ENVIRONMENTAL ASSESSMENT

OF THE

CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE

BEET CURLY TOP VIRUS CONTROL PROGRAM

August 2012

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APPENDICES

LIST OF ACRONYMS

AChE	Acetylcholinesterase Inhibitor
ADSB	Andrew's Dune Beetle
APCS	Agricultural Pest Control Specialist
APHIS	Animal Plant Health Inspection Service (USDA)
BCTV	Beet Curly Top Virus
BCTVCP	Beet Curly Top Virus Control Program
BLH	Beet Leafhopper
BLM	Bureau of Land Management
BLMS	BLM Sensitive
BNLL	Blunt-nosed Leopard Lizard
BVLS	Buena Vista Lake shrew
CAC	County Agriculture Commissioner
CASB	Ciervo Aegialian Scarab Beetle
CBR	California Black Rail
CEQA	California Environmental Quality Act
CDFA	California Department of Food and Agriculture
CDFG	California Department of Fish and Game
CDPR	California Department of Pesticide Regulation
CDWR	California Department of Water Resources
CNDDB	California Natural Diversity Data Base
CRLF	California Red-legged Frog
CTS	California Tiger Salamander
EA	Environmental Assessment
ESRP	Endangered Species Recovery Program
DOE	Department of Energy
FAA	Federal Aviation Administration
FTHL	Flat-tailed Horned Lizard
GGS	Giant Garter Snake
GKR	Giant Kangaroo Rat
LD_{50}	Lethal dose to cause mortality in 50% of a test animal population
LC_{50}	Lethal concentration to cause mortality in 50% of a test animal population
L&M	Limited and Moderate
MSDS	Material Safety Data Sheet
NEPA	National Environmental Policy Act
NPR	Naval Petroleum Reserve
PUP	Pesticide Use Permit
NAS	Nelson’s Antelope Squirrel
SJDB	San Joaquin Dune Beetle
SJKF	San Joaquin Kit Fox
TKR	Tipton Kangaroo Rat
UCR	University of California, Riverside
USDA	U.S. Department of Agriculture
USEPA	U. S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U. S. Geological Survey
VELB	Valley Elderberry Longhorn Beetle
WSA	Wilderness Study Area
YCR	Yuma Clapper Rail

List of Tables

1.0 PREFACE

This environmental assessment (EA) is developed by the California Department of Food and Agriculture with the assistance of the Bureau of Land Management (BLM) for the review and compliance of National Environmental Policy Act (NEPA) requirements and issuance of necessary permits as proposed by the California Department of Food and Agriculture (CDFA). In addition, this EA will be used to satisfy Section 7 requirements of the Federal Endangered Species Act of 1973, the California Endangered Species Act and the California Native Plant Protection Act.

The Department files a Negative Declaration or a Mitigated Negative Declaration in compliance with the requirements of the California Environmental Quality Act for the BCTV Control Program based on the initial study; and, on findings and mitigation requirements through NEPA analysis by BLM and the United States Fish and Wildlife Services (USFWS).

Although BLM administered lands are highlighted throughout the document, unless otherwise specified, the descriptions and impact analysis will pertain to private as well as BLM lands.

A Pesticide Use Permit (PUP), issued by the BLM, authorized the CDFA to conduct this program on BLM lands. The current permit will be considered for re-authorization upon its expiration, February 2014.

1.1 PROGRAMMATIC vs. SITE SPECIFIC ENVIRONMENTAL ASSESSMENT

This is a programmatic EA of the Beet Curly Top Virus Control Program (BCTVCP). Normally there would be site specific assessments tiered to the programmatic EA. This has not been done for this program. There are four reasons for this.

- A reasonable, worst case scenario was used to evaluate possible negative impacts from program activities. Once possible negative impacts were identified, appropriate avoidance measures were considered to minimize the possible negative impacts. Program Activities less than those used in the reasonable worst case scenario will have negligible negative impacts.

- The EA identifies the specific avoidance measures needed to minimize possible negative impacts on threatened and endangered species and areas of special concern including bodies of water. The EA establishes a protocol to annually update information about the presence of these organisms and areas with USFWS, BLM and the California Department of Fish and Game (CDFG).

- The impacts of program activities vary little across the areas in which they are conducted. This is because the primary abiotic factors that affect the stability of the Malathion sprays, alkaline water and soil, are found in all program areas; and, because a reasonable worst case scenario was used to develop the avoidance measures needed to minimize possible negative effects of the program.

- The biology of the targeted pest, beet leafhopper (BLH), precludes the development of site specific EAs after populations large enough to warrant treatment have been discovered. BLH populations are not static in time and space. Rather, the pest migrates to and from farmland and its overwintering sites in the adjacent rangeland habitat. Once discovered, a population of BLH can complete a life cycle in 30-45 days before moving to another area. By the time a BLH population large enough to warrant treatment has been discovered, there is insufficient time to write a site specific EA and post it for review before the BLH population has left the area covered in the site specific EA. The programmatic EA incorporating the points discussed above provides the avoidance measures normally covered in a site specific EA and allows the BCTVCP to meet its statutory requirements while protecting the environment from possible negative impacts from its activities.

1.2 KNOWN AND SUITABLE HABITATS

This EA proposes a number of measures designed to avoid take of threatened and endangered species within areas known to harbor extant populations of the organisms. The program uses the best available information on the extant occurrences of threatened and endangered species. This includes annual reviews of information contained in the California Natural Diversity Data Base (CNDDB); and, annual oral updates from USFWS, BLM, and CDFG for extant occurrences not entered yet into the CNDDB.

The program does not conduct survey of “suitable” habitat to look for previously undiscovered populations of threatened and endangered species within the area encompassed by program operations. Most descriptions of “suitable” habitat are so vague that identifying potential survey locations is nearly impossible. The professional biologists conducting field operations are trained to identify threatened and endangered species that might occur within the area encompassed by program operations and they look for sensitive species prior to starting treatment activities. Any new occurrences are immediately reported so immediate appropriate avoidance measures, listed herein, can be taken.

1.3 BEET LEAFHOPPER/CURLY TOP VIRUS RESEARCH

Research into the BLH and the curly top virus, like most agricultural pests, is conducted when there is a need. The success of the BCTVCP has meant that there has been little to no recent research into the BLH's biology, phenology, migration, virus transmission, etc or into crop losses due to the disease. Areas lacking extensive data like biological control of the BLH have been investigated more recently. This lack of recent research in these areas reflects the extensive nature and thoroughness of the older work performed in the early 1900's. Advances in technology have focused current BLH research in the epidemiology of the beet curly top virus (BCTV) and the differentiation of strains or virus species. Researchers determined that the origin of replication was unique within species but different between species (Stenger 1998). A species of BCTV was identified and researched in spinach from Texas (Baliji 2004 & 2007) and Arizona (Hernandez, 2010). Several studies have investigated the prevalence and distribution of BCTV strains among a variety of crop and non-crop host plants through polymerase chain reaction amplification (Wintermantel 2004, Strausbauch 2008, Chen, 2009 & 2010). The BCTVCP is currently funding a 2-year research project, with the United States Department of Agriculture, Agricultural Research Service (USDA-ARS) in Salinas, California, to determine the impact of virus concentration on efficiency of transmission by beet leafhopper.

1.4 OVERVIEW OF IMPACT ANALYSIS

This EA uses a reasonable worst case scenario based on available data when analyzing the possible impacts of the malathion sprays and related program activities on threatened and endangered species and the environment. The amount of malathion sprayed assumes full label amounts over the largest likely treatment areas. If we identify possible negative impacts from program actions, appropriate avoidance measures (see section 3.1.7 and Appendix K) are used to prevent the negative impacts. Once the possible negative impacts from the reasonable worst case scenario have been avoided, program activities less than those used in the reasonable worst case scenario will themselves have negligible negative impacts on threatened and endangered species and the environment.

Although California is a diverse state with numerous natural communities, varied climates and physical features; the impacts of the program activities vary little across the areas in which they are conducted. The abiotic factors that most affect malathion stability are alkaline water and soil which are found in all program areas. Plants are not directly affected by the malathion sprays at the rates used in the program. Although animal responses to the malathion sprays may vary, the avoidance measures are tailored for each threatened and endangered species and number of special preserves will not be treated (Section 3.1.7 and Appendix K). The largest likely treatment areas were used to develop the reasonable worst case scenario from which avoidance measures were developed. Smaller treatment areas, than those used in the reasonable worst case scenario, will therefore have negligible additional negative impacts on threatened and endangered species or the environment.

ENVIRONMENTAL ASSESSMENT

Beet Curly Top Virus Control Program

2.0 INTRODUCTION

Beet curly top virus (BCTV) is a viral disease of sugar beets, tomatoes, melons, peppers, beans, cucumbers, squash, pumpkins, spinach, vine seed and other commercially important crops, including ornamentals. BCTV not only infects commercial crops, but also at times infects backyard vegetable and flower gardens. The only known vector of BCTV is *Circulifer tenellus* (Baker), commonly known as the sugar beet leafhopper (BLH).

Survey and chemical control of BLH may take place at various locations in the San Joaquin, Salinas, Cuyama, Imperial and Palo Verde Valleys including portions of Stanislaus, San Joaquin, Merced, Fresno, Kings, Kern, San Luis Obispo, Monterey, Santa Barbara, Eastern Riverside and Imperial Counties (See Appendix "D" for potential survey maps and multi-year aerial treatment maps). While the potential for treatment is widespread, the majority of the aerial treatment occurs on the westside of the San Joaquin Valley in Fresno, Kings and Kern Counties.

Not all BLH breeding grounds require treatment every year. On an annual basis, the Beet Curly Top Virus Control Program (BCTVCP) controls BLH populations within a portion of the total survey area. The size and location of annual control activities are totally dependent on the location, size, and distribution of the BLH population. BLH development is influenced by winter temperatures, rainfall, vegetative growth, fire and soil disturbance. A cumulative 9-year treatment footprint has been developed to illustrate past areas where treatment activities have occurred within the general survey areas (Appendix D, Multi-year Aerial Treatment Maps).

Treatment priorities are given to areas subject to perennial virus infection, areas sustaining significant infection from the previous year, and areas with the highest current BLH populations (Table 6, page D23). The BLH is a desert insect preferring habitats and environmental conditions that produce sparse open vegetation. In years with above normal rainfall, BLH populations are generally limited. Lush rangeland vegetation reduces optimum breeding acreage and concentrates BLH populations into smaller areas. In years with below normal precipitation, sparse rangeland vegetation increases optimum breeding acreage and the potential for developing a large BLH population. In periods of drought (successive years of below normal rainfall) a significant reduction in rangeland vegetation has led to a decline in BLH populations and a reduction in treatment activities. In years with low or average BLH populations, it has been necessary for the BCTVCP to treat between 25,000 to 65,000 acres of rangeland and cultivated fallow fields by air to control BLH in western Fresno, Kings, and Kern Counties. In years where environmental conditions favor the development of BLH, it has been necessary to treat more than 100,000 acres (Table 7, page D24). Aerial treatments in the Imperial Valley are intermittent and have been necessary only once in the last 15 years.

2.1 PURPOSE AND NEED

The purpose of the BCTVCP, as laid out in the Food and Agriculture Code (FAC), is to prevent the transmission of beet curly top virus by controlling the BLH (FAC section 6031).

"The necessity of controlling beet leafhopper, the only known vector of the curly top virus, is recognized by the Legislature as being in the public benefit. The state's agricultural business economy could be seriously damaged if measures are not continued to prevent the transmittal of curly top virus by this insect. Since the control program primarily is carried on in uncultivated areas, involving both private and public lands, often far removed from the areas receiving benefits, it is necessary for a state agency to take primary responsibility. The Legislature therefore supports a program jointly funded by industry and public funds whereby protection is provided to both home gardens and commercial crops" (Section 6031).

Treatment will occur on uncultivated lands, both BLM and private, to control BLH populations. The CDFA is the lead state agency that maintains regulatory oversight over the BCTV control program. CDFA judged all potential alternatives evaluated in this EA against this standard: Would they control BLH numbers and thus meet the statutory mandate. As discussed below, the use of malathion sprays is the only alternative evaluated that meets this standard.

Without control where required, BLH is capable of an infection rate of 10 to 40% or more. With only a 1% loss from BCTV in California, it is estimated that during the period 1974-1976, California suffered annual losses of $9.75 million in commercial crops alone. A $2.68 million loss in home gardens can be extrapolated from a 1974 value of $268,199,643 using a 1% infection rate (Yokomi 1979). Infection rates as high as 80% were observed near Huron, CA in 1977 (Magyarosy 1977).

BCTV out breaks occurred again 1991 and 2001. Not only was the 2001 outbreak witnessed in California, but was also experienced in Snake River Valley of Idaho, west Texas and New Mexico (Wintermantel 2004). The outbreak was particularly severe in California sugarbeets effecting plant growth and yield.

Another outbreak occurred during the spring of 2008 and was attributed to the failure of the BCTVCP to perform treatments during the entire year. Delays in Section 7 Consultation resulted in the expiration of the Program's Federal Pesticide Use Permit prior to spring 2008. The California Tomato Growers Association estimated a $20 million dollar loss due to BCTV infection in processing tomatoes with organic tomato plantings sustaining the highest losses. The BCTV infection outbreak in 2008 and permitting issues were reported in trade publications (Western Farm Press 2008 & 2009).

BLH development and BCTV epidemiology are weather dependant phenomena. Literature, and antidotal observations from Program staff, indicates a correlation with peaks in the 11 year sun spot cycle and high virus outbreak years.

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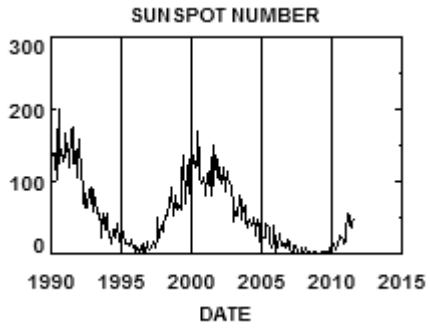
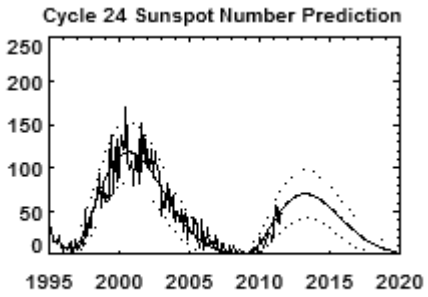


*Graphs NASA



(http://solarscience.msfc.nasa.gov/SunspotCycle.shtml)

A graph of sun spot number peaks, from the National Aeronautics and Space Administration corresponds to the outbreaks observed in 1991 to 2001. Predicted sun spot numbers indicate the next peak will be between 2012 and 2013 and will not be as elevated as peaks in 1991 and 2001.

As witnessed by BCTV infection in 2008, the Program's effective control of BLH protects the state from annual crop losses in a substantial portion of tomato, sugar beet, melon, bean, squash, pumpkin, cucumber, pepper and spinach crops valued in excess of $1.2 billion annually.

2.2 BACKGROUND

In the early part of the 20th century, large areas in California and the western United States were cleared of natural vegetation to plant grain. In succeeding years, price fluctuation led to alternate use and abandonment of much of this land. At the same time, unrestricted grazing of cattle and sheep denuded what was once lush grazing land. The long-range result has been an enormous increase in areas ideal for BLH reproduction, where natural vegetation was replaced by mustards (*Brassica* spp.), Russian thistle (*Salsola* spp.), and other annual BLH host plants.

BLH is a desert insect introduced from the Middle East, probably in the late 1800's. The association of BCTV with the BLH was discovered by E. D. Ball through field observations in Utah (Ball 1906). Early researchers theorized that BLH's "only known vector" status in North America, was most likely due to it being a native of the Mediterranean with no close relatives in North America (Oman 1948 in Bennett 1958). Early researches also investigated incubation periods and the rate of viral acquisition and transmission in single and multiple leafhoppers (Shaw 1910, Smith & Boncquet 1915, Stahl & Carsner 1918 & Severin 1921). A study by Piemeisel and Chamberlain (1936) found well managed grazing land does not produce economically important numbers of BLH.

Years with below normal precipitation provide favorable environmental conditions for the growth and reproduction of BLH populations; which in turn, increases the potential for the spread of BCTV and its devastating effects within the agricultural economy. The year 1919 was such a year and nearly ended the then young sugar beet industry in California. Out of the near disaster of 1919 emerged a concerted effort by private, state and federal researchers to design control methods that would minimize BCTV incidence. After extensive research over a

period of several years in California, it was found that BLH populations migrated between the valleys and the foothills and at times concentrated on particular host plants (Severin, 1933). It was apparent that once breeding grounds and migration patterns were determined, control efforts could be economically carried out with a minimum of expense.

The sugar companies originally carried out control until the realization that a number of other important crops were susceptible to infection. As the other susceptible crops such as tomatoes, melons and beans increased in acreage, growers found control work becoming futile because of the migratory nature of BLH and the fact that the main breeding grounds were in uncultivated foothill areas under control of disinterested parties. Private growers and industry could not pursue the insect into the breeding grounds where control was most effective.

In 1943, the State of California, Department of Food and Agriculture, assumed full responsibility for the control of BLH. In the first years the annual control budget was only $15,000; however, as the effectiveness and cost of the Program increased, the State Legislature enacted a law requiring grower assessments totaling 65% of the budget. In 1994 the BCTVCP became 100% funded through grower assessments.

A 15 year average of 67,198 acres is treated annually by air to control the BLH on rangeland and in cultivated fallow fields on both BLM and private lands (page D24). In any given year, the BCTVCP may treat between 5,000 to 15,000 acres of BLM land. An average of 3,959 acres of BLM land has been treated between 1995 and 2009. Appendix “A” lists BLM lands that are within or close to Program survey areas. The BCTVCP maintains BLM parcel map layers updated from the BLM website and from shape file requests through BLM staff.

While it is possible for BLH populations to develop anywhere within Program survey areas, the breeding areas and the Program’s treatments in a given year, cover a much smaller portion of the Program’s general survey area. The total surface area treated or “footprint”, are boundaries of individual aerial application events expressed as a treatment polygon in our mapping program. To illustrate the Program’s treatment history, these polygons have been “over-laid” to produce a composite map or multi-year treatment map showing aerially treated polygons in from 1997 to 2007 & 2009 to 2011. A set of detailed maps (D13 through D21) more clearly indicates what areas were sprayed and how often. The shading gradient of these treatment polygons shows the frequency of aerial treatments over specific acres of land (surface treatment area). Based on past treatment data, these maps illustrate the most probable locations and frequency of continued BLH control activities.

From 1997 to 2011 the total surface area (footprint), treated by the BCTVCP, at least one time, encompasses approximately 373,796 acres. The Multi-Year Aerial Treatments (Tables 4 & 5) illustrates the frequency of surface treatments between 1997 and 2011. For example, 55.8% or 208,762 acres of the cumulative surface area was treated just once during the past 14 years. Approximately 4.0 %, or 15,096 acres, out of the entire 373,796 acres, were treated 5 out of 14 years. A total of 480 acres were treated 9 times out of 14 years or 0.1% of the total aerial application footprint. In 14 years, approximately 14, 460 acres of BLM lands were treated just once; 2,833 acres were treated 4 years out of 14; and 632 acres were treated for 6 out of 14 years.

2.3 BEET LEAFHOPPER DESCRIPTION/LIFE CYCLE

The beet leafhopper (*Circulifer tenellus*) is a leafhopper in the family *Cicadellidae*. The wedge-shaped adult is approximately 1/8 inch long. Adults range in colors from pale green in spring, light brown during summer months and dark brown with blotches from late fall into winter.

From egg to adult a beet leafhopper can take 23 to 37 days. Egg and nymphal periods vary from 37 to 99 days. Incubation of the eggs varies from 11 to 55 days with temperature determining the length of the egg period and nymphal development (Severin 1921). There may be as many as 3 to 4 generations per year. BLH's have a high reproductive rate. The numbers of eggs deposited by a single female BLH from two locations were 237 and 247 eggs. Adults can survive 2 to 3 months during summer generations and survive 4 to 5 months when overwintering.

The BLH's host range includes more than 300 plants species from many families. A large number of host plant species are found in *Chenopodiaceae* and *Brassicaceae*. As the winter annuals dry in the spring in the San Joaquin Valley, the BLH migrates from the westside rangeland habitat into the valley to green summer annuals or onto crops. Summer annuals include Russian thistle, London rocket, mustards, *Bassia, Kochia,* pigweed, goosefoot, lamb's quarters. The BLH remains in valley floor until fall where it migrates back to rangeland habitat feeding on any green host plant (*Atriplex* sp.) until the first rains germinate winter annuals. Important winter annuals include peppergrass (*Lepidium* sp.), *Plantago* and filaree (*Erodium* sp).

3.0 PROPOSED ACTIONS AND ALTERNATIVES

3.1 ALTERNATIVE 1- PROPOSED ACTION

3.1.1 General Program

The Proposed Action alternative of BCTVCP represents an overall strategy for the control of the BLH statewide where the infection of susceptible crops and backyard gardens is likely. On an annual basis, the BCTVCP surveys for and monitors the development and movement of the BLH from historical breeding grounds on the west side of the San Joaquin Valley, and portions of the Salinas, Cuyama, Imperial and Palo Verde Valleys. Potential survey areas are not denoted by rigid boundaries, but represent generalized zones where the rangeland topography and weather conditions have been conducive to historical BLH development. BLH development is influenced by annual variations in temperatures; the timing and amount of rains, fires, and grazing. Variations in weed control practices within intensive agriculture can influence the development of BLH populations in cultivated fallow fields. Fallow fields are defined as temporally fallowed ground within intensive agricultural. Control is performed within historical rangeland breeding grounds on both private and BLM lands; and along ditches, roadsides and fallow fields in cultivation adjacent to rangeland.

Throughout California at various times of the year, BLH populations developing on host plants in rangeland, cultivated fallow fields and roadsides, posses the potential for vectoring BCTV to susceptible crops. Control is a year-round effort. Winter treatments are performed from January 15th to the end of February. Spring treatments can be performed from late March through the end of May. Fall treatments are performed during the month of October. The amount of rain, timing of rain, and temperature affect host plant development and the timing of treatments. As with most pest insects, control is linked to the life cycle and directed at disrupting its continuity. Aerial treatments (fixed-wing) are employed to control BLH populations in rangeland habitat and in large cultivated fallow fields, while ground-rigs are utilized to spot treat BLH populations within intensive agriculture adjacent to rangeland breeding grounds and BCTV susceptible crops.

San Joaquin Valley - In the San Joaquin Valley, the BCTVCP usually conducts three aerial campaigns annually which closely coincide with the reproductive biology of BLH. The winter, spring and fall control periods in the San Joaquin Valley are performed on the west side and southern end of the Valley and are generally performed within three separate geographical areas. A single treatment per calendar year for any given area is generally sufficient to control BLH populations.

Due to geographical distribution of the overwintering populations, the winter treatment area does not overlap with spring and fall treatment areas. Therefore, the maximum number of aerial treatments occurring in one area would be two treatments annually.

- Fall populations of BLH are developing in Russian thistle on rangelands previously treated in the spring, or

Approximately 17,000 acres of historical spring breeding grounds in the Pleasant Valley, Fresno County, have the potential to produce Russian thistle populations. Approximately 100 to 3,000 of the 17,000 acres may need a spring and fall treatment in any one calendar year. Appendix C, pages C3-C5 illustrate potential overlap of spring and fall intensive control areas in the San Joaquin Valley.

- Late spring rains rejuvenate drying rangeland vegetation and a second generation of BLH develops on rangeland treated earlier in the spring. Late spring rains have historically developed a second spring generation of BLH in the San Joaquin Valley every 5 or 6 years involving an estimated 1,000 to 10,000 acres of rangeland.

Imperial and portions of the Palo Verde Valley - In the Imperial and Palo Verde Valleys, the BCTVCP conducts a single aerial treatment when necessary, in the winter or spring, depending on host plant development. Aerial treatments in the Imperial Valley have been performed once in the last 15 years. Ground-rig spot treatments are more commonly used to control BLH populations in the Imperial Valley than aerial treatments. Aerial treatment acreage varies from one hundred to several thousand acres and the specific locations receiving treatments vary from treatment period to treatment period. Many years may pass between treatments to any specific location. A second treatment per calendar year, over the same geographical area, due to additional rain in the Imperial Valley has never been necessary and is not anticipated in the future.

Salinas Valley - Aerial treatments have been performed twice in the Salinas Valley during the last 28 years (1977 & 2002). Aerial treatments in the Salinas Valley have been rare, but might be performed as frequently as once every 7 to 10 years.

Program Vehicles – The BCTVCP utilizes 4-wheel drive pickups and small sports utility vehicles to perform survey and treatment activities. Program vehicles are driven on paved and unpaved established roads. Ground-rig vehicles are 4-wheel drive pickup trucks with a Buffalo Turbine blower mounted in the truck bed.

Ground-rig Spot Treatments - While aerial treatments are employed to control BLH populations in rangeland habitat and large fallow fields, ground-rigs will be used to spot treat migrating BLH populations along roadsides or ditch banks within intensive agriculture adjacent rangeland breeding grounds. General ground-rig spot treatments target BLH host weeds in areas where BCTV susceptible crops are grown and ongoing weed control activities are prevalent including disking, mowing and herbicide use. The greatest potential for ground-rig spot treatments are those areas where high BCTV infection has been seen in susceptible crops on the extreme western edge of the San Joaquin Valley, from Little Panache Canyon, south to Kettleman City, between Interstate 5 and the California Aqueduct. From Kettleman City, south into Kern County, potential ground-rig spot treatments are performed near susceptible crops on both sides of Interstate 5 due to potential migrations from the Elk Hills, Buena Vista Hills and the various oil fields spread throughout the west side of Kern County. In the Imperial Valley, ground-rig spot treatments are performed within the agricultural region surrounding El Centro, Brawley and Calipatria. Ground-rig spot treatments in the Salinas Valley have been performed

within intensive agriculture along the Salinas River from Greenfield south, to the San Ardo oil fields. See survey area maps in Appendix D.

On rare occasions, ground-rigs are used to treat BLH populations in small-cultivated fallow fields too small or isolated to be economically treated by aircraft. Small fallow fields, subject to ground-rig applications, range from 1 to 20 acres and are usually located at the periphery of larger cultivated fields isolated by the intersection of roads, ditches, power lines, equipment yards, or dry washes.

A ground-rig is typically a four-wheel drive pickup truck with an engine-powered blower in the bed. Insecticide is injected into the air stream of the blower nozzle, which is movable. Although a ground-rig can treat a swath as wide as 50 feet, the swath width is constantly adjusted to the width of the area containing roadside host plants and averages 20 to 25 feet wide. The blower is equipped with dripless nozzles and electric cutoff for precise control of spray. All controls are inside the cab where the operator can start and stop the blower engine, turn the spray off and on and control the direction of the blower. Malathion is mixed in a 100-gallon tank mounted in the bed of the truck and applied at the same rate as an aerial application. Ground-rig vehicles are generally driven on roads accessed by agricultural vehicles and equipment within intensive agriculture. The size and locations of ground-rig treatments in cultivated areas are related to the size and location of BLH populations in adjacent rangeland habitat. Ground-rig applications are performed immediately following aerial treatments. Spring ground-rig applications are performed for duration of one to two weeks and target BLH populations migrating from rangeland. Fall ground-rig applications are generally one week in duration and target BLH populations developing through the summer. In most locations, one ground-rig treatment per year is generally sufficient to control roadside and ditch bank BLH populations.

Designated Ground-rig Only Areas - The BCTVCP personnel use ground-rigs exclusively to control BLH populations in three distinct control areas. These areas are designated "ground-rig only" and include a portion of the San Joaquin Valley (page D2-D3), the Palo Verde Valley (page D11) and the Cuyama Valley (page D12). The frequency of ground-rig only treatments within “ground-rig only” areas, are tabled on page D25. Both spring and or fall treatments are possible within the San Joaquin Valley “ground-rig only” control areas (Table 6, D23)..

Fall Survey

Fall control operations in the San Joaquin Valley are the culmination of monitoring the BLH population on Russian thistle (*Salsola* sp.) developing in rangeland habitat or in cultivated fallow fields on the west side of the San Joaquin Valley. Russian thistle is a significant epidemiological host plant, not only as a BCTV reservoir (Wintermantel 2004, Chen 2010), but a significant reproductive host plant as well. Beginning in June, developing Russian thistle is mapped in cultivated fallow fields, oil fields or rangeland. The BLH populations are monitored with sweep net surveys and the maps are updated weekly. Fall treatments selectively reduce BLH populations concentrating on summer host vegetation before they can migrate to historical overwintering sites.

Determining the status of BLH populations throughout the year is dependent on survey with insect nets. Both pre and post-treatment surveys in Russian thistle are conducted on foot using a heavy-duty sweep net with shallow net bag of BCTVCP design. The net frame consists of a stiff 15" round hoop constructed of 3/16" steel attached to a hardwood handle 7/8" round by 25" long. During survey, the net is vigorously swung horizontally in order to contact the Russian thistle plant in such a manner as to enter the foliage several inches and sweep through with sufficient velocity to dislodge BLH and collect them in the attached net bag. The bag is 16" deep and 15" in diameter, constructed to form a shallow cone. Once captured, the BLH begin migrating from the base of the net towards the open top where they are counted as they attempt to exit.

TABLE 1 **BLH Population Levels Determined through Sweep Net Counts**
(Adults and Nymphs)

Treatment Period	Low BLH Population	Moderate BLH Population	High BLH Counts
Winter/Spring	<5 BLH's/ 10 net sweeps	5-14 BLH's/ 10 net sweeps	15-50+ BLH's per 10 net sweeps
Fall	<5 BLH's /single net sweeps	5-14 BLH's /single net sweeps	15-50+ BLH's per single net sweeps

Moderate and High BLH counts are subject to treatment. Factors determining treatment include size of area, density of natural enemies; and the proximity to overwintering and sensitive species habitats, susceptible host crops, and recent viral outbreaks. The single net sweep method is directly related to actual counts from enclosed trap studies. If BLH counts on Russian thistle averaged 100 per net sweep and post-treatment counts (72 hours after treatment) average three BLH's per net sweep in the same area, the population is considered to be reduced by 97%. A 97% reduction is considered excellent control since malathion at 7.7 oz. per acre cannot fully penetrate the canopy of moderate sized (60 to 72 centimeters) Russian thistle. However, most treatments result in a 90 percent or higher mortality because of BLH movement to the outer perimeter of the plants where contact with the malathion is assured.

By mid or late September, the Russian thistle harboring the largest populations of BLH has been delimited and the emergence of nymphs, which will be the overwintering generation, has begun. The overwintering generation will be the adults that migrate from the Russian thistle to the hills on the west side of the San Joaquin Valley to seek out sunny south-facing slopes on which they produce the spring generation of BLH. A percentage of the overwintering BLH carry BCTV to winter annuals where the disease multiplies and is carried back to cultivated crops by the spring generation of BLH. The only differences between the spring and winter treatments are the time of year and the phase of the life cycle of the BLH that is targeted. In winter, the adult female is targeted prior to egg deposition, whereas, spring operations target adults and nymphs of the first spring generation (See Appendix "F" for detailed control strategies). Once the BCTVCP personnel, biologists and Agricultural Pest Control Specialists (APCS), determine that the probability of achieving maximum population reduction is high, pre-treatment counts of the BLH populations are made and aerial control operations are started.

Fall Treatment

Aerial control of BLH is accomplished by insecticidal application with fixed-wing aircraft or helicopter. Malathion is applied across delimited areas at one gallon of mix per acre. A swath width of 100 to 125 ft is utilized with fixed-wing aircraft while a 100 ft swath is used for helicopter applications. The BCTVCP currently uses Fyfanon ULV AG 96.5% (67760-35). ULV malathion is mixed at a rate of 7.7 oz. in 120.3 oz. of buffered water. The mix is sprayed at a rate of one gallon/acre, or 0.583 lbs. a. i. /acre, to control BLH populations. Malathion is the only product registered in California for the control of BLH on rangeland.

Concentrated malathion and water are transported to the aircraft loading site as near to the control area as practical. Mixing is accomplished by metering water, buffered to a pH of 6.5, into a mix tank then metering the prescribed ratio of malathion into the mix tank under agitation. The aircraft is loaded by connecting a hose with a drip proof connector between the mix tank and the aircraft. Each load transferred to the aircraft is metered and checked against the known area treated to assure proper application rate. Spray booms are calibrated on site under the supervision of the CDFA supervisor before application is started and periodically re-checked during the course of the operation. Nozzle arrangement and boom lengths are adapted to allow for the differences in operating speeds of various aircraft while delivering a gallon/acre with an average droplet size of 350 microns.

To aid the accuracy and efficiency of the aerial application, Global Positioning System (GPS) navigational equipment is now required under contract to aid the precise application of malathion. The use of the GPS system with a fixed-winged aircraft, for the most part, has eliminated the need for flag persons on foot. Prior to treatments, Program staff obtains GPS points around mapped potential treatment sites with a hand held GPS unit. This information is placed on a potential treatment map and given to the pilot for reference. The GPS point allows the pilot to locate the general vicinity of the treatment polygon where BCTVCP personnel are present in vehicles to mark and direct the aircraft to starting points, cutoff points, and observe the applications from the ground.

To initiate aerial treatment, BCTVCP personnel on the ground visually identify a starting point and communicate that position to the pilot using ground-to-air radio. The pilot sets a starting point into the on-board GPS unit at that visual position while flying through to the opposite boundary identified by Program staff on the ground. A second visual point is set, establishing an “A-B” line. The on-board GPS unit then generates 100 to 125 foot parallel interval treatment swaths, from that “A-B” line, across the entire polygon. When the aircraft reaches the end of the polygon, BCTVCP personnel on the ground, directs the final swath by position of a vehicle or referencing a visual landmark. Because the accuracy of GPS equipment may vary from several meters to 10 feet, the BCTVCP does not depend solely on the on-board GPS equipment to select the application site. Program staff is directing the establishment of the A-B line and defining the boundaries of the treatment polygon visually from the ground to assure only the areas selected for treatment are sprayed.

In the event that GPS cannot be used, flag persons are placed at each end of the swath and at intervals in the swath line if needed. The flaggers keep the aircraft in line by waving a flag or

providing the pilot a bright flash of light from either a signal mirror or powerful spotlight. Once the aircraft approaches one flagger and is sighted on the next, the flagger moves 100 to 125 feet to direct the next swath. Since flaggers are on foot, communications are maintained by hand held radio. Supervisors are in constant contact with the pilot and flaggers by radio to give directions, where needed.

The aircraft and pilots are under contract to CDFA and meet or exceed all Federal Aviation Administration (FAA) standards. In addition, CDFA requires that the pilot hold a valid pest control aircraft pilot's certificate per FAC 11901, an appropriate and valid commercial pilot's certificate, a current appropriate medical certificate issued by the FAA as a journeyman agricultural pilot, and have a minimum of 1,000 hours in the type and model aircraft being used. Equipment used in conjunction with aerial control operations normally consists of one helicopter or airplane, fuel and water/mixing trucks, furnished by the contractor. CDFA vehicle include five to six pickups for biologists, APCS's and flaggers if needed. Flaggers are placed and retrieved via the passenger vehicle where roads are available. If no roads are available, flaggers are placed and retrieved by helicopter.

When fixed-wing aircraft are utilized, the fuel truck and mixing vehicles are located at a landing strip, which is frequently remote to the treatment area. This effectively reduces the number of vehicles supporting treatment activities within the immediate treatment. The number of BCTVCP personnel needed to support a single fixed-winged aircraft or helicopter during treatment operations varies from 8 to 12 people. More people are utilized in areas where constant surveillance with extra passenger vehicles is necessary to minimize accidental exposure to people, water sources or to assist in flagging sensitive habitat boundaries. Within 72 hours after application is completed in an area, post-treatment checks are made to assure the desired reduction of the BLH population has been achieved.

