passage, and restoration of native canopy trees to the site.

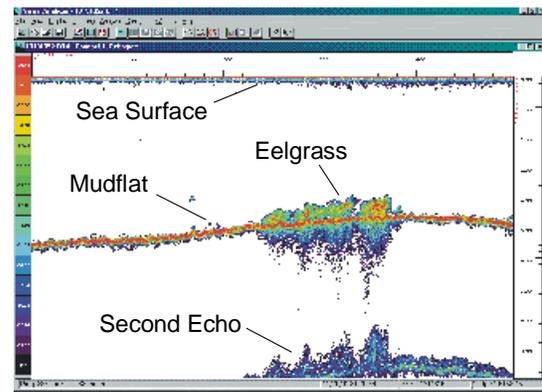
## Eelgrass Surveys

*Corona Del Mar, San Pedro, and Morro Bay, California*

Tenera has completed several eelgrass surveys for waterfront construction and dredging projects in California. Eelgrass surveys were conducted for the U.S. Coast Guard for permitting facility expansions in Corona Del Mar, San Pedro, and Morro Bay, California.

While the surveys are generally conducted by divers using SCUBA, we have also used

hydroacoustic sounders for aquatic vegetation mapping. Hydroacoustic surveys are especially useful in mapping project areas that may be too large to be effectively surveyed using divers or in conditions where visibility or other factors limit the effectiveness of divers. The hydroacoustic surveys are conducted using a differentially corrected geographic positioning system rover, base unit, and navigation software so the data from the echosounder can be geographically referenced and analyzed using GIS. The mapping technique includes a pattern recognition procedure that visually scans the digital echogram images to distinguish eelgrass from other bottom types.



Echogram of eelgrass from hydroacoustic survey.



## Biological Surveys and GIS mapping of the Irish Hills Ecological Area

*City of San Luis Obispo  
San Luis Obispo, California*

Tenera conducted a survey of the biological resources of the Irish Hills Ecological Area that will be used by resource managers to develop a comprehensive management plan for the area. The main focus of the study was on special status and sensitive wildlife species (birds, reptiles, amphibians, mammals, and invertebrates) listed in the California Natural Diversity Database. Plant species and other animals observed during the surveys will also be documented. A GIS map layer will be generated for each vegetative community encountered on the site that has not been previously identified.

## Chorro Creek Ecological Reserve Instream Surveys

*Coastal San Luis Resource Conservation District  
USDA Natural Resources Conservation Service  
The Bay Foundation of Morro Bay  
Morro Bay, California*

Tenera conducted surveys of approximately 1.5 miles of the main stem of Chorro Creek located within the Chorro Creek Ecological Reserve (CCER) in western San Luis Obispo County. The surveys were conducted as part of an environmental baseline of the CCER needed for development of an Interim Management Plan for the area. Chorro Creek, its tributaries, and associated riparian corridors provide habitat for the federally threatened South-Central California Coast DPS steelhead and the California red-legged frog. The objectives of the surveys were to provide an assessment of existing instream habitat and describe the relative distribution and abundance of juvenile steelhead (and occurrence of other species) throughout the surveyed reach of Chorro Creek. Pool habitats within the reach were mapped and described, and steelhead abundance was estimated using direct observation (snorkeling) methods.

## Guadalupe Oil Field Diluent Spill Study

*California State Coastal Conservancy  
Guadalupe, California*

Tenera was contracted by the California State Coastal Conservancy to review study designs, monitor ongoing remediation efforts, and collect site-specific ecological data in support of a Natural Resources Damage Assessment of the UNOCAL Guadalupe Oil Field diluent spill. Input from Tenera scientists was used to develop and refine sampling protocols for the assessment. Tenera personnel assessed impacts to sandy beach biota and nearshore subtidal invertebrates and fishes resulting from chronic diluent releases. Studies included implementation of a tag and recapture study on recreationally important fishes in the vicinity of the spill site to document hydrocarbon bioaccumulation.



## Integration of Smolt Position and Environmental Variables

*US Army Corps of Engineers  
Dalles Dam, Washington*

Tenera worked with BioSonics and BioAnalysts to acquire, merge, and analyze three-dimensional data sets of fish position and environmental variables at the Dalles Dam. This included acquiring and merging fish position data from a sonar tracker with hydraulic data from a computational fluid dynamics model and real-time velocity data from an acoustic doppler current profiler. The data was used to determine statistical associations between three-dimensional fish movements and environmental variables (e.g., water velocity, water acceleration, water depth, distance from dam, location along dam, day/night).

