United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
08EVEN00-2013-F-0146

April 10, 2013

Pete Yribarren
Community Programs Specialist
U.S. Department of Agriculture
3530 West Orchard Court
Visalia, California 93277-7360

Subject: Reinitiated Biological Opinion for the Los Osos Wastewater Project, Community of Los Osos, County of San Luis Obispo, California (8-8-13-F-14R)

Dear Mr. Yribarren:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion prepared in response to your February 21, 2013, request to reinitiate consultation on the Los Osos Wastewater Project (LOWWP). The U.S. Department of Agriculture (USDA) has determined, based upon the results of monitoring surveys, the proposed action is likely to adversely affect a greater number of the federally endangered Morro shoulderband snail (*Helminthoglypta walkeriana*) than were considered during our previous analysis made as part of biological opinion 8-8-11-F-5R. Our response to your request is in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act)(16 U.S.C. 1531 et seq.).

Your request to reinitiate consultation for the LOWWP addresses previously unanticipated effects to Morro shoulderband snail that would result from project implementation. This request is for Morro shoulderband snail only. As such, the project description, inclusive of those minimization measures, and terms and conditions provided in biological opinion 8-8-11-F-5R remain in place for those species addressed therein. This reinitiation remains unchanged in its determination regarding critical habitat for the Morro shoulderband snail as provided in biological opinion 8-8-11-F-5R and, as such, will not be discussed further.

This biological opinion is based on information relevant to your February 21, 2013, request including the biological assessment for the LOWWP (County of San Luis Obispo Department of Public Works 2010a); the 2012 Annual Construction Monitoring Report for the LOWWP (SWCA 2013); biological opinion 8-8-11-F-5R, phone conversations between Service staff biologist Julie M. Vanderwier and County of San Luis Obispo Department of Public Works Environmental Specialists Kate Ballantyne and Eric Wier; and other information contained in Service files housed at our Ventura Fish and Wildlife Office (VFWO).

CONSULTATION HISTORY

A complete consultation history is included in biological opinion 8-8-11-F-5R and is incorporated herein. Information regarding consultation associated with this current LOWWP project is provided below.

On April 14, 2010, the Service issued biological opinion 8-8-10-F-14 as part of our interagency consultation with the USDA regarding the County of San Luis Obispo's LOWWP. As part of the California Coastal Commission's approval of the CDP for the current LOWWP, several measures were added during their June 11, 2010 meeting. Relevant to project implementation was the requirement to stabilize and restore environmentally sensitive habitat values (ESHA) at the Mid-Town site (formerly known as the Tri-W site). This implementation of site stabilization and habitat restoration activities would result in adverse effects to Morro shoulderband snail. Because this additional adverse effect was not identified or analyzed in the biological opinion 8-08-10-F-14, the need for reinitiation of consultation was triggered. The Service conducted this analysis in biological opinion 8-8-11-F-5R, issued on February 9, 2011.

During implementation of preconstruction monitoring for Morro shoulderband snail associated with the restoration efforts at the Mid-Town site, site preparation at the Broderson property, and installation of the collection system, substantially more Morro shoulderband snails were encountered than anticipated or analyzed in our previous biological opinions. Our analysis in the previous opinions was based upon an assumption that Morro shoulderband snails would be more commonly encountered and abundant in coastal dune scrub and other native habitats; however, individuals have been encountered in a diversity of native and non-native habitats throughout the action area. This widespread distribution of Morro shoulderband snail throughout the community of Los Osos requires us to reevaluate our previous analysis of adverse effects and take of Morro shoulderband snail associated with project implementation and forms the basis for the USDA to request reinitiation.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

Los Osos is an unincorporated coastal community of approximately 15,000 residents located in western San Luis Obispo County at the southern end of Morro Bay, approximately 19 kilometers (km) west of the City of San Luis Obispo, California. The community is bounded by Morro Bay and its estuary and Morro Bay State Park to the north, Montaña de Oro State Park to the west and southwest, rural open space to the southeast, and production agricultural lands to the east. The City of Morro Bay lies approximately 3 km to the north. The LOWWP is a proposal by the County of San Luis Obispo to develop a wastewater collection/treatment and recycled water reuse system to serve the majority of the community of Los Osos (which includes an area known as Baywood Park).

Water quality degradation in the community Los Osos has been an issue of concern to the California Regional Water Quality Control Board (CRWQCB) since the 1970s. Septic systems are the sole method of wastewater treatment and disposal throughout the community. As many of the existing parcels are considered too small for conventional leach fields, deeper seepage pits have frequently been used for wastewater disposal. In areas where the depth to groundwater is shallow, many of these seepage pits discharge directly into the upper aquifer with no separation. Contaminated groundwater sometimes reaches the surface, especially during the rainy season (CRWQCB 2001).

Elevated levels of fecal coliform are present in Morro Bay and indicate that other pollutants such as bacterial, viral, or cyst forming pathogens may be present (CRWQCB 2002). Human and animal illnesses can result from eating seafood that has been contaminated by these pathogens. Illness can also result from coming in contact with water or accidentally ingesting water in contaminated areas. Portions of the commercial oyster beds in Morro Bay have been closed for harvest by the California Department of Health Services per the United States Food and Drug Administration's National Shellfish Sanitation Program standards because of high fecal coliform levels. Based on the level of fecal coliform bacteria, seasonal restrictions have been imposed on commercial shellfish harvesting in other portions of Morro Bay; however, no restrictions are in place on non-commercial shellfish harvesting related to these levels (CRWQCB 2002).

In 1983, the CRWQCB adopted Resolution 83-13 that prohibits (effective November 1, 1988) discharges of waste from individual and community sewage systems within portions of the community (i.e., the prohibition zone). This resolution restricts the use of existing septic systems and additional discharges that would occur from new septic systems. Since 1988, existing septic systems in the prohibition zone have been considered to be discharging illegally (CRWQCB 2001).

To remedy these issues, the County proposed to develop a wastewater collection, treatment, and recycled water reuse system to serve the majority of the community of Los Osos. Key objectives of the LOWWP are to develop a community wastewater project that will comply with CRWQCB Waste Discharge Requirements and alleviate groundwater contamination (primarily nitrates) that has occurred partially because of septic system use throughout the community. Other objectives include the incorporation of measures to avoid and minimize potential environmental impacts on the community and surrounding areas; to meet water quality requirements while minimizing costs to mitigate affordability impacts on the community; to comply with all applicable local, State of California, and Federal ordinances, laws, and permitting requirements (e.g., ESHA standards, cultural resource concerns); to address water resource issues by mitigating project impacts on saltwater intrusion; and to maintain a diversity of options for beneficial re-use of recycled water. Project construction started in 2012 and will take between 16-36 months to complete. With the exception of a new dewatering activity, the detailed project description is incorporated by reference from biological opinion 8-8-12-F-5R. Figure 1 depicts the action area along with proposed project components.

