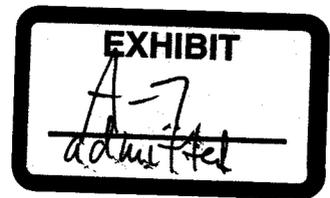




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**OPTIONS FOR LAND MANAGEMENT FOR
THE SEMPRA ENERGY PROJECT SITE
ARLINGTON VALLEY, ARIZONA**

for

Sempra Energy

by

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Introduction

Sempra Energy plans to construct a gas-fired power plant in Arlington Valley, Arizona. The facility will be developed on a 3,000 acre site some 50 miles west of the metro area of Phoenix in Maricopa County. The large site is being acquired in order to obtain adequate water rights to operate the power generating facility. The site consists of both unfarmed land and recently retired agricultural fields. The actual facility proposed will require only a small part of the land area and will be built on the unfarmed acreage. The primary purpose of this report is to address issues related to the retirement of recently actively-farmed portions of the overall site and related research and management needs.

Sempra Energy has consulted with various state agencies, private parties and communities to explore the possible beneficial uses of this area as well as the potential for revegetation of the retired farmland. The following groups have been approached for their comments, interest and expertise:

- § The Arlington Valley Community
- § The Tonopah Community
- § The Arizona Game and Fish Department
- § The Arizona Department of Water Resources
- § The Arizona Department of Environmental Quality
- § The Office of Arid Lands Studies at The University of Arizona
- § The Phoenix Zoo
- § Southwest Wildlife Rehabilitation

Retired Farmland Reclamation in Arizona

In most areas of central Arizona retired farmland is typically invaded by an introduced weed called Russian thistle or tumbleweed (*Salsola kali*). Typically this plant dominates the plant community to the exclusion of all other species for several years after farming activity has ended. Russian thistle will decline after a few years and may be replaced by London rocket (*Systemia irio*) and other exotic species such as Mediterranean grass (*Schismus spp.*) and filaree (*Erodium cicutarium*). Ruderal shrubs such as burroweed (*Haplopappus tenuisectus*) and desertbroom (*Baccharis sarathroides*) could invade these areas relatively quickly. After many years, climax native species of shrubs such as saltbush (*Atriplex spp.*) or creosotebush (*Larrea tridentata*) may be found.

This process is called secondary succession. It involves the replacement of short-lived species by longer-lived species, and continues until a climax self-sustaining plant community again dominates a disturbed site. However, on many areas in

Arizona with clay soils and low rainfall, the land may remain without plant cover indefinitely.

Revegetation of retired farmland in southern and central Arizona is challenging because of the low rainfall and other unique environmental conditions of the Sonoran Desert. Problems associated with the retirement and/or the abandonment of actively-irrigated fields in Arizona have been well-documented:

- Dust from recently-fallowed fields has contributed to damaging vehicle finishes and windshields, and more importantly to dust storms that have resulted in automobile accidents and deaths on Arizona highways and other adverse health-related respiratory problems.
- Noxious weeds, especially Russian thistle also known as tumbleweed, have been reported to grow abundantly on recently-retired irrigated fields or repeatedly disturbed areas. These plants can be readily blown off a site to adjacent property or across roads, becoming a major nuisance. They also can damage crops, fences or other property.
- Many areas that have been retired from irrigated agriculture for periods of nearly 50 years remain almost devoid of climax plants and are sometimes even barren of any vegetation. These areas can continue indefinitely to be potential problems.

Importance of a Vegetation Cover

If a stable plant cover can be established prior to or shortly after the actual time of field retirement, the soil surface may be stabilized with an arid-adapted climax plant community. This established plant community will help prevent the soil from blowing and decrease tumbleweed establishment. The costs of reestablishing these plants can be relatively easy to measure once appropriate methods are developed and tested. The benefits, however, are not as easy to quantify, but are important for health and welfare reasons as well as potential legal issues. The environmental costs of not establishing a stable plant community on retired farmland are much more difficult to establish because these are often borne by others: dust pollution, rapid water runoff during precipitation events from the barren unvegetated soil surfaces, tumbleweeds blowing onto roadways and adjoining properties, and auto accidents caused by lost visibility during dust storms. Bare, unprotected Arizona soil can erode as much as 30 tons per acre per year from wind.