Winter/Spring Survey & Treatment

Survey and treatment of BLH populations in winter/spring differs from fall control strategies. BLH overwintering and spring breeding sites in the San Joaquin Valley are located on south to southwestern facing slopes within the upland foothill terrain of western Kern, Kings, Fresno and Merced counties. Breeding sites are located where dense growing wild oats, red brome, foxtail dominated rangeland gives way to slopes harboring sparsely populated, stressed plant communities, including filaree (*Erodium*), peppergrass (*Lepidium*) and *Plantago*.

Soils are typically low in organic matter and are unable to retain moisture necessary for robust plant development. The BLH, being a desert insect, benefits from these sparse and stunted plant zones. The slope, sun angle and sparse growth provides heat necessary for egg and nymph development at a time of year when the vast portion of the San Joaquin Valley is influenced by fog and cool temperatures. BLH migrate and concentrate in these microhabitats during the winter and early spring months. In addition, the sparse plant growth and poor soils are subject to rapid dehydration and are usually the first rangeland areas to show moisture stress in the spring while rangeland on north and east facing slopes and flats remain green. BLH treatments target these sparsely vegetated breeding areas after a majority of the nymphs (90%) have hatched but prior to the adult migrations.

A different net and sweeping technique is used during winter/spring survey. The net bag is the same; however, the stiff 15" hoop is replaced with a flexible hoop made of flat stainless steel attached to a 30" handle. In sweeping, the net is held against the ground and swiftly moved in a horizontal arc approximately 150^{o} from side to side. As it passes over the tops of host plants, BLH attempting to escape are caught in the cone of the net. BLH counts are determined by the number of BLH's present in the net by sweeping 10 times across short peppergrass, *Plantago,* or filaree. Both pre and post-treatment surveys are conducted and daily evaluations of populations are made in order to alert growers of susceptible crops as to the threat posed by BCTV infection in various areas.

Due to the early drying of sparsely vegetated breeding habitat, pilots can easily discern BLH breeding areas from other rangeland vegetation. Treatments using fixed wing aircraft are performed as in fall treatment. If flaggers are necessary, they are used to direct the aircraft to pre-designated slopes where concentrations of BLH have been located. Mixing and loading of aircraft is identical to fall treatment.

In contrast to BLH breeding sites in the San Joaquin Valley, historical spring breeding sites in the Imperial Valley develop across the desert floor where seasonal rainfall patterns influence the random growth of host plant populations. (Further information regarding control strategies can be found in Appendix "F".)

3.1.2 Pesticide Training

BCTVCP personnel are trained in the safe and proper mixing, loading and application of malathion in compliance with both federal and state pesticide regulations and the product label. Each full time employee maintains and updates a BCTVCP Safety/Pesticide Training Manual consisting of general safety rules and the written pesticide-training program. Each employee attends a documented pesticide training session annually or prior to working with malathion. In addition, members of the BCTVCP staff maintain a Qualified Applicator Certificate, issued by the California Department of Pesticide Regulation. To maintain a certificate, 20 hours of continuing education courses must be completed every two years.

3.1.3 Notification

The notification of property owners prior to survey and BLH control is a fundamental part of the program. Written permission for continued survey and possible treatment is solicited from the owners or lessees of BLM and private lands where BLH host plants have been mapped. County property plat books are used to locate names and addresses of property owners. Within winter and spring treatment areas, where large tracks of rangeland are held by small numbers of oil companies or ranchers, the landholders are notified in person. The written waiver informs the owner of the presence of BLH host plant populations and the potential for harboring BLH on their property. Comments or special instructions are requested from the landowners in an effort to minimize the impact of the Program on their daily activities. Special concerns of property owners and the BCTVCP may include honeybees, livestock, endangered species, water sources, work crews, recreational uses or pre-existing medical conditions of landowners. Copies of both the malathion label and material safety data sheet are made

available on request (See Malathion label and Material Safety Data Sheet (MSDS) in Appendix B).

A special effort is made to give a 24/48-hour notice of treatment, if requested by property owners. The one to two-day notice is more commonly requested by the various oil companies to inform company personnel and private contractors within the oil fields, where BLH control will be performed.

Agencies, such as the BLM, California Department of Water Resources (CDWR) and California Department of Parks and Recreation (CDPR), have requested a substantial prior notice of treatment, coordination meetings, or a temporary permit prior to survey or treatment. Pre-treatment meetings and temporary permits generally highlight safety concerns, the notification of local field supervisors, descriptions of the potential treatment sites and known endangered species locations.

3.1.4 Honeybees

Due to the susceptibility of honeybees to malathion, care is taken to locate apiaries during pre-treatment survey activities. The County Agricultural Commissioners (CAC) offices and the Kern Agricultural Chemical Association are utilized by the BCTVCP to notify beekeepers prior to BLH treatment activities.

Commercial beekeepers are required to register apiary locations with CAC offices and may register with the Kern Agricultural Chemical Association. Comparisons of BCTVCP potential treatment maps to current bee locations at both the CAC and the bee notification service are made prior to treatment. Locations are noted and follow-up field surveys are performed to confirm the presence of bees. The beekeeper is contacted if BLH control must be performed within 1 mile (1600 meters) of the apiary. Pre-treatment contact with the CAC and the bee service also alerts beekeepers, looking for new apiary locations, of the BLH survey areas and approximate time frame. BCTVCP staff attempt to contact owners of unregistered apiaries, found during pre-treatment surveys, using the owner information stenciled on the hive boxes. If the owner's name and phone number does not appear on the hives, the CAC is contacted in an effort to locate the owner.

3.1.5 Avoidance of Non-target Sites

Program personnel, through extensive field experience, become intimately acquainted with all physical characteristics of the terrain within their assigned districts. This includes familiarity with non-target sites and situations such as human activity, livestock, water sources, endangered species locations and riparian zones.

The close familiarity with treatment areas and continual BLH delimitation surveys performed during the 4-5 week period prior to the commencement of aerial applications enables Program personnel to predict where non-target sites and situations are likely to occur. Maps provided by private parties, the BLM, National Resource Conservation Service and the U.S. Geological Survey are utilized to record the locations of BLH populations and the position of non-target

sites. In addition, computerized field maps, created by the BCTVCP, aid field personnel and aerial applicators in identifying non-target areas within or adjacent to delimited treatment areas.

Prior to the treatment of each area, the aerial applicator is briefed and given a map of non-target sites, treatment restrictions and potential aviation hazards within areas to be treated. On occasion, reconnaissance flights are performed to point out non-target areas and potential aviation hazards to pilots unfamiliar with a particular treatment area.

Aerial applicators and Program personnel performing ground-rig applications, leave buffers around non-target sites within the treatment area. To aid the aerial applicator in this task, Program personnel routinely place flag persons or position vehicles, as cutoff points, between the non-target sites and the flight path of the aircraft, assuring a proper buffer. In addition, field supervisors are in constant radio contact with the pilot to aid and direct the pilot in locating and avoiding non-target sites.

3.1.5.1 Water

The site specific protection measures for water include:

- The prohibition of direct application to bodies of water.
- No-spray aerial buffer zones of 650 feet (200 meters) and ground-rig buffer zone of 50 feet (15 meters) are established for bodies of water (canals, ponding basins) in and adjacent to agricultural settings. The BCTVCP exceeds BLM established buffer zones for pesticide treatments near water of 100 feet, for aerial; 25 feet, ground application; and 10 feet for hand applications.
- Aerial and ground-rig buffer zones are enlarged for specific endangered species habitat.
- To reduce potential for drift, malathion is not applied when average wind speed exceeds 5 mph.
- Application restrictions are established when rain is forecast (page 25).

3.1.5.2 NPDES Permit

The BCTVCP conducts all treatments in compliance with the requirements of the Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for Biological and Residual Pesticide Discharges to Waters of the United States from spray applications. CDFA's Pesticide Application Plan (PAP), and the BCTVCP section, can be accessed at <http://www.cdfa.ca.gov/plant/npdes/>. For the BCTVCP, most of the water bodies, likely to be exposed to treatments when water is present are located in the winter/spring treatment areas, on the west side of the San Joaquin Valley. Sampling of approximately 1 to 3 representative sites per year may be possible in the winter/spring treatment period. One sampling site per year during the fall aerial treatments may also be chosen.

Aerial applications to control the Beet Leaf Hopper (BLH) populations are directed by the results of BLH population surveys as determined with sweep net methods. The proximity of BLH development to water bodies can not be pre-determined in advance of population surveys. BLH population development is weather dependent and varies in extent and density from year to year. The variations in temperature, quantity and timing of rainfall influence the

development of host plants and BLH populations. In any given year, rangeland habitat chosen for treatment may or may not be in close proximity to water bodies. The ephemeral nature of the streams on the west side of the San Joaquin Valley also dictates the quantity and location of appropriate sampling sites in a given year. Sampling sites will be chosen when water is present and there is a maximal likelihood that the pesticide could drift to the water.

3.1.5.3 Riparian Habitat

Riparian habitat is not conducive to the growth and development of BLH host plants and therefore is not treated. The area of riparian influence or "green belt" is in stark contrast to drying rangeland vegetation where treatments are conducted. Buffer areas of at least 650 feet (200 meters) are left untreated near riparian watercourses. The buffers extend from the outer edge of the influence of the watercourse (green belt) into arid areas of drying rangeland vegetation. Buffer zones are widened sufficiently to compensate for the curvature of streambeds and current wind direction.

BLH breeding habitat, in close proximity to riparian water courses, are most often located on the north side where the slope direction and host plant growth is suitable for BLH development. The slope and sun angle in rangeland habitat on the immediate south side of water courses is not conducive to BLH development and when left untreated, functions as a buffer of 400 to 600 yards (356 to 584 meters) or more.

3.1.5.4 Dune Habitat

Dune habitat in the San Joaquin and Imperial Valleys is not conducive to the growth and development of BLH host plants and therefore is not treated.

3.1.5.5 Critical Habitat

The BCTVCP will not survey or treat within in critical habitat units. A standard ¼ mile buffer (400 meters) will be left untreated adjacent to critical habitat. A ½ mile (800 meters) buffer will be established around critical habitat designated for vernal pool fairy shrimp and desert pupfish to conform to avoidance measures for occupied habitat.

3.1.5.6 Runoff and Drift Prevention

Weather conditions within potential treatment areas are important factors in determining the effectiveness of control applications. Each canyon is different with respect to weather patterns, precipitation, propensity for fog and winds. A great deal of time and money is invested in the survey, delimitation and treatment of BLH populations. It makes little sense to apply expensive materials by expensive methods when windy or inclement weather conditions could nullify control efforts and increase the potential for drift or runoff into non-target areas.

Listed below are guidelines employed by the BCTVCP to reduce the potential for drift and runoff from the influences of weather:

- Prior to and during treatment activities, the local weather forecasts are consulted on a daily basis to ascertain the likelihood of rain and wind. During control operations, wind speed and direction are constantly monitored in the target area to eliminate drift into non-target areas. Aerial and ground-rig applications are curtailed when average wind speeds exceed 5 mph. Constant communication is maintained with aircraft to alert the pilot should weather conditions change. When necessary, buffer zones enlarged to compensate for wind direction in several ways. The swath application can be applied parallel or perpendicular to the water body depending on wind direction. Perpendicular swaths can be shortened or the last one or two parallel swaths can be eliminated thereby increasing the width of the buffer.
- When plant cover is moist due to recent rain, dew, or frost, the BCTVCP delays the application of malathion until the plant cover is nearly dry.
- Local weather conditions are monitored to ensure that there is an adequate window of time to allow the application to properly dry prior to any rain incident.
- If rainfall of more than a moderate amount (.25 inch or more) is predicted locally within 48 hours, applications will be discontinued until the predicted rain period passes.

3.1.5.7 Drift Model Analysis

The BCTVCP utilizes a standard 650 feet (200 meter) aerial buffer zone to reduce the effects of potential drift to Program Area water bodies. Larger aerial buffer zones are specified for particular listed species (Section II, and Appendix K). The adequacy of aerial buffer zones, to assure significant reductions in potential exposure to water bodies, has been examined by USDA at the request of the BCTVCP. A drift simulation using the model AgDrift® was developed to analyze the percent reduction in drift deposition over varying distances from the edge of a typical BCTVCP treatment swath (Appendix D, pages 27-33). BCTVCP application parameters were used as input data for the model. Wind direction was assumed to be -90^0 directly towards the sensitive habitat at a sustained 8 mph. The drift analysis also states that large reductions in deposition with relatively short buffer zones are typical for most pesticide applications.

TABLE 2 USDA AgDrift® Estimate of Drift and Residue Reductions

Chemical	Buffer zone (ft)	Initial Average Deposition (mg/cm^2)	Percent Reduction in Deposition
Malathion	0	0.0042	-
	108.3 (33 meters)	0.0007	83.3
	328.1 (100 meters)	0.0002	95.2
	984.2 (300 meters)	0.00003	99.3
	2600.0 (792 meters)	0.000002	99.9

***Table 2 was constructed from Aerial Drift and Terrestrial Residue Estimates page D29.**

Table 2 lists the deposition residues at the edge of the spray block at different buffer zones adjacent to the spray block expressed as mg/cm2. Residues from 100 meters to 300 meters

range from 95.2-99.3 percent reduction or between 0.0002 & 0.00003 mg malathion/$cm^{2.}$ The estimated deposition reduction at 100 & 300 meters is a conservative estimate as published literature validating the drift model has demonstrated the model predictions, beyond 80 meters (262 feet), overestimates actual concentrations.

The AgDrift® model can be used to estimate potential Malathion residues at 650 feet (200 meters). The calculations are shown on page D33. Assuming a body of water 4 inches (10.16 cm) deep receives the entire malathion residue from a treatment 200 meters away, the model estimates Malathion drift residues in water 1.28 ppb.

In addition, water bodies in the Program Area have a pH ranging from 8.1 to 8.75 (D34-37). A half-life of malathion in water was estimated at 1.65 days at pH 8.16 (Wang 1991). Most water bodies are streams and not static. Recharge flow of upstream waters would immediately dilute potential drift concentrations.

TABLE 3 **Dissipation Distances from Various Aerial Applications**

Wind Speed (mph)	Boom Width (% of wing span)	ULV	Non-ULV Formulations (formulations using water carriers)
Most Sensitive Freshwater fish – Rainbow trout: LC_{50} = 4 ug/L			
10	60 ft	0	25 ft
	75 ft	0	100 ft
15	60 ft	0	50 ft
	75 ft	50 ft	150 ft

***Table 3: Re-constructed from Re-registration Eligibility Decision for Malathion (USEPA 2006).**
(LC_{50} is the lethal concentration to cause 50% mortality of a test animal population)

BCTVCP buffer zones can be compared to those recommended by United States Environmental Protection Agency (USEPA) to assure malathion concentrations in water bodies from potential drift are below those for the most sensitive freshwater fish (rainbow trout=LC_{50} = 4 ug/L (USEPA 2006). Table 3 shows USEPA recommended buffer zones for non ULV formulations using water carriers. BCTVCP buffer zone of 650 feet (200 meters) is 4.3 times larger than the largest buffer (150 feet, 46 meters) recommended by USEPA and 6.5 times larger than BLM's 100 foot recommended aerial buffer for water.

3.1.6 Key Features of the Proposed Action

- BLH population levels are assessed through sweep net survey within historical breeding sites prior to undertaking control measures.

- The state is divided into five control districts with an APCS assigned to each district, depending on workload in the particular area. APCS utilize seasonal and permanent intermittent personnel to perform Program tasks. Professional CDFA biologists coordinate workload and evaluate BLH population levels statewide based on predator/prey relationships, virus analysis, weather trends and available host plants. Biologists also supervise activies on the ground during treatment campaigns. Both

biologists and APCS's obtain and hold a Qualified Applicator Certificate from the California Department of Pesticide Regulation.

- Control of the BLH will be accomplished through the application of malathion by aircraft or by ground-rig spot treatments where and when the BCTVCP determines that BLH populations pose a threat to adjacent susceptible croplands.

- Fixed-winged aircraft or a helicopter is utilized to apply BLH treatments to rangeland and cultivated fallow fields. All terrain vehicles are utilized by BCTVCP staff on existing roads to perform pre and post-treatment surveys, monitor aerial applications and if utilized, to position and retrieve flag persons.

    - The use of a GPS equipped fixed-winged aircraft eliminates the use of flag persons, the associated impacts of traversing the treatment area on foot, and vehicle movements to place and retrieve flag persons during treatment activities.

    - When helicopters are utilized, a specially built tank truck equipped with a closed mixing system and a roof mounted landing pad is employed. The nearest existing roads are utilized to move mixing vehicles associated with helicopter applications. If two treatment crews are needed simultaneously in separate areas, a second water truck and an additional vehicle carrying malathion and mixing tank is employed to service the second helicopter.

    - Aerial Standard Operating Procedures

        - The prohibiting of direct application to bodies of water;
        - A 650 feet (200 meter) buffer is established for water bodies.
        - Utilization of dripless nozzles.
        - The BCTVCP utilizes an aerial contractor to perform aerial applications.
        - The on-board flow control equipment is set to deliver 1 gallon mix per acre regardless of aircraft speed. To assure proper calibration, the size of each field treated is routinely compared to the gallons of mix applied to that field.
        - Aircraft pilot is in constant radio communication with Program personnel on the ground to verify wind speed and direction and location of non-target sites and water bodies, are not down wind from treatments.
        - Wind speed and direction is constantly monitored. Treatments are halted when average wind speed exceeds 5 mph. Mixing and loading of aircraft is supervised by Program staff. Applications halted with forecast of rain

- Landing strips and related mixing equipment for fixed-winged aircraft are usually located at a distance, further reducing noise and traffic in the immediate treatment area.

- BCTVCP aerial operations can take place during pre-dawn hours, but only when sufficient light exists to safely navigate and observe obstacles such as power poles, wires and structures. Rarely can BCTVCP aerial treatments begin earlier than 30 to 45

minutes before sunrise. BCTVCP aerial operations are terminated when wind speeds exceed label requirements and/or air temperatures exceed approximately 80^{o}F.

- Ground-rigs are generally used to treat BLH host plants along roadsides and in cultivated fallow fields. (Ground-rigs consist of a mist blower mounted in the bed of a pickup.)

    - The ground-rigs are calibrated to deliver 7.7 oz. of malathion per acre while treating a 25-foot maximum swath, at approximately 10 mph, along roadsides where the BCTVCP determines that population levels warrant treatment. The treatment swath is adjusted to match the width of the target area.

    - Ground-rigs generally use established roads when treating roadside host plants in areas where BCTV susceptible crops are grown. Ground-rig treatments target BLH host weeds in areas where intensive weed control activities are ongoing and may be subject to frequent disking, mowing and herbicide use.

    - Ground-rig Standard Operating Procedures

        - The prohibiting of direct application to bodies of water;
        - A 50 feet (15 meter) buffer is established for water bodies.
        - Utilization of dripless nozzles.
        - The blower boom is directed to the precise angle needed to treat host plants and away from water sources.
        - The spray boom is equipped with electric on/off switch to treat precise target areas where host plants have developed while moving at 10 mph.
        - Wind speed and direction is constantly monitored. Treatments are halted when average wind speed exceeds 5 mph. Spot treatments are made down wind from water bodies.
        - Ground-rig spray booms are operated at a lower pressure than aerial equipment reducing the quantity of fine droplet particles
        - Ground-rig spot treatments are performed by BCTVCP staff.
        - Applications halted with forecast of rain

- The ground-rigs will also be used to treat small-cultivated fallow fields where the size or location of the fallow field, if treated by aircraft, would not be cost effective.

    - The fallow fields will be covered by driving a ground-rig in parallel lines, 25 feet (7.6 meters) apart, across the length of the field with a 25-foot treatment swath.

    - The majority of ground-rig use within cultivated fallow fields is adjacent to rangeland breeding grounds and slows BLH migration toward susceptible crops.

- Aircraft and ground-rigs are calibrated and monitored during treatment to assure a rate of 7.7 oz. of 95% malathion per acre.

  Mix Formulation: 7.7 oz. + 120.22 oz. water + .08 oz. spreading/buffing agent = 128 oz.. mixture per acre

  7.7 ounces of ULV = approx. 0.583 lbs a.i. malathion/acre

  $$7.7 \text{ oz/acre} \times \frac{28349 \text{ mg/oz}}{4046.8 \text{ m}^2/\text{acre}} = 53.9 \text{ mg/m}^2$$

- After treatment is completed, post-spray kill checks are taken by BCTVCP personnel in all areas at 24, 48 or 72-hour intervals. Sampling is the same as pre-treatment sampling. These post-spray checks give a means of measuring effectiveness of the control work. The areas that were not sprayed are also sampled, both to check for possible build-up of the BLH population and predator population, and as a control to measure against areas sprayed.

- The use of a totally closed mixing system reduces the possibility of chemical spill at the loading site.

- Motorized Vehicle Use

  - All BCTVCP vehicles will be restricted to established roads to prevent damage to flora and fauna and to prevent soil compaction. BCTVCP personnel are trained and required to be observant of and avoid wildlife while driving in the area of operation.

  - While vehicle speeds can vary and are commensurate with the quality and condition of established roads, the speed of vehicles will not exceed 25 mph.

  - All vehicle restrictions established for travel on BLM administered lands will be adhered to when applicable. Special designated vehicle restrictions in lands administered by State Agencies will be observed.

- Pre and post-treatment BLH surveys are performed on foot. If personnel are used to direct aircraft across rangeland, flagging activities are performed on foot. Where no roads exist, flag persons walk to the proper position or are placed and retrieved by helicopter.

- Aircraft landing sites will be watered to reduce dust.

- All malathion applications are monitored by program personnel on the ground to ensure proper placement of insecticide and to monitor environmental conditions in the treatment area.

- Wind speed and direction is continually monitored to ensure that the insecticide does not drift into non-target areas. Program staff use hand held Dwyer anemometers to monitor and measure wind speed on the ground.

- To minimize drift, no application of malathion will take place when sustained wind velocities exceed 5 mph.

- Great care and effort is taken to ensure that natural or man-made bodies of water, sufficient to support any kind of wildlife, are not contaminated by runoff, drift, or by direct application. These areas include; springs, wildlife guzzlers, alkali sumps, vernal pools, ephemeral pools, stock ponds, reservoirs, streams and riparian zones (Avoidance of Non-target Sites, page 22).

    - Permanent and ephemeral water sources are located prior to treatments during delimitation survey.

    - Adjacent to all bodies of water, a 650 feet (200 meters) aerial buffer zone is left untreated, and a ground-rig buffer of 50 feet (15 meters) to ensure water quality and reduce impacts to sensitive wildlife.

    - Weather forecasts are consulted prior to and during treatment operations to reduce the potential for runoff (page 25).

- All registered beekeepers are notified by the BCTVCP within a minimum of 48-hours of pending pesticide application (Honeybees, page 22).

- BCTVCP personnel are trained and required to be observant of and avoid wildlife while using established roads within the areas of operation. The speeds of vehicles are commensurate with the quality and condition of roads not to exceed 25 mph.

- Managers of camps and recreation areas are notified prior to treatment.

- All Program personnel have been trained to minimize contamination in the event of a pesticide spill (See “Pesticide Spill Contingency Plan”, Appendix “H”).

- Application contractors are required to furnish journey level pilots who have a minimum of 1,000 hours experience flying the type of aircraft used in pesticide application. The pilot must possess all licenses required by the county and state.

- To minimize contamination in the unlikely event of an aircraft accident, fixed-winged aircraft carry a maximum of 50 gallons active ingredient (a.i.) while helicopters carry a maximum of 24 gallons.

- All vehicles carry fire fighting equipment including a chemical fire extinguisher, type A-B-C, of at least one pound minimum capacity of a type approved by the California Department of Forestry; and, a shovel in good condition with a handle not less than three feet in length

and a blade width not less than 7-3/4 inches. When helicopters are utilized, the tanker truck usually has several hundred gallons of clean water that can be applied by high pressure to control fire, if needed.

3.1.7 Avoidance Measures for Species of Special Concern

Avoidance measures to avoid potential effects to species of special concern have been adopted directly from terms and conditions, and conservation recommendations outlined in USFWS biological opinions 1-1-85-F-36 (1985); 1-6-91-F-20 & 1-1-91-F-6 (1991); 1-6-96-F-32 & 1-1-95-F-141 (1996); and 1-1-00-F-0212 (2001). Avoidance measures are stipulated as terms and conditions of BCTVCP's Federal Pesticide Use Permit. Measures were also adopted from consultations with the CDFG and sensitive areas identified in development of San Joaquin Valley Habitat Conservation Plans.

3.1.7.1 Species of San Joaquin, Salinas and Cuyama Valleys

Blunt-nosed Leopard Lizard (BNLL)

Measures to minimize impacts to BNLL involves a conservation strategy which focuses on efforts to eliminate or severely restrict malathion treatments within habitat important for the recovery and maintenance of the BNLL while allowing control of BLH, when necessary, in historical high BCTV virus areas. (See “Summary of Measures” and Maps in Appendix “C”).

Measures within BCTVCP Designated Conservation Areas

BNLL conservation boundaries are drawn based on best available knowledge and preliminary recovery planning and CNDDB location data. BNLL conservation areas are estimated to cover approximately 154,060 acres (67,060 acres in San Joaquin Valley; 87,000 acres in the Carrizo Plain). Maps of BNLL conservation areas 1-10 are found in Appendix “C”.

Malathion will not be applied in areas designated as BNLL conservation areas # 1, 2, 3, 4, 8, 9, and10.

Aerial applications of malathion will be applied in designated BNLL conservation areas 5, 6, 7.

- Only large BLH populations will be treated (at least 15 BLH’s/10 net sweep average).
- No more than 50% of the area will be treated by alternating a treated swath with an untreated swath to facilitate the quick establishment of insect prey species and spot applications will not cover contiguous parcels exceeding 20 acres.
- BLH control will be restricted to a single annual treatment.

Measures within BNLL Habitat Outside of Conservation Areas

No more than 50% of the area will be treated by alternating a treated swath with an untreated swath to facilitate the quick establishment of insect prey species and spot applications will not

cover contiguous parcels exceeding 20 acres. BLH control will be restricted to a single annual treatment.

Intensive spring treatment areas which overlap intensive fall treatment areas, highlighted in Appendix "C", will have the option of a second additional treatment in fall, up to 50% coverage, of delimited BLH populations on Russian thistle. (These intensive control areas, approximately 17,000 acres, have the potential of developing large BLH populations in Russian thistle on rangeland where a single spring treatment may have been performed. The majority of these areas are located on the west side of Fresno County in the Pleasant Valley. Approximately 100 to 3,000 acres may need treatment in any one year).

USFWS will be consulted prior to the treatment of rangeland habitat, burned the previous year, requiring more than 50% coverage to control large BLH populations**.**

On an annual basis, the BCTVCP will consult informally with BLM, USFWS and CDFG, if necessary, to modify designated BNLL conservation habitat areas and review the status of the BNLL conservation strategy and research.

BNLL habitat is based on occurrence data maintained by the CNDDB, BLM, and the Endangered Species Recovery Program (ESRP) outside the BCTVCP designated BNLL conservation areas.

Tipton Kangaroo Rat and Giant Kangaroo Rats (TKR & GKR)

All malathion applications in the vicinity of known TKR or GKR habitat shall be aerial.

BCTVCP vehicles are restricted to established roads in known TKR or GKR habitat.

San Joaquin Kit Fox (SJKF)

All malathion applications in the vicinity of known SJKF habitat shall be aerial.

Known and potential dens of SJKF will be avoided during ground surveys.

BCTVCP vehicles are restricted to established roads within known SJKF habitat.

San Joaquin Dune Beetle; Ciervo Aegialian Scarab Beetle

Application of malathion is strictly avoided within 1/4 mile (400 meter) of known habitat of the San Joaquin dune beetle; Ciervo Aegialian scarab beetle.

Additional potential dune habitat for each species will be inventoried. Malathion application in such areas, found occupied, is strictly avoided.

Aerial application of malathion within one mile of known and probable population sites are curtailed when sustained wind velocity exceeds 5 mph.

Federal and State Listed San Joaquin and Intercostal Valley Plants

The BCTVCP on an annual basis will consult plant records prepared and maintained by the CNDDB and BLM to update known plant locations.
A one mile buffer (1,600 meters) will be maintained around extant populations of California jewelflower.

A ¼ mile (400 meters) buffer will be maintained around Bakersfield cactus, Kern mallow, Monterey spineflower and robust spineflower during the flowering periods. Monterey spineflower critical habitat will be avoided.

Malathion will not be applied within a ¼ mile (400 meters) of extant populations of San Joaquin Woolly-threads during the flowering period; unless, a critically large leafhopper population is found during pre-treatment surveys, averaging at least 15 BLH's per 10 sweeps. If a critically large leafhopper population is found, malathion treatments will be restricted to a single application every other year.

If it is not possible to maintain a 1/4-mile buffer (400 meters), ground-rig spot applications will be utilized.

If circumstances do not allow the use of ground-rigs, fixed-winged aircraft or helicopters will be used with special effort to minimize pesticide drift and treat only when winds are moving away from the plant location. The BCTVCP can anticipate that a reduced treatment buffer may be necessary to control BLH populations near two historical jewelflower locations in the mouth of Jacalitos and Zapatos Canyons. CNDDB occurrence #'s 7 & 8 are historical sites located in close proximity to BLH breeding grounds. Jewelflower has not been seen in these locations for many years and is considered possibly extirpated. Sites 7 & 8 were surveyed in 1986 (Taylor & Davilla, 1986). Additional surveys were performed at site #8 in 1991 & 1992 in the development of the Pleasant Valley Habitat Conservation Plan; and in 1998 by BLM and BCTVCP.

Nelson's Antelope Squirrel (NAS)

All malathion applications in the vicinity of known NAS habitat shall be aerial.

BCTVCP vehicles are restricted to established roads in known NAS habitat.

California Red-legged Frog (CRLF)

CRLF Critical Habitat will not be treated. An aerial buffer of at least 1/4 mile radius (400 meters) will be maintain around occupied aquatic CRLF habitat.

An aerial and ground-rig buffer of at least 650 feet (200 meters) will remain untreated near aquatic or riparian areas in occupied suitable as potential habitat for CRLF.

BCTVCP will not enter water off road in CRLF habitat to reduce the spread of chytrid fungus between pools and streams.

Program personnel are trained to recognize CRLF while driving off road to avoid hitting migrating adults.

California Tiger Salamander (CTS)

CTS Critical Hbitat will not be treated. An aerial buffer of at least 1/4 mile radius (400 meters) will be maintain around occupied aquatic CTS habitat.

An aerial and ground-rig buffer of at least 650 feet (200 meters) will remain untreated near aquatic or riparian areas suitable as potential habitat for CTS.

BCTVCP will not enter water off road in CTS habitat to reduce the spread of chytrid fungus between pools and streams.

Program personnel are trained to recognize CTS while driving off road to avoid hitting migrating adults.

Giant Garter Snake (GGS)

An aerial or ground-rig buffer of at least 650 feet (200 meters) will remain untreated near aquatic or riparian areas suitable as potential habitat for the giant garter snake.

Valley Elderberry Longhorn Beetle

An aerial or ground-rig buffer of at least 650 feet (200 meters) will remain untreated near riparian areas suitable as potential habitat for Elderberry.

During the time when adult beetles are active (March 15th through June 15th), a buffer of at least 1/4-mile radius (400 meters) will remain untreated near known occurrences of valley elderberry longhorn beetle as defined by the California Natural Diversity Data Base (CNDDB) or other available data base sources. BCTVCP personnel will be trained to recognize elderberry shrubs and potential beetle exit holes.

Conservancy Fairy Shrimp, Longhorn Fairy Shrimp, Vernal Pool Fairy Shrimp, Vernal Pool Tadpole Shrimp

The BCTVCP will annually identify and inventory known habitat for listed fairy shrimp within potential BCTVCP survey areas from the CNDDB.

The BCTVCP will not spray vernal pool grasslands when any aquatic features contain water.
A treatment buffer of a ½ mile (800 meters) will be maintained around vernal pools.

A treatment buffer of 650 feet (200 meters) will be maintained around suspected vernal pools.

Preserves, Reserves & Wildlife Areas

To support ongoing community and ecosystem level preservation efforts within or near the general Program area, the BCTVCP will not perform survey and treatment activities in Wildlife Refuges, Ecological Reserves, Preserves and Wildlife Areas. A 650 feet (200 meter) buffer will be left untreated around the perimeter of these lands. Maps of these areas are founding Appendix L. Listed below are conservation land parcels within or near BCTVCP survey and treatment areas:

Specialty Preserves

National Wildlife Refuges

- Grasslands National Wildlife Refuge
- Kern National Wildlife Refuge
- Pixley National Wildlife Refuge

Ecological Reserves

- Allensworth Ecological Reserve
- Kerman Ecological Reserve
- Lokern Ecological Reserve
- Panoche Hills Ecological Reserve
- Pleasant Valley Ecological Reserve
- Semitropic Ecological Reserve
- Stone Corral Ecological Reserve
- Yaudanchi Ecological Reserve
- State owned Alkali Sink Ecological Reserve

Preserves

- Nature Conservancy's Paine Wildflower Preserve
- Coles Levee Ecosystem Preserve

Wildlife Areas

- Cotton wood Creek Wildlife Area
- Little Panoche Reservoir Wildlife Area
- Los Banos Wildlife Area
- Medota Wildlife Area
- North Grasslands Wildlife Area
- O'Neill Forebay Wildlife Area
- San Luis Reservoir Wildlife Area
- Volt Wildlife Area
- West Hilmar Wildlife Area

Other Parcels

- Allensworth State Park
- State of California Lands along the California Aqueduct
- Metro-Bakersfield HCP mitigation lands

The BCTVCP recognizes three "Specialty Preserves" as defined in the Pleasant Valley Habitat Conservation Plan (Hopkins, 1994). These areas are categorized as sand dune or stabilized sand dunes, and fall within the potential winter BCTVCP survey area. These areas are potential habitat for the San Joaquin dune beetle (*Coelus gracilis*), ciervo aegelian scarab beetle (*Aegialia concinna*) or the redheaded sphecid wasp (*Euceris ruficeps*).

All malathion treatments will be eliminated from within the specialty preserves and BCTVCP vehicles are restricted to established roads.

Doyen's Dune Weevil

Malathion will not be applied to dune weevil habitat. (The portion of T22S-R19E-Sec. 30 which lies on the west side of Interstate 5 at the intersection of Hwy 41 and Interstate 5)

Buena Vista Lake Shrew

The BCTVCP will not treat known Buena Vista Lake shrew (BVLS) habitat to reduce the potential for impacts to the Buena Vista Lake shrew population and indirect impacts to insect prey base.

An aerial or ground-rig buffer of at least 650 feet (200 meters) will remain untreated near marsh areas suitable for BVLS habitat.

No treatments will be performed in BVLS Critical Habitat.

Center For Natural Lands Management (CNLM) Lands and Nature Conservancy

The BCTVCP will not treat Nature Conservancy and CNLM lands that are generally dedicated to threatened and endangered species management and habitat preservation.

Mountain Plover

All BCTVCP personnel will be trained to recognize the mountain plover.

If treatments are necessary during the wintering period of November through early March; alkali sink scrub, fallow fields, and annual grassland areas shall be avoided when mountain plover is present including a minimum buffer of 160 feet (50 meters).

If treatments are necessary adjacent to agricultural fields occupied by mountain plovers, a minimum buffer of 160 feet (50 meters) shall be left untreated adjacent to the occupied field.