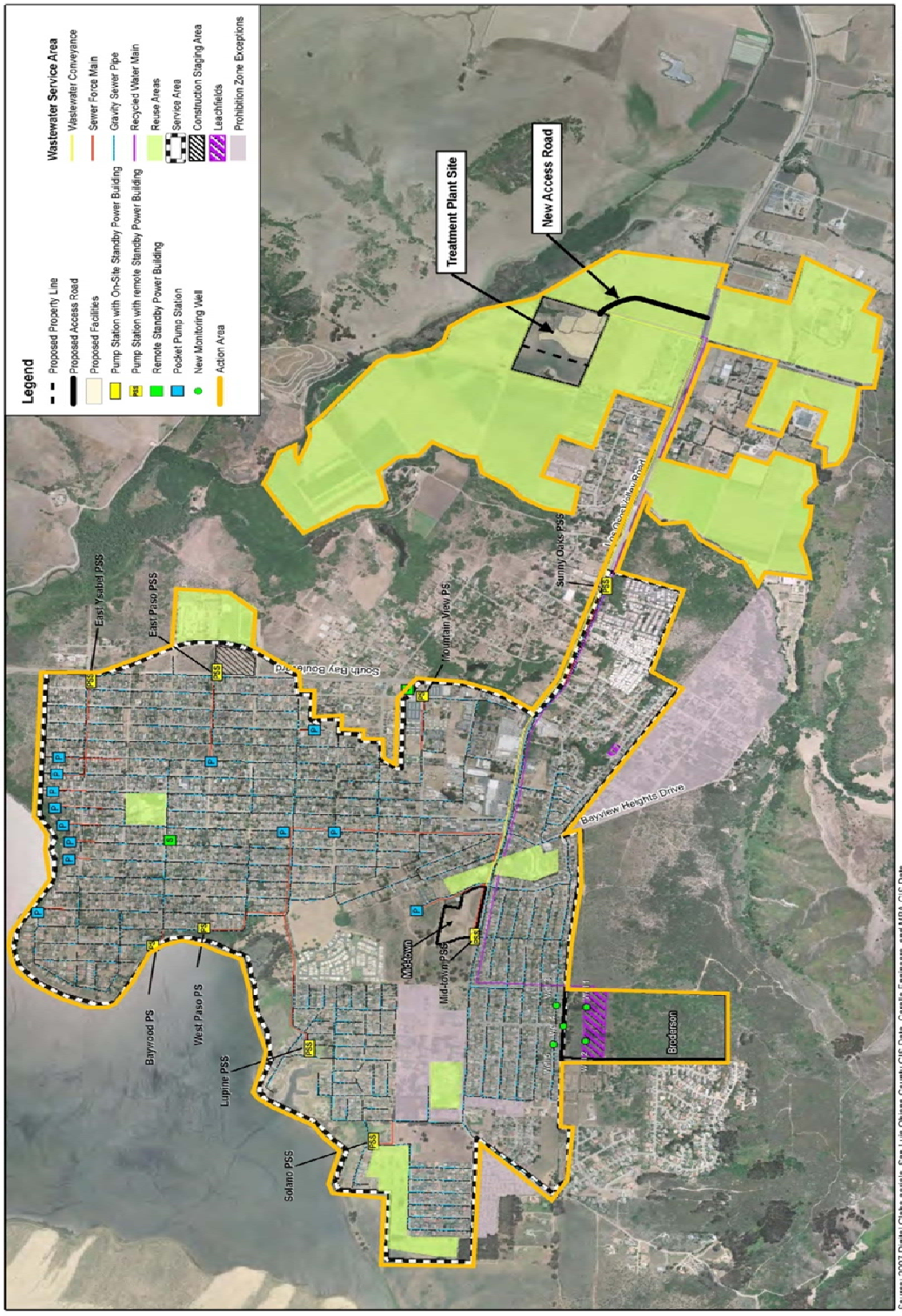

Figure 1
Overall Project Site Plan
Los Osos Wastewater Project 2010
COUNTY OF SAN LUIS OBISPO • LOS OSOS WASTEWATER PROJECT

Dewatering System

A temporary dewatering system was added to the project description in February 2013. This dewatering system involves installation of an aboveground, 30.5-centimeter (cm) polyvinyl chloride pipeline that would follow a route commencing at the corner of Ramona Avenue and 4th Street across the Morro Shores property east of the residential mobile home park and Morro Shores property to the Mid-Town site. The pipeline route will follow existing sand off-road trails or traverse areas of veldt grass (*Ehrharta calycina*) grassland from the corner of Ramona Avenue at 4th Street to end at the corner of Los Osos Valley Road and Palisades Avenue (Figure 2).

Measures to Minimize Adverse Effects

The USDA has proposed to include measures in the proposed action to minimize adverse effects to the Morro shoulderband snail. These measures constitute a portion of the total commitments being made to by the County to reduce impacts to this species during the construction and operation phases of the LOWWP and include the following:

- Environmental training sessions for all project-related personnel will be conducted by a Service-authorized biologist prior to the start of vegetation removal, grading, and ground-disturbing construction-related activities. To date, the County (or its contractor) has conducted at least 27 training sessions for new employees. These trainings will continue for the duration the project.

- Construction areas will be clearly marked with high visibility flagging or barrier fencing. Construction equipment and personnel will be restricted to the marked areas. The delineation of construction areas is ongoing and will continue for the duration of project implementation.

- A Service-authorized biologist will be retained to monitor all vegetation removal, grading, and ground-disturbing construction-related activities that will take place within habitat suitable (inclusive of private property for purposes of lateral installation and/or septic tank decommissioning) for the Morro shoulderband snail. Monitoring activities will be required daily until completion of initial disturbance at each location and to ensure appropriate minimization measures are implemented during construction. The monitor will be granted full authority to stop work at his or her discretion and will stop work if project-related activities occur outside the demarcated boundaries of the construction footprint. The monitoring biologist will stop work if Morro shoulderband snails are detected within the proposed construction footprint and will capture and relocate them to suitable habitat out of harm's way prior to construction activities resuming. If no suitable habitat opportunities are available in the immediate vicinity of the construction footprint, salvaged and relocated specimens may be transported to an off-site location in accordance with the "Morro Shoulderband Capture and Relocation Methodology" developed by the County (County of San Luis Obispo 2012). To date, authorized biologists have conducted a number of pre-disturbance surveys within the action area. Those areas that have been the subject of such surveys in 2012 are depicted in Figure 3.