## Visitor Use Impact Evaluation

*Monterey Bay National Marine Sanctuary  
Pacific Grove, California*

Point Pinos, located in Pacific Grove on the Monterey Peninsula and within the Monterey Bay National Marine Sanctuary, is one of the most popular areas in California for visiting the shoreline. Its rich diversity of biological communities combined with ease of access makes the area an ideal attraction for tidepoolers, educators, and research scientists. The City of Pacific Grove has raised concern



that the marine biota of the Point Pinos shoreline is becoming degraded as a direct result of increasing numbers of tourists and educational institutions visiting the shoreline. Tenera Environmental completed field studies to support an objective assessment on visitor use and consequential effects on the Point Pinos marine biota. We also used volunteers of BayNet to complete the visitor census surveys and questionnaires, and developed a student intern project for a Moss Landing Marine Laboratory student to supplement our studies. The integrated results of the study explained how visitor use is potentially affecting the Point Pinos intertidal zone (magnitude and extent) and what biological assemblages are at greatest risk. The quantitative evaluation will be used as a baseline for developing a resource stewardship management policy and program for Point Pinos.



## Fitzgerald Marine Reserve Resource and Visitor Use Impact Assessment

*Parks and Recreation Division  
San Mateo County, California*

The James V. Fitzgerald Marine Reserve (currently re-classified by the California Department of Fish and Game as the James V. Fitzgerald State Marine Park) is among the highest used shoreline areas, if not the highest used shoreline in California for tidepool exploring by school groups, tourists, and the local public. The Park is located approximately 20 miles south of San Francisco, and receives high use due to its close proximity to the San Francisco Bay metropolitan areas. Based on shared concerns by the CDF&G and San Mateo County of potential visitor use impacts, we completed several field sampling studies and GIS resource mapping surveys in high and low use areas to evaluate visitor effects. The study also incorporated volunteers of the Friends of Fitzgerald who completed the visitor census and questionnaire survey components of the study. The results that were integrated from all of the study components provided a quantitative evaluation of visitor attendance and use of the Park, activities, and visitor effects that will be used by the County in developing a new managed access program for the State Marine Park.

## Endangered Species Monitoring

*Pacific Gas and Electric Company  
Avila Beach, California*

Tenera coordinates and conducts endangered species monitoring at the Diablo Canyon Power Plant for Pacific Gas and Electric Company. The monitoring and reporting is required under the power plant's Nuclear Regulatory Commission operating permit. Components of the monitoring include counts of peregrine falcons, brown pelicans, elephant seals, and other listed species; and a long-term study of the abundance, reproduction, and feeding habits of sea otters.



## Geographical Information System Services

*Various Clients throughout California*

Tenera scientists often use Global Positioning System (GPS) equipment and Geographical Information System (GIS) software as analytical tools in categorizing and quantifying spatial data. These technologies are not simply elaborate mapping tools. They provide tools for linking spatial data with other analytical or categorical data, and allow researchers to investigate geographic



relationships. Tena scientists have integrated GPS and GIS with other technologies and analytical techniques to provide unique solutions for our clients. For example, we have integrated GPS equipment with sensitive bathymetric equipment to provide very accurate seafloor profiling data. These data are then used in a GIS analysis to track changes in seafloor profiles over time for determining changes in sedimentation. These analyses are used to plan and schedule dredging activities to maintain harbor channels and basins. A specific GIS application project was done for the Gulf of the Farallones, Monterey Bay, and Channel Islands National Marine Sanctuaries that resulted in a GIS of coastal marine habitats in all three sanctuaries. Another project integrating GIS with other data and statistical analysis techniques involved the analysis of aerial infrared photographs of kelp beds in nearshore coastal waters. Aerial photographs were digitized, and color bands analyzed for the presence of kelp. Data from physical oceanographic instrumentation were then integrated with the data from the GIS to analyze changes in kelp coverage over time. This method of area quantification and analysis is an important part of the power of GIS when used to describe the natural environment.



# Resource Restoration and Management

## Morro Creek Restoration Project

*Silver City Mobile Manor  
Morro Bay, California*

Tenera worked with jurisdictional agencies on mitigating flood damage, designing a streambank revetment project, and drafting a plan to restore the lost functional values of the Morro Creek corridor adjacent to Silver City Mobile Manor. The Morro Creek Restoration Project first prioritized the objectives of all stakeholders—federal, state, and local agencies, special interest groups, and individual property owners—to design a project that satisfied the needs of the majority and that complied with environmental regulations. A hydrograph of the watershed was constructed to characterize historic streamflows, and physical attributes of the drainage (e.g., soils, slope, bank roughness, vegetation composition and cover) were collected. Data were run using a hydraulic model to predict flood flow elevations and flow velocities associated with various restoration plans. Species of concern included southern steelhead trout, California red-legged frog, and western pond turtle. Existing stormwater drainages were replaced with higher-capacity inlets fitted with state-of-the-art hydrocarbon filters to improve the water quality of Morro Creek.