South-central California Coastal Steelhead

An aerial and ground-rig buffer of at least ¼ mile (400 meters) will remain untreated adjacent to Critical Habitat designated in the Salinas river and tributaries including agricultural drains and canals.

California Condor

Program ground staff and pilots are trained to look for condors during aerial treatment activities.

Should a condor be sighted within 1/2 mile (800 meters) of aerial treatments, the treatments will be stopped until the bird is at least 1/2 mile from the projected treatment area.

Areas designated as California condor critical habitat will not be surveyed or treated for BLH control.

Least Bell's Vireo

Application of malathion will not be carried out in riparian habitats.

A buffer of 650 feet (200 meters) shall not be treated around all such habitats.

The CDFA will not spray in the Salinas Valley prior to March 15 nor any sooner than July 31.

3.1.7.2 Species of Imperial and Palo Verde Valleys

Desert Tortoise

Vehicles used in the BCTVCP will not exceed 15 mph while conducting surveys or treatment activities within desert tortoise habitat.

Desert tortoises encountered by vehicles used in the BCTVCP will be avoided. If a tortoise cannot be avoided without moving the animal out of harm's way, the following procedure will be followed. Stationary tortoises (i.e. those in the path of a survey vehicle) may not be moved out of harm's way until 10 minutes have elapsed from the time of first encounter. Such tortoises may be handled (i.e. moved out of the way) after 10 minutes have elapsed only by personnel who have received instruction in the appropriate procedures for handling tortoises from trained BLM personnel prior to the commencement of surveys.

Trash will be removed daily from within desert tortoise habitat to avoid attracting ravens and other predators.

Yuma Clapper Rail (YCR) California Black Rail (CBR)

No aerial applications of malathion will be made within 300 yards (270 meters) of potential YCR or CBR habitat. Potential rail habitat is defined as any wetland, including agricultural drains with suitable vegetative cover, in the areas shown on Spring Survey Maps, pages D10-11.

Host plants between 200 to 300 meters of potential YCR or CBR habitat will be treated with ground equipment only.

Areas less than 650 feet (200 meters) from potential YCR or CBR habitat may be treated only with equipment that can deliver malathion to specific target plants.

Malathion will not be applied within 4.3 miles (8 kilometers) of occupied YCR or CBR habitat if rain is expected within 72 hours of treatment.

Desert Pupfish

Application of malathion will not be carried out within a ½ mile (800 meters) of San Felipe Creek.

Application of malathion within 1 mile (1,600 meters) of occupied or designated critical habitat boundaries will not take place when sustained wind velocities exceed 5 mph.

Application of malathion within 4.3 miles (8 kilometers) of designated critical habitat will be curtailed if weather conditions indicate a moderate to high possibility for precipitation within 72 hours of planned treatment.

Southwestern Willow Flycatcher

Application of malathion will not be carried out in riparian habitats which may be used for migration and nesting by the southwestern willow flycatcher.

A buffer of 650 feet (200 meters) shall not be treated around all such habitats during the migration and nesting periods (April 1 to October 31).

Andrew's Dune Scarab Beetle (ADSB)

Malathion application will be curtailed within the geographic range of the ADSB between the months of February through May to prevent mortality of adult beetles during the breeding season.

Prior to an application in January and June, a field examination of proposed treatment areas will be conducted to determine if adult scarabs are active. If present, the malathion application will be postponed until the beetle flight is completed.

A ¼ mile (400 meter) buffer will not be treated around dune habitat of the scarab beetle.

Flat-tailed Horned Lizard (FTHL)

No malathion treatments shall occur in designated flat-tailed horned lizard management areas as set forth in the Flat-tailed Horned Lizard Range-wide Management Strategy.

Application of malathion within the geographic range of the FTHL will be aerial and consist of no more than a single treatment per given area per year.

No spraying from off-road vehicles or use of off-road vehicles on other than designated roads will be used within FTHL habitat.

Peirson's Milk-vetch

Applications of malathion will not be made within known extant populations of Peirson's milk-vetch.

3.2 ALTERNATIVES CONSIDERED

All potential alternatives evaluated in this EA were evaluated against this standard: Would they control BLH numbers and thus meet the statutory mandate. As discussed below, the use of malathion sprays is the only alternative that meets this standard. The only program option that meets this statutory mandate is the Proposed Action Option.

3.2.1 Alternative 2 - No Action

Under the No Action alternative, the BCTVCP would not use any of the above actions. Pesticide treatments would not be performed by the BCTVCP to control BLH. Without annual control, BLH populations and the spread of BCTV would increase in susceptible crops. There is a potential for millions of dollars in losses each year due to the infection of BCTV in susceptible crops.

Regional control of BLH populations would be replaced by local control performed by private growers in rangeland adjacent to their property. It is expected that pesticide use would increase in crop lands to control BLH populations migrating from uncontrolled rangeland habitat. The production of BCTV susceptible organic crops would be nearly impossible in croplands close to historical BLH breeding grounds.

3.2.2 Alternative 3- Reduced Project Alternative

Under the Reduced Project alternative, the BCTVCP would not treat BLM lands. The BCTVCP would control BLH populations where necessary on adjoining private lands using the same procedures as in the Proposed Action.

Historically, BLM lands harbor several areas in which BLH numbers regularly meet treatment thresholds. Leaving these populations untreated will allow large numbers of curly top virus infected BLH to move into commercial and dooryard plantings and to infect these plants with the virus as seen in 2008 when BLM lands were not treated. This program option does not meet the statutory mandate to control BLH numbers and is thus rejected.

Reasons for Rejection

- This program option does not meet the statutory mandate to control BLH numbers and is thus rejected. The law must be followed.
- Potential for increased pesticide use to control BLH by individual growers.
- Potential for increased impact to Threatened and Endangered species as BLH control would not be centralized.
- Potential for increased pest populations, disease incidence and crop damage.

- Negative monetary impact to commercial agricultural production and home gardens.

3.2.3 Alternative 4 -Alternative Pesticide

The use of an alternative pesticide in conjunction with the "Proposed Action," the BCTVCP would conduct the same program activities using an alternative pesticide. No other pesticide is currently registered for use in California for the control of BLH in rangeland. Malathion is used extensively and safely as demonstrated by extracts from the Initial Scientific and Minieconomic Review of Malathion (USEPA 1975) and toxicological evaluation by Cal-EPA (Appendix "I").

Reasons for Rejection

- This program option does not meet the statutory mandate to control BLH numbers and is thus rejected. The law must be followed.
- Inability to conduct treatments as no alternative pesticide is currently registered for the required use in California.
- Potential for increased pest populations, disease incidence and crop damage.
- Negative monetary impact to commercial agricultural production and home gardens.

3.2.4 Alternative 5- Host Plant Eradication-All Potential Hosts

Under this alternative the BCTVCP would attempt eradication of all BLH hosts plant species in rangeland areas. The BLH utilizes many species of host plants for food and/or ova-position sites. The elimination of all host plant species would include native and introduced species, and would have a major impact on the rangeland ecosystem and to grazing animals and wildlife that utilize many BLH host plants. A few host plants are rare and threatened species. The distribution and diversity of host plant species would make the eradication of BLH host plants practically impossible, extremely costly, and environmentally devastating.

Reasons for Rejection

- This program option does not meet the statutory mandate to control BLH numbers and is thus rejected. The law must be followed.
- Increased pesticide use to control many species of host plants.
- Elimination of all host plant species would include native and introduced species, and would have a major impact on the ecosystem and wildlife dependent on the many BLH host plants.
- Potential for increased impact to Threatened and Endangered species from habitat damage and herbicide use.
- Eradication of BLH hosts practically impossible and extremely costly.
- Potential for increased pest populations, disease incidence and crop damage as insect control will not be conducted.
- Negative monetary impact to commercial agricultural production and home gardens.

3.2.5 Alternative 6- Host Plant Eradication-Single Plant Species

This alternative would focus the activities of the BCTVCP on the local eradication of a single plant species used by BLH almost exclusively during specific times of the year. During 1940 to 1965, the BCTVCP endeavored to eradicate localized populations of Russian thistle to reduce the large acreages found on the west side of the San Joaquin Valley. The Project utilized hoeing crews to eliminate young Russian thistle plants prior to seed production. The project was terminated due to high costs and a persistent seed bed making even local eradication of Russian thistle nearly impossible.

Reasons for Rejection

- This program option does not meet the statutory mandate to control BLH numbers and is thus rejected. The law must be followed.
- Financial costs to implement and maintain.
- Elimination of entire BLH host plant would have a major impact on the ecosystem and wildlife dependent on the BLH host plants.
- Potential for increased impact to Threatened and Endangered species from habitat damage to dependent wildlife.
- The need for 100% cooperation from property owners within a region.
- Potential for increased pest populations, disease incidence and crop damage as insect control will not be conducted.
- Negative monetary impact to commercial agricultural production and home gardens.

3.2.6 Alternative 7-Biological Control Alternative

As an alternative to insecticides, the BCTVCP funded research to explore the prospects for utilizing egg parasites to control BLH. From 1989 through 2002, approximately $830,000 of research was contracted by the BCTVCP to develop a classical biological control strategy. Nine species of BLH egg parasites were initially imported from Turkmenistan and Iran, to be cultured. These species are: *Anagrus atomus, Gonatocerus* species 1A & 1B, *Gonatocerus* species 2, *Polynema* species 1 & 2, *Aphelinoidea turanica, Aphelinoidea anatolica*, and a single *Oligosita* species. With the exception of *Gonatocerus* species 1B, all parasite species were successfully cultured and mass reared in the University of California at Riverside (UCR) insectary. A total of 109,100 adult parasites have been released since 1996 in BLH overwintering and spring breeding habitats.
host exposure and vegetation sampling methods were used to assess parasitism in the field as well as providing a measure of the relative effectiveness of each introduced parasite species (Bayoun, 2008). Imported parasite species were shown to be established, but did not show a classical biological control response on BLH populations in the areas where established. The feasibility of using indigenous parasites in augmentative releases was briefly considered as an alternative control strategy. However, the large costs associated with producing large numbers of native parasites in the laboratory makes augmentative releases of native parasites impractical.

After the release of over 100,000 imported egg parasites, researchers agree that there has been a reasonable opportunity for these imported parasite species to show a classical biological response by impacting BLH populations where they were established. In November 2001, the Curly Top Virus Control Board (CTVCB) recommended that biological control research be terminated for now.

Reasons for Rejection

- This program option does not meet the statutory mandate to control BLH numbers and is thus rejected. The law must be followed.
- Typical biological control response was not demonstrated.
- Financial costs to implement and maintain.
- Potential for increased pest populations, disease incidence and crop damage as insect control not achieved.
- Negative monetary impact to commercial agricultural production and home gardens.

3.2.7 Alternative 8- Reduced Aerial Application Alternative

This alternative considers the control the BLH using a combination of minimal aircraft and mostly ground spray rigs; or ground-rigs only, no aircraft. Aerial malathion applications would only be conducted in areas inaccessible by wheeled vehicles, or not used at all. Spray-rigs using malathion mounted on wheeled vehicles would be used in areas where they are able to negotiate the terrain. Ground-rig treatments would include roadsides, fallow fields and rangeland where accessible. Treatment of rangeland would be performed using the same methods as ground-rig use in fallow fields (page 17).

This would be a very inefficient way to treat the large acreages of BLH breeding grounds. BLH populations would not be controlled in some terrains. An increase in damage to habitat important to listed species on BLM and private lands would most likely result from the use of ground-rigs to treat rangeland where ground-rigs are able to negotiate the terrain.

Large tracts of BLM and State lands restrict the use of cross-country-motorized vehicles. BLM designates large tracks of desert lands as “open,” “closed,” or “limited” for motor vehicle use within the California Desert Conservation Area plan. Area designations are made on the basis of four multiple-use classes. Specific routes in the California desert are designated as either “open”, “closed” and “limited” and generally correlate to the area designation (BLM 1980). Within the Carrizo Plain Natural Area and on NPR-#2, motorized vehicle use is limited to designated routes of travel. Lands administered by the State of California including the CDWR, CDPR and CDFG, place restrictions on motorized vehicles use.

Reasons for Rejection

- This program option does not meet the statutory mandate to control BLH numbers and is thus rejected. The law must be followed.
- Vehicle restrictions would severely limit ground-rig treatments.

- Potential for increased impact to Threatened and Endangered species from ground rigs on rangeland.
- Potential for increased pest populations, disease incidence and crop damage as adequate control would not be achieved.
- Negative monetary impact to commercial agricultural production and home gardens.

4.0 DESCRIPTION OF EXISTING ENVIRONMENT

The following describes the existing environment in all areas where BCTVCP activities take place.

4.1 SAN JOAQUIN, SALINAS AND CUYAMA VALLEYS

4.1.1 Physical Components

4.1.1.1-Soils

The San Joaquin Valley soil series is the oldest continuously recognized soil series and is one of California's Benchmark Soils. The San Joaquin series became the Official State Soil in 1997. San Joaquin soils formed in old alluvium on hummocky topography (USDA-NRCS).

The San Joaquin Series consists of moderately deep duripan, well and moderately well drained soils that formed in alluvium derived generally from granitic rock sources. They are on undulating low terraces with slopes of 0 to 9 percent. The alluvial soils of the westside are derived from Coast Range alluvium and are generally fine-textured. The mean annual precipitation is 15 inches and the mean annual temperature is 61° F (PSSAC 2008).

4.1.1.2-Water

Water is scarce except where irrigation canals such as the California Aqueduct wind along the west side of the Valley, generally following the line of low foothills of the Coast Range.

Seasonal streams drain from west to east carrying runoff in arroyos and canyons during wet periods. This runoff is carried to the Valley floor where it is absorbed or becomes associated with wildlife guzzlers, alkali sumps, vernal pools, stock ponds or into one of several small reservoirs in the region. Runoff can be carried directly into streams or rivers during periods of heavy rains.

There are numerous seeps, both natural and created by petroleum production, in the Coalinga area, Kettleman Hills, Lost Hills, Elk Hills and McKittrick area. These seeps support small numbers of aquatic organisms and marsh plants. Oily sumps are screened to reduce access to wildlife.

4.1.1.3-Topography

The elevation of the area where control work takes place is 90-600 meters above sea level. The area varies from flat to gently sloping, to steep hills deeply cut by washes and canyons.

4.1.1.4-Air

The air quality in the west side of the San Joaquin Valley is variable and depending on the inversion layers and coastal intrusion, ranges from good to poor. There are many factors that

can contribute to the accumulation of chemicals and particulates in the air: Growing urban centers with increases in automobile and truck traffic; agricultural chemicals, pesticides, herbicides and agricultural vehicles; dust from cultivation; oil fields (local influence); agricultural burning; and pollution from population centers in the Sacramento Valley and Bay area driven by prevailing winds.

4.1.2 Living Components

4.1.2.1 Flora of Western San Joaquin Valley

Valley Grassland and Valley Saltbush plant communities dominate the west side and southern portions of the San Joaquin Valley. Important annual BLH hosts include filaree (*Erodium* spp.), peppergrass (*Lepidium* spp.), and Plantain (*Plantago* sp.).

Valley foothill grasslands were originally dominated by bunch grasses such as *Stipa pulchra*, *Stipa cernu*a, and *Poa scabrella*. The grasslands are now dominated by annual species of *Bromus, Vulpia, Lepidium, Erodium*, and various flowers. Valley grasslands grow and set seed during a winter/spring growing season of 7 to 11 months and die during the arid summer season. Seed dormancy is broken at the onset of late fall or winter rains.

The San Joaquin Valley is separated from the influences of the ocean by a series of parallel mountain ranges and inter-coastal valleys. Generally, the San Joaquin Valley has winters that are warm and relatively short. The summers are long and hot with low humidity (Twisselmann, 1967).

Annual rainfall ranges from 6 inches (15 centimeters), in southwestern Kern County, to 10 inches (25 centimeters) in western Merced County. Large floral displays are observed in years with wet springs where dense stands of non-native grasses are absent. Approximately 90% of the rains fall between December and April. Dense ground fog persists for days and sometimes for weeks in late November, December and January (Twisselmann, 1967).

The Valley Saltbush Scrub plant community occurs in the southern and western San Joaquin Valley in poorly drained alkali soils on gently sloped alluvial plains or moderately steep to rolling terrain. The more prominent plants in the Valley Saltbush Scrub community are saltbush (*Atriplex polycarpa*), iodine bush (*Allenrolfea occidentalis*), *Lepidospartum squamatum* and snakeweed (*Gutierrezia* spp.) along with large disturbed areas covered with Russian thistle, (*Salsola* spp.).

Although the boundaries are not always distinct, a series of vegetation zones are generally observed from the Valley floor; west, into the hills. The Valley Grassland plant community is often a fire or grazing serialized stage that will develop into a Valley Saltbush Scrub plant community. These communities lie below the mixed chaparral plant community in the higher elevations. It is common to find Valley grassland plants such as *Lasthenia*, *Erodium, Bromus*, *Vulpia* and *Lepidium* species as under story growth in Valley Saltbush Scrub. Within the Program's survey areas, annual grasses dominate the northern slopes, while *Erodium*,

Lepidium, and *Plantago* are found on the sparsely vegetated, south-facing slopes. The tops of some hills and sides of canyons at times support a combination of *Atriplex* and *Gutierrezia.*

Small, isolated, areas of riparian habitat are found along major drainage areas and creeks on the west side of the San Joaquin Valley. Primary tree species within riparian habitats include cottonwood (*Populus fremontii*) and tamarisk (*Tamarix ramosissima*). In the northern portions of the San Joaquin Valley, *Lepidospartum squamatum* and *Baccharis vininea* can be found growing as under-story plants within these riparian habitats.

In washes and relatively moist areas, occasional small stands of tree tobacco (*Nicotiana glauca*) occur. Where buildings or homesteads once stood, plantings of tamarisk and other exotic trees are evident, providing shade or windbreaks.

4.1.2.2 Flora of Cuyama and Salinas Valleys

The Cuyama and Salinas Valleys are classified generally with the Great Central Valley. The Cuyama Valley is dominated by annual grasslands, scrub and chaparral habitats. Blue oak and pinyon-juniper woodlands are present including rare habitats such as saltbush scrub, alkaline marshes, and riparian forests (CACV 2009).

The climate of the Cuyama Valley is semi arid and similar to the southern end of the San Joaquin Valley and the Carrizo Plain with respect to rainfall and arid soils. Desert plant distributions were found almost entirely in the southern San Joaquin Valley, Cuyama Valley and the Carrizo Plain. Some researchers view the southern San Joaquin Valley, Cuyama Valley and the Carrizo Plain as desert rather than annual grassland due to the overlap of abiotic factors and desert adapted species (Germano et al. 2011).

The Salinas River dominates the Salinas Valley and its riparian habitat composed of an occasional cottonwood (*Populus fremontii*) and Red willow (*Salix laevigata*), box elder (*Acer negundo* var. *californicum*), blue elderberry (*Sambucus mexicana*) and western red dogwood (*Cornus douglasii*). In the upper Salinas Valley and other more arid inter-coastal valleys, the grasslands give way to an oak savanna dominated by blue oak (*Quercus douglasii*). The climate of the Salinas Valley is influenced to a greater degree by the ocean than the Central Valley.

4.1.2.3 Federal and State Listed and BLM Sensitive Species which May Occur within BLH Survey/Treatment Areas

The following list and descriptions of listed Threatened and Endangered species are brief. Detailed life history accounts and species profiles are available on line at http://www.fws.gov/sacramento/es_species/es_species.htm & http://www.fws.gov/endangered (Federal listings); http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.aspx (State listings); and http://www.blm.gov/ca/st/en/prog/ssp/lists/by_species/ssplist_all.html (BLM sensitive plants). Species information can also be obtained from the recovery plan for upland species of the San Joaquin Valley, California (USFWS 1998).

FT	Federal Threatened	**ST**	CA State Threatened
FE	Federal Endangered	**SE**	CA State Endangered
FPT	Federal Proposed Threatened	**SR**	CA State Rare
FSC	Federal Species of Concern	**BLMS**	BLM Sensitive
SC	CA State Species of Concern		

PLANTS

California Jewelflower (*Caulanthus californicus*) (FE, SE)

The California jewelflower is a member of the mustard family and differs from other *Caulanthus* species by possessing flattened, sword-shaped fruits and spherical seeds. The stems rise out of a basal rosette of leaves to a height of one foot and may produce several flowering branches. This species historically occurs in slightly alkaline sandy loam in native grasslands of the southern San Joaquin Valley. Plant populations today are found in Santa Barbara Canyon, the Carrizo Plain, and in the Kreyenhagen Hills (USFWS 1998). The bloom period is February through May.

Kern Mallow (*Eremalche kernensis*) (FE)

The Kern mallow is a small annual herb in the family *Malvaceae*. It has a restricted distribution in western Kern County occurring only in the Lokern area between Buttonwillow and McKittrick. It is endemic to Valley Sink Scrub, Valley Saltbush Scrub and adjacent grassland. The Kern mallow blooms during March and May. The amount of precipitation can directly impact the size of the Kern mallow population in any given year. A significant reduction in annual population size has been observed following winters of below normal rainfall. Oil exploration and agricultural activities has contributed to the decline of habitat in the Lokern area.

San Joaquin Woolly-threads (*Monolopia congdonii*) (FE)

San Joaquin woolly-threads occur within many operational areas of the BCTVCP. Its name is taken from the white, multi branched stems that grow to a length of 20 to 25 centimeters. The annual herb is a member of the sunflower family and blooms from March through May. San Joaquin woolly-threads are endemic to the southern San Joaquin Valley within the Valley Saltbush Scrub or Valley Grassland plant communities. Many new occurrences of San Joaquin wooly-threads have been discovered since 1986 in the Carrizo Plain, Lost Hills, Kettleman Hills and Jacalitos Hills (USFWS 1998).

Bakersfield Cactus (*Opuntia basilaris* var*. treleasei*) (FE, SE)

The Bakersfield cactus is a prickly pear type of cactus. It occurs on coarse well-drained granite sand on the grasslands of Kern County and blooms from April through May. Agricultural development and urbanization are suggested as the main factors in the loss of habitat and fragmentation of population groups. It is currently known from five general areas in the southeastern San Joaquin Valley.

Bakersfield-saltbush (*Atriplex tularensis*) (FSC, SE)

The Bakersfield-saltbush is a member of the family *Chenopodiaceae* and is an erect annual with a scaly surface on the stems. This salt-tolerant species has only been reported from Kern County as part of the Kern Lake Preserve. Population size of this annual species fluctuates with local rainfall patterns and blooms from June through October.

Palmate Bracted Birds Beak (*Cordylanthus palmatus*) (FE, SE)

This plant has soft hairy gray-green leaves with five lobes. It grows from 10 to 30 cm tall and is a parasite of salt grass. Floral spikes, 50 to 150 mm tall, hold whitish to pale lavender flowers, which appear, May through October. This plant can be found inhabiting alkaline flats in Colusa, Alameda, San Joaquin, Madera and Fresno Counties.

Large-Flowered Fiddleneck (*Amsinckia grandiflora*) (FE, SE)

The large-flowed fiddleneck is an annual herb, green in color, hairy with linear to narrowly ovate leafs, red-orange flowers, 10 to 15 millimeters wide, bloom from April through May. The plant inhabits grassy slopes and is known from just three native populations near Corral Hollow in San Joaquin County. Some apparently successful reintroductions have been attempted.

Monterey Spineflower *(Chorizanthe pungens var. pungens) (FT)*; **Robust Spineflower** (*Chorizanthe robusta* var. *robusta*) (FE)

The Monterey and robust spine-flowers are members of the buckwheat family (*Polygonaceae*). The plants grow to 50 centimeters in height with grayish soft hair. The flowers are 2 to 4 millimeters and contain 9 stamens. Both species are found growing in the Coastal Sage Scrub plant community. Occurrences of these plants, near survey areas in the Salinas Valley, are represented by a few old records and may be extirpated from those locations.

Horn's Milk-vetch (*Astragalus hornii* var. *hornii*) (BLMS)

Is an annual dicot in the family *Fabaceae*. It is native to California but is also found in west-central Nevada. Horn's milk-vetch is likely to occur in Alkali sink, wetland-riparian plant communities between 60 and 152 meters in elevation. The growth is open and widely branched with 8 to 10 millimeters white to pale lilac flowers growing in a dense inflorescence of 10 to 35 individual flowers. The bloom period is from May through September.

Heart-leaved Saltbush (*Atriplex cordulata*) (BLMS)

Heart-leaved saltbush is an annual herb 10 to 50 centimeters inches long in the family *Chenopodiaceae*. It inhabits grassland or alkaline soils that are hard or trampled soils. Branches are gray and scaly, with hairs covering the tips. Leaves are 6 to 15 millimeters long, with a cordate base on the lower leaves. Both female and male flowers are found in clusters. The seeds are red-brown in color. Heart-leaved saltbush flowers from April to October.

Lost Hills Saltbush (*Atriplex coronata* var. *vallicola*) (BLMS, SC)

Atriplex coronata var. *vallicola* is a California native annual from the family *Chenopodiaceae*. It has a long bloom period from spring-fall. It is found in dried rain pools and alkaline soils from 46 to over 610 meters in elevation. Plant records indicate a distribution in Fresno, Kings, Kern, and San Luis Obispo Counties.

Round-leaved Filaree (California macrophylla) (BLMS)

Round-leaved filaree is a native California annual herb from the family *Geraniaceae*. It grows a few centimeters high with an umbel inflorescence containing white to pinkish flowers one centimeter long. Round-leaved filaree occurs in open habitat in grassland or *Atriplex* scrub plant communities between 15 and 1,220 meters in elevation.

Lemmon's Jewelflower (Caulanthus lemmonii) (BLMS)

Caulanthus lemmonii, is an annual herb native to California in the family Brassicaceae. The flowering period is from February to May and is found in grassland, chaparral, and scrub plant communities from 80 to 800 meters in elevation. The 8 to 20 millimeters petals are white with dark purple veins.

Recurved Larkspur (Delphinium recurvatum) (BLMS)

Byron or recurved larkspur is a native California perennial herb endemic to California. Most of its historical range is in the Central Valley occurring in scrub, valley grassland and foothill woodland plant communities. The blue wildflower grows to a height of 48 centimeters with sepals and lower petals darker than upper petals. The sepals are usually curved back, which gives the plant its name.

Temblor Buckwheat (Eriogonum temblorense) (BLMS, SC)

Temblor buckwheat is an endemic California native annual in the family Polygonaceae. The flowering period differs from most San Joaquin Valley annuals, May through September. Temblor buckwheat typically occurs on slopes of shale and sandstone in the valley grassland plant community. Temblor buckwheat varies in height depending on annual precipitation. The range of Temblor buckwheat is restricted to eight areas in the inner coastal ranges.

Coulter's Goldfields (*Lasthenia glabrata* ssp. *coulteri*) (BLMS)

Coulter's goldfields is a California annual native in the *Asteraceae* family. It occurs in tidal marsh areas and the edge of vernal pools in alkali sink, coastal salt marsh, and wetland-riparian plant communities. It flowers are arranged in corymbs and bloom from April to May. The distribution ranges from San Diego County to Kern County and Twenty-nine Palms.

Panoche Pepper-grass (*Lepidium jaredii* ssp. *album*) (BLMS)

Panoche peppergrass is a California native in the *Brassicaceae* family. It grows from 10 to 71 centimeters in height. Panoche peppergrass occurs in dry stream beds, on alluvial fans, and on slopes associated with a variety of grasses and forbs. Panoche peppergrass flowers from February to June with white flowers and numerous branches. Currently, approximately 15 occurrences of Panoche peppergrass are known from San Benito County south to San Luis Obispo County.

Pale-yellow Layia (*Layia heterotricha*) (BLMS)

Pale-yellow layia is a California endemic annual herb in the family *Asteraceae*. It grows from 13 to 91 centimeters tall and is found in grassland/foothill woodland plant communities. Leaves are pear-shaped, with white to cream colored flowers blooming from March through June.

Showy Golden Madia (*Madia radiata*) (BLMS)

Madia radiata is a California endemic annual herb in the family *Asteraceae*. It occurs in grassland and oak woodland plant communities between 24 and 1,128 meters elevation. It prefers heavy clay soils in openings away from closed canopies Showy golden madia is a tall, showy plant with yellow flowers blooming March to May. In some sites, it appears only in wet years.

Oil Neststraw (*Stylocline citroleum*) (BLMS, SC)

Oil neststraw is a California native herb in the *Asteraceae* family. It is endemic to Kern County, occurring in valley saltbush scrub on sandy flats and clay soils. Oil neststraw grows low to the ground without a showy flower. The stems are grayish and no more than 13 centimeters long. The inflorescence is a round head, about 5 millimeters in diameter, each containing many individual woolly florets. The self-pollinated flowers bloom in April.

ANIMALS

San Joaquin Kit Fox (*Vulpes macrotis mutica*) (FE, ST)

This kit fox is the smallest canine species ranging throughout the San Joaquin Valley from San Joaquin County south through southern Kern County. Portions of Monterey, Santa Clara, San Benito and Santa Barbara Counties are included in the kit fox range. They eat a varied diet of small rodents, lizards and insects. One kit fox per square mile has been estimated as the average density throughout the San Joaquin kit fox range.

Giant Kangaroo Rat (*Dipodomys ingens*) (FE, SE)

The Giant kangaroo rats (GKR) are small mammals with elongated hind limbs for hopping and external cheek pouches for carrying food. The GKR is the largest of all kangaroo rats and feed almost entirely on the seeds of annual plants. Colonies are found in western Kern County and on the Elkhorn and Carrizo Plains in eastern San Luis Obispo and western Fresno and Kings

Counties. They prefer sparsely vegetated Valley Grassland plant communities with sandy loam soils.

Tipton Kangaroo Rat (*Dipodomys nitratoides nitratoides*) (FE, SE)

The Tipton kangaroo rat (TKR) is a small mammal with specialized hind limbs and external cheek pouches. The TKR feeds almost entirely on seeds. They live in arid, open land where they dig burrows for shelter and food storage. The range has been reduced to approximately 6,400 acres among five separate parcels and supports low to moderate population levels.

Short-nosed Kangaroo Rat (*Dipodomys nitratoides brevinasus*) (SC, BLMS)

The average short-nosed kangaroo rat adult is larger in size than Tipton and Fresno kangaroo rats. Short-nosed kangaroo rats have essentially the same diet and foraging behavior as the other San Joaquin kangaroo rat species. Short-nosed kangaroo rats can be identified by their large hind feet, small front feet, and long tail. The short-nosed kangaroo rat occupies arid grassland on the westside of the San Joaquin Valley, from Los Banos south to the foothills of the Tehachapi Range, and around the bottom of the valley, north to Poso Creek.

Buena Vista Lake Shrew (*Sorex ornatus relictus*) (FE)

The Buena Vista Lake shrew is one of nine subspecies of the *Sorex* sp. found in California. The shrew is a local endemic subspecies found in very restricted marshy wetland areas encompassing 10 acres in the Kern Lake Preserve. It is an insectivorous mammal the size of a mouse with black back with brown speckles, the sides are of a brown tint and the belly of the shrew is gray. The shrew is active day or night and eats an equivalent of its own weight (4 grams) every day. Its breeding period is from February or March until the start of the dry season (usually around late May or early June).

Nelson's Antelope Squirrel (*Ammospermophilus nelsoni*) (FSC, ST, BLMS)

The Nelson's antelope squirrel is about 10 inches long with a white stripe on each side of the body. It has an omnivorous diet consisting of grass, seeds and insects. They are generally active at temperatures between 68^{o} to 86^{o}F. Significant populations exist in the Elk Hills and portions of the Carrizo and Elkhorn Plains in western Kern and eastern San Luis Obispo Counties; also, in the Kettleman, Quijarral and Panoche Hills in western Fresno and Kings Counties.

San Joaquin Pocket Mouse (*Peroqnathus inornatus inornatus*) (SC, BLMS)

The San Joaquin pocket mouse occurs in dry, open grasslands or scrub on fine-textured soils between 335 and 610 meters in the Central and Salinas Valleys; and, the Mojave Desert in portions of Los Angeles, Kern and western San Bernardino Counties. They subsist on mainly small seeds of grasses and shrubs. Insects are not a major part of their diet but will eat soft bodied insects such as cutworms. The San Joaquin pocket mouse is nocturnal spending daylight hours in simple burrows at the base of shrubs (Best 1993).

Pallid Bat (*Antrozous pallidus*) (BLMS, SC)

The pallid bat is a species in the family *Vespertillionidae*. It occurs generally in western North America from western Canada to central Mexico and is most abundant in the Great Basin, Mojave, and Sonoran Deserts. They have on average a total length of 9 to 13.5 centimeters. Pallid bats are insectivores feeding crickets, cicadas and scorpions consuming up to half their weight in arthropods every night.

Western Mastiff Bat (*Eumops perotis californicus*) (BLMS, SC)

The western mastiff bat is a member of the free-tailed bat family, *Molossidae*. The subspecies ranges generally in the southwest desert regions of the United States but also extends north to Alameda County California. They do not undergo either migration or hibernation and are periodically active in winter. It feeds on insects with moths comprising up to 80% of the diet.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) (SE, BLMS)

The western yellow-billed cuckoo is a slender brown bird with white under parts. Its natural nesting habitat is in deciduous riparian forest in primarily cottonwoods and willow trees. Food consists of grasshoppers, katydids, tree frogs and caterpillars. Breeding pairs are found along the Sacramento River in Butte, Glenn, Colusa Counties, the south fork of the Kern River, and along the Santa Ana, Amargosa and lower Colorado Rivers.

Swainson's Hawk (*Buteo swainsoni*) (ST, BLMS)

The Swainson's hawk is a medium-sized hawk with long pointed wings and a long square tail. The Swainson's hawk often nests in riparian systems of the Central Valley adjacent to open grasslands and annual agricultural row crops. The California vole is an important staple in their varied diet.

Peregrine Falcon (*Falco peregrinus anatum*) (SC)

The peregrine falcon is about the size of a crow with slate gray color above and lighter color below. The range includes most of California during migrations and in winter, except in deserts. Nesting sites are typically on ledges of cliff faces. The peregrine falcon eats a variety of birds.

Bald Eagle (*Haliaeetus leucocephalus*) (SE, BLMS)

The bald eagle is a large brown bird of prey with a white head and tail. It occurs widely in North America and winters at lakes, reservoirs, river systems and some rangelands and coastal wetlands. The bald eagle eats rabbits and large rodents, but chiefly consumes dead or dying fish.

California Condor (*Gymnogyps californianus*) (FE, SE)

Formerly widespread in North America from Baja California to British Columbia, the California condor declined in number during the l970's and 1980's. In 1987 the remaining birds were trapped and placed in a captive breeding program. The number of birds was increased in captivity until the reintroduction of two birds in January 1992. Subsequent releases were made in December 1992 and December 1993. Five condors currently occupy a range adjacent to the Sierra Madre Ridge, south of the Cuyama Valley.

Least Bell's Vireo (*Vireo bellii pusillus*) (FE, SE)

The least Bell's vireo is a small migratory songbird with a drab gray color on top and whitish below with sides of grayish olive-yellow. The vireo is insectivorous and is a summer resident of the cottonwood-willow thickets and dry washes. The breeding range is restricted to primarily Santa Barbara, Riverside and San Diego Counties and into northwestern Baja California. In a biological opinion of the BCTVCP, USFWS also considers potential habitat to include an area between Bradley and Camp Roberts, in the Salinas Valley (USFWS 2001b). Several birds were found in the area in 1986 and a single bird was observed in 1993.