- Prior to the initiation of project-related activities that would result in vegetation removal, soil disruption, or any construction, the approximately 29 hectares (ha) of the Broderson property not part of the proposed leach fields will be secured and granted, in perpetuity, to an appropriate agency or conservation organization who will assume the responsibility for its management. A long-term management and monitoring program will be prepared and approved by the Service and the California Department of Fish and Wildlife (Department). The County is currently the landowner responsible for the allocation of

funding necessary to implement management and monitoring activities on the conserved lands.

- The existing degraded coastal dune scrub at the Broderson property will be restored and maintained to promote its function as habitat for Morro shoulderband snail and sensitive plants and wildlife species that are local or endemic to the area. Restoration activities will be conducted by qualified personnel with expertise in restoration ecology and knowledge of local sensitive plant and wildlife species. To date, restoration activities have been conducted in accordance with the Restoration Plan specifically prepared for the effort and approved by the Service and the Department. Future habitat restoration and maintenance will be implemented in accordance with a Habitat Mitigation and Monitoring Plan intended to evaluate the progress and success of this effort.

- Habitat restoration activities will include measures for the removal and eradication of competitive, invasive, and/or non-native (i.e., target) plant species known to occur in the local area, including veldt grass and pampas grass (*Cortaderia* spp.). Activities that involve the removal of invasive species will be employed so as not to cause unnecessary trampling or removal of native species. Techniques used in the removal of target plant species will result in the least damage to native species. Any disturbed portions of the acquired Broderson property will be evaluated for their restoration potential to coastal dune scrub habitat that could support Morro shoulderband snail, Morro Bay kangaroo rat (*Dipodomys heermanni morroensis*), and other locally sensitive coastal dune scrub species.

- The restoration effort will include the implementation of a seed collection program to gather materials from native sources. The focus of collection will be plant species that will be affected by project implementation. Collection will be conducted by personnel with demonstrated expertise in seed collection and storage techniques and occur during the appropriate time of year for seed production and harvesting for each species. The seed collection program has been, and will continue to be, implemented in accordance with the proposal developed in 2011 (Ballantyne, in litt. 2011).


U.S. Fish & Wildlife Service
Los Osos Wastewater Project, San Luis Obispo County, California
Figure 3: Pre-Construction Surveys for Morro Shoulderband Snail
Los Osos MSBS Collections 2012
Capture
Mortality
Project Area Boundaries
Morro Shoulderband Snail Pre-Construction Survey Locations 2012
Area A
Area B
Area C
Area D
San Luis Obispo County
Area of Detail Map
Miles
Kilometers
Datum: NAD 83
The USFWS makes no warranty for use of this map and cannot be held liable for actions or decisions based on map content
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March 2013

- The County will provide annual reports to the USDA and Service documenting the results of all restoration and monitoring activities. Annual reports will be provided for a minimum of 5 years or until it is determined that the requisite performance criteria have been met. The County will provide a written report to the USDA and Service within 90 days following the completion of the proposed project. The report must document the number of Morro shoulderband snails captured and relocated from project areas, the locations of all Morro shoulderband snail relocations, and the number of Morro shoulderband snails known to have been be killed or injured. The report will contain a brief discussion of any problems encountered in implementing minimization measures, results of biological surveys, observations, and any other pertinent information.

Reporting

Biological and annual reports will be submitted by the County to the USDA and Service by January 31 of each year to document project progress, compensation activities, and results of pre-construction surveys required. A final report will be submitted by the County to the USDA and Service within 60 days of the end of project activities. This report will provide a summary of all annual reports and include a discussion regarding project activities and those minimization measures implemented. The details of all required reporting are incorporated by reference from biological opinion 8-8-11-F-5R.

The County submitted the first of these reports, which contained all of the requisite information, to the Service on January 31, 2013 (SWCA 2013).

ANALYTICAL FRAMEWORK FOR THE JEOPARDY DETERMINATION

Jeopardy Determination for Morro Shoulderband Snail

The jeopardy analysis in this biological opinion relies on four components: (1) the *Status of the Species,* which describes the range-wide condition of the Morro shoulderband snail, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline,* which analyzes the condition of the Morro shoulderband snail in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the Morro shoulderband snail; (3) the *Effects of the Action,* which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the Morro shoulderband snail; and (4) the *Cumulative Effects,* which evaluates the effects of future, non-Federal activities in the action area on the Morro shoulderband snail.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed federal action in the context of the current status of the Morro shoulderband snail, taking into account any cumulative effects, to determine if implementation of

the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the Morro shoulderband snail in the wild.

The jeopardy analysis in this biological opinion places an emphasis on consideration of the range-wide survival and recovery needs of the Morro shoulderband snail and the role of the action area in the survival and recovery of the species as the context for evaluation of the significance of the effects of the proposed federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

STATUS OF THE SPECIES

The Morro shoulderband snail was federally listed as endangered on December 15, 1994 (Service 1994), and a recovery plan for the species and four plants from western San Luis Obispo County was published in September 1998 (Service 1998). A 5-year status review for the Morro shoulderband snail was completed in 2006 (Service 2006). Critical habitat for the Morro shoulderband snail was designated on February 7, 2001 (Service 2001). With the exception of new status information relevant to this consultation, the "Status of the Species" for Morro shoulderband snail is hereby incorporated by reference from biological opinion 8-8-11-F-5R.

The Morro shoulderband snail is a member of the land snail family Helminthoglyptidae. The genus *Helminthoglypta*, is a complex of many species of shoulderband snail, each with a relatively small range (Burke et al. 1999). The Big Sur shoulderband snail (*H. umbilicata*) occurs sympatrically with Morro shoulderband snail (Walgren 2003). The Chorro shoulderband snail (*H. morroensis*) was once believed to occupy a distinctly different geographic distribution from the Morro shoulderband snail (Roth and Tupen 2004); however, areas where intermediate forms occur have been documented by Walgren (2003) and we now have information that reveals these two species do co-occur sympatrically (Tenera 2006).