Unfortunately the state of knowledge for reestablishing a climax plant community on retired farmland in Arizona are not well developed and no reliable methodology

currently exist for resolving this problem on a sound ecological and economical basis.

Program Objectives

The University of Arizona will work with representatives of Sempra to develop a management program and conduct selected research. The goal of the land management program will include the following objectives:

- § Minimize blowing dust from previously farmed fields
- § Minimize the growth, production and dissemination of tumbleweed
- § Minimize the growth, production and dissemination of salt cedar
- § Provide improved wildlife habitat at selected locations
- § Provide opportunities for educational programs related to desert animals
- § Revegetate previously farmed areas with desert species
- § Provide support of research opportunities to address issues directly related to revegetation of the site
- § Provide support of opportunities for research into critical issues related to arid environments
- § Protect existing native vegetation

Preliminary Management Approach

The site will be divided into several program management areas:

- Area 1: The actual plant site and the nearby surrounding landscaped area
- Area 2: Areas never farmed
- Area 3: Areas set aside for Arizona Game and Fish Wildlife developments
- Area 4: Areas set aside for Phoenix Zoo activities
- Area 5: Areas set aside for other beneficial uses
- Area 6: Previously farmed areas to be revegetated
- Area 7: Revegetation and related research areas

Vegetation Management Approach

Revegetation research would be applicable directly to the management and restoration of the retired farm lands. Reestablishment of vegetation on these fields would require determining effective methods for plant establishment. The methods would need to be both technically and economically feasible, leading to a stable self-replicating plant community that would reflect the existing plant community in surrounding areas as well as the one that existed on the actual site prior to agricultural development.

In preparation for field trials, it will be necessary to conduct soil surveys and to understand the soil plant interface. Information is needed on the nutrient status of the soil as well as the presence or absence of a plow layer that may have to be deep-ripped to provide adequate root access for deep-rooted trees and shrubs.

The most cost-effective method to minimize the problems associated with retired or abandoned farmland is to use any existing infrastructure of the previous farms. To a limited extent, traditional crop residues or sludge could act as a mulch or soil amendment for emerging arid-adapted plant seedlings. Remaining furrows, borders or irrigation canals also may make it easier to irrigate during the revegetation process.

The appropriate mixture of plant species will depend on the climate and soils of the site, and the intended use of the site. Preliminary determination of which plants are potential candidates for use in revegetation can be made by observing the vegetation growing nearby. The native vegetation has survived and responded to stresses imposed by the climatic conditions, soils, and grazing and trampling by wildlife and livestock. A limitation to this approach is that these surrounding areas are typically degraded sites that do not contain all possible plant species that are adapted to the site. A further consideration is that the land's history of irrigation may have increased the soil salinity, making plant establishment difficult. Soil type is a critical factor in determining which species are adapted to the site. Typical climax species for the Arlington Valley site include:

Acacia	<i>Acacia constricta</i> , <i>Acacia greggi</i>
Bursage	<i>Ambrosia dumosa</i>
Creosote bush	<i>Larrea tridentata</i>
Palo Verde	<i>Cercidium floridum</i> , <i>Cercidium microphylla</i>
Saltbush	<i>Atriplex canescens</i> , <i>A. polycarpa</i> , <i>A. lentiformis</i>
Mesquite	<i>Prosopis juliflora</i>

Since no definitive methods are available for revegetation of retired farmland in Arizona, test plantings are the best way to determine which species under which planting method are adapted to the site and can be replanted with success. Ideally these plantings should be observed for a number of years to determine the long-term survivability of the species. However, preliminary observations of test plants can be used to begin the revegetation process while continued observation will provide increased reliability and improved rates of success.

A problem with direct seeding trees and shrubs is that seedlings are slow to start, and can be at a severe disadvantage compared to containerized shrubs and trees as well as weeds. University of Arizona researchers have successfully direct seeded plants such as creosote bush and four-wing saltbush in hyper arid areas.

On particularly severe sites, only trees and shrubs may be adapted. Transplanting containerized seedlings and applying establishment irrigations is the most reliable method of establishing trees and shrubs, but it is also the most expensive.