Burrowing Owl (*Athene cunicularia*) (SC, BLMS)

The burrowing owl is ground-dwelling. It has a sandy colored head, back and underneath parts of the wings; and, white to cream on the breast and belly with a white chin stripe. They yellow eyes with white eyebrows and no ear tufts. They are often active in daylight. They feed primarily on arthropods, also small mammals, reptiles, birds and carrion. This species has an extremely large range in both North and South America.

Tricolored Blackbird (*Agelaius tricolor*) (SC, BLMS)

The tricolored blackbird is a passerine bird in the family *Icteridae*. Tricolors are found almost exclusively in California's Central Valley, with small groups north to southern Oregon and Washington, and east to western Nevada. The name is taken from the male's white stripes under their red shoulder patches. The tricolor blackbird is insectivorous and responds to the abundance grasshopper and other insect outbreaks. Tricolor colonies were historically located in freshwater cattail/tule marshes created by natural flooding cycles in the Central Valley. Since the 1970's, more tricolor colonies have been observed in blackberries, thistles, and silage fields. While tricolors forage in remnant native habitats, they now forage in mostly managed habitats includes rice, alfalfa, irrigated pastures, feedlots and dairies (Tricolor Blackbird Working Group 2007).

Aleutian Canada goose (*Branta canadensis leucopaveia*) (SC)

The Aleutian Canada goose is one of the smaller races of *B. canadensis*. External markings are consistent with the greater Canada goose, but the neck and bill are relatively shorter and check patches are slightly smaller. Breeding occurs in the western Aleutian Islands. The goose winters in the Central Valley of California and arrives as far south as Merced County in

December. Due to its recovery, it was removed from the Federal list of “threatened” species March, 20, 2001 but remains as a species of concern with California Fish and Game (USFWS 2001a).

Mountain Plover (*Charadrius montanus*) (BLMS)

The mountain plover is a migratory bird that over winters in heavily grazed California grasslands. Populations of the plover winter primarily in the San Joaquin Valley west of Highway 99 and south of Sacramento to Kern County, and portions of southern California including the Antelope Valley, Carrizo Plains and the southern end of the Salton Sea in the Imperial Valley. The mountain plover is an insectivorous bird the size of a killdeer (17.8 centimeters) the back of the body being light brown and the belly being lighter. There is no dark breast belt as found in other plover species.

Western Snowy Plover (*Charadrius alexandrinus*) (FT, SC)

The western snowy plover is a small inhabitant of sandy seashores, alkali flats and sand flats. They consume shellfish, marine invertebrates and worms. The western snowy plover is a migratory bird which breeds along the Pacific Coast from Washington, south to Baja California and inland along riverbanks, sand dunes and alkali flats.

California Coastal Steelhead (*Oncorhynchus mykiss*) (FT)

The steelhead is an anadromous rainbow trout, found in Pacific Ocean drainages from southern California to Alaska. In California, steelhead spawn in coastal waterways from Malibu Creek to Smith River. Steelheads, like salmon, are born in fresh water, migrate to oceans and return to fresh water to spawn. However steelhead need longer fresh water rearing requirements and vary with salmon in the amount of time spent in fresh and saltwater. There are two basic types of steelhead; stream maturing and ocean maturing. Most steelhead In California spawn from December through April in water that is cool and well oxygenated year-round. The fry hatch and migrate to the protection of stream margins during the early stages of development. Most juveniles inhabit riffles but large individuals inhabit pools.

Blunt-nosed Leopard Lizard (*Gambelia silus*) (FE, SE)

The blunt-nosed leopard lizard is a large lizard with dark blotches on the back and tail. Breeding females have orange or reddish spots on their sides. It inhabits sparsely vegetative plains, alkali flats, foothills and canyon floors from San Joaquin County south through Kern County and into eastern San Luis Obispo County. Their diet consists of a wide variety of insects and small lizards.

Giant Garter Snake (*Thamnophis gigas*) (FT, ST)

The giant garter snake (GGS) inhabits marshes and swamps and basks near water in the spring and fall. Adult GGS can reach 64 inches in length. The color of the GGS is dull brown with black spots on the dorsal side, separated by a yellow dorsal stripe and two lateral stripes.

Thirteen population clusters have been identified in the Central Valley and coincide with historical flood basins in the Central Valley. The GGS occupies waterways and agricultural wetlands and water delivery systems. Surveys in the San Joaquin Valley during 1986 and 1992 failed to discover any GGS although a few remnant populations may still occur in the northern San Joaquin Valley.

Western Spadefood Toad (*Spea hammondii*) (BLMS)

The western spadefoot toad is a smooth skinned toad with a wedge-shaped black spade on each hind foot. Adult toads are between 3.8 and 7.6 centimeters long. It ranges throughout the Central Valley of California as the coast, south of San Jose. The western spadefoot toad occurs in grassland, scrub, chaparral and oak woodlands. The toad is nocturnal and active during wet seasons, summer storms, or humid evenings.

California Red-legged Frog (*Rana aurora draytonii*) (FT)

The historical range of the California red-legged frog (CRLF) extended along the California coast from Point Reyes inland to Redding and south to Baja California. Frogs range in size from 3.8 to 12.7 centimeters in length and has a rusty-red color on its belly and the underside of its hind legs. CRLF occurs in lakes, reservoirs, ponds, marshes, streams and other mostly permanent water sources. CRLF are attracted to cattails or other plant cover in or near water. Adult frogs are mobile dispersing from aquatic environments to other aquatic or riparian habitats. After rains they may appear on roads at night.

California Tiger Salamander (*Ambystoma californiense*) (FT)

The tiger salamander occurs in foothill and grassland habitats in association with vernal pools of central California. They are also known from golf courses and stock ponds. The California tiger salamander utilizes ground squirrel burrows and the burrow systems of other burrowing mammals to take refuge during the dry summer months. Three remaining major populations groups remain in Alameda and Contra Costa Counties, Southern Santa Clara-Northern Monterey-San Benito Counties and Madera-Fresno Counties near Millerton Lake.

San Joaquin Dune Beetle (*Coelus gracilis*) (FSC, SC, BLMS)**; Ciervo Aegialian Scarab Beetle** (*Aegialia concinna*) (BLMS, SC)

The San Joaquin dune beetle (SJDB) and the Ciervo Aegoalian scarab beetle (CASB) appear to be endemic to dune systems along the west side of the San Joaquin Valley. The SJDB restricted to five locations along the western edge of the San Joaquin Valley. The CASB is found north of Coalinga in the Ciervo dunes. The dunes are generally not isolated from other San Joaquin Valley coastal dunes by great distances and display uniform vegetation over broad areas. Larvae are thought to feed on the roots of dune vegetation.

Doyen's Trigonoscuta Dune Weevil (*Trigonoscuta* sp.) (SC)

The Doyen's dune weevil is a flightless and nocturnal weevil. Similar to other weevils in the genus *Trigonoscuta,* they are described as gray, sand colored, oval weevils, with a slightly lighter color than other coastal weevil species.

Conservancy Fairy Shrimp (*Branchinecta conservatio*) (FE)

The Conservancy fairy shrimp inhabits vernal pools with highly clouded water and is known from six separate populations within the Counties of Tehama, Solano (Sacramento Natural Wildlife Refuge), Glenn, Merced and Ventura. The Conservancy fairy shrimp are found in rather large pools and have been observed from November to early April.

Longhorn Fairy Shrimp (*Branchinecta longinatenna*) (FE)

The longhorn fairy shrimp is found inhabiting vernal pool depressions in grasslands and sandstone and is known from four separate populations within the counties of Contra Costa (Altamont Pass), San Luis Obispo (Carrizo Plain), and Merced (Kesterson National Wildlife Refuge). The longhorn fairy shrimp have been observed from late December until late April.

Vernal Pool Tadpole Shrimp (*Lepidurus packardi*) (FE)

The vernal pool tadpole shrimp is known from 18 populations ranging from Shasta County, south to Merced County (San Luis National Wildlife Refuge); and a single population in Alameda County (San Francisco Bay National Wildlife Refuge). Winter rains break diapausing eggs in dry pool sediments. Vernal pool tadpole shrimp have been reported to mature within three weeks. Adults are present until the pools dry up in the spring.

Vernal Pool Fairy Shrimp (*Branchinecta lynchi*) (FT)

The vernal pool fairy shrimp is known from 32 populations distributed sporadically from Shasta County in the north through most of the length of the Central Valley to Pixley in Tulare County; along the central coast range from northern Solano County, south to San Benito County. Additional populations have been found in San Luis Obispo County (north of Soda Lake), northern Santa Barbara County, and on the Santa Rosa Plateau and near Rancho California in Riverside County. They feed on algae, and other aquatic microorganisms as adults. The eggs lay dormant in the soil until rainwater replenishes the vernal pool.

Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*) (FT)

The elderberry longhorn beetle is found in elderberry plants associated with valley oak woodlands along the borders of streams and their tributaries including the Sacramento, Cosumnes, Mokelumne and northern San Joaquin Rivers.

4.1.3 Miscellaneous Components

4.1.3.1 Natural Resources

Numerous oil fields are found within the BCTVCP survey areas from Maricopa north to Coalinga on the west side of the San Joaquin Valley. Many oil and gas leases have been issued on BLM lands within these areas. The oil fields have been active for many years and represent some of the first settlements in the southern San Joaquin Valley.

4.1.3.2 Naval Petroleum Reserve No. 2 in the Buena Vista Hills

During the previous Pesticide Use Permit period, the BCTVCP operated under cooperative agreement with the DOE for the control of the BLH in NPR #2. In 2005, the jurisdiction of NPR#2 was transferred to BLM. BLH control on transferred lands will be conducted in a similar manner to adjacent BLM lands.

4.1.3.3 Cultural Components

There are many historical and archeological sites throughout the west side of the San Joaquin Valley. They include prehistoric sites from American Indians and more recent artifacts from the early oil exploration and settlements (1911 to 1912).

4.1.3.4 Wilderness

Wilderness study areas (WSA) #301a (Panoche Hills North), #301b (Panoche Hills South) and #309 (San Benito) lie within or near BCTVCP survey areas on the west side of the San Joaquin Valley.

4.1.3.5 Critical Habitat

Critical habitat is defined as specific areas that are essential to the conservation of a Federally listed species, and which may require special management considerations or protection. Critical habitat is determined using the best available scientific information about the physical and biological needs of the species.

These needs, or "primary constituent elements," include: space for individual and population growth and for normal behavior; food, water, light, air, minerals or other nutritional or physiological needs; cover or shelter; sites for breeding, reproduction and rearing of offspring; habitat that is protected from disturbance or is representative of the historical geographic and ecological distribution of a species.

Appendix “E” contains maps of critical habitat units that overlap potential BCTVCP survey/treatment areas. Critical habitat units overlapping Program survey/treatment areas in the San Joaquin or Salinas Valleys include those for Buena Vista Lake shrew, California condor, Monterey spineflower, vernal pool fairy shrimp and south/central California coast steelhead.

Buena Vista Lake Shrew *(Sorex ornatus* ssp. *relictus)* (BVLS) - One unit was designated as Critical Habitat for BVLS. The Kern Lake Preserve Unit (7A & 7B) comprises approximately 84 acres (USFWS, 2005a) and overlaps potential ground-rig spot treatment area (page E-2). A proposal to revise critical habitat for BVLS was initiated (USFWS 2009a) to include the same areas proposed in August 19, 2004. The area comprises approximately 4,649 acres within 5 units. In 2011, U.S. Fish and Wildlife Service reopened the comment period on the October 21, 2009 proposed designation of revised critical habitat for the Buena Vista Lake Shrew (USFWS 2011a).

California Condor (*Gymnogyps californianus*) - Approximately 570,400 acres, covering six California counties, is designated as critical habitat for California condor (USFWS 1977). The Tejon Ranch unit overlaps a portion of the fall treatment/survey are near Laval Road in Kern County (page E-3).

Monterey Spineflower *(Chorizanthe pungens var. pungens)* - Critical habitat is designated for the Monterey spineflower May 29, 2002 (USFWS 2002). Ten units (A-J) were designated comprising approximately 18,830 acres in Monterey and Santa Cruz Counties. Critical habitat for the Monterey spineflower was revised, January 9, 2008 (USFWS 2008), and now comprises 9 units totaling 11,055 acres. The Soledad Unit lies within the Programs potential survey/ground-rig treatment area in the Salinas Valley (page E-4).

California Coastal Steelhead (*Oncorhynchus mykiss*) - Critical habitat was designated for seven evolutionary significant units of west coast salmon and steelhead (USFWS 2005b). Potential survey areas in the Salinas Valley overlap designated critical habitat for the South-central California Coastal Steelhead in a potion of the Salinas River and tributaries (page E-5).

Vernal Pool Fairy Shrimp (*Branchinecta lynchi*) - Approximately 598,000 acres in 35 units is designated as critical habitat for the vernal pool tadpole shrimp (USFWS 2003, 2005c & 2006). Vernal pool fairy shrimp units 28, 29A and 29B overlap a small portion of BCTVCP survey/treatment areas in the Salinas Valley (E-6). Aerial treatments in the Salinas Valley have been rare with only 2 treatments in the past 27 years (1977 & 2003).

4.2 IMPERIAL AND PALO VERDE VALLEYS

4.2.1 Physical Components

4.2.1.1 Soils

Soils are formed in stratified alluvial materials and can vary greatly in texture and thickness of layers within short distances. Many soils are affected by soluble salts and drainage is a problem in the irrigated areas. The average annual rainfall is about 7.6 centimeters (USDA, 1981).

4.2.1.2 Topography

The general topography is undulating with small rises cut by water-eroded gullies varying in depth from a few inches to many feet. Wind storms and flash floods can move large amounts of desert soils not held by scrub brush.

The desert area is high in minerals and is subject to large and small-scale mining or quarrying operations. The vast open area attracts large numbers of off-road vehicle enthusiasts, contributing to erosion where they concentrate.

4.2.1.3 Water

Water on the desert is scarce. The irrigated portions of the county are crisscrossed by canal systems the largest being the All-American and Coachella Canals. The Salton Sea is the major body of water fed by runoff from streams and irrigation. Since there is no outlet for the Salton Sea, the water is highly saline. Despite the Salton Sea's salinity, it harbors an abundance of fish and aquatic invertebrates, plus it is frequented by vast numbers of migratory waterfowl.

The Colorado River is the largest source of fresh water in the region and is the main source for the All-American and the Coachella Canals. Annual precipitation averages approximately two inches. Rainfall is extremely varied within localized areas due to periodic thundershowers.

4.2.1.4 Temperatures

Daytime temperatures during the summer often exceed 100^{o}F and may climb to 120^{o}F. During the winter, daytime maximum temperatures range from 60^{o} to 80^{o}F. The average frost free season is about 300 days.

4.2.1.5 Air

The air quality in the Imperial Valley and eastern Riverside County varies with weather, temperature and inversions. Winds frequently move through the Imperial Valley creating dust storms, which constantly shift loose top soil. Man-caused pollutants from the Riverside-San Bernardino Basin frequently move into the Imperial Valley through Beaumont Pass when cooler coastal air responds to inland temperature gradients. When Santa Ana wind conditions exist, pollutants can move out of the Imperial Valley towards the coast.

4.2.2 Living Components

4.2.2.1 Flora of Imperial and Eastern Riverside Counties

The Creosote Bush Scrub plant community inhabits well drained soils of low alkalinity. The co-dominant plants are creosote bush (*Larrea tridentata*) and ragweed (*Ambrosia dumosa*), interspersed with *Coldenia palmeri*, *Croton californicus*, smoke tree (*Parosela spinosa*), Mexican tea (*Ephedra trifurca*), and galleta (*Hilaria rigida*).

In the arroyos or washes that cross the Creosote bush community there is a relatively dense wash woodland community dominated by coyote brush (*Baccharis sarathroides*), Palo Verde (*Cercidium floridum*), desert willow (*Chilopsis linearis)*, C*ondaliopsis lycioidea*, smoke tree (*Parosela spinosa*), water jacket (*Lycium andersonii*), desert ironwood (*Olneya tesota*), and honey mesquite (*Prosopis glandulosa*).

Wildlife species utilize the washes for travel corridors, cover, and den sites. The mesquite hummocks provide important habitat and cover for a variety of animal species. Burrows of round-tail ground squirrel, desert kit fox, and kangaroo rats are found at the base of the mesquite hummocks (BLM, 1998). Wind blown sands and stabilized dunes provide habitat for specialized animals such as the sidewinder and Colorado Desert fringe-toed lizard. Root systems of dune plants species stabilizes loose soil particles, which allow animals to establish burrows. Washes provide important habitat for a variety of avian species as well as providing prime habitat for the flat-tailed horned lizard (BLM, 1983).

Where soils grade into sandy loam with a higher salinity range, the saltbush scrub community is evident with saltbush *Atriplex polycarpa*, *Atriplex canescens*, *Haplopappus acradenius* and *Prosopis glandulosa* as the dominant perennial plants.

Along the edge of the Salton Sea and in areas where there are heavy, wet soils with high salt content, Iodine bush (*Allenrolfea occidentalis*)*, Atriplex lentiformus, Baccaris glutinosa*, screw-bean mesquite (*Prosopis pubesens*), cottonwood (*Populus fremontii*), arrow-weed (*Pluchea sericea*), willow (*Salix gooddingii*), and tamerisk (*Tamarix* spp.) form the Alkali Sink plant community.

Along rocky hillsides or where the soils are gravelly, cactus species are found including *Opuntia, Ferocactys* and *Echinocereus*. Water in both the Coachella and All-American Canals have influenced vegetation along their banks. The vegetation along the Coachella Canal was almost eliminated when it was lined with concrete in 1980. The All-American Canal contains the majority of canal influenced vegetation which is dominated by Carrizo cane.

The Colorado River influences vegetation along its shores through the Colorado River Valley region of the Sonoran Desert. The plant community consists of tamarisk, arrow-weed, cottonwood, mesquite, bulrushes, cattails, coyote bush (*Bacchaus* spp.), willow, sedges and various composites. Throughout the above perennial plant communities, when rainfall is sufficient to germinate seeds, BLH host plants emerge. The more common BLH hosts are: chinch-weed (*Pectus papposa*), filaree (*Erodium* spp.), plantain (*Plantago* spp.), Mignonette (*Oligomeris linifolia*), mustard (*Brassica* spp.), peppergrass, spectacle pod, lense pod, sand verbena (*Abronia villosa*) and dune primrose (*Oenothera deltoides*). Russian thistle, Bassia and wild mustards are also found along roadsides and in cultivated fallow fields.

4.2.2.2 Federal & State Listed and BLM Sensitive Species

PLANTS

Giant Spanish Needle (*Palafoxia arida* var*. gigantea*) (FSC, BLMS)

Giant Spanish needle is an annual or perennial herb native to California and Arizona in the family *Asteraceae*. The plant grows from 30 to 90 centimeters high with as many as 100 flowers per plant. The giant Spanish needle is scattered throughout the dunes east of the Coachella Canal. Its total range is within the Imperial Sand Dunes.

Peirson's Milk-vetch (*Astragalus magdalenae* var. *peirsonii*) (FT, SE)

Peirson's milk-vetch is a perennial herb in the family *Fabaceae* native to California, Arizona and Baja California. It is a stout herbaceous perennial with leaves divided into oval leaflets. It blooms from December to April. The inflorescence contains 5 to 20 pink to purple flowers, some with white tips. Peirson's milk-vetch is known from the Imperial Dunes and areas west of the Salton Sea. The highest concentrations are in the North Algodones Dunes Wilderness Area.

Algodones Dunes Sunflower (*Helianthus niveus* subsp. *tephrodes*) (FSC, SE, BLMS)

The Algodones dune sunflower is a perennial herb native to California, Arizona and Sonora, Mexico. A dense covering of fine hairs, which protect the plant from extreme heat and light, gives the leaves a silvery appearance. It has a bright yellow flower and blooms March-May and October-January. The Algodones dunes sunflower is known from the Imperial Dunes and other dune systems in the Southwest.

Wiggins' Croton (*Croton wigginsii*) (SR, BLMS)

Wiggins' croton is in the family *Euphorbiaceae* and is native to California, Arizona, Baja California and Sonora, Mexico. It is associated with the creosote bush scrub plant community. It is a multi-branched perennial shrub 1 to 2.5 meters high with silvery hairs. Flowers are small (2 to 4 millimeters) and dioeceous with male and female flowers on different plants. Both sexes lack petals and bloom March to May. The plant is common on the west side of the Imperial Sand Dunes and found occasionally on the east side.

Sand Food (Pholisma sonorae) (BLMS)

Sand food grows in sand dunes and is a perennial herb in the family *Lennoaceae*. It is a root parasite with fleshy stems 0.3 to 1,5 meters long buried in the sand. Sand food is grayish in color because it lacks chlorophyll. The inflorescence is mushroom like and lies at the surface of the sand. The flowers are pink to purple and bloom from April through June. To obtain nutrients, the parasitic plant attaches itself to roots of various desert plants.

ANIMALS

Western Mastiff Bat (*Eumops perotis californicus*) (BLMS, SC)

The western mastiff bat is a member of the free-tailed bat family, *Molossidae*. The subspecies ranges generally in the southwest desert regions of the United States but also extends north to Alameda County California. They do not undergo either migration or hibernation and are periodically active in winter. It feeds on insects with moths comprising up to 80% of the diet.

California Leaf-nosed Bat (*Macrotus californicus*) (BLMS, SC)

The California leaf-nosed bat is a species in the family *Phyllostomidae* is found in lowland desert habitats in the Colorado River Valley, Nevada, Arizona and western Mexico. They capture crickets, grasshoppers, beetles, and sphinx moths directly from the ground or foliage. They weigh between 12 and 20 grams and have a wingspan of over 30 centimeters. The body is over 6 centimeters long and colored brown.

Pallid Bat (*Antrozous pallidus*) (BLMS, SC)

The pallid bat is a species in the family *Vespertillionidae* and ranges from western Canada to central Mexico. They have on average a total length of 9 to 13.5 centimeters. Pallid bats are insectivores feeding crickets, cicadas and scorpions consuming up to half their weight in arthropods every night.

Desert Tortoise (*Gopherus agassizii*) (FT, ST)

In California, the desert tortoise occurs in northeastern Los Angeles, eastern Kern, southeastern Inyo and most of San Bernardino, Riverside and Imperial Counties, as well as parts of Arizona and Utah. The desert tortoise can be found in washes, rocky hillsides and flat desert. Adult tortoises grow to 20 to 35.5 centimeters long. Creosote bush, burro bush, saltbush, Joshua tree, and Mojave yucca are often present in areas inhabited by the tortoise. They eat a variety of annual and perennial plants. The desert tortoise is active during spring and retreat into burrows during severe winter and summer weather.

Flat-tailed Horned Lizard (*Phrynosoma mcallii*) (SC, BLMS)

The present distribution of the flat-tailed horned lizard ranges from the Coachella Valley in Riverside County, south along both sides of the Salton Sea into Imperial County. The most favorable habitats are areas of low relief with surface soils of packed sand, overlain with loose, fine sand, and associated with Creosote bush and bursage. The flat-tailed horned lizard is insectivorous with harvester ants accounting for the majority of its prey.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) (SE, BLMS)

The western yellow-billed cuckoo is a slender brown bird with white under parts. Its natural nesting habitat is in deciduous riparian forest in primarily cottonwoods and willow trees. Food

consists of grasshoppers, katydids, tree frogs and caterpillars. Breeding pairs are found along the Sacramento River in Butte, Glenn, Colusa Counties, the south fork of the Kern River, and along the Santa Ana, Amargosa and lower Colorado Rivers.

Yuma Clapper Rail (*Rallus longirostris*) (FE, ST)

The Yuma clapper rail (YCR) is a resident of the shallow, freshwater marshes along the lower Colorado River and the Salton Sea and prefers dense growths of cattail, bulrush and reeds to forage and nest. The YCR eats mostly crayfish; also small fish, isopods, insects, clams and seeds. The YCR is gray-brown and grows to the size of a chicken.

Least Bell's Vireo (*Vireo bellii pastilles*) (FE, SE)

The least Bell's vireo is a small migratory songbird with a drab-gray color on top and whitish below with sides of grayish olive-yellow. The vireo is insectivorous and is a summer resident of the cottonwood-willow thickets and dry washes. Its breeding range is restricted to primarily Santa Barbara, Riverside and San Diego Counties and into northwestern Baja California.

Arizona Bell's Vireo (*Vireo bellii arizonae*) (SE, BLMS)

The Arizona Bell's vireo is very similar in habitats and appearance as the least Bell's vireo. The Arizona Bell's vireo is only found at a few sites on the California side of the Colorado River near Needles and Laguna Dam.

California Black Rail (*Laterallus jamaicensis coturniculus*) (ST, BLMS)

The California black rail is about the size of a sparrow. It is blackish in color with nape of deep chestnut. They eat a variety of insects, frogs, crustaceans and mollusks. It is known to inhabit saltwater, brackish and fresh water marshes in California, particularly the Salton Sea and lower Colorado River, north of Yuma.

Burrowing Owl (*Athene cunicularia*) (SC, BLMS)

The burrowing owl is ground-dwelling. It has a sandy colored head, back and underneath parts of the wings; and, white to cream on the breast and belly with a white chin stripe. They yellow eyes with white eyebrows and no ear tufts. They are often active in daylight. They feed primarily on arthropods, also small mammals, reptiles, birds and carrion. This species has an extremely large range in both North and South America.

Elf Owl (*Micranthene whitneyi*) (SE, BLMS)

The elf owl is the smallest owl in North America and breeds in the southwestern United States and Mexico. The plumage is spotted with buff and white on a gray or brown base. The diet of the elf owl consists almost entirely of large insects, centipedes and scorpions but small birds and amphibians are occasionally taken. It is found in central and southern Mexico in the winter. Elf Owls migrates north in mid-August or early May and can be found during the

breeding season in the cottonwood, willow and mesquite riparian zone along the lower Colorado River and Corn Springs in Riverside County.

Mountain Plover (*Charadrius montanus*) (FPT, BLMS)

The mountain plover is a migratory bird that over winters in heavily grazed California grasslands. Populations of the plover winter primarily in the San Joaquin Valley west of Highway 99 and south of Sacramento to Kern County, and portions of southern California including the Antelope Valley, Carrizo Plains, and the southern end of the Salton Sea in the Imperial Valley. The mountain plover is an insectivorous bird the size of a killdeer (18 centimeters) with the back of the body being light brown and the belly being lighter. There is no dark breast belt as found in other plover species.

Gilded Flicker (*Colaptes auratus chrysoides*) (SE, BLMS)

The Gilded flicker has a brown-barred back, white rump, yellow wing and tailings and a brown crown. This woodpecker nests in mature cottonwood and willow trees along the lower Colorado River and consume ants, other insects, wild fruits and berries. The bird is found only at several sites on the California side of the Colorado River north of Blythe.

Gila Woodpecker (*Melanerpes uropygialis*) (SE, BLMS)

This is a large woodpecker with a grayish-brown head, neck and under parts. The back is narrowly barred with black and white. Food items include insects, mistletoe berries, cactus pulp, bird eggs, and fruit. The Gila woodpecker is a primary cavity nester of the mature cottonwood, willow riparian forest. The woodpecker is now only found in scattered locations along the California side of the river between Needles and Yuma.

Southwestern Willow Flycatcher (*Empidomax traillii extimus*) (SE, FE)

The southwestern willow flycatcher is an insectivorous transient bird and is found from the middle of May through the middle of June in the deserts of southern California. They are found along rivers and streams in dense growing riparian habitat, canyon woodlands, desert washes and desert oases. Southwestern willow flycatcher breeds in late spring and has generally departed from breeding grounds in southern California by September. Habitat destruction and the parasitism by brown-headed cowbirds have been proposed as causes of population decline.

Desert Pupfish (*Cyprinodon macularius*) (FE, SE)

The desert pupfish is a small pupfish with a tan to olive coloration with lateral vertical bars. This species occurs in the San Felipe Creek, Salt Creek, Carrizo Wash, Fish Wash, the mouths of agricultural drains and shoreline pools along the edge of the Salton Sea. The desert pupfish forage on invertebrates, algae and detritus. Exotic fish and habitat destruction have contributed to the decline of the species.

Bonytail Chub (*Gila elegans*) (FE, SE)

The bonytail is a large chub, 30 to 35.5 centimeters long with a gray or olive back and white sides and belly. There is usually a conspicuous hump behind the head. The bonytail are bottom feeders and are presently very rare. The bonytail historically occurred in the mainstream of the Colorado River and lower-gradient portions of its major tributaries.

Humpback (Razorback) Sucker (*Xyrauchen texanus*) (SE, FE)

The humpback sucker has a sharp hump or keel on the back, which elevates the dorsal region of the body above the head. Its back is a brown to olive and its belly is yellowish. The fish was known from the mainstream of the Colorado River and major tributaries. Recent records of occurrence on the lower basin are sporadic and isolated.

Colorado Pikeminnow (*Ptychocheilus lucius*) (FE, SE)

The Colorado pikeminnow (formally squawfish) is the top carnivore of the Colorado River system. The fish is a dusky green on top and yellowish to white below, with silver sides. The head is long, slender and depressed. The eyes are small and the mouth is large and toothless. The Colorado pikeminnow has not been seen below the Glen Canyon Dam since 1968. Habitat alteration is cited as a direct cause of extirpation in the lower Colorado River basin (CDFG, 1992).

Andrew's Dune Scarab Beetle (*Pseudocotalpa andrewsi*)

This scarab species appears to be endemic to the Algodones Dunes in Imperial County and possibly portions of the same dune system in Baja California Norte, Mexico. Activity may start as early as February but typically, Andrew's dune scarab beetle (ADSB) activity ranges from mid-April through the first week of May. ADSB emerge from the sand in late afternoon, but before dark, with a brief activity period. Flights of beetles numbering 3 to 20 have been observed in "clouds" around Creosote and occasionally Palo Verde and *Eriogonum* spp. during this short dusk activity period, from first emergence until last disappearance, ranges from 10 to 30 minutes. After the flight individuals can be seen burying themselves rapidly in the sand within 1 to 2 minutes of landing on the surface (Hardy and Andrews, 1979).

4.2.3 Miscellaneous Components

4.2.3.1 Imperial Sand Dunes

The Imperial Sand Dunes are one of the largest dune systems in North America forming a band 40 miles long and five miles wide. The dune system extends across the border into Mexico and runs northwest to southeast. The dune system is home for many specialized plants and animals.

4.2.3.2 Cultural Components

There are many archeological and historical sites throughout the Imperial Valley and eastern Riverside County. There are three historical cemeteries (from 1880-1930) at the railroad town sites of Amos, Glamis and Ogilby. Remnants of the Plank Road, utilized by vehicles between 1914 and 1926, can be seen fenced at Grays Well. Remnants of Native American pottery and signs of ancient trails are evident around the edge of the Ancient Lake beach line.

4.2.3.3 Wilderness

The North Algodones Dunes Wilderness Area is located on the Algodones sand dune system and covers approximately 32,240 acres including both state and private lands. The primary and secondary dunes support a variety of desert plant and animal species. The Imperial Sand Hills National Natural Landmark and the Algodones Outstanding Natural Area are specially areas found within this wilderness.

4.2.3.4 Critical Habitat

Critical Habitat units that overlap potential BCTVCP survey/treatment areas in the Imperial and eastern Riverside Counties include those for desert pupfish and desert tortoise.

Desert Pupfish (*Cyprinodon macularius*) - Four units were designated as critical habitat for the desert pupfish (USFWS 1986) in San Felipe Creek, Carrizo Wash, Fish Creek and Qutobaquito Spring. Carrizo Wash and Fish Creek are tributaries of San Felipe Creek. Desert pupfish critical habitat overlaps a small portion of BCTVCP potential survey/treatment area in Imperial County (page E-7).

Desert Tortoise (*Gopherus agassizii*) - Approximately 6.4 million acres of Critical Habitat is designated for the desert tortoise in California, Nevada, Utah and Arizona (USFWS 1994c). A small portion of desert tortoise critical habitat is within BCTVCP potential survey/treatment area near the intersection of Highway 78 and Ogilby Road (page E-8).

5.0 ENVIRONMENTAL CONSEQUENCES

5.1 ASSUMPTIONS FOR IMPACT ANALYSIS

Malathion will be applied at the rate of 0.583 pounds of active ingredient (a.i.) per acre. This compares to recommended dosages ranging from 0.292-1.166 pounds a.i./acre for insect pests on various agricultural crops.

- Malathion is broken down relatively fast by hydrolysis and by the action of soil microorganisms. Actual degradation rates depend on prevailing conditions. The variety of mediums such as soil, water, foliage and air influences the rate of degradation. Factors such as acidity, temperature, moisture, presence of microbes, organic matter, and other factors influence the exact rate of breakdown of malathion within the medium. Malathion has particular chemical properties which reduces leaching and presents small risks to ground water. Malathion is not generally phytotoxic and is registered for use on a variety of vegetation and crops.

- Conclusions drawn in this EA are based in part on toxicological evaluation of laboratory and domestic animals and on professional judgment of BLM, USFWS, CDFG and CDFA personnel. This is necessary because few studies have been performed to determine the effects of malathion on wildlife species. However, there have been many studies performed on the effects of malathion on laboratory and domestic animals (See Appendix “I” for the Summary of Toxicology Data). Correlations have been drawn from those laboratory studies on possible affects to wildlife populations.

- The control of the BLH with malathion in rangeland and cultivated fallow fields has been performed for over 30 years. BCTVCP staff are trained to identify and required to report any major impacts observed during post-treatment surveys. No major impacts from BCTVCP activities have been observed nor reported by the staff.

- The BCTVCP has cooperated with the following federal, state and local agencies in the control of BLH in California: Department of the Interior, USFWS, BLM, CDFG, CDWR and the CAC within the counties where BLH control work is performed. No major impacts to vegetation or wildlife has been observed and documented by cooperating governmental agencies from BCTVCP activities.

- Accidental spillage or treatment of malathion on non-target areas is possible due to vehicle or aircraft accidents, equipment malfunction, drift and miscommunication. While the possibility of accidents is recognized, they would be infrequent and isolated. The BCTVCP has maintained a good safety use record throughout the life of the Program; therefore, the likelihood of major adverse impacts to the environment from accidents would be low (See Appendix “H” for "Pesticide Spill Contingency Plan”).

5.2 IMPACT TOPICS

5.2.1 Impact Topics Dismissed from Detailed Analysis

5.2.1.1 Wilderness Areas

Any proposals to apply the control procedures within wilderness study areas or designated wilderness areas will be analyzed and authorized separately, following the terms of the Bureau's Interim Management Policy for Wilderness Study Areas or Wilderness Management Policies for designated Wilderness Areas and not be considered within the scope of this document.

5.2.1.2 Cultural/Prehistoric Components

The prehistoric and cultural sites within treatment areas are quite varied. The survey and aerial control of BLH populations are non-surface disturbing activities. The restriction of vehicles to existing roads reduces the potential to impact unknown cultural resources. It is unlikely that cultural artifacts protected by soil or plant cover would be adversely affected by pesticide treatments. For these reasons, the Proposed Action will have little potential to effect cultural or prehistoric resources.

5.2.1.3 Bat Species

There are several bat species, which may occur or range within potential BLH treatment areas including the pallid bat (*Antrozous pallidus*), western mastiff bat (*Eumops perotis californicus*), and California leaf-nosed bat (*Macrotus californicus*). Direct exposure of malathion to bats and roosting sites from daytime treatment activities is not likely due to the nocturnal foraging habits and roosting behavior of bats. Indirect effects of temporarily reducing insects utilized as food by bats is not expected to be significant because:

- The large foraging range of bats;
- The movement of prey insects and bats within treated and adjacent non-treated areas;
- All three bat species have significantly large ranges well outside the BCTVCP survey/treatment area.

