Risks of Telone Use to Federally Threatened California Red-legged Frog

(*Rana aurora draytonii*)

$$Cl – CH = CH – CH_2 - Cl$$

Pesticide Effects Determination

Environmental Fate and Effects Division
Office of Pesticide Programs
Washington, D.C. 20460

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1. Executive Summary

The purpose of this assessment is to evaluate potential direct and indirect effects on the California red-legged frog *(Rana aurora draytonii*) (CRLF) arising from FIFRA regulatory actions regarding use of Telone on agricultural and non-agricultural sites. In addition, this assessment evaluates whether these actions can be expected to result in modification of the species' designated critical habitat. This assessment was completed in accordance with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) *Endangered Species Consultation Handbook* (USFWS/NMFS, 1998) and procedures outlined in the Agency's Overview Document (U.S. EPA, 2004).

The CRLF was listed as a threatened species by USFWS in 1996. The species is endemic to California and Baja California (Mexico) and inhabits both coastal and interior mountain ranges. A total of 243 streams or drainages are believed to be currently occupied by the species, with the greatest numbers in Monterey, San Luis Obispo, and Santa Barbara counties (USFWS, 1996) in California.

Telone is a soil fumigant used to kill insects, fungi, and nematodes. Application methods include soil injection with a barrier (tarp) to prevent premature evaporation and drip irrigation. Currently, labeled uses of Telone include a wide variety of agricultural uses and turf. The following uses are considered as part of the federal action evaluated in this assessment: agriculture, orchards, vineyards, and turf.

Telone (*cis*- and *trans*-1,3-dichloropropene) is a low molecular weight, volatile chlorinated hydrocarbon. It is expected to dissipate mainly by evaporation, either directly from the soil, or from water after being transported there from the soil. It is mobile in soil-water systems, and so may be transported to groundwater; however, the 13.5-day hydrolysis half-life at 20ºC (2 days at 29ºC) tends to mitigate the potential for persistent groundwater contamination. Due to the application methods (injection and drip irrigation), spray drift is not expected to be a significant exposure route. However, inhalation of vapors at the time that fumigation tarps are removed may be significant at the edge of the treated field; this exposure will be quantified with laboratory and field volatility studies. Because it is an olefin (unsaturated hydrocarbon), telone is subject to oxidation by ozone and hydroxyl radicals in the atmosphere, so long-range transport and re-deposition may not be an exposure route. Run-off to water bodies will be considered as an exposure route, however, previous experience has shown that the surface water exposure model, PRZM-EXAMS, is not well-suited to a chemical as volatile as telone, and may over-estimate concentrations in surface water. Monitoring data for both surface and ground water, including California, generally show that contamination with telone is rare.

Since CRLFs exist within aquatic and terrestrial habitats, exposure of the CRLF, its prey and its habitats to Telone are assessed separately for the two habitats. Tier-II aquatic exposure models are used to estimate high-end exposures of Telone in aquatic habitats resulting from runoff and spray drift from different uses. Peak model-estimated environmental concentrations resulting from different Telone uses range from 1.2 to 448 µg/L with the PRZM volatilization routine turned on, and 36.9 to 1270 µg/L with the routine turned off. These estimates are supplemented with analysis of available California surface water monitoring data from U. S. Geological Survey's National Water Quality Assessment (NAWQA) program and the California Department of Pesticide Regulation, as well as other targeted monitoring in surface and ground water. In general, telone is not detected in surface water in California or elsewhere due to its rapid volatilization both from soil and water. (The EPISuite v3.12 program (EPA, 2000) estimates that the volatilization half-life from a 1-meter deep river, flowing at 3 meters per second, with a wind speed of 1 meter per second, is 3.3 hours. For a lake of 1 meter depth, with a current of 0.05 meters per second, and a wind velocity of 0.5 meters per second, the volatilization half-life is 4.2 days.) However, it has been infrequently detected in targeted ground water studies. The exposure estimates from the PRZM-EXAMS model are expected to be conservative, that is, higher than actual exposures in the open environment. PRZM-EXAMS exposure estimates for telone must be viewed with caution because the model was not designed for use with a chemical as volatile as telone.

Due to its volatility, and the methods of application (soil injection and drip irrigation), there is expected to be no dietary exposure for the terrestrial-phase CRLF. Thus, dietary exposure models such as T-REX and T-HERPS will not be used. Anticipated exposure routes are inhalation, and runoff water. These exposure routes will be quantified by use of laboratory and field volatility studies, and by use of applied irrigation water concentrations. Based on application methods, spray drift is not expected to be an exposure route, thus the AgDrift and AgDisp models will not be used. The TerrPlant model is used to estimate Telone exposures to terrestrial-phase CRLF habitat, including plants inhabiting semi-aquatic and dry areas, resulting from runoff.

The effects determination assessment endpoints for the CRLF include direct toxic effects on the survival, reproduction, and growth of the CRLF itself, as well as indirect effects, such as reduction of the prey base or modification of its habitat. Direct effects to the CRLF in the aquatic habitat are based on toxicity information for freshwater fish, which are generally used as a surrogate for aquatic-phase amphibians. In the terrestrial habitat, direct effects are based on toxicity information for birds, which are used as a surrogate for terrestrial-phase amphibians. Given that the CRLF's prey items and designated critical habitat requirements in the aquatic habitat are dependant on the availability of freshwater aquatic invertebrates and aquatic plants, toxicity information for these taxonomic groups is also discussed. In the terrestrial habitat, indirect effects due to depletion of prey are assessed by considering effects to terrestrial insects, small terrestrial mammals, and frogs. Indirect effects due to modification of the terrestrial habitat are characterized by available data for terrestrial monocots and dicots.

Degradates of telone include chlorinated alcohols formed by substitution of –OH for –Cl, and chlorinated acids formed by further oxidation of the alcohols. The degradates are less volatile, and more water soluble than parent telone, and are therefore more likely to remain in water. The amounts of degradates formed are too low to quantitatively affect the risk quotient based on parent telone alone.

Risk quotients (RQs) are derived as quantitative estimates of potential high-end risk. Acute and chronic RQs are compared to the Agency's levels of concern (LOCs) to identify instances where Telone use within the action area has the potential to adversely affect the CRLF and its designated critical habitat via direct toxicity or indirectly based on direct effects to its food supply (i.e., freshwater invertebrates, algae, fish, frogs, terrestrial invertebrates, and mammals) or habitat (i.e., aquatic plants and terrestrial upland and riparian vegetation). When RQs for a particular type of effect are below LOCs, the pesticide is determined to have "no effect" on the subject species. Where RQs exceed LOCs, a potential to cause adverse effects is identified, leading to a conclusion of "may affect." If a determination is made that use of Telone use within the action area "may affect" the CRLF and its designated critical habitat, additional information is considered to refine the potential for exposure and effects, and the best available information is used to distinguish those actions that "may affect, but are not likely to adversely affect" (NLAA) from those actions that are "likely to adversely affect" (LAA) the CRLF and its critical habitat.