Irrigation will be needed to keep the surface of the soil moist until seeds are germinated and seedlings are established. Plants are unlikely to persist on level surfaces where rainfall does not penetrate into the soil. It may be possible to irrigate using existing furrows or water harvesting techniques. If containerized transplants are used it is vital that the soil be kept moist until roots grow from the root ball into the surrounding soil.

Potential Field Trials for Revegetation

- § No treatment (control)
- § Surface rip
- § Surface rip and seed
- § Surface rip, seed and select planting (with irrigation)
- § Deep rip only
- § Deep rip and seed
- § Deep rip, seed and select transplanting (with irrigation)
- § Deep rip in catchment and berm for water harvesting; seed only
- § Deep rip in catchment and berm for water harvesting; seed and select transplanting (with irrigation)
- § Land imprinting with no surface preparation
- § Land imprinting with surface preparation and seeding
- § Grade for water harvesting, seed and select transplanting (with irrigation)

Area 1: Landscape areas in and around the facility.

At appropriate times during construction of the facility, landscape area plants will be planted. These will include both boxed or potted transplants and direct seeded landscape species. Maintenance and irrigation of the landscape plants will continue indefinitely.

Area 2: Areas never farmed.

As some areas already have high quality climax vegetation, care will be taken to protect these areas during construction and revegetation efforts. These areas will be left in their native state.

Area 3: Areas set aside for Arizona Game and Fish activities.

Arizona Game and Fish Department (AGFD) currently is developing a conceptual plan for waterfowl management or other wildlife habitat management activities.

If these activities are not feasible at the site, Sempra will vegetate this parcel as outlined for the revegetation areas above

Area 4: Areas set aside for Phoenix Zoo activities.

The Phoenix Zoo has submitted a conceptual plan for possible on-site activities.

Area 5: Areas set aside for other potential beneficial uses.

This area will be held for additional beneficial uses. If no beneficial uses are found or are deemed feasible, this area will be revegetated.

Area 6: Retired farmland to be revegetated.

The retired agricultural lands will be revegetated using arid-adapted vegetation in such a way as to provide a continuing seed source for the establishment of more arid-adapted vegetation at naturally-occurring densities.

After the arid-adapted vegetation techniques are refined, Sempra will begin revegetation efforts on these fields at the site within 3 years after the start of the research activities in Area 7. Revegetation efforts will be conducted in a phase approach and completed within 10 years of the start of construction of the facility.

Area 7: Revegetation research areas.

Implement the University of Arizona research activities during the first year of construction. This will require approximately 50 acres of retired farmland as test plots. A number of different techniques will be tested as listed above to identify the most effective procedure to use for large-scale revegetation on the remainder of the site. Techniques that will be evaluated will include the use of container-grown plants, broadcast seeding, and various other techniques. Several irrigation technologies will be used including flood, bubbler and drip irrigation. Test plots will need to be developed in the fall or early spring to provide the greatest opportunities for plant survival. Particular emphasis will be placed on the soil plant interface.

When the pilots have been underway for one to two years, the efficacy of the various processes investigated during the pilot will be evaluated. The UofA will

identify the most successful processes and will provide a plan for phased implementation on the retired farmed lands.

Alternative Land Use Activities

Throughout construction and the revegetation process, Sempra with the assistance of the University of Arizona, will actively manage the site to prevent weed nuisance situations. It is likely that tumbleweeds will need to be mowed and fences maintained and repaired during the active revegetation period in order to prevent nuisance situations.

Related Research Activities

Carbon Cycle

The Kyoto Accord has promoted interest in the potential for sequestration of carbon. One aspect of carbon sequestration that is not well-known is the ability of arid areas to store carbon. These areas cover about a third of the world's land area. The general concept here would be to explore the ability of farmed, retired and never-farmed Sonoran Desert areas to provide carbon storage. These areas also may provide for an income stream as industry is beginning to pay landowners for carbon storage.

Animals

Animal studies of interest include the determination of species composition, diversity and population densities on retired farmland and the factors that increase the rate at which these species reestablish stable populations on these disturbed areas. These studies could cover a range of animals from insects to herps, birds and mammals.

Soils

The microbial changes in the soils are important. On sterile copper mine tailings the use of sludge has greatly improved the microbial population of the tailings. It also is known that the replacement of desert vegetation by irrigated agriculture changes the microbial community of the desert soils. These differences in microbial populations could influence the rate at which plant establishment takes place. The use of sludge and/or composted animal waste could prove beneficial to the revegetation of retired farmland.