5.2.1.4 Birds of Prey; California Condor

The bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus anatum*), Swainson's hawk (*Buteo swainsoni*) and California condor (*Gymnogyps californianus*) are listed as threatened or endangered by the State of California, and/or the Federal Government and may occur within the potential BLH treatment areas. The American peregrine falcon has been delisted but remains as a species of concern. No major impacts to birds of prey and condors are anticipated due to BLH treatment activities due to:

- The large foraging range within and outside BLH survey areas;
- The minimal indirect impacts to food supplies other than insects, including small and medium-sized mammals, birds, reptiles, fish;

- Riparian systems or cliff faces used for nesting sites are not treated during BCTVCP operations and;

- Avoidance measures for the California Condor (page 36) will reduce the risk of accidentally striking a condor by aircraft during aerial applications.

5.2.1.5 Fish Species

Colorado River: The bonytail chub (*Gila elegans*), humpback sucker (*Xyrauchen texanus*) and the Colorado pikeminnow (*Ptychocheilus lucius*) may occur in the Colorado River adjacent to BLH survey areas. No major impacts to fish or fish species of concern are expected due to the avoidance of aquatic habitats during treatment operations. Malathion may enter aquatic water systems in runoff if isolated thundershowers occur over treated areas before the complete degradation of malathion has taken place. (Discussion on the effects of malathion in water and impacts to aquatic life (page 79) and fish (page 90). Small residues of malathion washed into the Colorado River or Salton Sea from runoff would be exposed to absorbing organic particles and be diluted by the large bodies of water. Residues of malathion in runoff resulting from isolated thunderstorms are not expected to have a major impact to fish species of special concern.

Salinas River: Potential aerial treatment areas in the Salinas Valley overlap designated critical habitat for the south-central California coastal steelhead (*Oncorhynchus mykiss*) in a portion of the Salinas River. A ¼ mile (400 meters) buffer for aerial and ground-rig spot treatments will remain untreated along both sides of the Salinas River and its tributaries (including agricultural drains & canals) to eliminate impacts to steelhead critical habitat. Aerial treatments in the Salinas Valley are rare and have been performed only twice in the past 25 years; 1977 & 2001.

5.2.1.6 Desert Pupfish (*Cyprinodon macularius*)

Due to the potential impacts of malathion on the desert pupfish, specific measures have been adopted to avoid impacts (page 38). Adherence to the procedures, within the proximity of desert pupfish habitat is anticipated to eliminate impacts of BCTVCP treatments to desert pupfish populations.

5.2.1.7 Dune Beetle Species

Potential impacts to the San Joaquin dune beetle (*Coelus gracilis*), Ciervo Aegialian scarab beetle (*Aegialia concinna*), Andrew's dune scarab (*Pseudocotalpa andrewsi*), and Doyen's dune weevil (*Trigonoscuta* sp.) would be expected if adult beetles were exposed to malathion during their brief flight periods or while above ground. On rare occasions, BLH hosts may be in close proximity to dune systems in the Imperial or San Joaquin Valleys. BLH host plants do not develop in dune habitat which is avoided by the BCTVCP. Due to potential adverse impacts of BCTVCP activities, specific measures are adopted to minimize impacts to dune beetle species (pages 32, 36 & 38). Avoidance measures will reduce potential adverse impacts of BCTVCP treatments to dune beetle species.

5.2.1.8 Aleutian Canada Goose (*Branta canadensis leucopaveia*)

The migratory patterns of Aleutian Canada geese are expected within the periphery of BCTVCP control boundaries during a time of year when malathion applications, for the control of BLH, are very rare (USFWS 1994a). Frequency of Treatment by Region (Table 6) indicates potential ground-rig activities in or near overwintering grounds to be completed prior to the first of December. Since 1989, ground-rig treatments have not been performed in either San Joaquin or Stanislaus Counties (page D25). The frequency of Merced County ground-rig treatments during October and November is low. Due to the seasonal application of malathion, low volume of malathion used, the low frequency of use and the restricted application of malathion to roadsides and ditch banks by “ground-rigs only”; no major impacts to Aleutian Canada geese is expected. Due to its recent recovery, the Aleutian Canada goose was removed from the Federal list of “threatened” species (USFWS 2001a) but remains listed as a species of concern with California Fish and Game.

5.2.1.9 Palmate-bracted Bird's Beak and Large-flowered Fiddleneck

Palmate-bracted bird's beak *(Chorizanthe pungens* var. *pungens)* and large-flowered fiddleneck (*Amsinckia grandiflora*) are known from relatively few occurrences outside potential BCTVCP control boundaries. Both plants occupy specialized habitats not typically utilized by BLH host plants. Since very little, if any, natural habitat is expected to occur within the "ground-rig only" treatment region of the San Joaquin Valley, there will little chance that BCTVCP ground-rig treatments would encounter unknown populations of palmate-bracted bird's beak or large-flowered fiddleneck.

5.2.1.10 Western Snowy Plover

Habitats utilized by the western snowy plover include sandy seashores, shorelines along rivers and alkali vernal pools. These habitats are generally not found within the Program’s BLH survey areas, and if present, are avoided as prescribed by the Proposed Action.

5.2.1.11 Buena Vista Lake Shrew

Due to the potential impacts of malathion on the insect prey base of the Buena Vista Lake shrew (BVLS), specific measures have been adopted to avoid impacts to BVLS habitat (page 36).

BVLS consume more than their weight in insects and small invertebrates each day to maintain body weight due to its high metabolism. Specific feeding and foraging habits are unknown. Adherence to these procedures, within the general proximity of BVLS habitat is anticipated to eliminate impacts to BVLS. The BVLS is most likely found in habitat described generally as riparian vegetation associated with marshes and wet lands (USFWS 2000a & 2000b). Riparian habitat utilized by the BVLS is not conducive to the development of BLH and is considered by the BCTVCP as non-target sites.

5.2.1.12 Dune Plant Species

Giant Spanish needle (*Palafoxia arida* var*. gigantea*), Peirson's milk-vetch (*Astragalus magdalenae* var. *peirsonii*), Algodones Dunes sunflower (*Helianthus niveus* subsp. *tephrodes*), Sand Food *(Pholisma sonorae)* and Wiggins' croton (*Croton wigginsii*) occur in the Algodones Dunes. The Algodones dunes sunflower and Peirson's milk-vetch have essentially the same distribution. While the distribution of giant Spanish needle and Wiggins' croton varies within the dune system, they are largely confined to dune habitat. BLH host plants do not develop in dune habitat and is subsequently avoided by the BCTVCP. There should be minimal impacts to dune plant species.

5.2.1.13 Critical Habitat

Critical habitat units overlapping BCTVCP survey/treatment boundaries include those for Buena Vista Lake shrew, California condor, Monterey spine flower, vernal pool fairy shrimp, south/central California coast steelhead, desert tortoise, and desert pupfish. Maps of these critical habitat units and the BCTVCP survey/treatment areas are illustrated in Appendix E. The BCTVCP will not survey or treat within in critical habitat units. In addition, a ¼ mile buffer (400 meters) will be left untreated around critical habitat borders. Due to the avoidance of critical habitat and a treatment buffer, no impacts to critical habitat from the Proposed Action are anticipated.

5.2.1.14 Visual Impacts

The Proposed Action does not make permanent changes to the visible landscape. Visual impacts associated with the Proposed Action would include the temporary movement of:

- Survey/treatment vehicles in rangeland habitat and truck mounted ground-rigs on roadsides in intensive agriculture;
- Program Staff performing BLH survey on foot outside vehicles;
- Low level fixed wing aircraft applying malathion;
- Aircraft and loading/mixing vehicles on airstrips.

Public lands have a variety of visual values and are managed through the Visual Resource Management System (VRM) (BLM 1986). Areas identified as Class IV allow for the most visual change to the existing landscape while class I allows for the least. The Proposed Action will not affect VRM objectives.

BLM uses a systematic process to analyze potential visual impacts of proposed projects and activities with the goal to minimize visual impacts. The degree to which an activity affects the visual quality of a landscape depends on contrasting the proposed project features with the major features in the existing landscape (BLM 2007a).

Vehicle use and movement in the existing landscape is common. The intermittent use of various pickups, ATV's and flatbed trucks are associated with grazing activities in rangeland habitat. Large numbers of pickups and specialized vehicles and equipment are found moving within oil and natural gas production regions within the Project Area. Proposed Action vehicle

use is temporary, seasonal, and localized; requiring 4 to 5 survey evaluations per area prior to spring or fall treatments.

The temporary movement of aircraft is not as common as vehicle movement in the Project Area. Low flying aircraft are used to inspect pipelines on the westside of the San Joaquin Valley. Small aircraft utilize small airports in Coalinga, Lost Hills and Taft. Crop dusting activities are intermittent and common within intensive agriculture, and observed occasionally from rangeland habitat bordering crop lands.

While the presence and movement of vehicles and aircraft of the Proposed Action are visible for only short durations of time, the degree of contrast to similar activities observed in the existing landscape would be “none” or “weak”. The Proposed Action does not allow for alterations in the existing landforms and landscape features; and therefore, would not establish permanent visual elements in contrast with the existing landscape.

Behavioral responses from wildlife to the presence of vehicles, aircraft, and Program staff moving through the Project Area would be similar to those behaviors exhibited due to the presence of noise. Behavioral responses in wildlife from potentially disturbing activities can be from a combination of both auditory and visual stimulus (Pater 2009) and may include head-raising, body-shifting, and turning and orienting towards vehicles or aircraft (USFWS 1988b). Animals may be flushed or retreat away from the vehicles or aircraft. Behavioral responses would be expected to subside as vehicles and aircraft move through and away from the survey/treatment areas. Because the Proposed Action is short term, localized and seasonal; visual impacts to wildlife would be less than significant.

5.2.2 Impacts Discussed in Detail

5.2.2.1 Proposed Action

5.2.2.1.1 Malathion & Malathion Co-products

Malathion is a broad spectrum organophosphate insecticide. The primary mode of toxic action of malathion occurs through inhibition of acetylcholinesterase (AChE) function in the nervous system (Smith 1987; Klaassen 1986 in USDA 2002). Malathion can block the normal breakdown of the neurotransmitter, acetylcholine, which destroys or interferes with nerve conduction or the duration of nerve action.

Malathion may contain other chemicals or co-products formed through the synthesis, storage or degradation of the parent compound. The main impurities of malathion include isomalathion and malaoxon which are also AChE inhibitors. In addition to isomalathion and malaoxon, other impurities and inerts have also been reported as possible contaminants in malathion ULV formulations.

The BCTVCP could not obtain inert product information from the manufacture. Purity information is part of a Confidential Statement of Formula that is treated as Confidential Business Information by both U.S. Environmental Protection Agency and California

Department of Pesticide Regulation (CDPR). It is not the policy of USEPA or CDPR to release this information. Impurities of toxicological significance are evaluated and included in risk assessments conducted by USEPA and/or CDPR.

Isomalathion: Isomalathion is a known impurity present as a product during the manufacture of malathion. The upper certified limit of Isomalathion is 0.2% by weight in the technical product. There are limited data on the toxicity of isomalathion alone or products containing elevated levels of the compound. A survey by the USEPA of malathion products in 2004 found all samples had isomalathion levels within certified limits. The current toxicological data base for malathion reflects the presence of isomalathion up to the certified limit (USEPA 2006).

Malaoxon: Malaoxon is formed from malathion when the sulfur molecule is replaced with an oxygen molecule. This can occur in the environment or inside cells. Malaoxon is 61-100 times more toxic than malathion to test animals in laboratory tests (USEPA 2006, Sparling 2007). Malaoxon formation in the environment is greatest on hard, dry, biologically inert surfaces such as cement, roofs, steel and asphalt. The conversion of malathion to malaoxon does not occur readily on biologically active surfaces such as soil or plant surfaces. The conversion is not a simple linear function. That is, one unit of malathion is not converted to one unit of malaoxon. Studies have found that when 5% malaoxon has been formed only 40% of the parent malathion is left not 95% of the parent compound (Hernandez Torres et al. 2002, USEPA 2006, USEPA OPP 2007). Malaoxon, like malathion, degrades more rapidly under basic conditions (pH >7). Water and soils in the treatment areas typically have pH values greater than 8.

Field studies of malathion and malaoxon levels on fresh California strawberries treated with 1 pound malathion a.i. per acre, found no quantifiable malaoxon residues on either the leaves or fruit (level of detection was 0.01 ppm). This study reported malaoxon residues on the same samples of 0.19 nmole/gram on the strawberry leaves 2 days post treatment. This second analysis assumed malaoxon residues were present at ½ the level of detection (0.005 ppm) but it is unclear what data were used to support this assumption (Zhang 2008). Several studies found that malaoxon levels on plants were relatively stable and thus did not increase as the level of malathion decreased (Nigg 1981b, Zhang 2008).

Field studies of malathion degradation found that malaoxon accounted for a maximum 1.8% of the breakdown products in soil but 5% of the breakdown products on steel surfaces (USEPA OPP 2007). Assuming that malaoxon production on foliage within the treatment areas is similar to that on Florida citrus trees (Nigg 1981b), we estimate that malaoxon concentrations could range from 0.3-1.05 ng/cm^2. Given that California water and soils are basic not acidic like those in Florida and that malaoxon is less stable in basic conditions, it is unlikely that malaoxon levels in our treatment areas will reach these levels.

Based on the above information and our analysis, we conclude that malaoxon levels that might arise from the degradation of the malathion, applied by the BCTVCP, pose little threat to non-target organisms. The USEPA reached a similar conclusion stating; “The agency does not believe that the conditions for the formation of malaoxon exist such that residues of malaoxon will be found in or on the food sources of terrestrial wildlife. Malaoxon can enter surface water

via runoff when malathion converts to malaoxon and is wash off by rainfall. However the USEPA does not expect malaoxon to be significant component of the ecological hazard of malathion to non-target organisms. While other degradates and impurities of malathion exist, they too are not expected to be present in the environment at concentrations high enough to contribute to the toxicity of malathion to non-target organisms" (USEPA 2006).

5.2.2.1.2 Human Health

Malathion has been used for 50 years on commercial food crops, home gardens, landscaping, pets, livestock, mosquito abatement and fruit fly eradication projects. The relatively small quantity of 0.583 lbs. a.i. of malathion per acre, as specified in the Proposed Action, limits potential exposure for people living in or near the treatment areas. It is the policy of the BCTVCP to prevent accidental exposure of the general public or persons incidentally working within or near areas selected for treatment.

As a requirement of the Food Quality Protection Act of 1996, the U. S. Environmental Protection Agency (USEPA) periodically evaluates the use of malathion and other organophosphates for human health and ecological risks. In EPA's evaluation of malathion (USEPA, 2000), EPA's Health Effects Division's Cancer Assessment Review Committee proposed to classify malathion data as "suggestive evidence of carcinogenicity but not sufficient to assess human carcinogenic potential". In a subsequent re-registration review of (USEPA 2006-Appendix I), malathion remains classified as "suggestive evidence of carcinogenicity" in accordance with USEPA's Proposed Guidelines for Carcinogen Risk Assessment, July 1999. To date, malathion has not been classified by the USEPA as a carcinogen nor is there convincing evidence that malathion is a carcinogen, teratogen, reproductive toxin, or that it damages nerves. Malathion is not on California's list of compounds known to the state to cause cancer. Due to the low application rates and the remoteness of BCTVCP applications to urban environments, the Proposed Action is not expected to pose a significant carcinogenic risk to the general public or Program employees/contractors. There is a possibility for individuals to be affected by the Proposed Action who have a hypersensitive or allergic reaction to malathion or adjuvants utilized in the spray mix.

A summary of toxicological study evaluation worksheets for malathion from the Medical Toxicology Branch, Cal EPA is provided for review in Appendix "I". Detailed discussions of risk and hazard assessments of malathion can be found in the Exotic Fruit Fly Eradication Program-Final EIR (CDFA, 1994), and in the Health Risk Assessment of Aerial Application of Malathion-bait (CDHS, 1991).

Prior to treating an area by air, the pilot is informed of local non-target sites including water sources, endangered species sites, livestock, and any people working or passing through the treatment area. BCTVCP personnel patrol ahead of the aircraft to alert anyone who may be in the area where vehicles are allowed to travel. When feasible, entry points into the treatment area are restricted by stationing a person to notify people of the pesticide application in progress. Supervisors are in constant contact with the aircraft and ground crews by radio.

Wind direction and velocity is monitored to prevent pesticide drift out of the target area. Pilots are instructed to turn off spray when people or vehicles are encountered in the treatment area.

5.2.2.1.3 Noise

Noise sources associated with the Proposed Action would be those associated with the movement of passenger and ground-rig vehicles through the survey/treatment areas, mixing/loading of aircraft, and from the aerial application of malathion to control BLH populations. The Bureau of Land Management (BLM) noise standard is 48.6 $dBAL_{eq}$ over continuous 24 hour period (BLM 2004). The standard allows individual sound levels to exceed the numerical standard, but when individual sound levels are logarithmically averaged over 24-hours, the resulting levels must be below the standard of 48.6 dBA.

Vehicles: Noise from Program vehicles performing survey activities and observing aerial applications would raise ambient noise levels in areas closest to accessible roads within rangeland habitat. These activities are transitory and noise would only be elevated above ambient levels for a limited time.

Pick-up truck mounted ground-rig sprayers will increase ambient noise levels performing roadside spot treatments on the periphery of rangeland habitat and within intensive agriculture where susceptible crops are grown. Ground-rig spot treatments are limited in duration and are transitory. Ambient noise levels would be elevated for short periods of time and greatest near roads utilized by ground-rigs. Due to the short duration and mobility of Program vehicle use, impacts to terrestrial wildlife from noise generated by Program vehicles would be minimal.

Aircraft: The operation of aircraft would result in an increase in ambient noise levels in the vicinity of the aircraft treatment activity. Aircraft noise levels on the on the ground, closest to the aircraft, would be expected to exceed 48.6 dBA momentarily as aircraft passes overhead. No long-term effects were anticipated in the use of aircraft to apply the herbicides with temporary noise levels at 90 dBA (BLM 2006a). Although the amount of sound generated by aircraft can appear great close to the application swath, the impact would be minimal due to the limited time during which noise levels would be elevated.

Aircraft noise tends to be deflected up under normal temperature gradients and deflected down under temperature inversions. Air absorption has the most effect on noise propagation from flying aircraft. During low-level aircraft operations, objects such as hilly terrain can absorb and deflect noise at low angles of observation (USFWS 1988b). Impacts of sound would be minimized by variations in vegetation, topography and distance.

The potential for response of wildlife to aircraft noise would vary by species and be the greatest in the vicinity of the treatment swath. Animals exhibit very subtle and seemingly minor behavioral responses to over flights including head-raising, body-shifting, and turning and orienting towards the aircraft (NPS 1994). Behavioral responses in wildlife from potentially disturbing activities can be from a combination of both auditory and visual stimulus (Pater 2009). More adverse behaviors in mammals are associated with a strong startle response, retreating from the sound source, or freezing (USFWS 1988b). Perching or nesting birds may

be flushed up from a perch or nest and circle the area before landing again (NPS 1994). Biologists and field managers at field installations of National Wildlife Refuges have reported that helicopters appear to cause a greater flight/fright response in wildlife than fixed-wing aircraft. Waterfowl were the most often observed animal group disturbed by aircraft (USFWS 1988a) and may leave the area if amply disturbed (NPS 1994). These behavioral responses to aircraft noise would be short term and be expected to subside as the aircraft moves through and out of the treated area.

Mixing/Loading: Aircraft mixing and loading activities are performed on small county airstrips, or airstrips located within intensive agriculture, and would not raise ambient noise levels within rangeland habitat. The amount of sound generated by mixing/loading will be greater in the vicinity of the airstrip and would be of limited duration. Airstrips can be utilized for 1 to 4 days before operations are relocated to another strip. The Proposed Action aircraft loads approximately once every 45 to 60 minutes when conduction aerial treatments. The loudest noise generated by aircraft occurs during takeoff when the aircraft operates at high power (USFWS 1988b). Because noise from mixing/loading operations is intermittent and limited to when the aircraft is on the ground and taking off, impacts to terrestrial wildlife would be minimal.

5.2.2.1.4 Terrestrial Impacts

Soil compaction is expected to be minimal from BCTVCP operations and limited to existing roads or established airstrips. Vehicles, turning around on narrow dirt roads, would compact a small amount of soil to the edges of the road. Small amounts of dust from vehicles and aircraft would be created from BCTVCP activities with negligible impact. The amount of dust created by BCTVCP activities would vary with the types of soils and vegetation present and be temporary due to the mobility of treatment procedures through a specific area.

Field Dissipation: Varying rates of terrestrial dissipation have been reported for malathion in literature. No residues found in soil after the first year of an exaggerated application rate of 76.6 lb a.i./acre (Roberts et al, 1962 in USEPA, 1975). After a 5 lb a.i./acre application of malathion to Carrington silt loam, 83% degradation was observed in 3 days and 97% in 8 days (Lichtenstein & Schulz 1964 in USEPA 1975).

A dissipation half life of less than 0.2 days was reported in California field applications of malathion at 1.16 lbs. a.i./acre, once a week for 6 weeks. It is generally accepted that the fastest dissipation of malathion in a terrestrial field setting is through microbial degradation (USEPA 2000a). Malathion is unlikely to persist in any component of the physical environment.

Malathion in Soil: Malathion is broken down relatively fast by hydrolysis, especially under alkaline conditions, and by the action of soil micro-organisms (Matsumura and Boush 1966). Malathion does not absorb well to inorganic soil particles but binds tightly with organic matter.

Many values for malathion's half-life in soil have been reported:

- 5 days (Curley and Donohue 1986);

- 1 day (USEPA 1986);
- 7.5 to 11 days in soils with low organic content (Buckman and Brady 1969), and
- 6.6 days in 8.3 pH soil (Al-Wabel et al. 2010).

The range of values depends on soil's alkalinity, organic content, microbial population and chemical degradation. Biodegradation by microorganisms is an important fate process in soil. The major metabolite in soil is malathion beta monoacid and has a reported half-life of 4-6 days (Paschal et al. 1976). It is believed that bacterial mineralization by carboxylesterases and phosphatases accounts for a major portion of malathion's degradation in soil while chemical hydrolysis and photo-oxidation are less of a factor (Brown et al. 1993; Levanon 1993). Literature suggests that malathion will persist longer in dry, sandy, low nitrogen, low carbon or acidic soils (Walker and Stojanovic 1973, in USEPA 2000a). There are indications malathion is mobile in loamy sand and loam soils.

Malaoxon is a common degradation product of malathion in the soil. Degradation of malaoxon is primarily by basic hydrolysis and half-lives of 3.9 to 5 days were found for soils of pH 7.2 to pH 8.2 (Pascal and Neville 1976 in USDA 1991). This indicates that basic hydrolysis will lead to rapid degradation of malaoxon under conditions found in soils in many BCTVCP survey areas.

Soil Microorganisms: Malathion was slightly toxic to the bacterium *Nitrobacter* sp. (Bollen 1961) but caused complete inhibition of the cerium *Nitrosomonas* sp. (Garretson and San Clemente, 1968). Bacteria and fungi degrade malathion rapidly (Murry and Guthrie 1980; Paris and Lewis 1974 and Bourquin 1977). Malathion has the least effect on soil fungal species of 5 pesticides tested on cultured micro-fauna extracted from soil (Dey et al. 2010).

Malathion, applied 4 successive times at a rate of 2 lbs a.i./acre to a forested watershed, caused short-term effects on micro-arthropods and no observed effects on bacteria, fungi, earthworms, or snails. There was not a significant difference between earthworm populations before and after treatment using results data from both the cryptozoan board and potassium permanganate expulsion methods (Giles 1970).

5.2.2.1.5 Impacts on Air Quality

Air quality standards are threshold concentrations of pollutants used to protect human health. The Federal Clean Air Act requires the U.S. Environmental Protection Agency (EPA) to set national ambient air quality standards and permits states to adopt additional or more health-protective standards. California's air quality is governed by the California Air Resource Board which is responsible for monitoring the regulatory activity of 35 local air districts and establishing ambient air quality standards. Federal and state governments have established ambient air quality standards for six criteria pollutants: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, particulate matter (PM_{10}) & and fine particulate matter ($PM_{2.5}$).

The Proposed Action will generate emissions and dust but any effects would be temporary and minor. Sight increases in dust from off-road use and pollutants from internal combustion engines of vehicles and aircraft consuming fuel would be expected. Aerially applied pesticides

can volatilize and may be blown by winds and potentially adhere to dust and other wind-blown particles. Ground spraying would produce less potential for pesticide drift than aerial spraying. These pollutants would be minor, temporary, localized, and not anticipated to have direct or indirect impacts on air quality standards.

PM_{10} particles require winds in excess of 15 mph to remain airborne. Aerial and ground applications of malathion are halted when average wind speeds exceed 5 mph. Airborne particles of malathion are not expected to contribute significantly to the formation of photochemical smog (USDA 1991). Malathion has a low vapor pressure and is essentially non-volatile. Malathion has not been identified by the USEPA as a hazardous air pollutant to be regulated under Section 112 of the Clean Air Act. The Proposed Action would not significantly elevate ozone or PM_{10} concentrations.

5.2.2.1.6 Impacts to Water

Water quality is related to the geography and geology of the surrounding area. Soil types, vegetative cover, precipitation and topography determine the quality of the ground and surface water in a drainage basin. Literature shows that malathion is short lived and is subject to hydrolysis (Mulla 1981). The relatively quick degradation of malathion by ultraviolet light (USEPA, 1975) and hydrolysis, reduces the potential for residues in soil or runoff. Malathion is hydrolyzed rapidly in water with pH>7 (Beyers and Myers 1996).

Based on its rapid degradation and reported octanol-water partition coefficient, malathion is not expected to leach to ground water, especially with high organic soils (NLM 1988). Malathion has been detected in ground water in three states (USEPA 1992 in USEPA 2000a). In California, malathion was found in one well out of 499 wells sampled. USEPA believes the monitoring data indicates malathion to have a potential for movement into ground water especially in soils with low organic material and high sand content (USEPA 2000a). The foliar application site of the Proposed Action mitigates the movement of malathion to ground water due to the exposure of residues to degradation processes, such as photolysis (CEPA 2006). Malathion has particular chemical properties, which reduces the potential for leaching presenting small risks to people and animals drinking ground water (USDA 1991).

It is expected that extremely small quantities of malathion may leach from cultivated fallow fields and rangeland after major storms if the storms occur before complete degradation has taken place. Natural river water with a large amount of organic matter resulted in a half-life for malathion of 15 to 16 hours under sunlight photolysis (Wolfe et al., 1977 in USDA 1991). Malathion found dissolved in surface runoff would be available to bind with organic solids suspended in the water and would result in less malathion exposure to organisms living in or ingesting the water.

The degradation and sorption of malathion was studied in urban creek sediments in several Southern California streams. Rapid degradation of malathion was observed in stream bed sediments under aerobic conditions and was relatively non-persistent under either aerobic or anaerobic conditions (Bondarenko 2004).

5.2.2.1.7 Impacts to Aquatic Life

Adverse phytotoxic effects from malathion have not been reported on aquatic plants. Algae metabolize malathion rapidly into non-toxic components (Mulla and Mian 1981). Fogging or aerosol applications of malathion on salt marsh plants showed no adverse effects (Dobroski and Lambert 1984). Impacts to aquatic animals vary according to species, duration of exposure and the quality, temperature and flow rate of water. While malathion shows a range of moderate to high toxicity to fish species (USEPA 1975), aquatic invertebrates show the most sensitivity to malathion and would be most impacted if malathion was applied directly to surface water.

Should rain follow close behind a malathion application, or more critically, before the application can thoroughly dry, malathion may be washed from rangeland foliage and migrate toward small streams or ponds containing aquatic plants and wildlife. The potential for malathion in runoff is reduced if the application has sufficiently dried prior to a rain event and will continue to decline as the time between the application and the rain event increases. Treatment buffers around water bodies reduce the potential for malathion in runoff.

The impacts malathion may have on aquatic life is a function of the following six variables (USDA 1991):

- Volume of precipitation produced by a storm;
- Volume of rangeland runoff;
- Insecticide concentration in rangeland runoff;
- Quantity of insecticide washed into a stream or river;
- The length of time the insecticides are in contact with the receiving organism;
- Stream volume and flow;
- pH of stream.

Additional environmental variables influencing potential malathion exposure to aquatic organisms in streams include; flow rate, volume of water in relation to surface area, subsurface recharge of stream flow, microscopic organism burden, temperature, shading, oxygenation, and bottom characteristics (Peterle and Giles 1964).

Using the Groundwater Loading Effects of Agriculture Management Systems (GLEAMS), bare soils would have slightly higher runoff concentrations of malathion than vegetated areas. In this model, the greatest concentration in runoff occurs when soils have high runoff coefficients, poor quality vegetative cover, high clay composition, high portion of impervious surfaces, and steep slopes (USDA 2002). Estimated insecticide concentration in runoff water from sprayed water shed using GLEAMS, were negligible with a storm intensity of 1 inch or less.

Although the possibility exists for malathion to enter aquatic water systems in runoff, the occurrence of such an event would be rare and isolated. In addition, actual field studies indicate that malathion in runoff or drift would be subject to a wide variety of environmental factors; many of which can degrade and shorten the half-life of malathion under aquatic conditions. Measures to reduce potential runoff and drift into non-target areas are specified in the Proposed Action (pages 24-25). Treatment restrictions, in desert areas frequented by

thundershowers, have been adopted to minimize the potential impacts of runoff to desert pupfish habitat and Yuma clapper rail habitat (page 37). Large buffers, used around water bodies, have been shown to be adequate in significantly reducing malathion deposition rates at 650 feet (200 meters) (pages 25-26). Water is defined as any body of water, natural or man-made including; springs, wildlife guzzlers, alkali sumps, vernal pools, ephemeral pools stock ponds, reservoirs, streams, ditches and canals.

A study of the effects of malathion applications in a worst-case scenario was conducted at Stewart's Creek in Alabama where malathion was applied in cotton fields up to the edge of the creek bed. No adverse acute or long-term effects of malathion were observed in fish or aquatic invertebrate communities (Kuhajda 1996). BCTVCP avoidance measures around aquatic habitats are expected to minimize potential acute or sublethal effects to fish or aquatic invertebrates.

5.2.2.1.8 Impacts to Vegetation

The potential impacts of malathion on vegetation include direct toxicity to vegetation (e.g. burning of leaves or flowers caused by the insecticide or the carrier) and effects on plant reproduction through the reduction of insect pollinators. The half-life of malathion on foliage ranges from 1 to 6 days (Matsumara 1985; Nigg et al. 1981a; El-Refai and Hopkins 1972 in USDA 2005).

Phytotoxicity: Malathion is generally not phytotoxic to most plants and is registered on a wide variety of vegetation and crops (See Label in Appendix "B"). When used properly at appropriate concentrations, malathion does not appear to injure vegetation. Adverse effects to conifers, clover, and pea pants have been observed in malathion concentrations above field application rates (Ilnytzky 1974, Archer 1971, and Chakraborti 1983 all cited in USDA 2005 & USDA 2002). Malathion is not expected to be toxic to pants or aquatic algae due to it's mode of action that targets nervous systems of animals (USEPA 2006).

No phytotoxicity was observed in a forest watershed after several treatments of malathion at .72 lb. a.i./acre (Giles 1970). (Proposed Action rate is 0.583 lbs. a.i./acre.) The metabolizing of malathion to malaoxon in plants appears to be a minor pathway, and malaoxon is eliminated quickly (Costa 2008, Roberts 1998).

Indirect Impacts Caused by Decline of Pollinators: There are a number of native invertebrates that pollinate native plants including bumble bees, carpenter bees, moths, beetles, flies and butterflies. There are few studies on the impact of malathion sprays on their numbers similar to that done by Mussen and Gary (1984). Based on the general toxicity of malathion to insects, a significant increase in pollinator mortality is expected the day of the malathion spray as insects are directly sprayed or forage on flowers in bloom. The level of mortality would be expected to decrease over a 2 to 4 day post spray period as the number of flowers in bloom with malathion residues decreases and the number of flowers in bloom with no malathion residues increases. Based on the studies with honey bees (Gary and Mussen 1984) and the no treatment zones around threatened and endangered plants, we expect no long-term negative impact on the numbers of these other pollinators (Honeybee Notification, page 22).

USFWS BO speculated that the reproductive success of plants, due to a decline of pollinators by BCTVCP treatments, may lead to a loss of plant population persistence. A possible reduction in the connectivity between plant populations, and reduced diversity by increasing the potential for inbreeding depression was also referenced. (Pavlik and Manning 1993, Pavlik et al. 1993, Barrett and Kohn 1991 all cited in USFWS 2001b). USFWS commented that many self-compatible plants are facultative and will also outcross and the seeds resulting from the out-crossing will be more fit than those produced by selfing. The need for some self-compatible plants to be physically manipulated by insect visitors was also referenced (Corbet 1997, Karron 1991 in USFWS 2001b).

Plant Species of Special Concern: Plant species of special concern are those plants found within, or near, the BCTVCP survey/treatment boundaries that are listed as "endangered", "threatened" or "Rare" by Federal or State resource agencies or which are listed as "sensitive" by the Bureau of Land Management. They include the Algodones dunes sunflower, Bakersfield cactus, Bakersfield saltbush, California jewelflower, Coulter's goldfields, giant Spanish needle, heart-leaved saltbush, Horn's milk-vetch, Kern mallow, large-flowered fiddleneck, Lemmon's jewelflower, Lost Hills saltbush, Monterey spineflower, oil neststraw, pale-yellow Layia, palmate bracted birds beak, Peirson's milk-vetch, recurved larkspur, robust spineflower, round-leaved filaree, Panoche pepper-grass, San Joaquin woolly-threads, sand food, showy golden madia, Temblor buckwheat, and Wiggins' croton.

In the absence of species specific research, the effects of direct exposure of malathion to plant species of special concern is assumed to be essentially the same as other general plant species previously discussed in "Impacts to Vegetation". Malathion is generally not phytotoxic to most plants when used at label rates.

The temporary reduction of invertebrate pollinators of plant species of special concern is a potential indirect effect. The level of insect pollinator mortality would be expected to decrease over a 2 to 4 day post spray period as the number of flowers in bloom with malathion residues decreases; and, the number of flowers in bloom with no malathion residues increases. Insect pollinators would be expected to forage into treated areas from adjacent non-treated areas. Insect pollinator mortality from BCTVCP treatments would be lower for those plant species occurring within blunt-nosed leopard lizard habitat treated with every other swath applications.

Little is known about the pollination strategies of many plant species of special concern. Of concern to USFWS are potential impacts to listed plant species exclusively dependent on insect pollinators to set seed, including vernal pool plants dependant on pollinators which range only a few meters and California jewelflower possibly dependent on bumblebee pollinators (USFWS 1991b). USFWS speculated that the death of pollinators within a limited range could significantly affect the plant's ability to produce seed for the next generation. The survival of an isolated population of plants could be crucial if a single year's seed production was eliminated.

As a small portion of a larger study, pollination exclusion experiments were performed on San Joaquin woolly-threads and California jewelflower (Mazer & Hendrickson, July, 1993) and (Mazer & Hendrickson, Sept., 1993). While not conclusive, the San Joaquin woolly-threads

exhibited ability to set seed in the absence of pollinators while the California jewelflower showed a dependence on insect pollinators for seed production. USFWS listed several studies showing that fewer visits by pollinators can produce limited fruit set, decrease seed fitness, even in self-compatible plants (USFWS 2001b). While a reduction in out-crossing was also speculated by USFWS, neither the portion nor importance of out-crossing in San Joaquin Woolly-threads is known.