Based on the best available information, the Agency makes a May Affect, But Not Likely to Adversely Affect determination for the CRLF from the use of Telone. Additionally, the Agency has determined that there is not the potential for modification of CRLF designated critical habitat from the use of the chemical. A "May Affect" was concluded for direct effects to the CRLF, and for indirect effects via freshwater invertebrates and fish/frogs as dietary items. Also, there is a "May Affect" due to potential effects on terrestrial vegetation. It was concluded, however, that telone is "Not Likely to Adversely Affect" the CRLF, due to its absence in surface water monitoring data, and the known shortcomings of the aquatic exposure model when applied to telone. A summary of the risk conclusions and effects determinations for the CRLF and its critical habitat is presented in Tables 1.1 and 1.2. Further information on the results of the effects determination is included as part of the Risk Description in Section 5.2.

Table 1.1 Effects Determination Summary for Direct and Indirect Effects of Telone on the CRLF

Assessment Endpoint	Effects Determination[1]	Basis for Determination
Aquatic-Phase CRLF (Eggs, Larvae, and Adults)		
Direct Effects: Survival, growth, and reproduction of CRLF individuals via direct effects on aquatic phases	May Affect, But Not Likely to Adversely Affect	Acute RQs for the CRLF exceed LOC for most uses, based on PRZM-EXAMS modeling. However, the demonstrated inappropriateness of PRZM-EXAMS for telone and the low rate of detection in targeted and non-targeted monitoring make the potential effects discountable.
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via effects to food supply (*i.e.*, freshwater invertebrates, non-vascular plants, fish, and frogs)	Freshwater invertebrates: May Affect, But Not Likely to Adversely Affect	Acute RQs for the CRLF exceed LOC for most uses, based on PRZM-EXAMS modeling. However, the demonstrated inappropriateness of PRZM-EXAMS for telone and the low rate of detection in targeted and non-targeted monitoring make the potential effects discountable.
	Non-vascular aquatic plants: No Effect	All RQs are below LOC.
	Fish and frogs: May Affect, But Not Likely to Adversely Affect	Acute RQs for the CRLF exceed LOC for most uses, based on PRZM-EXAMS modeling. However, the demonstrated inappropriateness of PRZM-EXAMS for telone and the low rate of detection in targeted and non-targeted monitoring make the potential effects discountable.

Indirect Effects: Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat, cover, and/or primary productivity (*i.e.*, aquatic plant community)	Non-vascular aquatic plants: No Effect	All RQs are below LOC.
	Vascular aquatic plants: No Effect	All RQs are below LOC.
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via effects to riparian vegetation, required to maintain acceptable water quality and habitat in ponds and streams comprising the species' current range.	May Affect, But Not Likely to Adversely Affect	RQs are exceeded for terrestrial plants, however, the model TerrPlant is not suited to volatile chemicals. The effects are therefore discountable.
Terrestrial-Phase CRLF (Juveniles and adults)		
Direct Effects: Survival, growth, and reproduction of CRLF individuals via direct effects on terrestrial phase adults and juveniles	No Effect	All RQs are below LOC
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via effects on prey (*i.e.*, terrestrial invertebrates, small terrestrial vertebrates, including mammals and terrestrial phase amphibians)	Terrestrial invertebrates: No Effect	All RQs are below LOC
	Mammals: No Effect	All RQs are below LOC
	Frogs: No Effect	All acute RQs are below LOC; chronic data are not available, but are not expected based on mammal toxicity data.
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat (*i.e.*, riparian vegetation)	May Affect, But Not Likely to Adversely Affect.	RQs are exceeded for terrestrial plants, however, the model TerrPlant is not suited to volatile chemicals. The effects are therefore discountable.
[1] NE = no effect; NLAA = may affect, but not likely to adversely affect; LAA = likely to adversely affect		

Table 1.2 Effects Determination Summary for the Critical Habitat Impact Analysis

Assessment Endpoint	Effects Determination[1]	Basis for Determination
Aquatic-Phase CRLF PCEs (Aquatic Breeding Habitat and Aquatic Non-Breeding Habitat)		
Alteration of channel/pond morphology or geometry and/or increase in sediment deposition within the stream channel or pond: aquatic habitat (including riparian vegetation) provides for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRLFs.	No Habitat Modification	NLAA for Terrestrial Vegetation, therefore no habitat modification due to riparian vegetation
Alteration in water chemistry/quality including temperature, turbidity, and oxygen content necessary for normal growth and viability of juvenile and adult CRLFs and their food source.[1]	No Habitat Modification	Very low telone residues are expected in surface water based on monitoring data, therefore no water chemistry changes.
Alteration of other chemical characteristics necessary for normal growth and viability of CRLFs and their	No Habitat Modification	Very low telone residues are expected in surface water based on monitoring data, therefore no water

[1] Physico-chemical water quality parameters such as salinity, pH, and hardness are not evaluated because these processes are not biologically mediated and, therefore, are not relevant to the endpoints included in this assessment.

food source.		chemistry changes.
Reduction and/or modification of aquatic-based food sources for pre-metamorphs (*e.g.*, algae)	No Effect	NLAA or NE for all aquatic food sources.
Terrestrial-Phase CRLF PCEs (Upland Habitat and Dispersal Habitat)		
Elimination and/or disturbance of upland habitat; ability of habitat to support food source of CRLFs: Upland areas within 200 ft of the edge of the riparian vegetation or dripline surrounding aquatic and riparian habitat that are comprised of grasslands, woodlands, and/or wetland/riparian plant species that provides the CRLF shelter, forage, and predator avoidance	No Habitat Modification	No Effect on terrestrial food sources, and NLAA for terrestrial vegetation.
Elimination and/or disturbance of dispersal habitat: Upland or riparian dispersal habitat within designated units and between occupied locations within 0.7 mi of each other that allow for movement between sites including both natural and altered sites which do not contain barriers to dispersal	No Habitat Modification	
Reduction and/or modification of food sources for terrestrial phase juveniles and adults	No Effect	No Effect on terrestrial food items (invertebrates, mammals, frogs).
Alteration of chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs and their food source.	No Effect	No Effect on CRLF and food sources.
[1] NE = No effect; HM = Habitat Modification		

When evaluating the significance of this risk assessment's direct/indirect and habitat modification effects determinations, it is important to note that pesticide exposures and predicted risks to the species and its resources (i.e., food and habitat) are not expected to be uniform across the action area. In fact, given the assumptions of drift and downstream transport (i.e., attenuation with distance), pesticide exposure and associated risks to the species and its resources are expected to decrease with increasing distance away from the treated field or site of application. Evaluation of the implication of this non-uniform distribution of risk to the species would require information and assessment techniques that are not currently available. Examples of such information and methodology required for this type of analysis would include the following:

- Enhanced information on the density and distribution of CRLF life stages within specific recovery units and/or designated critical habitat within the action area. This information would allow for quantitative extrapolation of the present risk assessment's predictions of individual effects to the proportion of the population extant within geographical areas where those effects are predicted. Furthermore, such population information would allow for a more comprehensive evaluation of the significance of potential resource impairment to individuals of the species.
- Quantitative information on prey base requirements for individual aquatic- and terrestrial-phase frogs. While existing information provides a preliminary picture of the types of food sources utilized by the frog, it does not establish minimal requirements to sustain healthy individuals at varying life stages. Such information could be used to establish biologically relevant thresholds of effects on the prey base, and ultimately establish geographical limits to those effects.

This information could be used together with the density data discussed above to characterize the likelihood of adverse effects to individuals.

- Information on population responses of prey base organisms to the pesticide. Currently, methodologies are limited to predicting exposures and likely levels of direct mortality, growth or reproductive impairment immediately following exposure to the pesticide. The degree to which repeated exposure events and the inherent demographic characteristics of the prey population play into the extent to which prey resources may recover is not predictable. An enhanced understanding of long-term prey responses to pesticide exposure would allow for a more refined determination of the magnitude and duration of resource impairment, and together with the information described above, a more complete prediction of effects to individual frogs and potential modification to critical habitat.