At the time of listing, it was postulated that the species was restricted to sandy soils of coastal dune and coastal scrub plant communities (Roth 1973) and Roth (1985) speculated perhaps as few as several hundred individuals of Morro shoulderband snail remained throughout the geographic range of the species. A very limited survey for the species conducted in 1992 did not identify any live snails (Service 1994); however, subsequent surveys associated largely with proposed development projects reveal the current population is more robust than survey results from 1985 and 1992 indicated. We also now know the species occupies a diversity of both native and non-native habitats (Service files, SWCA 2013) throughout its geographic range.

In its native habitat on Baywood fine sandy soils, the Morro shoulderband snail is typically found in the accumulated leaf litter and the undersides of lower branches of shrub species of coastal dune scrub. Common plant species with which Morro shoulderband snails have been associated include mock heather (*Ericameria ericoides*), seaside golden yarrow (*Eriophyllum staechadifolium)*, deerweed (*Lotus scoparius*), dune lupine (*Lupinus chamissonis*), and dune almond (*Prunus fasciculata* var. *punctata*). Morro shoulderband snails are also commonly found in non-native iceplant species (e.g., *Carpobrotus* spp.) and the non-native invasive veldt grass.

Past and current observations (Walgren 2003, SWCA 2013) indicate that the microclimate necessary for species survival and reproduction is defined more on plant species physiognomy rather than presence of any particular plant species.

Active Morro shoulderband snails are typically observed when increased moisture availability facilitates their ability to find food, disperse, and mate. In the dry season, Morro shoulderband snails, like other terrestrial snail species, aestivate in accumulated litter or attached to the branches of shrubs. As with other snails in the genus *Helminthoglypta*, this species aestivates by producing an epiphragm (a seal of dried mucus in the aperture of the shell) to reduce water loss during the dry season. Information for *Helminthoglypta arrosa*, a terrestrial snail species found in coastal scrub in northern California, indicates smaller individuals are more often found aestivating under vegetation and leaf litter and, while also found aestivating under vegetation on the ground, larger individuals (e.g., 9 millimeter [mm] or greater) were more often found attached to twig surfaces in shrubs. The largest individuals (e.g., 14 mm) were found on dune lupine trunks and stems up to 30 cm above the ground (van der Laan 1973a). This may also be the case for Morro shoulderband snail as it is found in a habitat with similar plant species composition.

Like most terrestrial snails, Morro shoulderband snail is an herbivore and reducer of dead plant materials. It has been speculated that fungi are a potential food source for Morro shoulderband snails; however, in *Helminthoglypta arrosa,* dead material was strongly preferred over living material for those acceptable plant species (van der Laan 1973b). In *H. arrosa*, the frequency of palatable plant species was observed to be inversely related to the maturity of the plants community and van der Laan (1973b) suggests that in late versus early successional communities, snails and slugs, in general, will tend to have lower abundances and species diversity, tend to select disturbed areas more often for feeding, and tend towards feeding on dead or decaying plant materials (saprophagy) more than live plant materials (herbivory).

At the time of listing, identified threats included habitat loss or degradation, competition from non-native snail species, off-highway vehicle activity, and use of pesticides. The threats identified in the listing rule have diminished; however, loss and degradation of habitat continues to constitute a threat to the species. Dehydration is a major threat to all terrestrial mollusks and, therefore, a major threat to the Morro shoulderband snail is exposure that results from partial or complete removal of protective, sheltering vegetation. As with other species of *Helminthogypta* Morro shoulderband snails are likely subject to predation by small mammals and snakes (van der Laan 1980, Huntzinger et al. 2008). Although no studies have been conducted to determine how Morro shoulderband snails are affected when disturbed during aestivation, they may suffer physiological stress or even death if their epiphragm is broken or they are exposed to otherwise desiccating conditions.

ENVIRONMENTAL BASELINE

Action Area

Implementing regulations for section 7(a)(2) of the Act define the "action area" as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 *Code of Federal Regulations* 402.02). The action area for this consultation is the same as that described in biological opinion 8-8-11-F-5R and depicted on Figure 1. As such, it is incorporated by reference into this consultation.

Status of Morro Shoulderband Snail in the Action Area

Morro shoulderband snails are known to occur throughout the action area wherever suitable cover, food sources, and moisture regimes exist. Species presence at major project components sites was discussed in biological opinion 8-8-11-F-5R and this information is incorporated herein. The following paragraphs provide new, or more detailed, information regarding species presence and abundance for specific areas based upon pre-construction surveys conducted in 2012. Those areas of survey and results are depicted on Figure 3.

Mid-Town Site: Live individuals and empty shells of Morro shoulderband snail were found on the Mid-Town site as part of site preparation activities for the former wastewater project. While habitat at the Mid-Town site, at the time of approval for the LOWWP, was disturbed and degraded, much of it was recovering to coastal dune scrub and other habitats such that it was being reoccupied by Morro shoulderband snail (Tenera 2010). The Mid-Town site was again surveyed during October 2010 with all areas examined to determine the presence/absence and distribution of live Morro shoulderband snails, empty shells, suitable habitat, or other resources considered to be sensitive (County of San Luis Obispo 2010a). As this survey effort was considered an update of known information, only two surveys were performed (USFWS 2010). During the first survey conducted on October 7, 2010, four Morro shoulderband snails were observed along with one Class A shell (i.e., dead less than 1 year). In addition, approximately 300 common garden snails were observed. During the second survey conducted on October 30, 2010, seven Morro shoulderband snails were observed along with dozens of common garden snails. At that time, we believed the distribution of Morro shoulderband snail was light and uniform throughout the property, with a greater number occurring on the northern and eastern portions.

As part site stabilization and habitat restoration activities at the Mid-Town site, surveys for Morro shoulderband snails commenced in February 2012. These surveys continued as necessary through December 2012. During this time, monitoring biologists captured and relocated 404 Morro shoulderband snails (SWCA 2013; Ballantyne, pers. comm. 2013). Morro shoulderband snails that were captured at, or adjacent to, the Mid-town site were moved into native habitat onsite reserved as refugia for the species. These refugia are separated from the work area by protective fencing. Hand removal of dune lupine as part of mitigation for Morro blue butterfly (*Icaricia icarioides morroensis*) identified 17 adult Morro shoulderband snails in the

accumulated leaf litter and canopy of the shrubs. Three Morro shoulderband snails were discovered under sandbags during fence repair work. In the first week of June, approximately 2.83 ha of the 4.85-ha site were surveyed prior to site grading. During this 6-day period (152 survey hours), 351 individual Morro shoulderband snail individuals were captured and relocated to onsite refugia. Of these, approximately one-third were young of the year (SWCA 2013).