- In the absence of pollinator exclusion studies for other plant species of concern, the indirect effects of malathion would be a combination of the following factors:
- Was the plant or immediate area treated by BCTVCP;
- Mode of pollination for each species (wind, insect, self-pollinated);
- Variety and quantity of insects utilized in pollination;
- Foraging range of plant pollinators;
- Time of year plant species bloom;
- Duration of bloom period;
- Persistence of seed bed;
- Time of year BCTVCP treatment occurs; and
- Avoidance measures adopted for specific plant species.

Avoidance measures for California jewelflower, Kern mallow, Bakersfield cactus and Peirson's milk-vetch, Monterey spineflower, and robust spineflower (page 32) will reduce potential direct and indirect impacts.

Little direct and indirect impacts to Algodones dunes sunflower, Peirson's milk-vetch, sand food, Wiggins' croton and giant Spanish needle from the Proposed Action is expected due to the avoidance of dune habitat by the BCTVCP.

No impacts to large-flowered fiddleneck and palmate-bracted bird's beak are expected due to their occurrence outside Proposed Action boundaries.

Several occurrences of the round-leaved filaree, showy golden Madia and Lemmon's jewel-flower are found within the Proposed Action boundaries. However, a majority of the CNDDB occurrences for all three plant species are located outside, and to the west, of BCTVCP survey/treatment boundaries. While several occurrences of pale–yellow layia are found in or near Proposed Action boundaries, the majority of CNDDB sites lie outside Proposed Action boundaries in Monterey, San Luis Obispo, Santa Barbara, and Ventura Counties.

Coulter's gold fields and Horn's milk-vetch occur in tidal marshes, vernal pools, and alkali sink, habitat. Wetland habitats are avoided by the BCTVCP and large treatment buffers are established around such habitats. BCTVCP survey/treatment boundaries overlap only a small portion of the Coulter's gold field's total range.

A temporary decline of insect pollinators would have little reproductive affect on the self pollinating oil neststraw. A decline in invertebrate pollinators would have little effect on Temblor buckwheat or Horn's milk-vetch as both plants bloom (May to September) at a time when the BCTVCP is generally not performing BLH control. The long bloom period (April to October) of

Lost Hills saltbush and heart-leaved saltbush would lessen indirect impacts from a temporary reduction in insect pollinators from potential spring and fall BCTVCP treatments.

5.2.2.1.9 Impacts to Animals

The routes of potential exposure to animals include dermal, indirect contact with treated foliage, ingestion, and inhalation. Dermal exposure may result from the direct application of malathion during BLH treatment activities. Oral exposures may result from grooming, food and inhalation. Oral and inhalation LD_{50}'s for malathion in laboratory and domestic animals vary. (An LD_{50} is the lethal dose to cause mortality in 50% of a test animal population.)

Malathion is not expected to bioaccumulate significantly. Malathion has a low log KOW (< 3), is readily metabolized and shows high depuration rates (UCD 2010). The malathion concentration in fish tissues decreases readily and consistently with decreasing concentrations of malathion in water and bioaccumulation is not anticipated for grasshopper suppression programs (HSDB 1990; Tsuda 1989 in USDA 2002). Malathion has a low potential for accumulating in lipids (Dobroski and Lambert 1984; in USDA 1991). A half-life for one hour was reported for retention after exposure to malathion (Kenaga and Goring 1980; in Dobroski and Lambert 1984).

Few field studies have been performed on the direct effects of malathion on wildlife. A review of the limited literature sources shows wildlife to have a general tolerance to malathion applied at rates used to control insects. Based on a general comparison of field studies, malathion applied at the rate of 0.583 to lbs. of a.i./acre, will not adversely affect wildlife populations.

Sublethal effects to animals include their susceptibility to the inhibition of acetylcholinesterase. Birds and mammals have greater carboxylesterase activity levels with respect to insects. Acetylcholinesterase is an enzyme that hydrolyzes the neurotransmitter acetylcholine. Carboxylesterase is an enzyme that hydrolyzes carboxylic acid esters and is common in mammalian liver. These enzymes enable birds and mammals to detoxify malathion and malaoxon more readily than do insects (Mulla 1981, USEPA 2006). This would account for the relatively low toxicity of malathion to mammals thus minimizing potential effects of acetylcholinesterase inhibition from a single malathion application. In samples of birds and mammals from areas treated with carbaryl and malathion, no animals were found with >40% (moderately severe) brain AChE inhibition and only a few individuals were found with >20% inhibition (Fair et al.1995 in Beauvais & Struttman 2003).

Potential sublethal effects of malathion and malathion co-products in literature include immunosupression, carcinogenicity, mutagenicity, endocrine disruption, and reproductive effects. A portion of malathion literature, suggesting some of these possible effects, are in-vitro studies. In-vitro studies analyze the response of animal tissue to direct exposure of malathion or its co-products. In-vitro studies do not represent natural exposure pathways that occur in the field from a single application of malathion. The effects data can not be correlated to natural exposure pathways and are limited in their use to assess environmental exposure to animals from the Proposed Action

Sublethal effects have also been cited from injection studies. Potential exposure of malathion from the Proposed Action would come through natural exposure pathways functioning in the natural environment. Typically, the dose rates of injections cannot be correlated to field exposure pathways and do not account for metabolism and excretion that would occur if an equivalent dose was administered through oral, inhalation, or dermal exposure pathways. Contreras & Bustos (1999) considered correlating injection doses to environmental exposure by commenting, "there was no reference available to compare with normal environmental exposure".

Table 9, page D26, contains a list of 23 studies citing various sublethal effects from exposure to malathon. Dose rates and durations of exposure are summarized. Generally, the doses and or durations of exposure demonstrating sublethal effects are high and exceed the expected dose and duration of exposure to animals under natural systems from a single BCTVCP malathion application. Malathion may be immunosuppressive and immunopathologic *in vitro* at high concentrations (Desi 1978; Thomas and House 1989 in USDA 2002).

Mammals: Malathion is moderately toxic to mammals. Potential dermal or oral exposure to malathion is dependant on dose and mode of exposure. The lowest oral LD50 values for rabbits, rats, and mice are 250, 370 and 507 mg/kg, respectively (NIOSH, 1987; in USDA, 1991). According to the USEPA, the no observable effect dose of malathon from chronic administration to laboratory rodents is 4mg/kg/day. For a single dose, it is 50 mg/kg. The low observable effect dose for inhalation is 0.1mg/l based on a 90-day inhalation study. The effect seen at the next dose tested is a measurable decrease in cholinesterase enzyme activity in blood samples, an effect that is reversible (USEPA 2000b). A study in Michigan found no significant adverse effects on mammals and birds in areas treated with 1 lb. a.i./acre of malathion (DOI 1963). The Proposed Action application rate is 0.583 lbs a.i./acre which is less than the 1lb. a.i. /acre study above. Therefore, no significant adverse effects on mammals and birds from the Proposed Action are expected.

Potential sublethal effects to mammals include their susceptibility to the inhibition of acetylcholinesterase and various sublethal effects discussed under "Animals".

Sublethal productivity and survival effects on mice and chipmunks were evaluated from (Giles et al.1970 in CEPA 2006) a watershed treated 4 times with malathion at a rate of 2lbs. a.i./acre. White footed mice and chipmunk populations were reduced as much as 45 and 55% respectively. The application rate of malathion in this study is 13 times higher than the BCTVCP application rate of one application at 0.583 lbs a.i./acre.

Mice were given a daily oral sublethal malathion dose of 80.6 mg/kg body weight (1/3 of LC 50/96hr) for 2, 4, 8, 15 & 30 days. The V max/Km ratio decreased for up to four days after exposure to malathion. The V max/Km ratio then gradually increased over the 30 days of exposure to malathion. Findings indicate that the continuous and prolonged exposure to a sublethal dose of malathion resulted in the recovery of AChE activity (Varsha 2009).

USEPA classifies malathion as "suggestive evidence of carcinogenicity but not sufficient to assess human carcinogenic potential by all routes of exposure". The classification is based on

the occurrence of liver and nasal tumors in both mice and rats at excessive or very large doses (USEPA 2006).

A 100 mg/kg malathion dose (day 7 to day 12 of gestation) was given to New Zealand white rabbits. There were no detectable differences in treated and control groups with respect to number of resorptions, fetal size, and external anomalies suggesting that malathion has little or no teratogenic potential in mammals (Machin and McBride 1989).

Birds: Malathion is moderately toxic to birds. Oral, dermal and inhalation exposures of malathon to bird species may result from BCTVCP activities. Birds may become exposed directly or through grooming and feeding. Reported oral LD50 for various birds are as follows: Chicken 150-850 mg/kg (USEPA 1975); pheasant 167 mg/kg, horn lark 403 mg/kg (Hudson 1984); mallard duck 1,484 mg/kg (Smith 1987).

In addition to potential sublethal effects to birds of malathion exposure discussed under "Animals", the inhibition of acetylcholinesterase, impact on motor skills, changes in nesting behavior, disorientation, hormone disruption, genetic damage and a reduction in arthropod prey have been suggested in literature.

Malathion, being a broad-spectrum pesticide, can cause reductions in invertebrate food sources of birds foraging in treated areas. The effects of malathion treatments to control grasshoppers, found that the availability of invertebrates for foraging birds was significantly reduced following treatments. Nesting birds were observed switching diets to remaining insects and were as reproductively successful as birds in untreated plots (McEwen et al, 1996; Howe, 1993; Howe et al, 1996 & 2000 all cited in USDA, 2002).

Researchers have expressed concerned that chronic reproductive effects to nests and juvenile birds would result from exposure to repeated high malathion applications (CEPA 2006). A water shed was treated at a rate of 2 lbs a.i. malathion/acre with 4 successive malathion applications (Giles 1970). Reduced bird singing was observed for 2 days. By day 4 bird singing was the same as the control area. The study suggests sublethal effects from possible arthropod food reduction and bird emigration from treated areas CEPA 2006). Malathion application rates in this study are 13 times higher than the BCTVCP application rate.

An "unusual amount of intensive challenging and fighting" among wild Sharp-tailed Grouse *(Typanuchus phasianellus)* was reported 24 hours after some birds were given a sublethal dose of the malathion (McEwen and Brown 1966).

No major effects to birds were found in areas of Nebraska treated with 0.5 lb. a.i./acre. Domestic turkeys held in cages in the treated area were allowed to eat insects and had slightly depressed plasma cholinesterase levels, but no external symptoms were noted (USDA, 1985).

Surviving grasshoppers captured in rangeland that had been sprayed with 8 oz/ acre ULV malathion contained pesticide residues lower than the dietary levels required to cause effects on birds in the laboratory (Stromborg 1984).

Indirect effects of malathion the on nesting birds in Idaho were studied for 3 years. Although invertebrate availability was reduced by malathion spray applications (0.5 lb a.i./acre), nesting birds switch their diets and reproduce as successfully compared to birds on untreated plots (Howe, 1993).

No adverse effects on Vesper Sparrow nestlings were observed due to a reduction of grasshopper densities around nests. Birds in food-reduced areas foraged significantly further from the nest than control birds. Birds were also foraging to maximize intake rates. These results did not support the prediction that birds food intake level would decline to different levels of food supply (Adams 1994).

Bird densities were estimated before and after grasshopper control operations in rangeland habitat following ULV malathion applications at the rate of 9.6 oz/acre. Malathion, one of 4 chemicals used, showed few differences among the 4 treatments. There was no difference in any of the bird community parameters between pre- and post-treatment samples. Significantly lower densities of western meadowlarks (*Sturnella neglecta*) were observed on treated than untreated sites 10 and 21 days after treatment. Brain AChE levels in birds collected on sites treated with malathion showed no significant inhibition. The observations suggest that grasshopper treatments generally have little effect on breeding bird communities. Some insectivorous bird species may decline from the reduction in arthropod food sources (George 1995).

Nestling growth variables of Brewer's Sparrow and Sage Thrasher were monitored following the reduction of insect food base through aerial malathion sprays in 1989 and 1990. Few differences between the treated and untreated plots were detected in nest survivorship and a combination of five nestling growth variables. The reduction of insect food base by malathion had no observable direct effects on nestling growth and survival (Howe 1996).

Based on the numerous field studies cited above, only marginal and temporary sublethal effects to bird communities are expected from a single malathion application at Proposed Action rates.

Reptiles: Impacts of malathion on reptiles have not been widely studied in the natural environment and little information is available to aid in assessing impacts of BCTVCP activities. Acute oral administration of malathion was relatively non-toxic to a lizard of the family *Iguanidae*. Oral LD50 for *Anolis carolinensis* from a single dose was estimated to be 2,324 mg/kg, (Hall and Clark 1982).

Malathion LD50 for subchronically exposed dwarf lizards (*Lacerta parva*) was predicted to be 169.8 mg/kg (Ozelmas 1993 in Ozelmas and Akay 1995).

Dwarf lizard (*Lacerta parva)* was orally dosed 1, 2 or 3 mg/kg/d malathion in sunflower oil daily for 16 weeks. Heavy lipid accumulation around kidney, liver and intestines of lizards were noted in dosed groups. Histopathological changes were observed in the kidneys and liver of all treated lizards. A dose-severity effect was observed in kidneys (Ozelmas and Akay 1995). The exposure duration of 16 weeks far exceeds the expected duration of exposure to lizards in the environment from a single Proposed Action application of malathion.

The Ouisima skink (*Eumeces marginatus oshimensis*) was exposed through continuous impregnated paper method to various concentrations of malathion. Survival of animals was observed in lower doses but lethality was observed after 3h and 12h in higher doses (Kihara and Yamashita 1978 in EFSA 2009).

Acute risk to reptiles is not expected as reptiles are similar to mammals at being relatively efficient at detoxifying malathion (USEPA 2006).

Potential sublethal effects to reptiles, apart for those previously discussed for "Animals", is the temporary reduction in arthropod prey species. Depleted arthropod populations are expected to rebound quickly due to insect migration from untreated areas. In Program areas, in which 50% of the infested area is treated with malathion (blunt-nosed leopard habitat), insect prey species are expected to migrate from untreated swaths and all lizard species can forage in untreated swaths.

Other potential sublethal effects may include altered behavior, disorientation, and loss of motor control due to the inhibition of acetylcholinesterase.

Malathion was applied in seven low volume, high concentration sprays in the Presidio Valley in Texas. No malathion residues were detected in lizard tail muscle, brain tissue, liver, coelom fat, and stomach contents (Culley and Applegate 1967). Both reptiles and amphibians were unaffected by the treatment of a watershed with malathion at the rate of 0.7 lb. a.i./acre (Giles, 1970). Proposed Action malathion rates are 0.583 lbs. a.i./acre.

Adult salamanders and lizards exposed to field applications (up to 6 oz a.i./acre) of malathion had no observable adverse effects and no AChE inhibition (McLean 1975, Baker 1985 in USDA 2002).

The Oriental garden lizard (*Calotes versicolor*) was injected with 1ul of either 0.1% or 1% solution of malathion. At the 0.1% concentration, Cholinesterase inhibition was 58.5% in kidney and 30.3% in liver. At the 1% concentration Cholinesterase inhibition was 65.1% in kidney and 67.0% in liver (Khan 2003). There is no reference available to correlate injection doses in this study with natural environmental routes. Metabolism and excretion would be important factors in limiting cholinesterase inhibition if an equivalent dose was administered through inhalation, oral or dermal pathways.

A single, oral dose malathion at 0.2, 2.0, 20 & 200 mg/kg body weight was given to fence lizards. The three lower doses did not reduce sprint performance. Lizards fed the high dose showed signs of poisoning (Holm 2006).

Fence lizards were fed malathion doses of 2.0, 20, and 100 mg/kg body weight for 81 days. Repeated exposure caused reduced arboreal performance and some mortality but growth, food consumption, and terrestrial performance were not affected (Holem 2008).

It is unlikely that a single Proposed Action application, under normal environmental conditions, would expose lizards to high malathion doses and long exposure durations to cause the deleterious sublethal effects cited in the above studies.

Amphibians: The toxicity of malathion is relatively low to adult amphibians, but is highly toxic to the immature aquatic stages. The absorptive nature of amphibian skin makes exposure to malathion increases the potential for exposure compared to other animals. Laboratory studies have shown frog larvae to be sensitive to malathion. A 50% mortality of western chorus frog larvae (*Pseudacris triseriata*) was observed in fixed concentrations of malathion at 0.56 mg/L for 24 hours, and 0.20 mg/L for 96 hours. The LC50's for Fowler's toad larvae (*Bufo woodhousei fowleri*) were found to be 1.9 mg/L for 24 hours, and 0.42 mg/L at 96 hours (Devillers & Exbrayat 1992, in USFWS 1997; Mayer & Ellerseick 1986, in USDA 1991).

Toad embryos (*Bufo arenarum*) are quite resistant to malathion ($LC50_{5d}$ = 42 mg/L; Rosenbaum et al. 1988) and malathion only causes mortality in bullfrog tadpoles (*Rana catesbeiana*) when it exceeds 2.5 mg/L (Fordham 2001 in Relyea 2005).

No apparent clinical effect, mortality or feeding behavior disruption was reported in amphibians with greater than 30% suppression of cholinesterase activity (Baker 1985; Rosenbaum et al. 1988). Studies of adult salamanders and lizards exposed to field applications (up to 6 oz a.i./acre) of malathion found no observable adverse effects and no AChE inhibition (Baker, 1985; McLean, 1975 in USDA 2002).

In addition to potential sublethal effects discussed under "Animals", abnormal development and swimming in larvae, immunosupression to bacteria, and reduced vigor in amphibians have been reported in literature.

Continuous exposure to *Bufo arenarum* embryos to a 44 ppm malathion concentration for 72 and 120 hours, reduced ADhE activity (Caballero de Castro 1991).

Woodhouse's toads (*Bufo woodhousi*) were externally (ventral) exposed once to either a high or low sublethal dose of 0.011 or 0.0011 mg malathion/g toad. A 22% and 17% decrease in brain cholinesterase activity levels were found in the high and low doses respectively (Taylor 1999). Observations at 72-120 hours showed disease susceptibility and mortality were increased in toads exposed to malathion and then injected with *A. hydrophila* bacteria. The increase in susceptibility of malathion exposed frogs to bacterial infection from natural environmental exposure of *A. hydrophila* was not examined.

Exposure to bullfrog (*Rana catesbeiana*) tadpoles to a 1.0 mg/L malathion concentration for 28 days caused significant delays in development (Fordham 2001).

An outdoor mesocosm experiment was comprised of *Hyla versicolor, Bufo americanus*, and *Rana pipiens* larvae; plus, zooplankton and algae. The community was manipulated by adding newts (*Notophthalmus viridescens*), beetle larvae (*Dytiscus sp*.) and an initial 0.315 mg/L malathion concentration for 23 days. The malathion dose elicited few direct effects on the tadpoles and caused no indirect effects to the predatory newts. Malathion had substantial

positive effects on amphibians (5-fold increase in total tadpole survival and biomass) due to the effect of malathion on predatory beetles. Ecologically relevant concentrations can have large positive effects in mesocosms by removing predatory insects. Malathion had both direct and indirect effects depending on community composition. In the absence of predators, *no effect* on tadpole growth was observed (Relyea 2005).

An increase in tadpole biomass was observed under sublethal exposure to (0.1 and 1.0 mg/L) malathion concentrations by reducing insect predation rates and allowing more tadpole prey to survive (Relyea 2010).

Two-week old *Xenopus laevis* tadpoles were exposed to sublethal doses of malathion in concentrations of 1.0 ng/L, 1.0 µg/L and 1.0 mg/L for 30 days (Webb 2006). Malathion was added to the water, every 3 days during water change, to yield a chronic exposure regime. A majority of the abnormal effects were found in tadpoles exposed in the highest malathion concentration (1.0 mg/L). Tadpoles exposed to the 1.0 mg/L exhibited bent tails, unusual swimming behavior, and a higher mortality rate than when compared to the control group. There were no significant differences in mortality between the control group and either the low malathion concentration (1.0 ng/L; p=0.299) or the middle concentration (1.0 µg/L; p=0.124).

Frogs (*Limnonectus limnocharis*) were exposed to an acute 10.67 mg/L^{-1} malathion dose for 1, 2, 3, and 4 days; and a sublethal 2.13 mg/L^{-1} dose for 1, 5, 10, 15, 20, and 25 days. Changes in lipid metabolism in liver, muscle, ovary and testis were analyzed in frogs exposed to sublethal concentrations (Gurushankara 2007). Results are listed below:

- Significant lipid content was observed on the 15th, 20th, and 25th day of exposure.
- Significant free fatty acids showed significant increase on 10, 15, 20 and 25th days in liver and 20th and 25th in testis.
- Significant increased percent of glycerol was observed 5, 10, 15, 20 & 25th day of exposure in ovary and 15, 20, and 25 days of exposure in liver and muscle.
- Significant increases in lipase activity were observed from the 5th through the 25th days of exposure in liver, muscle and ovary and only on the 20th and 25th day of exposure in testis.

Pickerel frog embryos (*Rana palustris*) were exposed to concentrations of 0, 15, 60, and 600 µg/L malathion for 96 hrs. The latent susceptibility of tadpoles to the parasite *Echinostoma trivolvis* was examined. Hatchling and viability rates were decreased; and the incidence of malformations increased at 600 µg/L malathion exposure (Budischak 2008). The Proposed Action application rate, sprayed directly over water 4 inches deep, is equal to 650 µg/L (USFWS 2001b). The malathion concentration and exposure time examined in this study greatly exceeds expected malathion concentrations in water at buffer distances examined in the drift model. Project Area pH >8 and flow recharge further reduces potential exposure to frog embryos. Significant effects of sublethal malathion exposure to frog tissues in this study were observed generally under long durations of exposure not expected from Proposed Action rate under natural environmental conditions.

BCTVCP aerial treatment buffers, along streams and bodies of water, are effective in greatly reducing the deposition of malathion into sensitive areas as demonstrated by drift model analysis (pages 25-26). Streams in the Program Area have a pH ranging from 8.1 to 8.75 (D34-37). A half-life of malathion in water was estimated at 1.65 days at pH 8.16 (Wang 1991) and 1 hour at 40^{o}C at pH 8 (Wolfe 1977). Traces of malathion would be expected to degrade quickly in these waters minimizing the potential for sublethal effects in amphibians from exposure to a single BCTVCP application using prescribed treatment buffers.

Fish: Malathion can be moderately to highly toxic to fish. Malathion has a wide range of toxic effects and is largely dependant on fish species, exposure time, water quality and temperature (USEPA, 1975; Mayer & Ellerseick, 1986). The 96 hr LC 50's for species such as black bullhead and goldfish range from 10-11.7 mg/L; while, species such as green sunfish, bluegill, and walleye were found to have much lower LC50's between 0.030-0.146 mg/L (Mayer & Ellerseick, 1986). The most susceptible fish families were found to be trout, salmon, perch, and sunfish; while, the least susceptible include catfish and minnows (Macek and McAllister 1970).

The surveillance of fish and aquatic invertebrate populations were studied (Kuhajda et al. 1996). Malathion applications in to cotton fields were applied to the edge of the creek bed in a worst-case scenario. The conclusion based upon their data was that no adverse acute or long-term effects of malathion were evident in either the fish or aquatic invertebrate communities based upon numbers of individuals, numbers of taxa, and diversity indices over the 3-year study period. USDA concluded that any applications of malathion in grasshopper programs, designed to avoid water, would not be expected to have any adverse acute or long-term effects on fish and aquatic invertebrates in (USDA 2005 & USDA 2002).

In addition to potential sublethal effects discussed under “Animals”, gill lesions, gill damage, reduced feeding and alterations in growth and metabolic rates from exposure to malathion have been reported in literature.

Bluegill and channel catfish were exposed to two malathion concentrations (0.002 mg/L and 0.02 mg/L) in ponds during 4 malathion applications over 11 weeks. No significant differences were observed in the growth of the fish between treated and untreated ponds (Kennedy 1970).

The breakdown products of malathion in water are mono- and di-carboxylic acids. Whole body analysis of pinfish showed the presence of malathion, mono- and di-carboxylic acids but no malaoxon (Menzie 1980).

Immature fish (*Tilapia mossambica*) were exposed to 2 mg/L for 48 hours. No significant changes in body weight or body water content were observed. Sodium, potassium and calcium ions in muscle, gill and liver tissue, after 48 hr. exposure, showed significant decreases compared to normal tissues resulting in the hypertonicity of animal tissues under malathion stress (Sahib 1981).

A study of the effects of malathion applications in a worst-case scenario was conducted at Stewart’s Creek in Alabama where malathion was applied in cotton fields up to the edge of the

creek bed (Kuhajda 1996). Peak malathion concentrations in water in during the first year from 9 ground and aerial applications averaged 3.49 ppm for over 4 hours. Average concentrations of malathon during the 4 aerial applications during the second year were measured at 18.67 ppb. Acetylcholinesterace activity was significantly reduced in one out of two fish species examined. No adverse acute or long-term effects of malathion were observed on the abundance of fish or aquatic invertebrate communities examined in study area.

Gills of catfish were examined under scanning electron microscope after exposure to 4 and 6 mg/L solutions of malathion for up to 96 hours. Mild effects were noted after 24 hr. exposure to 4mg/L. Damage was observed after 48 & 72 hours of exposure in both concentrations. At 96 hours of exposure, structural recovery occurred to some extant in both 4 and 6 mg/L exposure levels (Dutta 1998).

Juvenile fish (*Sparus aurata* L.) were exposed 24, 48, 72, and 96 hours to a 0.4 mg/L sublethal concentration of malathon. Supeoxide dismutase, catalase and glutathione peroxidase activity were significantly altered from the 24 hours exposure onward ($p<0.05$). Histopathological alterations of the gills were observed at the 48 hour exposure with the most sever damage occurring at 96 hours exposure (Rosety 2005).

Larvae of *Scioenops ocellatus* were exposed to 0, 1, and 10µg/L for up to 7 days at environmentally realistic and sublethal concentrations of malathion. No adverse effects were recorded (Del Carmon Alvarez 2006).

Fish (*Clarius batrachus*) were exposed to a 0.05 ppm sublethal dose of malathion for 45 days. At 45 days of exposure, body weight decreased. Excess secretion of mucus, color change and changes in the equilibrium of fish were also seen in the 45 day exposure to malathion (Yogesh 2009).

BCTVCP aerial treatment buffers, along streams and bodies of water, are effective in greatly reducing the deposition of malathion into sensitive areas as demonstrated by drift model analysis (pages 25-26). Streams in the Program Area are the dominate water feature and have a pH ranging from 8.1 to 8.75 as measured by monitoring samples in 2010 (D34-D37). A half-life of malathion in water was estimated at 1.65 days at pH 8.16 (Wang 1991) and 1 hour at 40^{o}C at pH 8 (Wolfe 1977). Considering the effectiveness of aquatic buffer zones, natural degradation of malathion, and stream flow recharge, potential sublethal effects to fish in Program Area water bodies would be significantly reduced.

Aquatic Invertebrates: Aquatic invertebrates show the most acute sensitivity to malathion. The LC50's range from 0.0007 to 0.032 mg/L for daphnia exposed 48 hours; and, stonefly, caddisfly, grass shrimp, and scuds exposed for 96 hours (Mayer & Ellerseick 1986). Differences have been found in the ability of malathion to affect fish and aquatic invertebrates under actual field conditions verses laboratory studies. At application rates to control mosquito and rice pests, no effects were observed on crustacean species including shrimp, plankton and red crawfish (Tagatz et al. 1974; Wall & Marganian 1971; Muncy & Oliver, 1963). Malathion applied in a forest watershed at 0.7lb a.i/acre reduced aquatic insect populations but rapid

recovery was observed (Giles 1970). Fish and crayfish found sensitive to malathion in the laboratory were found in the stream bed to be unaffected.

Potential malathion exposure to aquatic species from BCTVCP activities could result from spray drift or from runoff should a rain event follow close behind treatment application. Strategies have been adopted to avoid impacting non-target aquatic sites (page 23) and reduce runoff and drift (pages 24-25). Streams in the Program Area have a pH ranging from 8.1 to 8.75 as measured under Program water monitoring D34-D37. A half-life of malathion in water was estimated at 1.65 days at pH 8.16 (Wang 1991) and 1 hour at 40^{o}C at pH 8 (Wolfe 1977). Malathion would be expected to degrade quickly under natural hydrolysis in these waters. Malathion is highly toxic to many aquatic invertebrates; however, malathion concentrations in water, as a result of BCTVCP treatment buffers are expected to present a low risk.

Insects: Malathion is a broad-spectrum pesticide. Non-target insects and other arthropods will be killed by malathion treatments. Reductions in populations of non-target arthropod species would be anticipated immediately following treatment. Because various insect groups vary in susceptibility to malathion, temporary changes in the composition of insect populations may also occur within the treatment areas. Soft-winged flower beetles, ladybird beetles, green lace wings, crickets, grasshoppers, plant bugs and wasps have shown a greater susceptibility to malathion than other insect groups. This effect is expected to be temporary due to the rapid decomposition of malathion in the environment, high reproductive rates for insects and the migration of insects from adjacent non-treated areas. The rate at which insect populations re-colonize a treated area depends on their biology, especially number of generations per year, and densities in untreated areas nearby.

The effects of malathion, applied at Proposed Action rates, on non-target organisms were studied in Wyoming. Researchers concluded that the sprays are not likely to have a large impact on non-targets due to their protection by plants, nests, & soil. Arthropods likely to be affected are those inhabiting foliage during the day. Individual ants foraging on plants during treatments were affected but colonies of all ant species were not affected (Pfadt et al. 1985 in USDA 1996).

The effects of large-scale insecticide applications, to control grasshoppers in rangeland, were found to have little long-term impact on non-target arthropod species examined. Four species of ground beetles and three species of darkling beetles rebounded to pretreatment levels 12 months after treatment. One species of beetle may have been affected (Swain 1986; Quinn et al. 1990, 1991, 1993 in USDA, 1996). Field crickets, ichneumonid wasps, and blister beetles, as groups, rebounded to or above pretreatment levels (Quinn et al. 1993).

Long-term decline of insect populations from repeated annual treatments is not anticipated. BLH control is accomplished because:

- BLH's are generally found only in areas selected for treatment, and;
- Those BLH's not affected by treatment will be migratory toward green agricultural areas and are generally not a major part of the rangeland ecosystem after host plants have dried.

Feral (Wild) Honeybees: The impact on honey bees of area-wide malathion and bait sprays used against the Medfly has been evaluated (Gary and Mussen 1984). There was a significant increase in honey bee mortality the day after the sprays which were applied at night. The level of honey bee mortality then decreased to background levels over a two-three day period. Gary and Mussen (1984) concluded that the Malathion and bait sprays posed no long-term threat to honey bee colonies unless there were periodic (e.g. weekly) sprays over a long period of time. This is because the honey bees were exposed to the malathion only when foraging on flowers that were in bloom at the time of the malathion spray as the malathion sprays in the study were applied at night when the bees were not outside the hive. Flowers that opened after the spray have no malathion residues. With each day post spray, the number of flowers in bloom with malathion residues decreases and the number of flowers in bloom with no Malathion residues increases until there are no flowers in bloom with malathion residues. The program will cause increased mortality in honey bees foraging in the treatment area the day of the Malathion spray. The level of honey bee mortality will decrease to background levels over a 2 to 3 day post treatment period as flowers with malathion residues senesce and untreated flowers come into bloom. In addition, the malathion levels on treated flowers will decrease as the material degrades. Over-all, the BCTVCP poses no long-term threat to honey bee populations.

Solitary bees and wasps: Solitary bees and wasps are not members of colonies and foraging adults could not be replenished as quickly as those from a social insect structure. The depression of solitary Hymenoptera may be temporary due to re-entry of solitary species from adjacent non-treated areas (Manser and Bennett 1962). Research indicates that insects of certain orders are more susceptible to malathion than others. Beetles and populations of flies (except mosquitoes) were found unaffected by low volumes of malathion (Hill, 1971).

5.2.2.1.10 BLH Resistance to Malathion

Resistance to malathion by BLH in the field has not been observed by BCTVCP personnel. The BCTVCP is a control program; therefore, treatments are not continuous and are generally performed only once a year in a relatively small portion of the BLH's range. A tendency towards resistance to malathion would be predicted if all five to six annual BLH generations were exposed to malathion.

5.2.2.1.11 Animal Species of Special Concern

The species listed in this document are no biochemicallier sensitive to malathion than any other animal species. As Threatened and Endangered species they are however, ecologically sensitive.

San Joaquin Kit Fox (SJKF) (*Vulpes macrotis mutica*)

Impacts from direct dermal exposure of malathion to SJKF populations would be negligible. For the most part, the kit fox is nocturnal and BCTVCP treatment operations are performed during daylight hours in the San Joaquin Valley. Any kit foxes, foraging during daylight in the vicinity of BCTVCP operations, would most likely be dispersed by the activities into

underground dens or out of the treatment area. The half-life of malathion for soil and plants show rapid degradation limiting long term exposure to SJKF based on a single treatment.
Acute and sub-chronic risk quotients to BCTVC applications have been calculated for the SJKF by USDA page D31-D32. Malathion exposure from BCTVCP treatments poses a low risk to SJKF.

The inhalation risk to SJKF from BCTVCP applications would be similar to the inhalation risk for kangaroo rats evaluated by the USDA page D32. Inhalation toxicities for mammals are high. Due to the low vapor pressure of malathion and the short half-life of malathion in the atmosphere, the BCTVCP will pose a low inhalation risk to SJKF.

The kit fox eats a variety of rodents, lizards and insects. There is no evidence that biomagnification of malathion in food chains occurs. Malathion is not accumulated in body fat (Metcalf 1972) and was not found in various tissue samples after seven low-volume, high concentration sprays (Culley and Applegate 1967).

BCTVCP operations may directly affect the SJKF through the destruction of its den sites during ground monitoring surveys and ground spray applications (USFWS 1991b). In the Proposed Action, vehicles are restricted to existing roads and potential den sites are avoided during ground survey activities (page 32). Minimal direct impacts to the SJKF from BCTVCP operations are anticipated.

Potential sublethal effects to SJKF would be similar to those previously discussed under animals and mammals.
Malathion spray treatments could indirectly impact the food base of the SJKF due to potential effects on kangaroo rats and invertebrates (USFWS 1991b). Although the kit fox utilizes vertebrates for a majority of its food, invertebrates are ingested.

Indirect impacts of BCTVCP treatments to kit fox vertebrate and invertebrate food base, as characterized by USFWS, would not be significant. These impacts are expected to be temporary due to the rapid degradation of malathion and the foraging mobility of both the kit fox and its prey within adjacent non-treated areas.

The USFWS suggested that drought related reductions of vertebrate prey in the San Joaquin Valley and the Carrizo Plains, combined with further reductions in optional invertebrate food sources, might affect the survival and recovery of the kit fox. Periods of drought may also result in a decline of BLH populations, thereby reducing the need to treat during these periods (USFWS 1991b).

Potential reproductive impacts from malathion treatments on rodent populations, cited in USFWS 1991b, and USFWS 1991a, were re-evaluated by USFWS. Malathion induced reproductive effects in rodent species and a corresponding reduction of kit fox food sources is not considered a likely potential impact.

Nelson's Antelope Squirrel (NAS) (*Ammospermophilus nelsoni*)

Potential impacts from dermal exposure of malathion to the NAS may be separated into two areas: direct exposure to fur and/or skin and exposure to feet from treated ground or foliage. With the absence of dermal LD50 studies of malathion on NAS in the literature, LD50's for laboratory rats are used for comparison. The dermal LD50 of malathion on rats is quite high at 4,444 mg/kg (Spiller 1961). If we assumed the dermal LD50 for NAS to be half that of the rats, the dermal LD50 would still be quite high. (BCTVCP uses malathion at 0.583 lbs. a.i./acre and is equal to approximately 6.0 mg/sq. ft.). It is unlikely that the NAS would be exposed to significant concentrations of malathion during treatment operations. No significant dermal impacts to NAS populations are expected.