2. Problem Formulation

Problem formulation provides a strategic framework for the risk assessment. By identifying the important components of the problem, it focuses the assessment on the most relevant life history stages, habitat components, chemical properties, exposure routes, and endpoints. The structure of this risk assessment is based on guidance contained in U.S. EPA's *Guidance for Ecological Risk Assessment* (U.S. EPA 1998), the Services' *Endangered Species Consultation Handbook* (USFWS/NMFS 1998) and is consistent with procedures and methodology outlined in the Overview Document (U.S. EPA 2004) and reviewed by the U.S. Fish and Wildlife Service and National Marine Fisheries Service (USFWS/NMFS 2004).

2.1 Purpose

The purpose of this endangered species assessment is to evaluate potential direct and indirect effects on individuals of the federally threatened California red-legged frog *(Rana aurora draytonii*) (CRLF) arising from FIFRA regulatory actions regarding use of Telone in agricultural fumigation uses. Crops on which Telone is used in California include alfalfa, almond, apple, apricot, asparagus, banana, barley, beans, beets, blackberry, blueberry, boysenberry, broccoli, brussel sprouts, buckwheat, cabbage, carrot, cashew, cauliflower, celery, Swiss chard, cherry, chestnut, citrus, clover, cole crops, collards, corn (unspecified), corn (pop), cotton, cowpea/black-eyed pea, cranberry, cucumber, currant, date, deciduous fruit trees, dewberry, eggplant, endive, field crops, fig, filbert, flax, forest plantings (reforestation programs – tree farms, tree plantations, etc.), forest nursery plantings, forest trees (all or unspecified), fruits, garlic, gooseberry, grapefruit, grapes, grass forage/fodder/hay, hickory nut, hops, horseradish, huckleberry, kale, kenaf, kohlrabi, kumquat, leek, legume vegetables, lemon, lespedeza, lettuce, lime, loganberry, melon (cantaloupe), melon (water), millet (foxtail), proso millet (broomcorn), mint/peppermint/spearmint, mustard, nectarine, oats, okra, olive, onion, orange, ornamental trees, ornamental nonflowering plants, ornamental lawns and turf, parsnip, pastures, peach, peanuts, pear, peas (unspecified), pecan, pepper, pepper (chili type), persimmon, pimento, plum, pomegranate, potato, prune, pumpkin, quince, radish, raspberry (black, red), rutabaga, rye, safflower, salsify, shallot, soil – preplant/outdoor, sorghum, sorghum (unspecified), soybeans (unspecified), spinach, spruce (forest), squash (summer), squash (winter), stone fruits, strawberry, sugar beet, sugarcane, sweet potato, tangelo, tangerines, tomato, trefoil, tree nuts, turnip (root), vegetables, vetch, walnut (English/black), wheat, and youngberry. In addition, this assessment evaluates whether use on these crops is expected to result in modification of the species' designated critical habitat. This ecological risk assessment has been prepared consistent with a settlement agreement in the case *Center for Biological Diversity (CBD) vs. EPA et al*. (Case No. 02-1580-JSW(JL)) settlement entered in Federal District Court for the Northern District of California on October 20, 2006.

In this assessment, direct and indirect effects to the CRLF and potential modification to its designated critical habitat are evaluated in accordance with the methods described in the Agency's Overview Document (U.S. EPA 2004). Screening level methods include use of standard models such as PRZM-EXAMS, T-REX, TerrPlant, AgDRIFT, and AGDISP, all of which are described at length in the Overview Document. Due to the volatile nature of telone, and the application methods used, spray drift and dietary exposure (i.e., residues on leaves, fruits, pods, insects) are not expected. Therefore, the T-REX, T-HERPS, AgDrift, and AGDISP models are not used. Rather, field volatility experiments and drip irrigation application rates (as soil concentrations) are used to assess risk to animals from exposure via inhalation and incidental soil ingestion. TerrPlant will also be used to estimate risks to plants in areas adjacent to treated fields.

In accordance with the Overview Document, provisions of the ESA, and the Services' *Endangered Species Consultation Handbook*, the assessment of effects associated with registrations of Telone is based on an action area. The action area is the area directly or indirectly affected by the federal action, as indicated by the exceedence of the Agency's Levels of Concern (LOCs). It is acknowledged that the action area for a national-level FIFRA regulatory decision associated with a use of Telone may potentially involve numerous areas throughout the United States and its Territories. However, for the purposes of this assessment, attention will be focused on relevant sections of the action area including those geographic areas associated with locations of the CRLF and its designated critical habitat within the state of California. As part of the "effects determination," one of the following three conclusions will be reached regarding the potential use of Telone in accordance with current labels:

- "No effect";
- "May affect, but not likely to adversely affect"; or
- "May affect and likely to adversely affect".

Designated critical habitat identifies specific areas that have the physical and biological features, (known as primary constituent elements or PCEs) essential to the conservation of the listed species. The PCEs for CRLFs are aquatic and upland areas where suitable breeding and non-breeding aquatic habitat is located, interspersed with upland foraging and dispersal habitat.

If the results of initial screening-level assessment methods show no direct or indirect effects (no LOC exceedances) upon individual CRLFs or upon the PCEs of the species' designated critical habitat, a "no effect" determination is made for use of Telone as it relates to this species and its designated critical habitat. If, however, potential direct or indirect effects to individual CRLFs are anticipated or effects may impact the PCEs of the CRLF's designated critical habitat, a preliminary “may affect” determination is made for the FIFRA regulatory action regarding Telone.

If a determination is made that use of Telone within the action area(s) associated with the CRLF “may affect” this species or its designated critical habitat, additional information is considered to refine the potential for exposure and for effects to the CRLF and other taxonomic groups upon which these species depend (e.g., aquatic and terrestrial vertebrates and invertebrates, aquatic plants, riparian vegetation, etc.). Additional information, including spatial analysis (to determine the geographical proximity of CRLF habitat and Telone use sites) and further evaluation of the potential impact of Telone on the PCEs is also used to determine whether modification of designated critical habitat may occur. Based on the refined information, the Agency uses the best available information to distinguish those actions that “may affect, but are not likely to adversely affect” from those actions that “may affect and are likely to adversely affect” the CRLF or the PCEs of its designated critical habitat. This information is presented as part of the Risk Characterization in Section 5 of this document.

The Agency believes that the analysis of direct and indirect effects to listed species provides the basis for an analysis of potential effects on the designated critical habitat. Because Telone is expected to directly impact living organisms within the action area (defined in Section 2.7), critical habitat analysis for Telone is limited in a practical sense to those PCEs of critical habitat that are biological or that can be reasonably linked to biologically mediated processes (i.e., the biological resource requirements for the listed species associated with the critical habitat or important physical aspects of the habitat that may be reasonably influenced through biological processes). Activities that may modify critical habitat are those that alter the PCEs and appreciably diminish the value of the habitat. Evaluation of actions related to use of Telone that may alter the PCEs of the CRLF’s critical habitat form the basis of the critical habitat impact analysis. Actions that may affect the CRLF’s designated critical habitat have been identified by the Services and are discussed further in Section 2.6.