Project Costs

The estimated cost for landscaping activities for highly visible areas or for the Plant Site itself would be about \$2,000 to \$5,000 per acre. If large transplanted plant materials are used the price could be significantly more. The best estimate

on the cost for reestablishment of a desert cover on retired fields would be in the area of \$200 to \$500 per acre.

Research efforts to address the research issues noted above would be in the range of \$30,000 to \$50,000 per year for a period of two or three years for each of the research areas discussed above.

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**SCOPE OF WORK
FOR
SEMPRA ENERGY RESOURCES
PHOENIX RESTORATION LAND PROJECT
BY THE PHOENIX ZOO**

The Potential Project

The Phoenix Zoo proposes a model functioning ecosystem recovery program on the Sempra Energy property. This site could be fully interpreted to a wide range of audiences both on site and off, through community based informal learning programs marketed throughout the Metropolitan Phoenix area.

The demonstration project could develop strategies and techniques for habitat and species recovery while supporting plant and animal reintroduction and public education. The Phoenix Zoo would assist in developing relationships with the conservation, science, education and interpretation communities. The Zoo would coordinate the overall project on behalf of Sempra ensuring maximum benefit in acquisition of knowledge on landscape recovery, wildlife reintroduction, and public education. The Zoo would involve professional ecologists, biologists, and associated sciences. We would also coordinate the involvement of volunteers with a focus on creating experiences for children that involve them in learning to care for plants and animals.

Specifically, the Zoo would work with other conservation organizations and institutions to qualify the site as a series of study plots that evaluate soil stabilization, recharge of aquifer, support for vegetative communities, the attraction of native wildlife and the rewilding of disturbed areas.

The Zoo will also screen opportunities to support appropriate breeding programs for extirpated native and exotic wildlife.

The Phoenix Zoo will work with Sempra to identify associated sources of support for all projects. The scope of the work may include the above as qualified below:

Scope of Work

1. Strategic Plan Development: The Phoenix Zoo would work with Sempra Energy and other potential partners in the project to develop a strategic plan for the area which would ultimately be a model recovery program. The Zoo management would work with partners to determine the types of plant and animal species needed to create a high profile recovery species program based on the topography of the land, with habitat and environmental restoration being the primary goal.

2. Partnership Development: The Phoenix Zoo would assist Sempra Energy with the development of essential partnerships to develop and sustain the project. The Phoenix Zoo has numerous excellent relationships with such organizations as, all universities in the state, the City of Phoenix, the Nature Conservancy, Arizona Audubon, Liberty Wildlife, Arizona Game & Fish, U.S. Fish & Wildlife Service, Bureau of Land Management, U.S. Forest Service, Pro Naturale in Mexico, Sonoran Institute, Pueblo Grande, and the Desert Botanical Garden.

3. Educational Programs: The Phoenix Zoo would work with Sempra Energy to develop educational science based programs through our renowned Educational Programs division at the Zoo. Such programs would be targeted for elementary and high school children and could include an endangered species recovery program or a model ecosystem recovery project. Programs could be developed on the Zoo campus, on site and through our Desert Connections programs throughout the state.

4. Public and Media Relations: The Phoenix Zoo, through our Marketing and Public Relations division, would work with Sempra Energy to effectively market the development and related programs associated with the project to the metropolitan Phoenix area. Our Media Relations division is very well connected in Phoenix and can assist Sempra energy with positive media stories and with developing a brand image in the state which will result in a strong environmental and community based public relations image.

Terms and Conditions

This particular Scope of Work is not legally binding and will be more fully developed once Sempra Energy and The Phoenix Zoo have come to mutually agreed upon terms and conditions. All fiscal responsibility for the project would be assumed by Sempra Energy, including for Zoo management and staff's time and expertise on the project.

Southwest Wildlife Rehabilitation and Educational Foundation, Inc.