The majority of snails found on the Midtown site (greater than 90 percent) were found in non-native iceplant. Due to site grading that occurred in 2005, coastal dune scrub habitat consisted largely of young, widely spaced plants lacking substantial duff accumulation (with the exception of dune lupine). Large areas of the site were bare sand or had solid stands of the non-native veldt grass. Morro shoulderband snails were also observed in association with the following plant species: dune lupine, deerweed, mock heather, and veldt grass. Despite the native coyotebush (*Baccharis pilularis*) being the dominant shrub species onsite, no Morro shoulderband snails were identified in association with this species (SWCA 2013).

Collection System: The collection system is being constructed in street rights-of-way and ruderal, disturbed or ornamental areas in and along road shoulders and on private residential parcels (e.g., the lateral connections). All or portions of Binscarth, Henrietta, Court, Nancy, Garden, Vine, Santa Ysabel, Fairchild, Mountain View, Bush, Ferrell, 5th, 6th, 7th, 9th, 14th, 15th, 16th, 17th, and Los Osos Valley Road were subject to pre-construction surveys associated with installation of portions of the LOWWP collection system. Morro shoulderband snails in all life stages and varying abundances were identified in disturbed and ruderal habitats as part of this survey effort. As no native habitat was typically present in those areas where individuals were identified, captured individuals were relocated to offsite coastal dune scrub habitat in accordance with the "Morro Shoulderband Capture and Relocation Methodology" developed by the County (County of San Luis Obispo 2012).

Broderson Leach Field: The lower portions of the Broderson site, purposed as a leach field for recycled water, are known to have supported high densities of Morro shoulderband snails in the past. The species has also been documented on the upper slopes of the Broderson property in open areas containing coastal dune scrub (County of San Luis Obispo Public Works Department 2010a). As part of surveys conducted in association with eucalyptus removal efforts as part of the site preparation for the leach fields, 32 Morro shoulderband snails were identified and relocated out of harm's way into adjacent coastal dune scrub habitat. Of the captured individuals, 28 were found in coastal dune scrub/veldt grass habitat and 4 were found in eucalyptus duff in an ecotone between the eucalyptus groves and coastal dune scrub habitat. Additional Morro shoulderband snail surveys will be conducted prior to construction of the leach field.

Walker Staging Area: The Walker staging area is located at the southwest corner of Pismo Street and South Bay Boulevard. This area has been subject to past disturbance and, as such, areas considered likely to be occupied by Morro shoulderband snail include those along property boundary and fence lines. As part of surveys conducted prior to site preparation, 11 individuals were identified in the work area. Ten of these were discovered along the northern fence line with

the remaining individual found along the southern fence line. Surveys have continued since this area has been in use for materials staging and an additional 15 individuals have been detected along the northern property line, many on anthropogenic features (e.g., tarps, manhole covers). Of these, 13 were live specimens and 2 were recently dead. Coastal dune scrub located to the north of the Walker staging area supports a healthy population of Morro shoulderband snail and it appears individuals continue to move onto the staging area from this habitat.

EFFECTS OF THE ACTION

Morro Shoulderband Snail

Due to the large action area, variety of actions, and the cryptic nature of the Morro shoulderband snail, we do not expect all individuals to be identified, captured, and relocated. Proposed construction activities during the dry season would occur when Morro shoulderband snails are aestivating. Conducting surveys for snails when they are inactive substantially increases the difficulty in their detection; however, because much of the work entails removal of vegetation, species detectability has been increased thorough examination of the removed vegetation by the surveying biologists. Morro shoulderband snails may also suffer physiological stress or possibly death upon disturbance of their shelter sites or epiphragms. These effects can be substantially reduced by minimizing handling time of captured individuals and ensuring that capture and relocation of individuals is conducted only by biologists with demonstrable experience handling the species and who have familiarity with the habitat needs of the species. Even with the incorporation of those minimization measures made a part of the project description and the detailed nature of the on-going surveys, we anticipate some Morro shoulderband snails would still be subject to take in the form of injury and mortality as part of the proposed action.

When we first consulted with the USDA on this project, we conducted our effects analysis with the assumption that Morro shoulderband snails would be present in greater numbers in native habitat (i.e., coastal dune scrub or its ecotone with maritime chaparral). We concluded that substantially fewer individuals would be present in developed or otherwise disturbed areas where the majority of project activities would be occurring. Based upon results provided in the first annual report submitted for the LOWWP (SWCA 2013) and conversations between Service staff and County and consulting biologists conducting the surveys, we now know Morro shoulderband snails occur in a diversity of habitats throughout the community of Los Osos and disproportionately high numbers of individuals have been identified in disturbed and ruderal areas within the community itself. Individuals have also been encountered on anthropogenic structures such as fences, trailers, and stockpiled materials. As such, we believe there is the potential for adverse effects to Morro shoulderband snail wherever project activities are conducted.

The following text first discusses those general effects expected throughout the project area and follows with detailed information for individual project components.

Potential General Effects: Any individual Morro shoulderband snails not identified as part of pre-activity or ongoing monitoring would be subject to injury or death. All identified, live individuals would be subject to the effects of capture and relocation activities.

As part of the proposed action Morro shoulderband snails may be injured or killed by crushing as a result of vehicular (e.g., cars, trucks, heavy equipment) activity, foot traffic, or equipment storage. Individuals could also be injured or killed in association with vegetation removal, trenching activities, inspection of vegetation or anthropogenic objects as part of monitoring surveys, or other activities associated with project construction and site stabilization actions; during monitoring surveys or capture and relocation activities; and when vegetation is being carefully examined for species presence.

Morro shoulderband snails could also be injured or killed during habitat restoration and management activities. The primary methods typically used to remove non-native invasive plant species in the Los Osos area include hand-removal of plants or mowing, use of black or clear plastic over the soil surface to increase soil temperature and block sunlight (solarization), and/or herbicide application. The hand pulling or mowing may cause result in the degradation or loss of sheltering sites needed to create an appropriate microclimate for Morro shoulderband snails. Solarization has the potential to kill or injure Morro shoulderband snails if individuals become trapped beneath the plastic and subjected to the resultant high temperatures and lack of sunlight.

The potential effects of herbicides on Morro shoulderband snails are not known; however, if herbicides are used, individuals could be exposed to herbicides by ingestion and absorption while living in, or traveling through, a recently treated area. Direct herbicide spray or drift from spray could contaminate soil and/or adversely affect potential food sources and potential sheltering sites for Morro shoulderband snails.