2.2 Scope

Telone is used as a pre-plant soil fumigant in many agricultural crops, orchards, vineyards, and on turf. Typically, telone is injected into the soil, and a covering (tarp) is put in place to prevent premature evaporation. Drip irrigation at or below the surface is also used as an application method.

The end result of the EPA pesticide registration process (*i.e.*, the FIFRA regulatory action) is an approved product label. The label is a legal document that stipulates how and where a given pesticide may be used. Product labels (also known as end-use labels) describe the formulation type (*e.g.*, liquid or granular), acceptable methods of application, approved use sites, and any restrictions on how applications may be conducted. Thus, the use or potential use of Telone in accordance with the approved product labels for California is “the action” relevant to this ecological risk assessment.

Although current registrations of Telone allow for use nationwide, this ecological risk assessment and effects determination addresses currently registered uses of Telone in portions of the action area that are reasonably assumed to be biologically relevant to the CRLF and its designated critical habitat. Further discussion of the action area for the CRLF and its critical habitat is provided in Section 2.7.

Telone has two main degradates, 3-chloroallyl alcohol and 3-chloroacrylic acid. The degradates are both mobile, but are not expected to be as volatile as Telone. The 3-chloroallyl alcohol is the major hydrolysis degradation product and is formed at 72 percent of applied. In an aerobic aquatic metabolism study, however, no degradate exceeded 6.5% of applied (cis-3-chloroacrylic acid). The 3-chloroacrylic acid is produced through aerobic soil metabolism at lower and variable amounts depending on the soil type. In studies submitted to the Agency, 3-chloroacrylic acid formed at 1 – 6 percent of applied. The degradation pathway is presumed to be telone to 3-chloroallyl alcohol to 3-chloroacrylic acid. Ecological effects data for these degradates are available for freshwater fish, invertebrates, and plants/algae, and also mammals and terrestrial plants. Some of these data indicate that one or both degradate is more toxic than the parent to some species. Therefore, this risk assessment will also consider the alcohol and acid degradates of Telone as "stressors" for the purposes of determining ecological risk to aquatic organisms. Similar data are not available for birds (surrogate for terrestrial-phase CRLF), but risk will be estimated based effects in mammals. Because the Telone and its degradates have different toxicity values and occur at different concentrations in the environment, EECs and RQs will be calculated separately for Telone and its degradates where possible.

The Agency does not routinely include, in its risk assessments, an evaluation of mixtures of active ingredients, either those mixtures of multiple active ingredients in product formulations or those in the applicator's tank. In the case of the product formulations of active ingredients (that is, a registered product containing more than one active ingredient), each active ingredient is subject to an individual risk assessment for regulatory decision regarding the active ingredient on a particular use site. If effects data are available for a formulated product containing more than one active ingredient, they may be used qualitatively or quantitatively in accordance with the Agency's Overview Document and the Services' Evaluation Memorandum (U.S., EPA 2004; USFWS/NMFS 2004).

Telone has registered products that contain multiple active ingredients. Analysis of the available open literature and acute oral mammalian LD_{50} data for multiple active ingredient products relative to the single active ingredient is provided in Appendix A. The results of this analysis show that an assessment based on the toxicity of the single active ingredient of Telone is appropriate.

2.3 Previous Assessments

A Reregistration Eligibility Decision for telone was issued in 1998. Use of telone in karst terrain was reviewed in 2005. A Section 3 New Use assessment was completed for use in citrus and stone fruits in 2000 and another Section 3 New Use assessment was completed for drip irrigation on grapes in 2007. These assessments found no significant terrestrial effects for animals. Due to the high volatility of telone, chronic effects were discounted, despite the lack of chronic data, because chronic exposure was not expected. However, the assessment for citrus and stone fruits acknowledged the possibility of chronic effects. In the EFED RED Chapter for telone, effects in fish and aquatic invertebrates were found, but EECs were modeled using

GENEEC, and it was noted that higher tier exposure estimates were necessary. The New Use assessments found risk for aquatic organisms, but the grape assessment noted that risks were reduced below the LOC if drip lines were buried. Prior to the new use assessment in grapes, terrestrial plant data were not available. The assessment in grapes found that risks to plants were possible, but could be minimized if drip lines were buried. The assessment did not address the appropriateness of the modeling for a highly volatile chemical like telone.

Telone was also the subject of an endangered species assessment for salmonids in the Pacific Northwest (Washington Toxics Coalition). In that assessment, the uses of telone were concluded to either have “No Effect” or be “Not Likely to Adversely Affect” all of the salmonid populations considered.

2.4 Stressor Source and Distribution

2.4.1 Environmental Fate Properties

Telone is a short-chain (3-carbon), unsaturated chlorinated hydrocarbon with high vapor pressure and high solubility in water. The major expected dissipation route from soil and water is vaporization. Telone in the atmosphere will be rapidly degraded by hydroxyl radicals (7 to 12 hour half-life). In water, telone is degraded by hydrolysis (13.5-day half-life at 20ºC, Acc #262484) or biotic metabolism (4.9-day half-life, MRID 44975502). The rates of these processes are expected to vary strongly with temperature, resulting in shorter overall persistence. For example, the hydrolysis half-life falls to 2 days at 29ºC (Acc# 262730, MRID 00158442). Likewise, the anaerobic soil half-life is 7.7 to 9.1 days at 15ºC, but only 2.4 days at 25ºC. Overall, despite its high application rates, persistent contamination of the environment by telone is not expected.

Table 2.1 lists the environmental fate properties of Telone, along with the major and minor degradates detected in the submitted environmental fate and transport studies.

Table 2.1 Summary of Telone and Degradate Environmental Fate Properties				
Study	**Value (units)**	**Major Degradates** ***Minor Degradates***	**MRID #**	**Study Status**
Molecular weight	110.97	n/a		
Henry's Law Constant	3.55E-3 atm-m3/mol	n/a	41532001	
Vapor Pressue	34 mmHg	n/a	41532001	
olubility in water	2500 mg/L	n/a	41532001	
Hydrolysis	13.5-day half-life at pH 5, 7, 9 and 20ºC 90 to 100-day half-life at pH 5.5, 7.5 and 2ºC 11 to 13 day half-life at 15º 2-day half-life at 29ºC	3-chloroallyl alcohol	Acc# 262484, 262730, 00158442	Acceptable Supplemental
Photolysis in Air	Stable to direct photolysis in air Reaction with hydroxyl: 7-hour half-life ((trans), 12-hour half-life (cis) Rxn with ozone: 12-day half-life ((trans), 52-day half-life (cis)	None Formyl chloride, chloroacetaldehyde Formyl chloride, chloroacetaldehyde, chloroacetic acid, HCl, CO, CO2, formic acid	40390101 Tuazon, 1984	Acceptable Supplemental
Direct Aqueous Photolysis	stable		40513401	Acceptable
Soil Photolysis	No data			
Aerobic Soil Metabolism	Half-lives 12 to 54 days	Cis/trans-3-chloroacrylic acid Cis/trans-3-chloroallyl alcohol	42642301	Acceptable
Anaerobic Soil Metabolism	Half-life 9.1 days (sility clay loam, 15ºC) Half-life 7.7 days (sandy loam, 15ºC) Half-life 2.4 days (silty clay loam, sandy loam, 25ºC)	Chloroacrylic acid, propionic acid	40025901	Acceptable
Anaerobic Aquatic Metabolism	No data			
Aerobic Aquatic Metabolism	Half-life 4.9 days (parent, 25ºC)	Chloroallyl alcohol (6.4% @ 1 day) Cis-3-chloroacrylic acid (6.5% @ 7 days)	44975502	Acceptable