Potential acute impacts from oral exposure of malathion to NAS populations may result from grooming and the ingestion of treated foods. Impacts from grooming should be minor due to the low concentrations of malathion in the environment coupled with the relatively quick degradation of malathion in soils with some organic mater.

The potential oral impacts associated with the ingestion of food are a combination of the following:

- Is the NAS foraging within a treated area;
- How long the treated vegetation persisted in the environment prior to ingestion;
- Seed coats or skins exposed to malathion being discarded before ingestion of the seed;
- Volume of treated food ingested/time and;
- Type of food ingested (Gains, 1969).

The inhalation risk to NAS from BCTVCP applications would be similar to the inhalation risk for kangaroo rats evaluated by the USDA page D32. Due to the low vapor pressure of malathion and the short half-life of malathion in the atmosphere, the BCTVCP will pose a low inhalation risk to NAS.

Potential sublethal effects to NAS would be similar to those previously discussed under animals and mammals. Potential indirect impacts of a reduction in the pollination of seed producing plants are previously discussed (page 80). Impacts to NAS habitat from BCTVCP operations, besides the reduction of non-target phytophogus insects on NAS seed producing plants, may include concerns of potential phytotoxicity of malathion to seed producing plants and potential destruction of vegetation and burrow systems with vehicles.

Malathion's low degree of phytotoxicity coupled with the restricted use of BCTVCP vehicles on existing roads greatly reduces impacts to NAS habitat. In the spring, BCTVCP treatments are applied to south-facing slopes in foothill terrain. This results in large areas of non-treated land on north and east-facing slopes. No major impacts to NAS are expected as a result of the Proposed Action.

Giant Kangaroo Rat (GKR) (*Dipodomys ingens*)

GKR are predominantly nocturnal; however, USFWS was concerned about potential direct exposure to GKR if BCTVCP applications occur in their habitat during pre-dawn hours (USFWS 1991b). BCTVCP operations in the San Joaquin Valley can take place during pre-dawn hours, but only when sufficient light exists to safely navigate and observe obstacles such as power poles, wires and structures. Rarely can BCTVCP treatments begin longer than 30 to 45 minutes before sunrise leaving little pre-dawn treatment time. A percentage of GKR's foraging during daylight or pre-dawn hours would be expected to react to the presence of control operations and temporarily retreat into burrows, avoiding possible dermal exposure.

Impacts from dermal exposure of malathion to GKR populations are expected to be minimal. Malathion applications would have sufficient time to dry before GKR, foraging during the following night, contact treated vegetation or soils with its feet or fur. Negligible dermal exposure to GKR is anticipated from treated vegetation carried in fur-lined cheek pouches. The dermal LD50 of malathion in rats is quite high at 4,444 mg/kg (Spiller, 1961). If we assumed the dermal LD50 for GKR to be half that of laboratory rats, the dermal LD50 would still be quite high.

Potential impacts from oral exposure of malathion to GKR populations can be separated into two areas: exposure from dry-tooth grooming of fur and the ingestion of sprayed vegetation such as peppergrass and red stem filaree (USFWS 1991b).

Impacts associated with dry-tooth grooming should have a minor impact on GKR populations because of the unlikely exposure of fur to direct applications. The potential for exposure to malathion from treated dirt used for dust baths is reduced greatly due to the rapid ultraviolet decomposition of malathion in sunlight and its absorption in organic matter. Malathion particles on the surface would not be expected to remain active for more than 4 to 6 days. The potential impacts associated with the ingestion of food are a combination of the following: 1) Is the GKR foraging within a treated area? 2) How long the treated vegetation persisted in the environment prior to ingestion; 3) seed coats or skins exposed to malathion being discarded before ingesting of the seed; 4) volume of food ingested/time; and 5) type of food ingested.

In the absence of specific GKR oral toxicity studies, impacts may vary widely with changes or combinations of food sources in their diet (Gains, 1969). The oral LD50 of malathion in laboratory rats was reported to be 4,445 mg/kg (Spiller, 1961). Past USFWS biological opinions expressed concern for differences in physiology and environmental stresses between laboratory rats and wildlife; and, potential reproductive impacts as suggested in (Dobbins 1967, cited in USFWS 1991b & (USFWS 1991a).

The inhalation risk to kangaroo rats from BCTVCP applications was evaluated by the USDA page D32. Due to the low vapor pressure of malathion and the short half-life of malathion in the atmosphere, the BCTVCP will pose a low inhalation risk to GKR.

Potential sublethal effects to GKR would be similar to those previously discussed under animals and mammals. Sublethal effects to seed producing plants utilized by GKR from

BCTVCP treatments may result from a temporary reduction of insect pollinators and phytotoxic injury. The low phytotoxicity of malathion and decline of insect pollinators was previously discussed.

BCTVCP vehicles have the potential to strike individual GKR and crush food plants and burrow systems. The restricted use of BCTVCP vehicles on existing roads greatly reduces impacts to individual GKR's, their burrows and food sources. Only minimal impacts to GKR are anticipated as a result of the Proposed Action.

Tipton Kangaroo Rat (*Dipodomys nitratoides nitratoides*);
Short-nosed Kangaroo Rat (*Dipodomys nitratoides brevinasus*)

It is expected that potential impacts to the Tipton and short-nosed Kangaroo rats, due to BCTVCP activities, would be similar to the GKR.

San Joaquin Pocket Mouse (*Peroqnathus inormatus inornatus*)

Although there are differences between K-rats and mice, the San Joaquin pocket mouse is also nocturnal and consumes seeds as a major portion of its diet. It would be expected that potential dermal, oral and inhalation impacts to the San Joaquin pocket mouse would be similar to those of the GKR. The potential indirect impact of reducing seed production from a temporary decline in insect pollinators is discussed in impacts to plants. Only minimal impacts to San Joaquin pocket mouse are anticipated as a result of the Proposed Action.

Blunt-nosed Leopard Lizard (BNLL) (*Gambelia silus*)

Seasonal fluctuations of BNLL activity are expected to reduce the impact of BCTVCP operations to BNLL populations during the winter and fall treatments in the San Joaquin Valley. A graph of BNLL seasonal activity (Montanucci 1965) shows no BNLL activity during the months of January and February and during the month of October, a small percentage of sub-adults comprise most of the activity. A majority of the potential impacts to BNLL would be expected from spring treatment activities. Because little information is available to address the affects of malathion on BNLL, the affects of malathion on other lizard species was examined.

Impacts from oral or dermal exposure to malathion are expected to be minimal. The acute oral LD50 to malathion for *Anolis carolinensis*, a lizard, is 2,324 mg/kg (Hall and Clark 1982). The genius *Anolis* is in the same family (*Iguanidae*) as the genus *Gambelia* to which the BNLL belongs. Because of the close relationship of *Anolis* to the BNLL, impacts to BNLL are assumed to be similar. Direct exposure of malathion is not expected to adversely affect BNLL (USFWS 1991b).

A study to explore the potential dermal impact of BCTVCP treatments to lizards found that malathion, applied at Program rates, will not cause significant elevations in brain cholinesterase (ChE) activity or significant changes in body weight of western fence lizards (CDFG 2005). The study was conducted by CDFG under contract to the BCTVCP as a Term

and Condition of USFWS biological opinion 1-1-00-F-0212 (complete study in Appendix G). In this study he western fence lizard was used as a surrogate for BNLL.

Potential oral exposure may occur if insect prey species, exposed to malathion, are ingested. Disoriented and dying insect prey species may become easy prey for BNLL. Surviving grasshoppers captured in rangeland that had been sprayed with 8 oz/ acre ULV malathion contained residues lower than the dietary levels required to cause effects on birds in the laboratory (Stromborg 1984). Reported oral LD_{50} for the Carolina anole (2324 mg/kg-Hall & Clark 1982) is higher than most reported LD_{50}'s for birds.

Because insect prey species are in motion only a brief time prior to death, BNLL's are limited to this type of potential exposure. Exposure to disoriented prey species is further limited when spring BCTVCP treatments are performed at temperatures below the BNLL activity threshold of 77 ^{o}F. Cool weather often accompanies spring treatment activities in late March or early April. Treatments are generally performed during the coolest part of the day, 30 to 40 minutes before sunrise until 1:00 p.m. During cooler spring weather, maximum daytime temperatures rarely exceed the BNLL activity threshold of 77^{o}F.

Potential sublethal effects to BNLL would be similar to those previously discussed under animals and reptiles and include the deprivation of arthropod prey species.

USFWS opinion on potential impacts of malathion treatments on BNLL populations focused on the sublethal effects of reducing insect prey species utilized by BNLL. Grasshoppers and crickets make up approximately 74% of the BNLL diet. The reduction of insect prey species would take place during a time when overwintering fat reserves are low and food availability is important (USFWS 1991b).

Food of the BNLL consists primarily of invertebrates, including Orthoptera, Hymenoptera, Hemiptera, Coleoptera and smaller lizards (Kato 1987; Snow 1972). BNLL stomach contents, examined in May, contained crickets and a small lizard (*Uta* sp.). The majority of the contents were crickets, but the lizards accounted for the greater bulk (Montanucci 1965). Climate, location and availability of invertebrate prey species may contribute to conflicting food source data observed by Montanucci in 1965 and food source evaluations reported by Tollestrup (Tollestrup 1972). Germano et al. 2007 showed the following Orders were important diet components of BNLL: Coleoptera, Diptera, Hymenoptera, Orthoptera, and Hemiptera.

No significant decrease to 2nd year rangeland grasshopper populations was found when rangeland was treated the previous year with a single 0.583 lb/acre malathion application (Quinn 1989). Pre-treatment grasshopper densities were found to be a significant determinant of 2nd year grasshopper populations rather than the treatment. In a parallel study, pre-treatment darkling beetle populations were also found to be a significant determinant of 2nd year beetle population densities (Quinn, 1990). As with grasshoppers, darkling beetle populations returned to pretreatment levels a year after a single, 0.583 lb/acre malathion treatment (same rate as Proposed Action).

The BCTVCP contracted with the University of California at Riverside to perform a 3-year (2005-2007) insect ecology study (Appendix J) to examine the impact of malathion applications on the arthropod prey base (Germano et al. 2007). The insect density and abundance were evaluated between untreated (control) plots and plots treated at 50% (alternating a treated swath with an untreated swath). Treated plots were treated only once annually, in the spring, for 3 consecutive years simulating Program treatments within BNLL habitat.

The overall effect of malathion applications applied at 50% on arthropods was found to be minimal. For Orders of concern as noted in Germano et al. (2007), there was no negative impact on abundance. The Orders Aranae and Homoptera, not shown to be important in the diet of BNLL, showed a negative impact with treatment on abundance. However; the negative impact was not consistent through season or year. The largest impact of 50% insecticidal treatments appears to be on the overall species diversity with respect to eliminating a small portion of the relatively rare species within the treated plots. Recovery of species numbers appeared to be occurring between years.

With BNLL food reserves lowered during drought conditions, USFWS surmised that fewer insect prey species would be available in adjacent non-treated areas. Continued insect prey reductions during drought periods may adversely affect the BNLL's survival in the areas sprayed (USFWS 1991b). Periods of drought also result in a decline of BLH populations, thereby reducing the need to treat during these periods.

A temporary depression of insect food sources from BCTVCP activities are anticipated due to:

- Insect prey study demonstrated little impact to abundance of insect prey Orders and recovery of species numbers between years;
- Arthropod migration from untreated areas and untreated swaths;
- Avoidance measures to minimize impacts to BNLL.

Only minor impacts to BNLL burrows and habitat vegetation may be expected due to the restricted use of vehicles, and the use of a virtually, non-phytotoxic treatment.

Flat-tailed Horned Lizard (FTHL) (*Phrynosoma mcallii*)

The use of malathion, in concentrations outlined in the Proposed Action, is likely to have no direct adverse effect FTHL populations. Studies cited previously in this EA have shown various lizard species to have a high tolerance to malathion (Hall and Clark 1982; Peterle and Giles 1964; Giles 1970).

Potential impacts to the FTHL prey food (harvester ants) was proposed by CDFG as perhaps a greater concern to the FTHL than the direct effects of malathion (Bolster and Nicol 1989). Potential sublethal effects to FTLH would be similar to those previously discussed under animals and reptiles.

A sublethal and temporary impact to insect food sources of the FTHL is expected from BCTVCP treatments. The FTHL utilizes ants as a major portion of their diet. Foraging harvester ants (*Veromessor pergandei*) may be killed by malathion treatments.

A mature ant nest may contain up to 50,000 individuals and contain multiple queens (Wheeler & Wheeler 1973) of which only a small portion are foraging on the surface during a malathion application. The queen, eggs, larvae and a majority of the workers are underground, shielded from exposure to malathion. The majority of treatments will be conducted in early morning, or at night (Imperial County only), prior to peak ant activity. Ant foraging activity usually does not begin until the soil temperature reaches 13^{o}C (55.4^{o}F) (Snelling 1979). In winter or early spring, this temperature isn't usually reached until about 12:00 noon P.S.T.

Because malathion treatments can occur until mid-morning with an average winter minimum temperature of 50^{o}C (41^{o}F), there is a possibility of ant foraging during spray activities (Bolster and Nicol 1989). Past monitoring required under the federal PUP has shown harvester ant colonies recover in areas following malathion spraying.

Historically, treatments are uncommon. The last two aerial applications of malathion in the Imperial Valley were performed in 1991 and 1998. The treatment acreage can also vary from a few hundred to several thousand acres. Since the areas receiving treatments vary from treatment period to treatment period, many years may pass between treatments to any particular area.

Due to the random occurrence, size and location of BCTVCP treatments in the Imperial Valley, no major impacts to harvester ant colonies are anticipated. Destruction of FTHL habitat is expected to be minimal due to the restriction of BCTVCP vehicles to existing roads and the low phytotoxic properties of malathion.

Desert Tortoise (*Gopherus agassizi*)

Potential impacts to the desert tortoise from BCTVCP operations may result from direct dermal or oral exposure to malathion, indirect impacts to insect pollinators of food plants, or direct impacts to individuals and habitat from vehicles.

Few studies have been performed on exposure of reptiles and amphibians to malathion. Of the studies available, none were found containing information on exposure to tortoise species to aid in assessing toxicological impacts of malathion applications.

Potential impacts from malathion exposure are more likely if BCTVCP treatments are performed during March and April, which coincide with post-hibernation activities. Impacts from BCTVCP treatments in the Imperial Valley during the months of January and February would be negligible due to the hibernation of the desert tortoise in underground burrows.

Direct dermal exposure of malathion from BCTVCP treatments is expected to have minimal impacts on the desert tortoise. The desert tortoise has a small surface area in proportion to its body mass. The desert tortoise would not be expected to absorb enough malathion, before complete degradation, from a single direct treatment or from dermal contact with treated soils or vegetation to cause morbidity. USFWS has concern for the potential of a foraging tortoise to ingest a substantial amount of malathion from food plants (USFWS 1991a).

Little information is available on effects of sublethal malathion doses to reptiles. Reptiles remain the least studied vertebrate taxa in ecotoxicological studies (Hopkins 2000, Sparling 2000 & DuRant 2007). Single, sublethal oral doses of malathion were given to fence lizards at 0.2, 2.0, 20 & 200 mg/kg body weight. The three lower doses did not reduce sprint performance (Holm 2006). Assuming the 200 mg/kg was a sublethal dose sufficient to cause effects, this value can be used to analyze the sublethal oral exposure to desert tortoise.

To compare the 200 mg/kg sublethal dose above, the reported NOAEL and LOAEL for sublethal effects to birds are 110 mg/kg & 350 mg/kg, respectively oral dose; and, the NOAEL and LOAEL for sublethal effects to mammals are 240 mg/kg & 1000 mg/kg, respectively (USEPA 2010). One tenth (sublethal dose) the LD_{50} for *Anolis carolinenses* (2,324 mg/kg) is 232 mg/kg). Because reptiles are relatively efficient at detoxifying malathion like mammals, the NOAEL and LOAEL for a desert tortoise would likely resemble that of mammals rather than birds.

Considering the weight of desert tortoise ranges 3.6 to 6.8 kilograms and the BCTVCP application rate of 54 mg/m^2, a desert tortoise would have to quickly consume approximately 13 to 25 square meters of treated vegetative surface area to equal the 200 mg/kg dose examined in (Holm 2006) and the 240 mg/kg NOAEL reported for mammals. In Banerjee et al. (1998), the author states, “The effects of malathion on immune responses are more time dependent than on dose”. The desert tortoise would only have 3 to 4 days to consume a sublethal dose of malathion prior to significant degradation of malathion in the environment; and like mammals, reptiles are relatively efficient at detoxifying malathion (USEPA 2006). Immune effects observed in other test animals received single malathion doses >200 mg/kg; and or, were exposed to longer durations than anticipated from a single BCTVCP application (Table 9, D26). Potential sublethal effects from oral malathion exposure in desert tortoise would be low.

Considering the low production of malaoxon on foliage in field studies (Nigg 1981a), the oral exposure of desert tortoise to malaoxon would not be a significant risk component of malathion to non-target organisms (USEPA 2006). Additional sublethal effects to desert tortoise would be similar to those previously discussed under animals and reptiles.

Indirect impacts could occur if insect pollinators are affected by the treatment program, and forage plants are unable to set seed for the following year’s growth (USFWS 1996).

Populations of desert tortoises and their food plants would not necessarily be exposed to BCTVCP treatments every year. Historical records show that treatments of any particular area in the Imperial Valley occur only once in every three to five years. In recent years, Imperial Valley aerial treatments have been performed once in the last 16 years (page D24). An occasional desert tortoise may migrate across roads and be in danger of being struck by BCTVCP vehicles. In the Proposed Action, ground-rigs and survey vehicles move at reduced speeds in desert tortoise habitat increasing the ability to avoid individual tortoises on roadways. The likelihood of hitting a desert tortoise with a BCTVCP vehicle would be low. Because malathion is generally non-phytotoxic, and vehicles are restricted to existing roads, minor to negligible impacts are anticipated to desert tortoise habitat.

No major impacts to the desert tortoise are expected for the following reasons:

- The vast majority of proposed treatment area occurs on lands where desert tortoise would not be expected to occur;
- BLH survey areas where desert tortoises are expected to occur is habitat characterized by low densities of desert tortoises, and;
- The total area of tortoise habitat which could potentially be treated is extremely small in relation to the occupied desert tortoise habitat in this area (USFWS, July, 1996).

California Red-legged Frog (CRLF) (*Rana aurora draytonii)*

Impacts to the CRLF as a result of the Proposed Action included the potential for direct and indirect impacts. There is no specific data available on the direct toxicity of malathion to the CRLF and there is little data available on amphibians in general. Several studies suggest that malathion in water, held at constant concentrations for 24 to 96 hours, showed adverse effects to frog and toad larva at low concentrations; 0.56mg/L (*24 hrs*.) & 0.20 mg/L (*96 hrs*.) (Devillers & Exbrayat 1992).

Risks of acute direct oral and dermal exposure to adult frogs from BCTVCP applications would be low. The toxicity of malathion is relatively low to adult reptiles and amphibians, but is highly toxic to the immature aquatic stages (USDA 2002). Frog brain cholinesterase has a greater resistance (100 times) to inhibitors than does cholinesterase in mammalian brain (Hall & Kolbe 1980). Huge doses of cholinesterase inhibitors are required to kill frogs (Tucker and Crabtree 1970). The BCTVCP maintains a standard 650 feet (200-meter) buffer from water and from riparian habitats (page 24) and maintains a 1/4-mile (400 meter) aerial buffer from known CRLF locations (page 33).

CRLF larvae in water bodies may be more sensitive to acute exposure to malathion. BCTVCP aerial treatment buffers, along streams and bodies of water, are effective in greatly reducing the deposition of malathion into sensitive areas as demonstrated by drift analysis (pages 25-26).

No difference was found in the survival of *Xenopus laevis* frog embryos exposed to malathion at levels up to 6 mg per liter. There were significant developmental problems after exposure to malathion at and above 1.5 mg per liter (Bonfanti 2004). The BCTVCP rate applied directly to water is 10 times lower than the highest rate examined. Potential drift depositions using a 650 feet (200 meter) buffer are calculated to be 1,000+ times lower than dose rates examined.

Potential sublethal effects to CRLF adults and larvae would be similar to those previously discussed under animals and amphibians.

Five tadpole species were exposed to malathion for <u>16 days</u> at 1mg/L & 2mg/L a.i. Test chamber water was changed and pesticide treatments were reapplied every 4 days. At 1mg/L there was no effect on tadpole survival but survival was reduced in tadpoles exposed to 2mg/L; and, growth was reduced under both exposure doses (Relyea 2004). This study examined a

longer duration of exposure than expected under natural degradation in Project Area water bodies.

In a mesocosm experiment, a portion of wood frogs (*Rana sylvatica*) and leopard frogs (*Rana pipiens*) examined were exposed to single 50 or 250 ug/L doses and or additional 10ug/L doses every week for 43 days (Relyea 2008). Trophic cascade was observed leading to increase in tadpole mortality only in tanks where trophic decline was reinforced by 7 additional malathion doses. Authors concluded that sublethal effects did not play an obvious role in outcomes of study due to the rapid degradation of malathion limiting exposure to very brief periods of time.

Exposure to malaoxon from runoff following a rain event may increase the toxic exposure to CRLF larvae. Malaoxon has been found to be more toxic to tadpoles than malathion (Sparling 2007). Malaoxon levels that might arise from the degradation of the malathion applied by the BCTVCP, pose little threat to non-target organisms (malaoxon discussion page 73-74).

The consumption of tree frogs and mice, by larger CRLF, represents over 50% of the mass consumed (Hayes 1985). Reduction of invertebrate prey species is a potential sublethal effect. The reduction of terrestrial insect prey species would be greater during spring treatments and less of a factor during treatments in winter when rangeland invertebrate prey species are not active. The risk is further reduced by the standard buffers given to aquatic situations and to known CRLF locations.

Only minimal impacts to CRLF are anticipated because:

- The BLH survey areas are on the periphery of the CRLF range as defined by the California Natural Diversity Database;
- Standard treatment buffers given to riparian and aquatic habitats;
- Buffers are effective in greatly reducing the deposition of malathion into sensitive areas as shown in drift model analysis (pages 25-26);
- Drift and runoff prevention;
- Measures to avoid potential impacts CRLF (page 33).

California Tiger Salamander (CTS) (*Ambystoma californiense*)

Potential acute dermal exposure to adult CTS from BCTVCP applications would be low. Adult CTS spend most of their life under ground in burrows of California ground squirrel and the valley pocket gopher. Adults favored grasslands with scattered large oaks over more densely wooded areas (USFWS 2009b). CTS migrate at night following the first major rain event in fall or early winter. The final average distance adult CTS traveled from a source pond was ranged 114 to 83 meters (Trenham 2001). A more recent study found that a majority of CTS migrated at least ½ mile (800 meters) from breeding sites and a few migrated farther (Orloff 2011, Orloff 2007 in USFWS 2009b). A portion of potential CTS migration distances are within the ¼ mile (400 meter) buffer distance used by the BCTVCP around vernal pools for fairy shrimp species; and, within the 650 feet (200 meter) buffer around water bodies to protect CRLF and CTS.

Mexican tiger salamander (*Ambystoma mexicanum*) embryos and larvae were killed by a 96 hour exposure to malathion at rates of 10 to 30 mg/liter of water. The malathion was replaced after 48 hours (Mendoza et al. 2009). The malathion levels are 15 to 46 times higher than the Proposed Action rate of 0.65 mg/L malathion applied directly to 4 inches (10cm) of water (USFWS 2001b); and, 19,000 to 48,000 times greater than those calculated from drift deposition residues in water 4 inches (10 cm) deep with a 650 foot (200 meter) buffer (drift model analysis pages 25-26).

Field studies spraying malathion ten times at a rate 8.45 times greater than that used in the found no changes in cholinesterase inhibition, decreases in abundance or effects on lipid storage in adult and juvenile northern slimy salamander (*Plethodon glutinosus)* (Baker 1985).

Salamanders exposed to 7.6 times the Proposed Action application rate of 06.53 micrograms/cm^2, showed the highest concentration of malathion in tissues examined 2 days after exposure. Malathion degradation within the animals was rapid and did not bioaccumulate. Salamanders did not show overt signs of pesticide poisoning exposed to malathion at a rate 15 times higher than the Proposed Action rate (Ramsey 2008).

Little data is available on the toxicity of malathion to salamander larvae. Ranges for acute toxicity of malathion to frog larvae range to widely for comparison. Toxicity of malathion to tadpoles of the Indian frog and the yellow-legged frog are 0.59 ug/L and 19,200 ug/L respectively (USEPA 2010).

Generally, amphibian larvae are more sensitive to the toxicity of malathion than adults. Malathion applied directly to pools containing CTS larvae and eggs may result in significant dermal exposure. BCTVCP aerial treatment buffers, along streams, bodies of water and vernal pools are effective in greatly reducing the deposition of malathion into sensitive areas as evaluated through drift modeling. Impacts due to dermal exposure would be minimal.

Sublethal effects to CTS adults and larvae would be similar to those previously discussed under animals and amphibians.

Exposure to malaoxon from runoff following a rain event may increase the toxic exposure to CTS eggs, larvae and adults. Malaoxon has been found to be more toxic to tadpoles than malathion (Sparling 2007). Malaoxon levels that might arise from the degradation of malathion applied by the BCTVCP, pose little threat to non-target organisms (pages 73-74).

The sublethal effects of aquatic and terrestrial invertebrate deprivation from BCTVCP applications are possible. BCTVCP buffers are effective in reducing malathion deposition into sensitive areas and thereby reducing the impacts to adult and larvae invertebrate prey species. Only minimal impacts to CTS is anticipated because:

- The BLH survey/treatment areas are on the periphery of the CTS range as defined by the California Natural Diversity Database;
- Standard treatment buffers adjacent to riparian and aquatic habitats are sufficient to greatly reduce malathion deposition in sensitive habitats;
- Drift and runoff prevention measures;

- Avoidance measures for CTS & CRLF;
- Avoidance measures for vernal pool fairy shrimp will protect CTS breeding in vernal pools.

Giant Garter Snake (GGS) (*Thamnophis gigas*)

Impacts to the GGS as a result of the Proposed Action may include the potential for direct and indirect impacts. Research indicates reptile species have a high tolerance to malathion. The risk to GGS of dermal or oral impacts to populations from malathion would be low as only BCTVCP ground-rig treatments could be performed in proximity to habitats where remnant populations may exist. Aquatic and riparian habitats occupied by the GGS are not suitable habitats for the growth and development of BLH host plants and as such, are not surveyed and treated by the BCTVCP. Ground-rig treatments within ground-rig only treatment areas, within the San Joaquin Valley, are small and infrequent (Table 8, page D25).

Potential sublethal effects to GGS would be similar to those previously discussed under animals and reptiles.

Narrow treatment areas will allow invertebrate prey to re-enter from adjacent untreated areas, reducing sublethal effects of invertebrate prey deprivation from malathion applications. In addition, the standard treatment buffer given to aquatic habitats, potentially occupied by the GGS, will reduce direct and indirect potential impacts.

Only minimal impacts to giant garter snake are anticipated because:

- The BCTVCP survey areas are on the periphery of the GGS range, only remnant populations may exist in proximity to the Proposed Action;
- BCTVCP aerial treatment buffers around riparian and aquatic habitats are effective in greatly reducing the deposition of malathion into sensitive areas as demonstrated by drift analysis (pages 25-26);
- Drift and runoff prevention measures (pages 24-25);
- GGS avoidance measure near aquatic or riparian habitat (page 34).

Yuma clapper rail (YCR) (*Rallus longirostris*)**;**
California black rail (CBR) (*Laterallus jamaicensis coturniculus*)

Potential direct impacts to bird species of special concern may result from both dermal and oral exposure to malathion from malathion contaminated food sources. Malathion is slightly too moderately toxic to birds. Effects from the direct application would be low due to the absence of rails foraging in habitat suitable for the aerial treatment of BLH populations.

The USFWS believes the Yuma clapper rail is susceptible to malathion both directly and indirectly. Of major concern to the USFWS was the potential for pesticide drift into occupied habitat. The reduction of available invertebrate food sources in a given area could force competition with other bird species in an environment already limited. Regions of concern included buffer zones between YCR habitat and treatment areas and agricultural drains (USFWS 1991a).

The sublethal effects of reducing invertebrate food sources of the YCR and the CBR would be impacted less than other bird species during BCTVCP operations. Both birds move and forage along water systems of the Colorado River and Salton Sea and possess diets consisting largely of aquatic arthropods (crayfish and isopods). Direct application to aquatic habitat is strictly avoided by the BCTVCP. Other potential sublethal effects would be similar to those previously discussed under animals and birds.

Minimal impacts to YCR and CBR are anticipated because:

- Direct application of malathion to YCR habitat (wetlands) will be avoided by the Proposed Action;
- Aerial treatment buffers around riparian and aquatic habitats are effective in greatly reducing the deposition of malathion into sensitive areas as demonstrated by drift analysis (pages 25-26);
- the amount of habitat which could be exposed to malathion is small in relation to the total amount of YCR and CBR habitat in the vicinity of the proposed treatment area.

On rare occasions, malathion may enter aquatic water systems in runoff when isolated thundershowers occur over treated areas before complete degradation has taken place. The small amount of malathion residue washed into the Colorado River or Salton Sea from runoff would be exposed to absorbing organic particles and be diluted by the large bodies of water. Residues of malathion in runoff resulting from isolated thunderstorms is expected to have minimal impacts to both the YCR and the CBR. Measures have been adopted to lessen impacts within potential YCR and CBR habitat (page 37). Due to the use of ground-rigs only in the Blythe survey region, impacts to YCR and CBR in the vicinity of Blythe will not be significant.

Mountain Plover *(Charadrius montanus)*

Impacts to the mountain plover from the BCTVCP include both a potential for direct dermal exposure and the indirect reduction of insect prey base. The deprivation of arthropod prey species and other potential indirect and sublethal effects have been previously discussed under animals and birds.

The mountain plover is an overwintering visitor to California from late November to late March (Small, 1994). While some early arrivals have been documented as early as September 11 in Firebaugh (Bent, 1929), large numbers do not appear until November (USFWS 1999c). The mountain plover does not nest in California (Graul, 1975) but migrates to its nesting grounds, in neighboring states, from March to August. Most birds overwintering in southern California have departed to overwintering grounds by mid-February, while the birds in northern California depart about two weeks later (Small, 1994). Unlike other plovers, the mountain plover is rarely found near water but, rather, likes short grass areas with bare and flat ground (USFWS 1999c).

Mountain plover migrate to spring breeding grounds in March, while BCTVCP activities in the San Joaquin Valley are conducted in April. It is likely that the majority of mountain plover will be absent from the San Joaquin Valley at the beginning of spring BCTVCP treatment activities.

Because a significant numbers of birds do not return to San Joaquin Valley overwintering grounds until November, the mountain plover is generally absent during the BCTVCP's fall treatment period in October. In addition, the type of overwintering habitat preferred by the mountain plover in the fall consists of a much shorter and more open type of rangeland habitat than the dense, Russian thistle dominated habitat, utilized by BLH populations.

The BCTVCP's winter treatment activities are conducted at a time when the mountain plover would most likely be present overwintering in the San Joaquin Valley. Treatment activity in the Imperial Valley may also have a potential for impacts if treatment activities are conducted during winter rather than spring.

Because the mountain plover has an extensive overwintering range, the potential for the mountain plover to be found overwintering in BCTVCP's winter treatment areas is small. Winter aerial treatments (Map D-5) in the San Joaquin Valley have ranged from 0 to approximately 20,000 acres. An average of 3,800 acres per year has been treated during the last 15 years (Table 7, D24). In addition, a majority of the BLH survey area comprises steep terrain (>5% slope) undesirable for the mountain plover.

The potential for impacts due to a winter treatment in the Imperial Valley would be small. Mountain plover overwintering areas to the south of the Salton Sea generally do not overlap BCTVCP's survey areas on the east and west mesas. In addition, treatments in the Imperial Valley are infrequent and have been performed once in the last 15 years (Table 7, D24). The May, 1998 treatment was performed well after the reported overwintering period ends.

Due to the wide overwintering range of the mountain plover and BCTVCP's limited treatment activities during the five overwintering months, no significant impacts to mountain plover**'**s are anticipated.

Riparian Bird Species of Concern

The western yellow-billed cuckoo, southwestern willow fly-catcher, coastal California gnatcatcher, elf owl, gilded northern flicker, Gila woodpecker, black-tailed gnatcatcher, Arizona Bell's vireo and least Bell's vireo are generally associated during different times of the year within the willow-cottonwood-mesquite riparian forest along the Colorado River or other riparian systems in California, Nevada, Arizona, New Mexico, and Mexico.

Riparian systems are not treated by BCTVCP due to the absence of BLH hosts. Nesting birds and hatchlings within riparian systems would not be exposed to direct applications of malathion during treatment operations.

Potential sublethal effects to riparian bird species would be similar to those previously discussed under animals and birds.

Bird species of special concern are dependent on insects for all or part of their diets and could be indirectly impacted by a reduction in arthropod prey species from Proposed Action treatments. Indirect impacts to insect populations outside of riparian systems are expected to

be temporary due to the high mobility of the birds, prey insects and the rapid degradation of malathion in the environment. Insects would be expected to re-enter treated areas from adjacent non-treated areas. Highly mobile bird species would be expected to move and forage in adjacent non-treated areas. BLH survey areas adjacent to riparian habitat are small in relation to the total amount or riparian habitat occupied by bird species of concern.

The BCTVCP will be minimally impacting riparian bird species of concern because:

- Malathion degrades quickly in the environment;
- Riparian habitat will not be treated in this program;
- BLH survey areas adjacent to riparian habitat are small in relation to the total habitat available;
- Riparian bird species of concern fluctuate seasonably in their association with riparian habitat;
- Buffers placed near riparian habitat in the San Joaquin Valley to protect the California red-legged frog, tiger salamander, giant garter snake and the valley elderberry longhorn beetle will minimize impacts to bird species and;
- Specific measures adopted to minimize impacts to southwestern willow fly-catcher (page 38), least Bell's vireo (page 37).

Burrowing Owl (*Athene cunicularia*)

Because the burrowing owl can be active during daylight hours, there is a potential for direct exposure; however, most foraging occurs from dusk until dawn. The potential for direct dermal and oral exposure of burrowing owls to malathion would be similar to those of birds previously discussed (page 85).

The burrowing owl's diet consists of both large invertebrates and small rodents. The indirect impact of invertebrate prey reduction from the Proposed Action would also be similar to those of birds previously discussed. The reduction of invertebrate prey species would be temporary. Owls foraging in treated areas would be expected to move to adjacent non-treated habitat to forage. Burrowing owls, foraging in treated blunt-nosed leopard lizard habitat, could forage between the treated and untreated swaths. Because BCTVCP survey/treatment boundaries overlap only a small portion of the burrowing owl's total range, the Proposed Action will have minor impacts to burrowing owl.

Tricolored Blackbird (*Agelaius tricolor*)

Potential direct dermal and oral exposure of tricolor blackbirds to malathion would be similar to those of birds previously discussed (page 85). Being insectivorous during the breeding season, the indirect impact of invertebrate prey reduction from the Proposed Action is a potential impact. While tricolor blackbirds forage in native habitats, most tricolors forage in managed habitats not treated by the BCTVCP. The temporary depression of invertebrate insect prey species of tricolor blackbirds in rangeland habitat would not impact a majority of tricolors foraging in rice, alfalfa, irrigated pastures, feedlots and dairies. The preferred nesting habitat for tricolor blackbirds includes freshwater cattail, blackberry and willow marshes. These habitats are avoided by the BCTVCP and large treatment buffers are established around such habitats. The Proposed Action will have minor impacts to tricolor blackbird nesting sites and invertebrate prey species.