The number of Morro shoulderband snails identified as part of pre-activity and monitoring surveys in 2012 was 617 individuals. Of these, only three individuals were injured or killed. This number represents less than 0.05 percent of the known individuals. Even considering those individuals that might not be discovered as part of pre-activity and monitoring surveys, we anticipate that less than 1 percent of those Morro shoulderband snails likely to be present in activity areas within the action area (estimated to be up to 3,000) would be subject to take in the form of injury or mortality. The remainder of the identified individuals would be subject to the effects of capture and relocation.

Potential Effects by Location

- Treatment Plant Site: The treatment plant site at the former Giacomazzi parcel does not have appropriate habitat for the Morro shoulderband snail and the species was not observed during surveys conducted in December 2009. As such, we do not anticipate Morro shoulderband snails to be adversely affected by construction and operations at this site.

- Andre Property: Similar to its neighbor, the Giacomazzi parcel, the Andre property lacks suitable habitat for the species and no Morro shoulderband snails were found as part of surveys conducted in 2009. As such, we do not anticipate Morro shoulderband snails to be adversely affected by activities at this site.

- The Mid-Town Site: In our previous consultation, based upon data available at the time, we anticipated that restoration and enhancement of approximately 2 ha of the Mid-Town site could adversely affect a small number of Morro shoulderband snails. Pre-activity surveys conducted in 2012 revealed there were many more individuals than anticipated. A total of 404 individuals were captured and relocated into 0.73 ha of undisturbed coastal dune scrub retained onsite to serve as refugia for the species. Of these, none were injured or killed. We expect additional Morro shoulderband snails to be identified at the Mid-Town site in association with the management and monitoring necessary to affect a successful habitat restoration program. These individuals would be subject to the effects of capture and relocation activities; however, we anticipate very few would be injured or killed. The long-term effects of those activities on the Mid-Town site will be beneficial to the Morro shoulderband snail, as a primary restoration goal is to re-establish suitable habitat into which Morro shoulderband snails that remain onsite and those that may disperse in from adjacent occupied habitat can establish.

- Pump and Pocket Stations: Based upon new information regarding the species' use of a diversity of habitat types within the action area, we expect Morro shoulderband snails are likely present at the pump and pocket station areas identified in Figure 1. Those individuals identified during pre-activity surveys will be subject to the effects associated with capture and relocation and we anticipate very few individuals would be injured or killed.

- Collection System: The collection system is currently being constructed within street rights-of-way and other areas that are, for the most part, highly disturbed and/or comprised of ruderal or non-native vegetation. Lateral connections to existing individual customers and abandonment of septic systems would also temporarily disturb habitat that may support Morro shoulderband snails. While we previously anticipated very low numbers of Morro shoulderband snails would be affected due to the disturbed nature of these work areas, we now know a substantial number of individuals may be present in these areas. As such, greater numbers could be adversely affected as part of the installation of the collection system. Of the 144 individuals identified as part of pre-activity surveys conducted in 2012, none were injured or killed. Of the additional individuals identified as part of pre-construction surveys necessary to complete the installation of the collection system, all would be subject to the effects of capture and relocation. Based upon past experience, we anticipate very few would be injured or killed.

- Broderson Leach Field: In the previous consultation, we determined that the construction of the leach field at the Broderson site would result in the direct loss of habitat for Morro

shoulderband snail and maintenance would result in the recurring loss (on an estimated 10 year rotation). Such activities have the potential to result in injury or mortality of individuals not identified during pre-activity surveys. Identified individuals would be subject to the effects associated with their capture and relocation. In 2012, activities at the Broderson leach field included grading of an access road to eucalyptus stands, felling of trees, chipping of the felled material, and installation of erosion control management practices. Work did not include excavating or grading for the leach field installation. As part of monitoring surveys, biologists identified 33 Morro shoulderband snails. Of these, 32 were captured and relocated. Only one individual was found injured as part of this survey effort. The number of individuals identified during pre-activity monitoring at the Broderson site was lower than expected. Of those individuals captured, 28 were identified in coastal dune scrub-veldt grass habitat and 4 were observed in an ecotone between the eucalyptus and coastal dune scrub habitats. All were relocated to adjacent coastal dune scrub habitat. It is anticipated that surveys conducted prior to the commencement of leach field construction will identify additional Morro shoulderband snails and these individuals would be subject to the effects of capture and relocation. We expect very few individuals would be injured or killed.

- Walker Staging Area: The Walker Staging Area is located at the corner of Pismo Avenue and South Bay Boulevard and just south of relatively intact coastal dune scrub habitat. The Walker site has been subject to past disturbances; therefore, our previous opinion anticipated that the number of Morro shoulderband snails that could be adversely affected would be low. Pre-activity surveys identified 36 individuals, 2 of which were recently deceased. These two appeared to have drowned in water that collected on tarps used to protect construction materials housed at the staging area. This was a wholly unanticipated effect. Based on recent survey results and ongoing observations, it appears that coastal dune scrub habitat located to the north of the Walker site supports a healthy population of Morro shoulderband snails that continue to disperse onto the Walker site. These individuals are often found on tarps covering materials or attached to concrete manholes. As part of ongoing monitoring to detect those individuals that appear to be dispersing in from native habitat to the north (despite the use of silt fencing to discourage this activity), we anticipate more individuals of Morro shoulderband snail will be identified. While the majority of individuals will be subject to the effects of capture and relocation, some will likely be injured or die as a result of ongoing use of the site as a staging area.

- Dewatering System: The installation of the dewatering system is not likely to adversely affect Morro shoulderband snails; the above-ground piping could attract individuals. As part of ongoing monitoring and that performed prior to dismantling this temporary system, Morro shoulderband snails are likely to be identified. These individuals would then be subject to the effects of capture and relocation; however, it is anticipated very few, if any, of these individuals would be injured or die.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Based upon the analysis in the previous biological opinion for the LOCSD wastewater project, we expect the CRWQCB to remove the building moratorium established by Resolution 83-13 when the proposed wastewater project is operational. This lifting of the moratorium would likely result in the build-out of those vacant lots that remain within the wastewater service area. Approximately 50.6 ha of degraded and fragmented Morro shoulderband snail habitat could be removed within this area as a result of the anticipated build-out. The wastewater service area consists primarily of parcels (approximately 500) that are less than 0.4 ha in size. These small parcels contain an estimated10.1 ha of fragmented and degraded Morro shoulderband snail habitat. The remaining 40 or so lots within the wastewater service area that are greater than 1 acre in size contain approximately 40.5 ha of potential Morro shoulderband snail habitat that is, for the most part, also fragmented and degraded. None of the parcels in the wastewater service area are within designated critical habitat for the Morro shoulderband snail or identified in the recovery plan as important for the recovery of this species (Service 1998).