Table 2.1 Summary of Telone and Degradate Environmental Fate Properties				
Study	**Value (units)**	**Major Degradates** ***Minor Degradates***	**MRID #**	**Study Status**
		Trans-3-chloroacrylic acid (3.5% @ 7 days)		
$K_{d\text{-}ads}$ / $K_{d\text{-}des}$ (mL/g) $K_{oc\text{-}ads}$ / $K_{oc\text{-}des}$ (mL/g)	Kd: 0.23 (loamy sand), 0.32 (sand), 0.42 to 1.09 (clay) Koc: 20 (sand), 25 (loamy sand), 41-42 (2 clay soils)		40538901	Acceptable
Field Volatility Studies	Grapes, postplant drip, 6.1 lb/acre Turf, direct injection, 49.8 lb/acre Strawberry, tarped, 166 lb/acre Vegetables, surface drip, tarp, 166 lb/acre Bare Ground, broadcast, 122 lb/acre Bare Ground, shank injection, 68 lb/acre Turf, direct Injection, 50.7 lb/acre	Max 138 µg/m3 on-field Max 1560 µg/m3 on-field Max 189 µg/m3 on-field Max 644 µg/m3 on-field Max 2010 µg/m3 on-field Max 1711 µg/m3 on-field Max 4556 µg/m3 on-field	45296101 45120702 45112901 45112902 45010501 45222501	Acceptable
Terrestrial Field Dissipation (California)	130 ppm in the 0.3 – 0.45-m layer of soil immediately after treatment at 342 lb ai/acre		40403301	Acceptable
Degradate Properties				
$K_{d\text{-}ads}$ (mL/g)	Chloroallyl alcohol Kads < 1	n/a	44940323	Acceptable
Hydrolysis Half-life, days	Chloroallyl alcohol pH 5, 2472 pH 7, 3912 pH 9, 1117 Chloroacrylic acid pH 5, 298 pH 7, 442 pH 9, 254	Chloroacrylic acid	44948601 44940321	Acceptable Acceptable
Aerobic Aquatic Metabolism Half-life, days	Chloroallyl alcohol 10ºC, 3.8 25ºC, 1.2 Chloroacrylic acid 25ºC, 3.4	Chloroacrylic acid, CO_2 CO_2	44975503 44975504	

2.4.2 Environmental Transport Mechanisms

Potential transport mechanisms include pesticide surface water runoff, spray drift, and secondary drift of volatilized or soil-bound residues leading to deposition onto nearby or more distant ecosystems. Surface water runoff and vaporization are expected to be the major routes of exposure for Telone.

A number of studies have documented atmospheric transport and re-deposition of pesticides from the Central Valley to the Sierra Nevada Mountains (Fellers et al., 2004, Sparling et al., 2001, LeNoir et al., 1999, and McConnell et al., 1998). Prevailing winds blow across the Central Valley eastward to the Sierra Nevada Mountains, transporting airborne industrial and agricultural pollutants into the Sierra Nevada ecosystems (Fellers *et al.*, 2004, LeNoir *et al.*, 1999, and McConnell *et al.,* 1998). Several sections of critical habitat for the CLRF are located east of the Central Valley. The magnitude of transport via secondary drift depends on Telone's ability to be mobilized into air and its eventual removal through wet and dry deposition of gases/particles and photochemical reactions in the atmosphere. Therefore, physicochemical properties of Telone that describe its potential to enter the air from water or soil (*e.g.*, Henry's Law constant and vapor pressure), pesticide use data, modeled estimated concentrations in water and air, and available air monitoring data from the Central Valley and the Sierra Nevadas are considered in evaluating the potential for atmospheric transport of Telone to locations where it could impact the CRLF. None of the cited studies analyzed for telone, however, given its volatility and rapid reaction with atmospheric hydroxyl radicals, it is not expected to reach remote areas in measurable concentrations.

In general, deposition of drifting or volatilized pesticides is expected to be greatest close to the site of application. Spray drift of telone is not expected, due to the application methods used, therefore, computer models of spray drift (AgDRIFT and/or AGDISP) are not applicable.

Exposure to volatilized telone will be assessed by use of field volatility studies listed in Table 2.1; exposures will be scaled up to the maximum application rate. Due to the study designs, exposure can only be assessed to a distance of 300 feet from the edge of treated fields.

2.4.3 Mechanism of Action

Telone is a soil fumigant that exerts toxic action on vital enzymes or enzyme systems in nematodes. Substitution of a sulfhydryl, ammonia, or hydroxyl group with the chlorine in telone results in restriction of the enzyme function, leading to paralysis and death[2]. Specific information was not available for the mode of action in other taxa, but is expected to be similar.

2.4.4 Use Characterization

All use of telone is for agricultural purposes, including turf. Telone is used as a pre-plant soil fumigant to kill disease-causing organisms before planting. Figure 2.1 presents a national-level view of the use of telone; the major national uses are on potatoes, tobacco, and sugarbeets. Its

[2] Cox, C. 1992. 1,3-Dichloropropene. Journal of Pesticide Reform. 12(1):33 -37, and references therein. Available at http://www.pesticide.org/dichloropropene.pdf

use in California ranges up to over 34 pounds per square mile of agricultural land. Data from the California PUR database (Table 2.3) indicate that the major uses in California are for carrots, strawberries, grapes, almonds, soil fumigation/preplant, and sweet potato (all greater than 500,000 pounds per year annual average). Table 2.3a indicates that the counties with the greatest usage (over 500,000 lb/year annual average) are Fresno, Kern, Merced, Monterey, Stanislaus, Imperial, and Tulare.

Analysis of labeled use information is the critical first step in evaluating the federal action. The current label for Telone represents the FIFRA regulatory action; therefore, labeled use and application rates specified on the label form the basis of this assessment. The assessment of use information is critical to the development of the action area and selection of appropriate modeling scenarios and inputs.

Table 2.2 presents the uses and corresponding application rates and methods of application considered in this assessment, and indicates which PRZM scenario was used to represent each crop.