## Introduced Species Awareness and Management

*National Estuary Program  
Morro Bay, California*



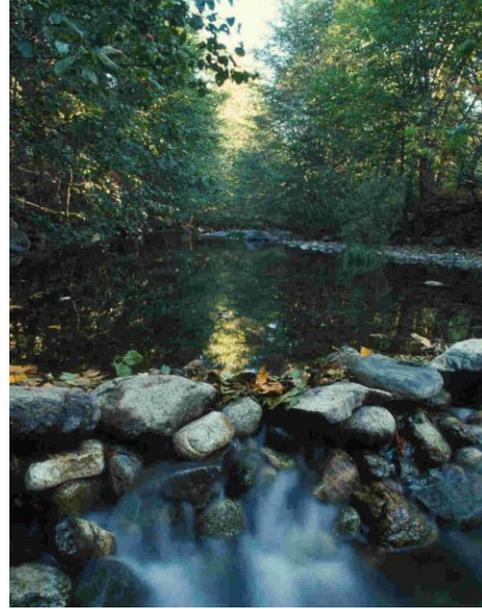
Tenera developed an outreach plan to increase public awareness of the ecological consequences of introduced marine species in Morro Bay. The tortellini slug (*Philine auriformis*) and European green crab (*Carcinus maenas*) were used to demonstrate the destructive ecological effects of non-native species introductions. Surveys were conducted to characterize the population dynamics of *Philine* within Morro Bay. Tenera designed educational pamphlets and posters to educate the public on measures needed to reduce both the transport and environmental impacts of these introduced species.



## Chorro Flats Instream Habitat Improvement Project

*Coastal San Luis Resource Conservation District  
Morro Bay, California*

Tenera conducted biological surveys, training, and monitoring in conjunction with construction activities for Phases II and III of the Chorro Flats Instream Habitat Improvement Project. The goal of the project was to improve summer rearing habitat for juvenile steelhead in the main stem of Chorro Creek. Tenera biologists conducted USFWS protocol pre-construction surveys for California red-legged frogs in the Chorro Flats region of Chorro Creek to determine if the species was present in the project area. Tenera biologists trained construction personnel in the identification of California red-



legged frogs and protective measures to ensure that no adverse impacts to the species occurred. To fulfill permit conditions Tenera prepared and submitted a project completion report describing the project, summarizing construction and monitoring activities, and documenting site conditions before, during, and after construction activities. The Coastal San Luis Resource Conservation District also requested that Tenera prepare a summary of initial revegetation efforts for the Chorro Flats Instream Habitat Improvement Project. Tenera biologists surveyed the extent of site disturbance at the Phase II and Phase III sites and inventoried the replacement plants.

## Toro Creek Restoration Project

*G.F. Garcia and Sons  
Morro Bay, California*

Tenera developed a restoration plan for Toro Creek, following catastrophic flooding and subsequent streambank erosion. Working with several stakeholders and permitting agencies Tenera drafted a plan that determined the pre-impact creek alignment and provided guidance for restoration of the creek and riparian corridor. Consultation with the U.S. Fish and Wildlife Service required surveys for the federally threatened California red-legged frog. Construction and biological monitoring services were provided. Tenera drafted an EPA-required Compliance Agreement for the restoration and environmental awareness training seminars were conducted for construction crews.



## Water Rights and Instream Flow Studies

*Pacific Gas & Electric Co.  
Avila Beach, California*

Tenera reviewed water rights on PG&E's use of Diablo Creek as a fresh water supply source for Diablo Canyon Power Plant operations. The study determined regulatory requirements associated with the use of the creek, and characterized instream flow regimes to assess what on-site desalination processing capacities might be needed in the future to augment creek flows for long-term water needs. The study reviewed:

- Past parcel purchases and ownership of the affected lands
- Watercourse and water right transfer agreements
- Past and present streambed alteration agreements
- Descriptions of existing and proposed places of use
- Descriptions of existing upstream and downstream adjoining land uses

The results of the study were incorporated into a comprehensive management plan for Diablo Creek.

## Review of Land Stewardship Program

*Hollister Ranch Homeowners Association  
Gaviota, California*

Tenera reviewed and prepared a report describing land stewardship and access programs for the Hollister Ranch near Gaviota in Santa Barbara County. The ranch program for public access has supported visits by educational and scientific researchers. The report summarized and reviewed scientific research that had been completed on the ranch



and contained recommendations for the program. Tenera staff also helped coordinate the stewardship activities of the Hollister Ranch Conservancy.