The County is developing a Habitat Conservation Plan to address development both inside and outside the sewer service area. Other covered activities anticipated to be addressed in the plan include operation and maintenance, required hazard abatement (i.e., fuels reduction, creation of defensible space), and facility development. As part of this plan, the County is seeking authorization for incidental take of the Morro shoulderband snail pursuant to section 10(a)(1)(B) of the Act.

CONCLUSION

After reviewing the current status of the Morro shoulderband snail, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that construction of the LOWWP, as proposed, is not likely to jeopardize the continued existence of the Morro shoulderband snail. We have reached these conclusions for the following reasons:

1. The County will continue to implement measures to minimize the adverse effects of the proposed project the Morro shoulderband snail, inclusive of those contained in the project description, the Final Environmental Impact Report, and the Coastal Development Permit;

2. Relatively few adult Morro shoulderband snails are likely be injured or killed because detailed pre-activity and monitoring surveys afford the opportunity for capture/relocation of individuals out of harm's way;

3. Habitat restoration activities at the Mid-Town and other sites, as provided for in the project description, would benefit the Morro shoulderband snail by contributing to its conservation and recovery; and

4. Protection and management of 28 ha of existing native habitat at the Broderson site would contribute to the conservation and recovery of Morro shoulderband snail.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary and USDA must include them as binding conditions of any contracts associated with the proposed action, for the exemption in section 7(o)(2) to apply. The USDA has a continuing duty to regulate the activity covered by this incidental take statement. If the USDA fails to require its contractors to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to its authorization, or contracts, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the USDA must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

All Morro shoulderband snails found within the project area may be subject to take in the form of capture and relocation efforts. A subset of captured Morro shoulderband snails may experience a significant disruption of normal behavioral patterns to the point that reaches the level of harassment. Any Morro shoulderband snails that remain in the project area may be subject to increased predation, crushed or entombed during construction activities, or be otherwise injured or killed.

Numbers and locations of Morro shoulderband snails within a population vary from year to year and injured or killed Morro shoulderband snails would be difficult to detect because of their small body size and cryptic nature. Take by predation as a result of exposure due to project activities would likely be impossible to detect. While we cannot determine the precise number

of Morro shoulderband snails that may be harassed, harmed, injured, or killed as a result of the proposed action, it is our opinion that no more than 1 percent of an estimated 3,000 individuals identified would be subject to these forms of incidental take. The County will continue to use those minimization measures described in the project description section of this document and incorporated by reference from biological opinion 8-8-11-F-5R.

This biological opinion does not exempt any activity from the prohibitions against take contained in section 9 of the Act that is not incidental to the actions as described in this biological opinion. Take that occurs outside of the action area or from any activity not described in this biological opinion is not exempted from the prohibitions against take described in section 9 of the Act.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the take of Morro shoulderband snails:

1. Worker environmental education programs must be implemented by the USDA and County.

2. Only Service-authorized biologists may survey for, monitor, handle, capture, and/or relocate Morro shoulderband snails.

3. Service-authorized biologists must have the authority to stop work if project-related activities occur outside the demarcated project boundaries if Morro shoulderband snails are detected.

4. The USDA must ensure that the amount and form of incidental take is commensurate with the analysis contained within this biological opinion.

The Service's evaluation of the effects of the proposed actions includes consideration of the measures proposed by the USDA to minimize the adverse effects of the wastewater project on the Morro shoulderband snail. Any subsequent changes to these measures may constitute a modification of the proposed action and warrant reinitiation of formal consultation, as specified at 50 CFR 402.16. These reasonable and prudent measures are intended to clarify or supplement the protective measures included in the description of the proposed action.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the Act, the USDA must ensure that the County complies with the following terms and conditions, which implement the reasonable and prudent measures described above.

1. The following terms and conditions implement reasonable and prudent measure 1:

    a. The worker environmental education program must be developed and presented by a Service-authorized biologist with experience in the identification of the Morro shoulderband snail and its habitat. The program must include descriptions and pictures of the Morro shoulderband snail, relevant provisions of the Endangered Species Act, specific measures being implemented to conserve the Morro shoulderband snail as they relate to the project and the project boundaries within which the work will occur, and identify a chain-of-command for all operational activities that would occur in Morro shoulderband snail habitat.

    b. Eric Wier, Kate Ballantyne, John Farhar, Katie Drexhage, Kelly Sypolt, Bob Sloan, Travis Belt, and Barrett Holland are hereby authorized to present this program. The USDA must request the Service's authorization of any other biologists it wishes to employ to present this environmental education. This request must be in writing and received by the Service at least 15 working days prior to the intended start date.

2. The following terms and conditions implement reasonable and prudent measure 2:

    a. Only Service-authorized biologists may survey for, monitor, capture, handle, or relocate Morro shoulderband snails. Eric Wier, Kate Ballantyne, John Farhar, Katie Drexhage, Kelly Sypolt, Bob Sloan, Travis Belt, and Barrett Holland are hereby authorized to independently conduct such activities as described in this biological opinion. Trevis Warner is authorized to conduct such activities only under the direct supervision of one of the above persons. The USDA must request the Service's authorization of any other biologists it wishes to employ to conduct these activities relative to the proposed project. This request must be in writing and received by the Service at least 15 working days prior to the intended start date.

    b. Any project areas not identified in the project description and biological assessment for the proposed action must be surveyed for the presence of Morro shoulderband snail. Survey results must be provided to the Service to ensure that any effects to Morro shoulderband snail do not exceed that identified and analyzed in this biological opinion.

3. The following term and condition implements reasonable and prudent measure 3:

    A Service-authorized biologist must monitor the proposed project area(s) daily during work activities until completion of initial site disturbance at each project site and have the authority to stop project activities that occur outside the demarcated boundaries of the construction footprint until such time as identified Morro shoulderband snails can be relocated to suitable habitat out of harm's way or the Service is contacted regarding how to proceed regarding the presence of an unanticipated federally listed species within the work area. Eric Wier, Kate Ballantyne, John Farhar, Katie

Drexhage, Kelly Sypolt, Bob Sloan, Travis Belt, and Barrett Holland are hereby authorized to conduct such monitoring and to direct the cessation of any work activities if they are anticipated to exceed demarcated project boundaries.