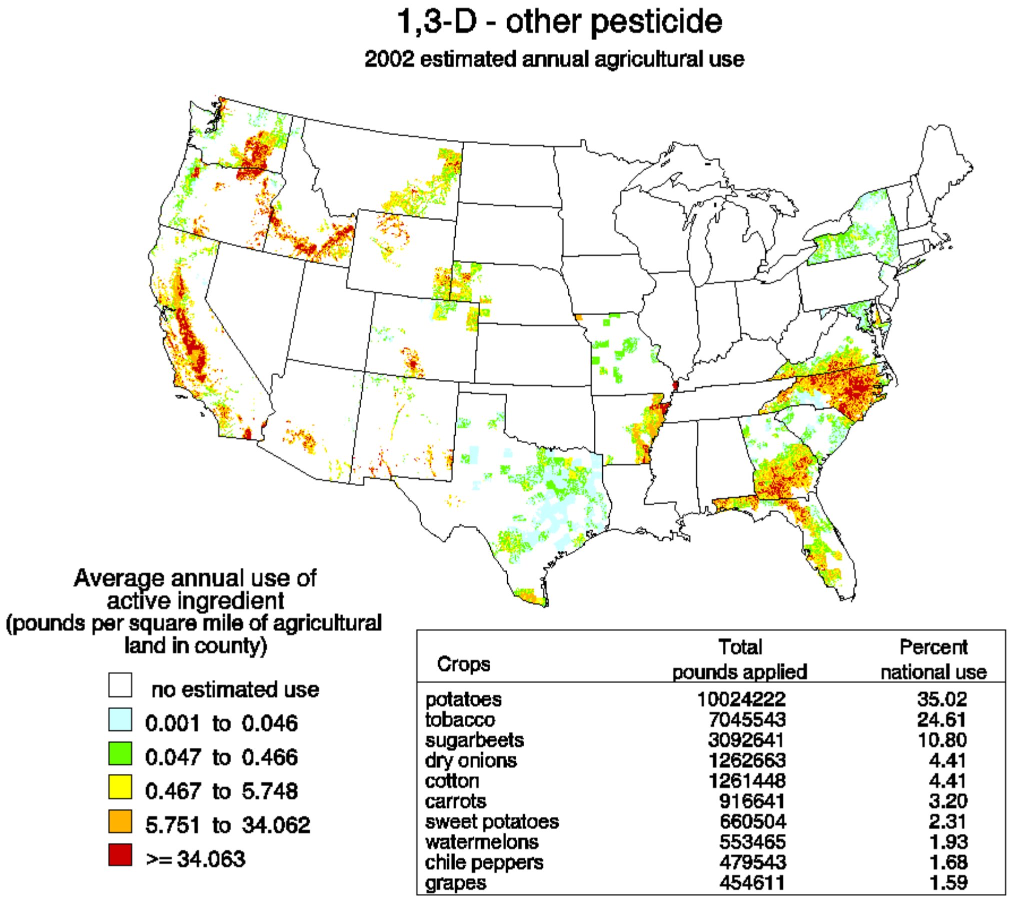
Table 2.2 Crops, Application Rates and PRZM Scenario for Telone Uses

(Crop/Use)	PRZM Scenario	Application Rate (lb/acre)
Alfalfa Clover Lespedeza Trefoil Vetch	CA Alfalfa OP	170.9
Almond Cashew Chestnut Filbert Hickory nut Pecan Tree nuts Walnut	CA Almond Std.	361.9
Apple Apricot Cherry Fig Fruits Nectarine Peach Pear Persimmon Plum Pomegranate Prune Quince Stone fruits Date Deciduous fruit trees Kumquat	CA Fruit Std.	367.92
Asparagus Beans	CA RLF Row Crop_V2	259.15

(Crop/Use)	PRZM Scenario	Application Rate (lb/acre)
Beets Carrot Horseradish Kale Legume vegetables Parsnip Peas Pepper & chili type Pimento Soybeans Cowpea/Blackeyed pea Peanuts		
Barley Oats Rye Safflower Sorghum Wheat Buckwheat Flax Kenaf	CA RLF Wheat_V2	181.8
Blackberry Blueberry Loganberry Boysenberry Raspberry Youngberry Currant Gooseberry Huckleberry	CA RLF Wine grape_V2	332.29
Broccoli Cabbage Cauliflower Celery Cole Crops Collards Mustard	CA RLF Cole Crop_V2	259.15
Brussels sprouts Chard-Swiss Endive Lettuce Spinach Salsify	CA Lettuce Std.	259.15
Citrus Grapefruit Lemon Lime Orange Tangelo Tangerines	CA Citrus Std.	367.92
Corn Millet Field Crops	CA Corn OP	259.15

(Crop/Use)	PRZM Scenario	Application Rate (lb/acre)
Cotton	CA Cotton Std.	181.8
Cucumber Eggplant Melon Pumpkin Squash	CA RLF Melon _V2	332.29
Forest Nursery planting Forest trees Spruce (forest)	CA RLF Forestry	555.5
Garlic Leek	CA RLF Garlic_V2	237.35
Grapes (2 applications at 60-day interval) Kiwi Fuit	CA Grapes Std.	332.29
Pastures	CA RLF Rangeland_V2	170.9
Hops	OR Hops Std.	185.76
Mint	OR Mint Std.	236.5
Okra Tomato Vegetables	CA Tomato Std.	355
Olive	CA RLF Olive_V2	332.29
Onion Radish Shallot	CA Onion Std.	259.15
Ornamental-Shady trees Ornamental Non flowering plants	CA Nursery Std.	571.05
Ornamental lawns & Turf	CA RLF Turf	49.24
Potato Rutabaga Sweet Potato Turnip (root) Kohlrabi	CA RLF Potato_V2	259.15
Soil – pre plant	CA RLF Wine grape_V2	575.1
Strawberry Dewberry	CA RLF Strawberry_V2	355
Sugar beet	CA Sugar beet OP	246

Figure 2.1 shows the estimated poundage of Telone uses across the United States. The map was downloaded from a U.S. Geological Survey (USGS), National Water Quality Assessment Program (NAWQA) website.



Crops	Total pounds applied	Percent national use
potatoes	10024222	35.02
tobacco	7045543	24.61
sugarbeets	3092641	10.80
dry onions	1262663	4.41
cotton	1261448	4.41
carrots	916641	3.20
sweet potatoes	660504	2.31
watermelons	553465	1.93
chile peppers	479543	1.68
grapes	454611	1.59

Figure 2.1 Telone Use in Total Pounds per County

The Agency's Biological and Economic Analysis Division (BEAD) provides an analysis of both national- and county-level usage information (Kaul and Jones, 2006) using state-level usage data obtained from USDA-NASS[3], Doane (www.doane.com; the full dataset is not provided due to its proprietary nature) and the California's Department of Pesticide Regulation Pesticide Use Reporting (CDPR PUR) database[4] . CDPR PUR is considered a more comprehensive source of usage data than USDA-NASS or proprietary databases, and thus the usage data reported for Telone by county in this California-specific assessment were generated using CDPR PUR data. Four years (2002-2005) of usage data were included in this analysis. Data from CDPR PUR were obtained for every pesticide application made on every use site at the section level (approximately one square mile) of the public land survey system. BEAD summarized these data to the county level by site, pesticide, and unit treated. Calculating county-level usage involved summarizing across all applications made within a section and then across all sections

[3] United States Depart of Agriculture (USDA), National Agricultural Statistics Service (NASS) Chemical Use Reports provide summary pesticide usage statistics for select agricultural use sites by chemical, crop and state. See http://www.usda.gov/nass/pubs/estindx1.htm#agchem.
[4] The California Department of Pesticide Regulation's Pesticide Use Reporting database provides a census of pesticide applications in the state. See http://www.cdpr.ca.gov/docs/pur/purmain.htm.

within a county for each use site and for each pesticide. The county level usage data that were calculated include: average annual pounds applied, average annual area treated, and average and maximum application rate across all five years. The units of area treated are also provided where available.

Tables 2.3 and 2.3a below summarize the recent use of telone in California, by crop and county, respectively. On average, millions of pounds of telone are used annually in California.