Fairy Shrimp Species of Concern

Malathion is highly toxic to aquatic invertebrates. The LC50's range from 0.0007 to 0.032 mg/L for daphnia exposed 48 hours; and, stonefly, caddisfly, grass shrimp, and scuds exposed for 96 hours (Mayer & Ellerseick 1986)

Studies of malathion exposure to aquatic habitats from drift or runoff suggest the potential for significant risk to fish and aquatic invertebrates including fairy shrimp. The potential for impacts to aquatic habitats are reflected in the BCTVCP's commitment to assure that no man-made or natural water sources are contaminated (page 23).

BCTVCP buffers are effective in greatly reducing the deposition of malathion into sensitive areas as calculated in drift model analysis (pages 25-26) for a 650 feet (200 meter) buffer. The avoidance measures for listed fairy shrimp species of ¼ mile (400 meters) would be much more effective in reducing drift deposition residues than a 650 feet (200 meter) buffer due to the curvilinear nature of drift deposition. This greatly reduces the potential direct, and runoff impacts of malathion and malaoxon to vernal pools and listed fairy shrimp species.

The Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool tadpole shrimp, and vernal pool fairy shrimp are known from a limited number of locations distributed from Shasta County in the north, through parts of the Central Valley and the coast range into San Luis Obispo, and Santa Barbara Counties. Known locations of listed fairy shrimp are generally not found within BCTVCP survey areas (Eng 1990; USFWS 1994b). In addition, the terrain and physical characteristics of the soils within historical BLH breeding grounds are generally not conducive to the formation of vernal pool habitat.

No major impacts to listed fairy shrimp species are anticipated from BLH control activities because:

- The general scarcity of known listed fairy shrimp locations within BCTVCP survey areas;
- The BCTVCP avoids natural or man-made aquatic situations with effective buffer zones;
- A relatively low risk of significant quantities of malathion leaching or migrating to vernal pools from treated rangeland due to post-treatment precipitation;
- Measures employed by the BCTVCP to avoid potentially major effects to listed fairy shrimp.

Valley Elderberry Longhorn Beetle (VELB)

Malathion could have a direct impact on adult VELB if BCTVCP treatments are performed near woody riparian vegetation or watercourses containing elderberry plants. No major impacts to the VELB are anticipated from the Proposed Action because:

- Habitat conducive to the development of elderberry plants is generally not found within BCTVCP survey areas;
- Woody riparian vegetation or watercourses with woody vegetation is not BLH habitat and is avoided in the Proposed Action, and;
- Measures to avoid major impacts to VELB, (page 34).

5.2.2.1.12 Designated "Ground-rig Only" Treatment Areas

Blythe (eastern Riverside County); Cuyama Valley (northwestern Ventura County, northeastern Santa Barbara and Southeastern San Luis Obispo Counties); San Joaquin Valley (portions of western Stanislaus, Merced, and San Joaquin Counties). The frequency and quantity of applications in the Blythe, Cuyama, and San Joaquin Valley "ground-rig only" areas have remained generally low (Table 8, page D25, and Table 6, page D23). There is every reason to conclude that the necessity for ground-rig applications in these designated control areas will continue at current levels or decline further.

When BLH treatments are necessary, the BCTVCP spot treats roadsides and ditch banks with ground-rigs adjacent to BCTV susceptible crops. Rangeland is not treated in these zones. Considering the small quantity of malathion presently utilized, the low frequency of ground-rig treatments and measures employed to reduce potential impacts to species of concern, it is likely that plant or animal species of concern or their habitat would be minimally impacted by BLH treatments within “ground-rig only” areas.

5.2.2.1.13 Impacts to BCTV Susceptible Host Crops

Positive impacts to BCTV host crops due to the Proposed Action may include the following:

- Maintenance of a 1% or less BCTV infection rate within host crops on a statewide basis;
- Adequate supplies of BCTV host crops and products;
- Stable prices of BCTV host crops and products;
- Stability of jobs and investments in BCTV host crop production and related product industries;
- Minimum amounts of pesticides used to control BLH; and
- Localized control and reduction of aphids and aphid vectored plant diseases and potential reduction of pesticide treatments in agricultural croplands adjacent to treatment areas.

5.2.2.1.14 Cumulative Impacts

To meet requirements under NEPA, Federal agencies must analyze the Proposed Action and other projects past, present, and foreseeable future, which together may have cumulative impacts that go beyond the impacts of the Proposed Action itself. A cumulative impact is the impact on the environment which results in the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of the agency or person undertaking the action. Individually the impacts of an action may be considered minor, however cumulatively and over time the same actions may become significant. Potential cumulative effects include those evaluated for all land ownership, including lands administered by federal agencies, and non-federal lands. Non-federal lands include lands owned or managed by the State, County, individuals, or corporations.

The cumulative impact analysis assumes that mitigation measures, identified through past USFWS consultations and Program BMP’s (best management practices), will be followed by Program staff to ensure that impacts to the environment will effectively mitigate impacts as designed to address.

Because the Project area is large, the cumulative impact analysis will be addressed regionally across broad landscapes by resource. The listing of all projects occurring in the areas is not practical as the Proposed Action has the potential to be implemented in specific sites across large potential Project Areas within California to affect the regional control of BLH populations.

Human Health

Cumulative impacts on human health will focus solely on the effects of pesticide use and any incremental contribution of Proposed Action pesticide use when combined with other reasonably foreseeable use of pesticides would be result in cumulative impacts to human health. Cumulative impacts to public health include the exposure of malathion to Program staff conducting survey/treatment activities, aerial contractors, and the general public. Occupational risks to Program personnel from the effects of malathion have are mitigated through personal protective equipment and annual training.

Total pesticide sales in California from 1980-2009 have remained fairly consistent, averaging 641,604,945 pounds per year (Table 10, D-40). This amount includes insecticides, miticides, fumigants, nematicides, rodenticides, desiccants, defoliants, growth regulators, herbicides, bactericides, antimicrobials, algicides, and fungicides. Also included in the total are chemical adjuvants, which are considered pesticides under California law; these include emulsifiers, spreaders, water modifiers, and other chemicals added to pesticides to enhance their effectiveness (CDPR 2012a).

Recent malathion sales in California, from 2005-2010, were fairly consistent averaging 731,531 pounds per year (CDPR 2012a). Sales ranged from a high of 794,864 pounds in 2010 to a low of 669,841 pounds (125,023 lb. variation) in 2006. Although total malathion sales do not translate directly to amounts used, CDPR sales data indicates that annual malathion use has decreased in recent years from the >1,000,000 pound average sales between 1995 and 2004.

From 1994-2009 the BCTVCP treated an average of 72, 356 acres per year (page D-24). This translates to approximately 43,100 pounds a.i. of malathion per year (page D-40). The average annual incremental use of 43,100 pounds per year is well within the variation of recent malathion sales (125,023 lbs.) in California (2005 to 2010) and is not cumulatively significant; when compared to total malathion sales in California and total annual pesticide sales (641,604,945 pounds) statewide.

No increase of malathion use in rangeland, idle and fallow ground is expected from other programs or private sources. A query of malathion use data, from the California Pesticide Information Portal (Calpip) (CDPR 2012b), shows only one use record in rangeland, fallow or idle ground from 6 counties queried (Kern, Kings, Fresno, Merced, Imperial and Riverside) from 2006 to 2010. Therefore, the Proposed Action would not add cumulatively to current malathion use in rangeland, idle or fallow ground.

The Proposed Action use of malathion to control beet leafhopper (BLH) populations is expected to be only minimally available for direct contact to human receptors due to the low application rate, rapid degradation in the environment, the general remoteness of Project Areas to residential and commercial centers, and precautions taken to identify and avoid

human activity within or in close proximity to treatment areas. Therefore, the incremental potential for human exposure to the Proposed Action is less than significant and the incremental impact of the Proposed Action will not contribute significantly to pre-existing cumulative impacts.

Air Quality

The cumulative effects of past pollutant producing actions have resulted in declining air quality in California. Locations in the Project area with high ambient pollution levels are those associated with commercial and industrial land use including agriculture, oil and natural gas extraction and population centers containing elevated commercial and private vehicle use. Because the San Joaquin Valley is bowl shaped, pollutants, generated from within the San Joaquin Valley or migrating downwind from the San Francisco Bay area or the Sacramento Valley, become trapped and concentrated. Although the population of California continues to grow, air pollutant levels peaked in the 1970's. Particulate matter emissions from all sources have trended lower since the 1970's (USEPA 2012). The establishment of stringent air quality regulations and improvements in pollution control technologies has improved ambient air quality.

Proposed Action emissions would result from the use of internal combustion engines in survey/treatment vehicles and in application aircraft. Malathion particles can be suspended in the air as a result of aerial applications; however, malathion has a low vapor pressure and is essentially non-volatile. The use of Program vehicles off road can add dust particles to the air add negatively to the local air quality.

The amount of Proposed Action emissions released into the air would relate to the number of acres treated. However, emissions associated with the Proposed Action would not be expected to exceed National Ambient Air Quality Standards (NAAQS) and would be minor, temporary, and localized. Because the Proposed Action's incremental contribution to the air quality is very temporary and minor, the cumulative impacts to air quality are less than significant.

Noise

Cumulative impacts to noise levels in the Project area occur mainly from human caused activities including on and off road vehicle traffic, oil and natural gas extraction equipment, agricultural vehicles and equipment, and the use of crop dusting aircraft.

The application of chemical treatments using ground-rig and aerial equipment can temporally increase noise above ambient noise levels near sensitive biological receptors. Noise generated by the Proposed Action could have potentially cumulative impacts on sensitive receptors including, raptors, grazing animals, and a small percentage of the human population that is particularly susceptible to noise. However, these impacts are not permanent or long term as the increase in noise levels would only occur during treatment periods. Proposed Action treatments are limited in duration and transitory across and through the treatment area.

Because the Proposed Action's incremental contribution to the ambient noise level is very temporary, the Proposed Action will not have a cumulative enduring impact to the ambient noise levels in Project Areas.

Water Quality

Permanent changes to natural stream flow from dams; highway and railroad construction has altered natural sedimentation processes and increased erosion. Urbanization and agricultural development has resulted in the loss of wetland and riparian habitat; and is responsible for the diversion surface waters and withdrawal of ground water. Water quality can also be affected by natural modifications, land management practices, industrial and municipal wastes.

In California, water quality issues were recognized in the 19th century from mining and from the development of oil resources. Newer sources of water pollution in the 20th century included those from agriculture (fertilizers, pesticides, and animal waste) industry and human activities associated with sewage, household cleaners, and the automobile. The Federal Water Pollution Control Act of 1948 was the first major U.S. law to address water pollution. In California, State Water Resources Control Board was created in 1967 to protect water quality. In 1970, the Environmental Protection Agency (EPA) was created and given the responsibility of coordinating federal water quality programs. Sweeping amendments to the Federal Water Pollution Control Act was made in 1972 (Clean Water Act) due to public concern for controlling water pollution. Section 303(d) of the Clean Water Act requires the listing of water bodies violating state water quality standards. The law requires that states establish a prioritized schedule for listed waters and develop Total Maximum Daily Loads (TMDLs) based on the severity of the pollution (USEPA 2009).

Past land management practices and the introduction and spread of invasive plant species has lead to a buildup of vegetative fuel and increased the potential for wildfires that negatively affect water sheds. The health of fish and other aquatic organisms in wetlands and riparian habitats can be influenced by both the quantity and quality of water. Nonpoint source pollution has been identified by the BLM as the largest source of water quality problems on public lands. Erosion of soils into streams is the primary nonpoint source pollution problem of concern to BLM (BLM 2007b). Free-standing water has been considered to be a resource that limits distribution and abundance of wildlife species in arid regions of the U. S. While water projects have been used since the 1940's to maintain surface water availability and improve habitat during dry seasons, wildlife and water quality resulting from water projects have had both positive and negative impacts (Simpson et al. 2011).

Water quality is also affected from the millions of pounds of pesticides and herbicides applied annually in California for agricultural and urban uses. Herbicides can directly affect phytoplankton, zooplankton and fishes, while insecticides can affect zooplankton and fish (Armor et al. 2005).

The quality of water bodies in the Project Area can be potentially degraded from the off-target drift or runoff of malathion during Proposed Action ground and aerial applications. However, treatment buffers and measures to reduce runoff employed under the Proposed Action will reduce potential impacts to aquatic habitats to less than significant. The foliar application of the Proposed Action mitigates the movement of malathion to ground water due to the exposure

of residues to degradation processes, such as photolysis (CEPA 2006). Malathion has particular chemical properties, which reduces the potential for leaching presenting small risks to people and animals drinking ground water (USDA 1991). Therefore, the Proposed Action will not contribute substantially to cumulative impacts from other factors affecting ground and surface water quality in Project Areas.

Vegetation

American Indians used fire as a tool to manage vegetation prior to the migration of European emigrants to North America. As European settlements moved west, the ecosystems were altered to meet agricultural and residential needs. The organized suppression of fire further contributed to the invasion of grasslands by woody species and the increased density of woodlands and scrublands (BLM 2007b). Decreases in grass cover and promotion of woody species was caused by overgrazing in the late 19th and early 20th centuries. Concerns of adverse environmental consequences from grazing led to the development, implementation and evaluation of grazing management strategies (BLM 2006b).

The invasion of exotic plant species over time has significantly altered California's ecosystem in California. Invasive plants have displaced native plants and wildlife, increased wildfire and flood danger, consumed valuable water, and degrade productive range (Cal-IPC 2012). Some invasive plants can alter soil chemistry across large areas, significantly altering soil pH or the availability of soil nutrients. The introduction of fire promoting grasses have altered entire plant and animal communities and changed the composition and structure of native plant and animal species. Invasive species also lead to large increases in fire-fighting costs and decrease foraging habitat for livestock (NCIS 2006). The spread of weed and other exotic plant species is expected to continue in the future commiserate to the rate of urbanization and degradation of private and public lands.

Herbicides are utilized to control noxious weeds in rangeland habitat within the BCTVCP survey/treatment boundaries by federal, state and county agencies. Small isolated acreages of tamarisk, arundo and yellow-star thistle are routinely treated. The majority of weed eradication acreage is quite small, localized; and the quantity of herbicides used for control is small and not significant. Herbicides do not have a known cumulative effect with malathion (BLM, 2010).

Small quantities of herbicides are currently use in rangeland habitat. Herbicide use in rangeland, idle or fallow ground in Kern, Kings, Fresno and Merced Counties was queried using CALPIP (CDPR 2102b) from 2006-2010. An average of 5,951 pounds of herbicides per year was reported used in habitats similar to those of the Proposed Action. The 5 year average includes herbicide uses county wide and not just uses on the westside of the San Joaquin Valley.

Proposed Action could temporarily reduce invertebrate pollinators and indirectly affect plant pollination. Any disruption in honeybees and wild bee activity would be temporary and localized to the treatment area. A significant increase in pollinator mortality is expected the day of the malathion spray as insects forage on flowers in bloom. The level of mortality would be expected to decrease over a two-four day post spray period as the number of flowers in bloom with malathion residues decreases and the number of flowers in bloom with no

malathion residues increases. Bee keeper notification procedures, employed by the BCTVCP, will reduce the potential exposure to commercial honeybee colonies but wild honeybee colonies will be venerable if foraging in rangeland during treatments.

Pollinator mortality could indirectly affect reproduction of listed plant species. However, mitigation measures are employed to reduce potential indirect impacts of pollinator decline to several listed plant species.

Recent overwinter declines in U.S. honey bees, or Colony Collapse Disorder (CCD) has affected honeybees and native pollinators in North America and Europe. CCD is characterized by a rapid loss of adult bees (not queen and brood) along with the absence of invasive responses by robber bees and other hive pests. Researchers found an association between CCD and a honey bee virus called Israeli acute paralysis virus (Cox-Foster et al. 2007). A higher total load of pathogens (viruses, bacteria and fungi) appears to have a strong link with Colony Collapse Disorder (vanEngelsdorp et al. 2009). Mullin et al. (2010) detected 98 pesticides and metabolites in bee pollen alone. The direct association with CCD and these chemicals was not determined. While CCD is not fully understood, declines in honeybee populations from CCD may be from a combination of factors including disease, pesticides and migratory beekeeping.

The incremental increase of impacts to vegetation from the Proposed Action is temporary and less than significant because: Malathion is virtually non-phototoxic when used at Proposed Action rates, the rapid degradation of malathion in the environment, rapid recolonization of invertebrates from infrequent (annual) applications, commercial bee notification, and mitigations to reduce impacts to invertebrate pollinations of listed plant species.

Aquatic Life

Human alterations of lakes, rivers, ponds, wetlands and riparian habitat, through water diversion, groundwater pumping, flood control structures, dams, and urbanization is responsible for cumulative impacts to fish and other aquatic organisms. Livestock and wild horses have degraded the habitat quality as well as recreation, fire exclusion, and natural resource extraction (BLM 2007b). The alteration of river flow regimes, nonpoint source pollution and invasive species, are major threats to aquatic animals (Richter et al. 2003).

Significant cumulative impacts to fishery resources in California are those associated with Pelagic Organism Decline (POD) and the recent collapse of Central Valley salmonid populations. POD refers to the seep decline of upper estuary pelagic fishes in the Central Valley Delta and Suisun Bay. Since 2002, populations of the longfin smelt, delta smelt, striped bass and treadfin shad have been near all-time lows. Although several of these species have shown long-term declines, the unexpected low population levels were observed during periods of moderate winter-spring flows from 2002 to 2007. Higher outflow conditions in 2005 failed to improve fish abundance. Toxins, invasive species, and water project operations are three general factors hypothesized for the decline (Armor et al. 2005). The Interagency Ecological Program studies have failed to identify a single factor responsible for the decline; however a matrix of factors has been suggested as potentially effecting pelagic fish populations.

The Central Valley drainage of California formerly produced immense numbers of Chinook salmon with four seasons of upstream spawning migration occurring in fall, late-fall, winter, and spring. Before widespread alteration of the landscape by Euro-American settlements, most of the major tributaries of the Sacramento and San Joaquin rivers had both spring and fall Chinook salmon runs (Yoshiyama et al. 1998). In the San Joaquin River Basin, Merced, Tuolumne, and upper San Joaquin rivers sustained very large salmon populations, while other streams had intermittent salmon runs in years when rainfall provided sufficient flows (NMFS 2009). The Chinook salmon and Central Valley steelhead have experienced long-term declines in the past several decades. Significant human impacts to population decline include the modification of natural hydrology by dams and water diversions, elevated water temperatures, and water pollution from agriculture and industry (Lufkin 1996). Out of an estimated 3,512 kilometers of Central Valley streams originally available to Chinook salmon, only 1,811 kilometers of main stream presently remain or 48 percent of the original total (Yoshiyama et al. 2001). The past decade has seen improvements in some runs and declines in others. Some runs are heavily influenced by hatchery stock which obscures the assessment of wild populations. While salmon studies in the Central Valley continue to deal with hatchery and fish management issues, the current emphasis on environmental restoration, has increased interest in basing management on understanding the species and the ecosystem (Williams 2006). In order to recover anadromous salmonids in the Central Valley, many biological, economical, social and technological issues must be addressed (NMFS 2009).

Steelhead populations are thought to be fragmented and are declining proportionally to deteriorating habitat conditions throughout the Central Valley. Lindley et al. (2006) modeled historical independent populations in the Central Valley based identifying discrete and interconnected habitat patches isolated from thermally unsuitable habitat. About 80% of habitat that was historically available to anadromous *O. mykiss* is now behind impassable dams and 38% of the populations have lost their entire habitat (Clark 1929 in Lindley et al. 2006). High summer temperature on the valley floor is one important driver of habitat fragmentation.

Streams in the San Joaquin Valley Project Area flow from the coast range into the basin on the westside of the valley. Basin streams flowing from the coast range were highly intermittent and none are known to have supported anadromous salmonids (Yoshiyama et al. 1996 in NMFS 2009). Because the decline in salmonid populations is from multiple water sheds, sources, and causes; and, the Proposed Action's incremental contribution is less than significant with mitigation, the Proposed Action will not have a cumulative impact on Salmonid populations.

California coastal steelhead habitat is located in the Monterey Valley Project Area. Ground-rig applications are infrequent (page D-25) and aerial applications have been performed only twice in the past 35 years (page F-5). Due to the infrequency of treatment activities and mitigation measures to potential drift and runoff, the Proposed Action's incremental contribution is less than significant and will not have a cumulative impact to California coastal steelhead populations in the Salinas River or its tributaries.

Malathion is highly toxic to many species of aquatic life including fish, amphibians, frogs and aquatic invertebrates. Off-target drift or runoff of malathion during ground and aerial applications could significantly effect aquatic species. However, treatment buffers, measures

to reduce runoff, and mitigation measures for listed aquatic species, will reduce potential impacts to aquatic habitats to less than significant. Because the Proposed Action's incremental contribution is less than significant with mitigation, the Proposed Action will not have a cumulative impact on aquatic life.

Animals

Modifications to wildlife habitats by human activities including urbanization, natural resource extraction, agriculture, fire suppression, invasive weeds and grazing has resulted in lands less favorable for sustaining wildlife than undisturbed lands.

The death and injury of wildlife each year results for many types of human related activities. Hunting is responsible for removing a large number of animals from the environment each year. Animals are killed each year by vehicles, and elevated structures such as power lines wind power generation. Wildlife strikes by aircraft in the U. S. have increased since 1990. Over 66,000 aircraft strikes were reported to the FAA between 1990 and 2005 (FAA 2006). Birds comprised 97.5 percent of the reported strikes followed by terrestrial mammals (2.2%), bats (0.2%), and reptiles (0.1%).

Non-target exposure from pesticides and herbicides have resulted in the death, sickness, and loss if reproductive success in wildlife. Pesticides have also been identified as a potential cause of amphibian declines and deformities. In addition to the application of malathion to rangeland for control of the BLH, additional pesticides may also be used to control grasshoppers, vertebrate pests and noxious weeds within portions of the Program's treatment footprint. The Rangeland Grasshopper and Mormon Cricket Suppression Program (USDA 2002), administered by USDA, utilizes block or buffer treatments for the control of grasshopper infestations that threaten food, fiber and grasslands. The USDA works closely with state agencies and private landowners to control extremely large grasshopper populations on BLM and private lands. Grasshopper control within the BCTVCP survey area would be rare. Rodenticide baits may be placed in rangeland to control vertebrate pests inflicting damage to adjacent cropland areas. The locations and amount of vertebrate pest control would be expected to fluctuate from year to year with changes in vertebrate pest populations.

The invasion and spread of non-native weed species reduces habitat complexity, the quality of forage and the diversity of wildlife. Invasive plant species compete with native plants for habitat and water. Economic loses to California from invasive species are estimated at $3 billion per year. The unique climate and geography of California provides diverse ecosystems for the establishment of a variety of new pests (CISR 2012).

Approximately 70% of the western North America is grazed. Extensive grazing has modified wildlife habitat in many western areas resulting in the alteration of species composition of communities, disruption of ecosystems functioning, and alteration of ecosystem structures (Fleischner 1994). Wetland and riparian areas have suffered from domestic livestock and wild horses. BLM has developed Grazing management strategies for riparian and wetland habitats (BLM 1989, 1997 & 2006) which allows managers to develop practices that will help protect riparian resources across a variety of land types. Implementing a grazing management plan to enhance wildlife habitat requires knowledge of plant community dynamics, habitat requirements of affected wildlife species, and potential effects on the livestock (Vavra 2005).

Malathion is moderately toxic to mammals and birds, moderately to highly toxic to fish, relatively low to adult amphibians, but highly toxic to immature aquatic stages, highly toxic to bees and terrestrial invertebrates, and most acutely sensitivity to aquatic invertebrates.

The Proposed Action mitigations are intended to greatly reduce the potential impacts to animals from BLH control. Off-target drift or runoff of malathion during ground and aerial applications could significantly affect aquatic species. However, treatment buffers, measures to reduce runoff, and mitigation measures for listed aquatic species, will reduce potential impacts to aquatic animals to less than significant. The rapid degradation of malathion in the environment, rapid recolonization of invertebrates from infrequent (annual) applications, commercial bee notification will reduce impacts to bees. Due to the infrequency of treatment activities and mitigation measures, the Proposed Action's incremental contribution is less than significant and will not have an impact measurably above existing impacts to animals.

Animal Species of Concern

Widespread human alterations to ecosystems in California have seriously affected some animal species to the point of extension. Agriculture in its many forms has the most wide reaching effects in changing the habitat for many sensitive, threatened and endangered species. The clearing of natural vegetation, the cultivation of soils and the use of herbicides, insecticides and rodenticide has affected the historical range of the blunt-nosed leopard lizard, desert tortoise, Tipton kangaroo rat, giant kangaroo rat, Nelson's antelope squirrel, Mojave ground squirrel, flat-tailed horned lizard, San Joaquin kit fox, Bakersfield cactus, Kern mallow, San Joaquin woolly-threads, Bakersfield saltbush, California jewelflower, peregrine falcon, Swainson's hawk and the bald eagle.

Urban sprawl, agricultural, livestock grazing, water diversion projects and associated activities, causing permanent habitat destruction and changes in air and water quality, have affected many species throughout California (USFWS 1998). In the San Joaquin Valley, species such as the San Joaquin kit fox, western yellow-billed cuckoo, Bakersfield cactus, blunt-nosed leopard lizard and Nelson's antelope squirrel have been subject to pressures resulting from urban growth.

A combination of urban sprawl and agriculture has impacted the ecosystems associated with the Colorado River. The development of flood control and the diversion of water from the Colorado River for urban and agriculture uses, has changed the lower Colorado River basin and impacted many sensitive species. The greatly reduced cottonwood-willow-mesquite riparian forest is the home for a large group of birds including the Gila woodpecker, gilded northern flicker, elf owl, California black rail, Arizona Bell's vireo and Yuma clapper rail. The bonytail chub and humpback sucker have also been impacted by changes in the Colorado River.

Oil, gas and mineral exploration or production has profoundly modified, over a limited area, the habitat of San Joaquin kit fox, blunt-nosed leopard lizard and Bakersfield cactus. The impacts of predation, poaching, and disease are impacting the desert tortoise, flat-tailed horned lizard, blunt-nosed leopard lizard, San Joaquin kit fox, peregrine falcon and bald eagle.

Although many factors are contributing to the degradation of natural habitat and decline of listed species in California, efforts are being made to reverse trends of habitat disruption and the decline of species. Protection for sensitive, threatened or endangered species is provided by federal and state legislation. The federal Endangered Species Act (ESA) was enacted in 1973 to protect and recover U. S. species and the ecosystems where they are found. The lead federal agencies for implementing ESA are the U.S. Fish and Wildlife Service (USFWS) and the U.S. National Oceanic and Atmospheric Administration (NOAA) Fisheries Service. There are currently a total of 1,393 federally listed species in the U. S. and a total of 1,138 distinct active recovery plans (USFWS 2012a).

The California Endangered Species Act (CESA) was signed into law in 1984 and generally parallels main provisions of the federal ESA. The CESA is administered by the California Department of Fish and Game. There are currently a total of 237 California State listed threatened and endangered plant and animal species and 64 plants listed as rare (CDFG 2011 & 2012a).

Habitat, identified by federal, state or local agencies to be crucial to the survival of endangered species, may be recommended for acquisition and set aside as wildlife preserves; national, state, county or city parks; national wildlife areas and ecological preserves.

USFWS designates specific geographic areas as Critical Habitat which is determined to be essential for the conservation and management of listed species. In designating Critical Habitat, biologists consider physical and biological features needed for life processes and successful reproduction of the species. Critical habitat has been designated for 615 of the 1,393 U.S. species listed as threatened or endangered (USFWS 2012b).

Management plans, developed by resource agencies, provide guidance to for the management of a sufficient portion of habitat to maintain viable populations of species in decline. Recovery plans have been adopted to enhance the recovery of individual endangered species such as the blunt-nosed leopard lizard, San Joaquin kit fox, bald eagle and the peregrine falcon. Both the bald eagle and the peregrine falcon are on the road to recovery as their numbers have increased in response to management programs. The bald eagle was downgraded from “Endangered” to “Threatened” status as of July 1, 1994. In the summer of 1999, the American peregrine falcon was removed from the Federal list of endangered and threatened wildlife (USFWS 1999b) and the bald eagle was proposed for removal from the list of endangered and threatened wildlife in the lower 48 states (USFWS 1999a). In 1998, the USFWS completed a recovery plan for the San Joaquin Valley, which covers many species of plants and animals (USFWS 1998).

Habitat Conservation Plans (HCP) are adopted primarily to address single projects to broad-based, landscape-level planning, utilized to achieve long-term biological and regulatory goals. They describe the anticipated effects of the proposed taking; how those impacts will be minimized, or mitigated; and how the HCP is to be funded. HCPs can apply to both listed and non-listed species, including those that are candidates or have been proposed for listing (USFWS 2011b).

The Natural Community Conservation Planning Act was added to CESA in 1991 and takes a broad-based ecosystem approach to planning for the protection and perpetuation of biological

diversity. These provisions provide for voluntary cooperation among CDFG, landowners, and other parties to develop and provides for regional protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity. There are currently 23 active NCCP's covering more than 11 million acres (CDFG 2012b).

Non-profit conservation organizations such as the Nature Conservancy, Center for Natural Lands Management, Audubon Society and the Sierra Club are promoting research and habitat improvement, which will greatly improve the survival of many species, including those listed as endangered or threatened.

Effects from malathion treatments under the Proposed Action are short-term and not persistent or cumulative. Malathion breaks down rapidly (1 to 4 days) and residue build up in the environment is not anticipated from single annual treatments. All short-term actions under this EA include, where applicable, appropriate mitigation measures to reduce effects on listed species using species specific mitigation measures adopted through previous USFWS consultations. These measures include avoidance of sensitive areas including, preserves and reserves; dune habitat, surface water, riparian and wetland habitats and critical habitat. Treatment buffers are established around these sensitive areas to further reduce potential impacts from drift and runoff. Reduced application rates, and limited application methods are also employed where deemed appropriate to reduce impacts. Studies have shown that insect populations re-establish rapidly within several months of treatment and would not experience long-term decline from repeated annual treatments. Due to the infrequency of treatment activities, rapid degradation of malathion in the environment and mitigation measures, the Proposed Action's incremental contribution is less than significant and will not have an impact measurably above existing impacts to listed animal species.

Designated Ground-rig Only Areas

Ground-rig only areas have been designated by the Proposed Action to control beet leafhopper populations through the use of only ground-rig spot treatments (no aerial applications). These areas include a portion of the San Joaquin Valley (page D2-D3), the Palo Verde Valley (page D11) and the Cuyama Valley (page D12).

Land use in "ground-rig only" areas comprises mostly cultivated lands where beet curly top virus (BCTV) susceptible crops are grown. These areas are highly impacted by intensive farming practices. Agricultural activities affect the environment directly through the transformation of natural lands into farmlands affecting wild plant, and animal genetic resources. Crop production and irrigation can affect soils leading to mineral depletion, acidification, alkalinization and salinization. These areas are also subject to the use of pesticides, herbicides and fertilizers to control agricultural pests, diseases and to sustain plant health and yields.

The quantity of malathion used in "ground-rig only" areas by ground-rig vehicles is small when compared to the potential use of chemicals in these crop production areas past, present and future. The treatment frequency of the Proposed Action in these areas is sporadic and infrequent (page D-25). Considering the small quantity of malathion presently utilized, the low frequency of ground-rig treatments and mitigation measures employed to reduce potential impacts to sensitive habitats and species of concern; the Proposed Action's contribution to

impacts in ground-rig only areas is not significant and will not have an impact measurably above existing impacts.

5.2.2.2 Alternative 2-No Action

Under the No Action alternative, the BCTVCP would not use any of the above actions. No pesticide treatment for BLH control would take place in California by the BCTVCP.

Where no treatment occurred, both BLH populations and BCTV would increase and become a threat to a wide range of agricultural crops and home gardens, statewide, valued at well over three billion dollars worth annually. Losses could be astronomical. A large portion of the produce consumed in the United States comes from California, and a major outbreak of BCTV could affect consumers nationally.

Potential impacts of No Action are expected to be:

- A large increase in pesticide use to control migrating BLH populations within cultivated crops;
- Increased potential for pesticide residue on produce and;
- Potential increases in air and ground water contamination from increased use of pesticides in crops;
- Unstable prices for BCTV susceptible crops and products;
- Inadequate supplies of BCTV susceptible crops and products;
- Loss of jobs and investments in BCTV susceptible crop production and related industries.

Without the control of BLH, BCTV infection would threaten over three billion susceptible crops and home gardens annually. Susceptible crops and gardens growing in California would be subject to the same devastating losses experienced in agricultural history prior to the establishment of the BCTVCP.

- Cumulative Impact

  In the No Action alternative the control of BLH would move from regional control in rangeland to individual grower control in private cultivation; and, rangeland control where individual growers and ranchers cooperate to effect control. Moving treatment responsibility from highly trained BCTVCP staff to individuals will create a scenario where there is no oversight for treatments and mitigation measures will not be required for T & E or species of concern or their habitats. By removing the treatment responsibility from BCTVCP there will be no guarantee that treatments are conducted in efficient or environmentally responsible manner.

  The increase in pesticide use by growers and individuals to control BLH populations in susceptible crops would add to the cumulative impacts of pesticides in cropland above that of the Proposed Action. Additionally, increased pesticide use in cropland can cause cumulative impacts to sensitive habitats that are near or adjacent to the treatment areas, or through misuse may cumulatively impact natural resources such as water, or air quality.

A decrease in the treatment of rangeland habitat to control BLH populations would decrease cumulative impacts in rangeland in relation to the Proposed Action. However, the untreated rangeland would become a reservoir for the BLH and BCTV. Without control BLH populations could increase and increased populations may expand outside historical habitats in an attempt to locate adequate hosts. An expansion in BLH would spread the BCTV and potentially infect new areas of the state putting pressure on production agriculture and residential and community gardeners to increase the use of pesticides to control BLH. Without adequate BLH control, commercial and residential crops will be severely impacted, causing significant economic losses.

Although the cumulative impacts of the No Action alternative may appear to be reduced in rangeland, the cumulative impacts will increase substantially in cropland and adjacent areas. The overall cumulative impact of the Proposed Action on all California lands will be less than the No Action alternative, as all of the Proposed Actions are short-term and where applicable include appropriate mitigation measures to reduce effects on long-term productivity and the No Action alternative will be conducted without any coordinated oversight.

6.0 CONSULTATION/COORDINATION

6.1 CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE

6.1.1 Division of Plant Industry

- Duane Schnabel - Chief, Integrated Pest Control Branch
- Victoria Hornbaker - Program Supervisor, Integrated Pest Control Branch
- Laura Petro - Environmental Coordinator
- Bob Dowell - Staff Environmental Scientist
- Rodney A. Clark - Environmental Scientist, BCTVCP

6.2 UNITED STATES DEPARTMENT OF THE INTERIOR

6.2.2 Bureau of Land Management

- California State Office:

    - Amy Fesnock - T and E Species Biologist
    - Lily Douglas - Wildlife Biologist
    - John Willoughby - Botanist
    - Sandra McGinnis - Planning and Environmental Coordinator
    - Dianna Brink - Range & Weed Program Lead

6.2.3 Fish and Wildlife Service

- Carlsbad Field Office:

- Sacramento Field Office:

- Ventura Field Office:

6.3 UNITED STATES DEPARTMENT OF COMMERCE

6.3.1 National Marine Fisheries Service

- Santa Rosa Field Office:

    Joe Dillon- Water Quality Coordinator

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