4. The following terms and conditions implement reasonable and prudent measure 4:

   a. The County must ensure that monitoring surveys are conducted as described in the project description and keep a detailed record of all Morro shoulderband snails captured and relocated, inclusive of the number of individuals, their capture site, and area of relocation.

   b. If more than 150 adult Morro shoulderband snails are found dead or injured during project implementation, the USDA or County must contact the Ventura Fish and Wildlife Office as soon as possible so that we can review the project activities and effects analysis to determine if additional protective measures are needed.

REPORTING REQUIREMENTS

For the duration of activities addressed pursuant to the biological opinion, the County must provide a written report to the Service by January 31 of each calendar year that documents the number and size of all Morro shoulderband snails identified, captured, and relocated from the action area, the date and time of relocation, and a description of relocation sites. The report must also provide photographic evidence and the number of Morro shoulderband snails killed or injured, describing the circumstances of the mortalities or injuries if known. The report must contain a brief discussion of any problems encountered in implementing minimization measures, results of biological surveys and sighting records, and any other pertinent information such as the acreage affected and restored or undergoing restoration of each habitat type. Upon project completion, the County must submit a written report that provides an overall summary of the annual reports submitted. This report must be submitted within 30 days of project completion.

In addition, the County must submit the results of all habitat restoration or enhancement activities conducted in relation to the proposed project. This timeframe may be modified with approval from the Service. We encourage you to submit recommendations regarding modification of or additional measures that would improve or maintain protection of the Morro shoulderband snail and simplify compliance with the Act.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The USDA should encourage the County to prepare and seek publication of an article in a peer reviewed journal that describes the restoration program implemented as part of the LOWWP in order to contribute to the body of knowledge regarding similar activities being undertaken for the recovery of listed species and to allow others to benefit from those lessons learned such that we may increase the success of similar, future habitat restoration efforts.

The USDA should encourage the County to prepare and seek publication of an article in a peer-reviewed journal that describes all of those habitat types in which Morro shoulderband snails are found during the course of the project to provide a greater understanding of the species.

The USDA should encourage the County to collect information on the survival of Morro shoulderband snails that were captured and relocated as part of this project in order to provide an understanding of the efficacy of this practice as a minimization measure.

The Service requests notification of the implementation of any conservation recommendations so we may be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the request for consultation. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any questions, please contact Julie M. Vanderwier at (805) 644-1766, extension 222.

Sincerely,

Diane K. Noda
Field Supervisor

REFERENCES CITED

Burke, T.E., J.S. Applegarth, and T.E. Weasma. 1999. Management recommendations for survey of terrestrial mollusk species - Terrestrial Mollusks. USDA Forest Service R-5/6, DOI Bureau of Land Management OR/WA/CA.

[CRWQCB] California Regional Water Quality Control Board. 2001. Status report on the Los Osos Community Services District wastewater project, San Luis Obispo County. San Luis Obispo, California.

[CRWQCB] California Regional Water Quality Control Board. 2002. Support document for Morro Bay total maximum daily load for pathogens (including Chorro and Los Osos Creeks). San Luis Obispo, California.

County of San Luis Obispo, Public Works Department. 2010a. Los Osos Wastewater Project biological assessment. January.

County of San Luis Obispo, Public Works Department. 2010b. Morro shoulderband snail modified protocol survey report for the Los Osos Wastewater Project – Mid-town site. Memorandum from Kate Ballantyne to Julie Vanderwier, November 4.

County of San Luis Obispo, Public Works Department. 2012. Morro shoulderband snail capture and relocation methodology. Memorandum from Eric Wier, County of San Luis Obispo, to Julie M. Vanderwier, Ventura Fish and Wildlife Office, March 29.

Huntzinger, M., R. Karban, and J.H. Cushman. 2008. Negative effects of vertebrate herbivores on invertebrates in a coastal dune community. Ecology 89:1972-1980.

Roth, B. 1985. Status survey of the banded dune snail, *Helminthoglypta walkeriana*. Final report. U.S. Fish and Wildlife Service, Sacramento Endangered Species Office, California.

Roth, B., and J. Tupen. 2004. Revision of the systematic status of *Helminthoglypta walkeriana morroensis* (Hemphill 1911) (Gastropoda: Pulmonata). Zootaxa 616:1-23.

SWCA Environmental Consultants. 2013. 2012 Annual Construction Monitoring Report for the Los Osos Wastewater Project, San Luis Obispo, California. Prepared for the County of San Luis Obispo, January.

Tenera Environmental, Inc. 2006. Letter from Dan Dugan to Steve Kirkland, VFWO, regarding presence of Morro and Chorro shoulderband snails on the Lee Property. April 3.

[Service] U.S. Fish and Wildlife Service. 1994. Final rule: endangered or threatened status for five plants and the Morro shoulderband snail from western San Luis Obispo County, California, December 15.

[Service] U.S. Fish and Wildlife Service. 1998. Recovery plan for the Morro shoulderband snail and four plants from western San Luis Obispo County, California. U.S. Fish and Wildlife Service, Portland, Oregon. 75 pp.

[Service] U.S. Fish and Wildlife Service. 2001. Final determination of critical habitat for the Morro shoulderband snail (*Helminthoglypta walkeriana*). 50 CFR Part 17. Prepared by the U.S. Fish and Wildlife Service, Ventura California for the U.S. Fish and Wildlife Service, Portland, Oregon.

[Service] U.S. Fish and Wildlife Service. 2006. Banded dune snail (*Helminthoglypta walkeriana)* [=Morro shoulderband snail (*Helminthoglypta walkeriana)* and Chorro shoulderband snail (*Helminthoglypta morroensis)*]; 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service. Ventura, California.

van der Laan, K.L. 1973a. Aestivation in the land snail *Helminthoglypta arrosa* (Binney) (Pulmonata: Helicidae). The Veliger 17:360-368.

van der Laan, K.L. 1973b. Feeding preferences in a population of the land snail *Helminthoglypta arrosa* (Binney) (Pulmonata: Helicidae). The Veliger 17:354-359.

van der Laan, K.L. 1980. Terrestrial pulmonate reproduction: seasonal and annual variation and environmental factors in *Helminthoglypta arrosa* (Binney) (Pulmonata:Helicidae). The Veliger 23:48-54.

Walgren, M. 2003. The current status of the Morro shoulderband snail (*Helminthoglypta walkeriana*). Masters Thesis, California Polytechnic State University. San Luis Obispo, California.