# Power Generation Support

## Cooling Water System Biofouling Control – Diablo Canyon Power Plant

*Pacific Gas and Electric Company  
Avila Beach, California*

The Diablo Canyon Power Plant uses a multifaceted biofouling control strategy, developed by the scientists of Tenera Environmental, to control macro- and micro-fouling within its seawater systems. This integrated biofouling control program incorporates such diverse techniques as manual cleaning, chemical injections, non-toxic foul-release coatings, and thermal treatment to limit the settlement and growth of biofouling organisms.



The treatment methodologies used are customized to not only meet the specific requirements of different seawater systems, but are also designed to optimize the efficacy of the program within discrete portions of the same systems. As an example, manual cleaning and chemical injections are used to control the growth of acorn and gooseneck barnacles that commonly grow on the walls of the main cooling water system conduits. In other portions of the same system, where these strategies are difficult to employ, silicone based foul-release coatings are used to retard the settlement and growth of these same organisms. This integrated approach to biofouling control has contributed greatly to the superior performance of this facility.

## Water Quality and Water Resource Studies

*Various Power Generating Clients*

Tenera has conducted NPDES-related water quality studies at Diablo Canyon, Moss Landing, Morro Bay, and other coastal power plant facilities. We have designed monitoring programs for collecting data on seawater temperature, pH, dissolved oxygen, salinity, conductivity, and light transmittance. The temperature monitoring at these facilities consisted of continuous data recording at permanent stations located inside and outside the influence of the discharge. Tenera scientists inventory, download, and compile temperature records from each site. We have designed and programmed a system for these studies that tracks the instrument inventory, calibration, and data storage functions for each unit, and manages the array of temperature sensors from our San Luis Obispo offices.



## Cooling Water System Coating Application - Moss Landing Power Plant

*F. D. Thomas, Inc.  
Medford, Oregon*

Tenera's biofouling control specialists planned, managed, and provided quality control for the application of a silico-elastomer coating in the cooling water conduits of Duke Energy's Moss Landing Power Plant New Generation Combined Cycle Units 1 & 2. The coating system was designed as a more efficient alternative to the thermal demusseling program originally intended for the new units.

The multi-layered coating system was applied over an area of more than 145,000 square feet. This included the seawater intake structure, and over 4,000 linear feet of piping. This non-toxic biofouling-release coating system inhibits settlement of marine growth on both reinforced concrete walls and un-reinforced mortar-lined pipe. The successful application of this coating will allow the operation of the cooling water system for extended periods of time without the biofouling concerns that would normally be associated with the operation of a system.

## Heat Treatment Optimization and Biofouling Control Evaluation

*Duke Energy Moss Landing, LLC.  
Moss Landing, California*

Tenera's biofouling control specialists reviewed and evaluated the biofouling control programs currently being utilized at Duke Energy's Moss Landing Power Plant Units 6 & 7. These twin 750 megawatt generating units have been in operation since the late 1960's and will now be used in combination with two new combined cycle units recently constructed at the same site. The older units use heat treatment (thermal demusseling) to control the growth of barnacles and mussels within their cooling water systems. The new units will achieve the same end by using a combination of non-toxic foul-release coatings and manual cleaning. Tenera monitored and analyzed a series of heat treatments at the existing units and reviewed the policies and procedures associated with these operations. Based on this information, recommendations were made to increase the efficacy of the existing program and to optimize this treatment strategy, in an integrated fashion, with the operation of the new units.



## Pump Performance Testing

*Duke Energy Moss Landing, LLC.  
Moss Landing, California*

Maintenance of cooling water and service water systems represents a multi-billion dollar expenditure for the utility industry in the US. To help optimize this sizeable investment, Tenera offers dye dilution-based, diagnostic flow testing, which can evaluate the operating performance of virtually any cooling or service water system. The results of these tests allows



utilities to improve maintenance planning, reduce the number and duration of unscheduled outages, increase system reliability, extend the life expectancy of pumping systems, and assure that systems meet regulatory discharge requirements.

## Kelp Control – Diablo Canyon Power Plant

*Pacific Gas and Electric Company  
Avila Beach, California*

Tenera is responsible for monitoring and controlling kelp and ocean-borne debris that can affect the operation of the power plant's cooling water intake system. Our responsibilities include harvesting of the intake cove kelp bed canopy, monitoring debris loads, and conducting aerial photographic surveys of coastal kelp beds. Tenera divers also conduct weekly surveys of debris impinged on the intake structure bar racks. The kelp canopy within the intake cove is controlled by a commercial kelp harvester operated by Tenera personnel. Divers also conduct underwater surveys of kelp plants within a special exclusion zone in front of the intake. This also includes the periodic removal of whole plants, under a special California Department of Fish and Game permit, to reduce potential loading of debris on the bar racks.