Table 2.3 Summary of California Department of Pesticide Regulation (CDPR) Pesticide Use Reporting (PUR) Data from 2002 to 2005 for Currently Registered Telone Uses. Summarized by Crop.

use site	avg annual lb applied	avg annual area treated	avg annual lb/acre
CARROT	1,113,659.	11,436.	97.3
STRAWBERRY	1,110,695.	22,202.	50.0
GRAPE	878,598.	3,084.	284.8
ALMOND	837,643.	3,027.	276.6
SOIL FUMIGATION/PREPLANT	586,392.	2,434.	240.8
SWEET POTATO	572,211.	4,953.	115.5
PEACH	316,531.	1,197.	264.2
N-OUTDOOR PLANTS	282,280.	1,006.	280.4
WALNUT	212,542.	732.	290.0
PEPPER	172,263.	2,295.	75.0
POTATO	152,113.	2,002.	75.9
TANGERINE	131,417.	420.	312.3
WATERMELON	129,233.	1,676.	77.0
NECTARINE	128,706.	518.	248.4
ORANGE	107,730.	376.	286.2
TOMATO	99,433.	1,080.	92.0
UNCULTIVATED	99,288.	395.	251.3
ONION	79,487.	911.	87.1
PRUNE	78,937.	242.	325.3
CHERRY	68,615.	228.	299.9
LETTUCE	58,293.	675.	86.3
PLUM	51,809.	210.	246.0
BRUSSELS SPROUTS	49,588.	648.	76.4
CANTALOUPE	47,064.	760.	61.8
MELON	35,753.	693.	51.5
PARSLEY	30,543.	320.	95.3
CITRUS	28,708.	95.	300.7
RASPBERRY	21,385.	186.	114.7
LEMON	15,318.	88	174.0
OAT	10,007.	34.	292.1
COTTON	9,923.	40.	242.3
BROCCOLI	7,760.	82.	94.2
APRICOT	7,289.	22.	319.3

use site	avg annual lb applied	avg annual area treated	avg annual lb/acre
BEANS	7,129.	87.	81.5
CELERY	5,168.	57.	89.6
CABBAGE	4,703.	51.	91.7
APPLE	4,133.	13.	302.8
WHEAT	3,350.	33.	99.6
ALFALFA	3,332.	12.	261.3
CORN	3,304.	15	220.3
BASIL, SWEET	3,095.	30.	102.9
EGGPLANT	2,955.	25.	117.6
ASPARAGUS	2,907.	20.	141.6
PISTACHIO	2,729.	48.	55.8
BLUEBERRY	2,627.	7.	341.1
N-GRNHS FLOWER	2,487.	16.	152.3
SQUASH	1,735.	32.	53.6
SWEET POTATO	1,213.	8.	136.7
CHINESE CABBAGE	608.	7.	84.5
RADISH	347.	3.	106.9
KIWI	232.	0.9	258.5

Table 2.3a Summary of California Department of Pesticide Registration (CDPR) Pesticide Use Reporting (PUR) Data from 2002 to 2005 for Currently Registered Telone Uses. Summarized by County.

County	AVG Annual Pounds Applied	AVG Annual Area Treated, Acres	AVG Annual Application Rate, lb/acre
FRESNO	1,070,012.	5,216.	205.1
KERN	974,563.	8,347.	116.7
MERCED	807,065.	6,129.	131.6
MONTEREY	626,037.	20,219.	30.9
STANISLAUS	620,786.	2,659.	233.4
IMPERIAL	593,084.	6,314.	93.9
TULARE	568,757.	2,118.	268.4
VENTURA	477,948.	3,598.	132.8
SANTA BARBARA	322,574.	1,872.	172.2
MADERA	239,692.	821.	291.6
SAN JOAQUIN	190,962.	1,248.	153.0
DEL NORTE	130,015.	463.	280.6
SONOMA	121,757.	393.	309.1
SUTTER	119,956.	375.	319.4
SANTA CRUZ	105,849.	987.	107.1
SAN LUIS OBISPO	100,837.	605.	166.6
KINGS	98,163.	516.	190.1
RIVERSIDE	83,707.	732.	114.2
ORANGE	49,714.	299.	166.1
BUTTE	49,505.	151.	327.0

Table 2.3a Summary of California Department of Pesticide Registration (CDPR) Pesticide Use Reporting (PUR) Data from 2002 to 2005 for Currently Registered Telone Uses. Summarized by County.			
County	AVG Annual Pounds Applied	AVG Annual Area Treated, Acres	AVG Annual Application Rate, lb/acre
SAN BENITO	47,808.	438.	108.9
NAPA	38,842.	126.	306.0
SAN DIEGO	35,448.	337.	105.1
LOS ANGELES	32,982.	263.	125.1
PLACER	27,342.	145.	187.4
SANTA CLARA	25,722.	286.	89.8
YUBA	20,044.	72.	278.0
TEHAMA	18,779.	58.	320.8
YOLO	12,343.	50.	243.2
MENDOCINO	9,707.	29.	325.6
GLENN	8,354.	25.	326.9
SACRAMENTO	5,902.	116.	50.7
HUMBOLDT	4,964.	25.	193.1
SAN MATEO	1,773.	17.	100.6
SAN BERNARDINO	1,638.	9.	170.1
LAKE	1,538.	8.	188.0
COLUSA	1,233.	3.	324.6
CONTRA COSTA	1,190.	5.	222.5
SOLANO	495.	12.	39.4
SISKIYOU	422.	7.	54.7
MONO	115.	123.	0.9
EL DORADO	34.	5.	6.4

2.5 Assessed Species

The CRLF was federally listed as a threatened species by USFWS effective June 24, 1996 (USFWS 1996). It is one of two subspecies of the red-legged frog and is the largest native frog in the western United States (USFWS 2002). A brief summary of information regarding CRLF distribution, reproduction, diet, and habitat requirements is provided in Sections 2.5.1 through 2.5.4, respectively. Further information on the status, distribution, and life history of and specific threats to the CRLF is provided in Attachment 1.

Final critical habitat for the CRLF was designated by USFWS on April 13, 2006 (USFWS 2006; 71 FR 19244-19346). Further information on designated critical habitat for the CRLF is provided in Section 2.6.

2.5.1 Distribution

The CRLF is endemic to California and Baja California (Mexico) and historically inhabited 46 counties in California including the Central Valley and both coastal and interior mountain ranges (USFWS 1996). Its range has been reduced by about 70%, and the species currently resides in 22 counties in California (USFWS 1996). The species has an elevational range of near sea level to 1,500 meters (5,200 feet) (Jennings and Hayes 1994); however, nearly all of the known CRLF populations have been documented below 1,050 meters (3,500 feet) (USFWS 2002).

Populations currently exist along the northern California coast, northern Transverse Ranges (USFWS 2002), foothills of the Sierra Nevada (5-6 populations), and in southern California south of Santa Barbara (two populations) (Fellers 2005a). Relatively larger numbers of CRLFs are located between Marin and Santa Barbara Counties (Jennings and Hayes 1994). A total of 243 streams or drainages are believed to be currently occupied by the species, with the greatest numbers in Monterey, San Luis Obispo, and Santa Barbara counties (USFWS 1996). Occupied drainages or watersheds include all bodies of water that support CRLFs (i.e., streams, creeks, tributaries, associated natural and artificial ponds, and adjacent drainages), and habitats through which CRLFs can move (i.e., riparian vegetation, uplands) (USFWS 2002).