Preliminary Proposal for Palo Verde Site

Objective: Southwest Wildlife Rehabilitation and Educational Foundation, Inc. is a non-profit organization specializing in rescue and rehabilitation of wildlife, education of the public, education of professional students, and training animal health professionals. Founded in 1994, Southwest Wildlife has cared for over 1800 injured and orphaned wild animals and has succeeded in releasing 60 % of these animals to the wild. Southwest personnel have educated thousands of children and adults through presentations with live, non-releasable wildlife. Such presentations have focused on the natural history of species native to the Sonoran Desert, the importance of habitat, and the importance of biodiversity and preservation. Because of these education efforts, Southwest Wildlife has been chosen to build a nature center at the McDowell Mountain Park in Scottsdale. The park will provide a forum for education of the public in a natural surrounding. Southwest Wildlife has participated in humane research and, in cooperation with state and federal agencies; provided education opportunities for undergraduate and graduate students in the biological sciences. Southwest Wildlife has established an internship program for veterinary students and graduate veterinarians. Education of these professionals occurs in a state of the art hospital and surgical facility located on premises. The main focus of the veterinary training is care of injured and ill wildlife, safe and humane capture of wildlife, medical and surgical treatment of these species, and population medicine. Through a Pulliam Foundation grant, the hospital is expanding and intermediate care facilities are being added. These facilities will accommodate large carnivores and herbivores and enhance the level of veterinary care possible, thus enhancing the opportunity for successful rehabilitation of injured wildlife.

Since its inception, Southwest Wildlife has fulfilled its goals admirably. Because of the success Southwest has had, and because of the dedication of the members of Southwest Wildlife, we feel that Southwest Wildlife is an ideal organization to plan, build, and maintain a working research center as outlined below.

11. Southwest Wildlife Rehabilitation and Educational Foundation Missions:

1. Management of Native and Endangered Species of the Desert Ecosystem. Efforts to include re-introduction of displaced species, release of rehabilitated injured wildlife, and preservation of endangered species.
2. Public Education. Efforts to include presentation of live animals in their native habitat to accentuate the importance of biodiversity and preservation.
3. Center for Higher Education. Provide facilities for humane research to undergraduate, graduate, and professional students in biological sciences and animal health sciences.
4. Research Center for the Desert Ecosystem. Provide an arena for humane habitat and population based research.

III. Overview of Proposed Facility

Phase I.

1. Construction of a Central Research Facility providing laboratory space, administrative space, education facilities, and living quarters for visiting scholars.
2. Development of natural habitats for controlled breeding programs, field research, and wildlife rehabilitation.

Phase II.

1. Construction of a Facility for Health Science Research and a Hospital for Animal Care. Such a facility will provide for acute medical care and facilitates for rehabilitation and intermediate care of injured wildlife.

Phase III.

1. Public Access Facilities. Patterned after the Southwest Wildlife Nature Center, this facility will provide for the education of the general public. The focus will be education rather than entertainment, as the patrons will become part of the working laboratory the center represents. By involving the public in the workings of a living laboratory, understanding of the desert ecosystem, and the importance of preservation will be conveyed. In addition, the education center will provide a source of revenue to allow the center to become self sustained.

IV. Personnel

1. Board of Directors

The current board of directors of Southwest Wildlife consists of high profile professionals and civic figures dedicated to the cause of wildlife rehabilitation and public education. The eight current board members include:

Linda Searles	Director
Gerry Dury	Assistant Director/Treasurer
Gil Shaw	Attorney at Law
Janet Evans	Attorney at Law
Stephen D. Gilson	Veterinarian
Daryl Abbott	Project Manager/Computer Consultant
Kim Ridgeway	Public Relations
Mark J. Soderstrom	Veterinarian

2. Administrative Facility:

A facility manager selected to supervise the general facility and ongoing research. This individual's responsibilities include supervision and maintenance of the physical plant, care of rehabilitation and education animals, and supervision of caretakers and public education personnel.

3. Caretakers:

Responsibilities include animal care and construction and maintenance of enclosures for rehabilitation, education, and research.

4. Public Education/Relations:

A staff devoted to educating patrons of the Center on wildlife in its natural habitat, wildlife and ecosystem research, and preservation of native and endangered species.

5. Institutional Animal Care and Use Committee:

At the heart of any research institution is a governing body whose purpose is to ensure that proposed research is both humane and relevant. This committee is charged with overseeing all research activities and the care of all education and rehabilitation animals. The committee will consist of members of the wildlife biology community, veterinary community, and the general public.