The distribution of CRLFs within California is addressed in this assessment using four categories of location including recovery units, core areas, designated critical habitat, and known occurrences of the CRLF reported in the California Natural Diversity Database (CNDDB) that are not included within core areas and/or designated critical habitat (see **Figure 2.2**). Recovery units, core areas, and other known occurrences of the CRLF from the CNDDB are described in further detail in this section, and designated critical habitat is addressed in Section 2.6. Recovery units are large areas defined at the watershed level that have similar conservation needs and management strategies. The recovery unit is primarily an administrative designation, and land area within the recovery unit boundary is not exclusively CRLF habitat. Core areas are smaller areas within the recovery units that comprise portions of the species' historic and current range and have been determined by USFWS to be important in the preservation of the species. Designated critical habitat is generally contained within the core areas, although a number of critical habitat units are outside the boundaries of core areas, but within the boundaries of the recovery units. Additional information on CRLF occurrences from the CNDDB is used to cover the current range of the species not included in core areas and/or designated critical habitat, but within the recovery units.

Recovery Units

Eight recovery units have been established by USFWS for the CRLF. These areas are considered essential to the recovery of the species, and the status of the CRLF "may be considered within the smaller scale of the recovery units, as opposed to the statewide range" (USFWS 2002). Recovery units reflect areas with similar conservation needs and population statuses, and therefore, similar recovery goals. The eight units described for the CRLF are delineated by watershed boundaries defined by US Geological Survey hydrologic units and are limited to the elevational maximum for the species of 1,500 m above sea level. The eight recovery units for the CRLF are listed in **Table 2.4** and shown in **Figure 2.2**.

Core Areas

USFWS has designated 35 core areas across the eight recovery units to focus their recovery efforts for the CRLF (see **Figure 2.2**). **Table 2.4** summarizes the geographical relationship among recovery units, core areas, and designated critical habitat. The core areas, which are distributed throughout portions of the historic and current range of the species, represent areas that allow for long-term viability of existing populations and reestablishment of populations within historic range. These areas were selected because they: 1) contain existing viable populations; or 2) they contribute to the connectivity of other habitat areas (USFWS 2002). Core area protection and enhancement are vital for maintenance and expansion of the CRLF's distribution and population throughout its range.

For purposes of this assessment, designated critical habitat, currently occupied (post-1985) core areas, and additional known occurrences of the CRLF from the CNDDB are considered. Historically occupied sections of the core areas are not evaluated as part of this assessment because the USFWS Recovery Plan (USFWS 2002) indicates that CRLFs are extirpated from these areas. A summary of currently and historically occupied core areas is provided in **Table 2.4** (currently occupied core areas are bolded). While core areas are considered essential for recovery of the CRLF, core areas are not federally-designated critical habitat, although designated critical habitat is generally contained within these core recovery areas. It should be noted, however, that several critical habitat units are located outside of the core areas, but within the recovery units. The focus of this assessment is currently occupied core areas, designated critical habitat, and other known CNDDB CRLF occurrences within the recovery units. Federally-designated critical habitat for the CRLF is further explained in Section 2.6.

Table 2.4 California Red-legged Frog Recovery Units with Overlapping Core Areas and Designated Critical Habitat				
Recovery Unit [1] (Figure 2.a)	**Core Areas [2,7] (Figure 2.a)**	**Critical Habitat Units [3]**	**Currently Occupied (post-1985) [4]**	**Historically Occupied [4]**
Sierra Nevada Foothills and Central Valley (1) (eastern boundary is the 1,500m elevation line)	**Cottonwood Creek (partial) (8)**	--	✓	
	Feather River (1)	BUT-1A-B	✓	
	Yuba River-S. Fork Feather River (2)	YUB-1	✓	
	--	NEV-1[6]		
	Traverse Creek/Middle Fork American River/Rubicon (3)	--	✓	
	Consumnes River (4)	ELD-1	✓	
	S. Fork Calaveras River (5)	--		✓
	Tuolumne River (6)	--		✓
	Piney Creek (7)	--		✓
	East San Francisco Bay (partial)(16)	--	✓	
North Coast Range Foothills and Western Sacramento River Valley (2)	**Cottonwood Creek (8)**	--	✓	
	Putah Creek-Cache Creek (9)	--		✓
	Jameson Canyon – Lower Napa Valley (partial) (15)	--	✓	
	Belvedere Lagoon (partial) (14)	--	✓	
	Pt. Reyes Peninsula (partial) (13)	--	✓	
North Coast and North San Francisco Bay (3)	Putah Creek-Cache Creek (partial) (9)	--		✓
	Lake Berryessa Tributaries (10)	NAP-1	✓	
	Upper Sonoma Creek (11)	--	✓	
	Petaluma Creek-Sonoma Creek (12)	--	✓	
	Pt. Reyes Peninsula (13)	MRN-1, MRN-2	✓	
	Belvedere Lagoon (14)	--	✓	
	Jameson Canyon-Lower Napa River (15)	SOL-1	✓	
South and East San Francisco Bay (4)	--	CCS-1A[6]		
	East San Francisco Bay (partial) (16)	ALA-1A, ALA-1B, STC-1B	✓	
	--	STC-1A[6]		
	South San Francisco Bay (partial) (18)	SNM-1A	✓	
Central Coast (5)	**South San Francisco Bay (partial) (18)**	SNM-1A, SNM-2C, SCZ-1	✓	
	Watsonville Slough- Elkhorn Slough (partial) (19)	SCZ-2 [5]	✓	
	Carmel River-Santa Lucia (20)	MNT-2	✓	
	Estero Bay (22)	--	✓	
	--	SLO-8[6]		
	Arroyo Grande Creek (23)	--	✓	

	Santa Maria River-Santa Ynez River (24)	--	✓	
Diablo Range and Salinas Valley (6)	**East San Francisco Bay (partial) (16)**	MER-1A-B, STC-1B	✓	
	--	SNB-1[6], SNB-2[6]		
	Santa Clara Valley (17)	--	✓	
	Watsonville Slough- Elkhorn Slough (partial)(19)	MNT-1	✓	
	Carmel River-Santa Lucia (partial)(20)	--	✓	
	Gablan Range (21)	SNB-3	✓	
	Estrella River (28)	SLO-1A-B	✓	
Northern Transverse Ranges and Tehachapi Mountains (7)	--	SLO-8[6]		
	Santa Maria River-Santa Ynez River (24)	STB-4, STB-5, STB-7	✓	
	Sisquoc River (25)	STB-1, STB-3	✓	
	Ventura River-Santa Clara River (26)	VEN-1, VEN-2, VEN-3	✓	
	--	LOS-1[6]		
Southern Transverse and Peninsular Ranges (8)	**Santa Monica Bay-Ventura Coastal Streams (27)**	--	✓	
	San Gabriel Mountain (29)	--		✓
	Forks of the Mojave (30)	--		✓
	Santa Ana Mountain (31)	--		✓
	Santa Rosa Plateau (32)	--	✓	
	San Luis Rey (33)	--		✓
	Sweetwater (34)	--		✓
	Laguna Mountain (35)	--		✓

[1] Recovery units designated by the USFWS (USFWS 2000, pg 49).
[2] Core areas designated by the USFWS (USFWS 2000, pg 51).
[3] Critical habitat units designated by the USFWS on April 13, 2006 (USFWS 2006, 71 FR 19244-19346).
[4] Currently occupied (post-1985) and historically occupied core areas as designated by the USFWS (USFWS 2002, pg 54).
[5] Critical habitat unit where identified threats specifically included pesticides or agricultural runoff (USFWS 2002).
[6] Critical habitat units that are outside of core areas, but within recovery units.
[7] Currently occupied core areas that are included in this effects determination are bolded.

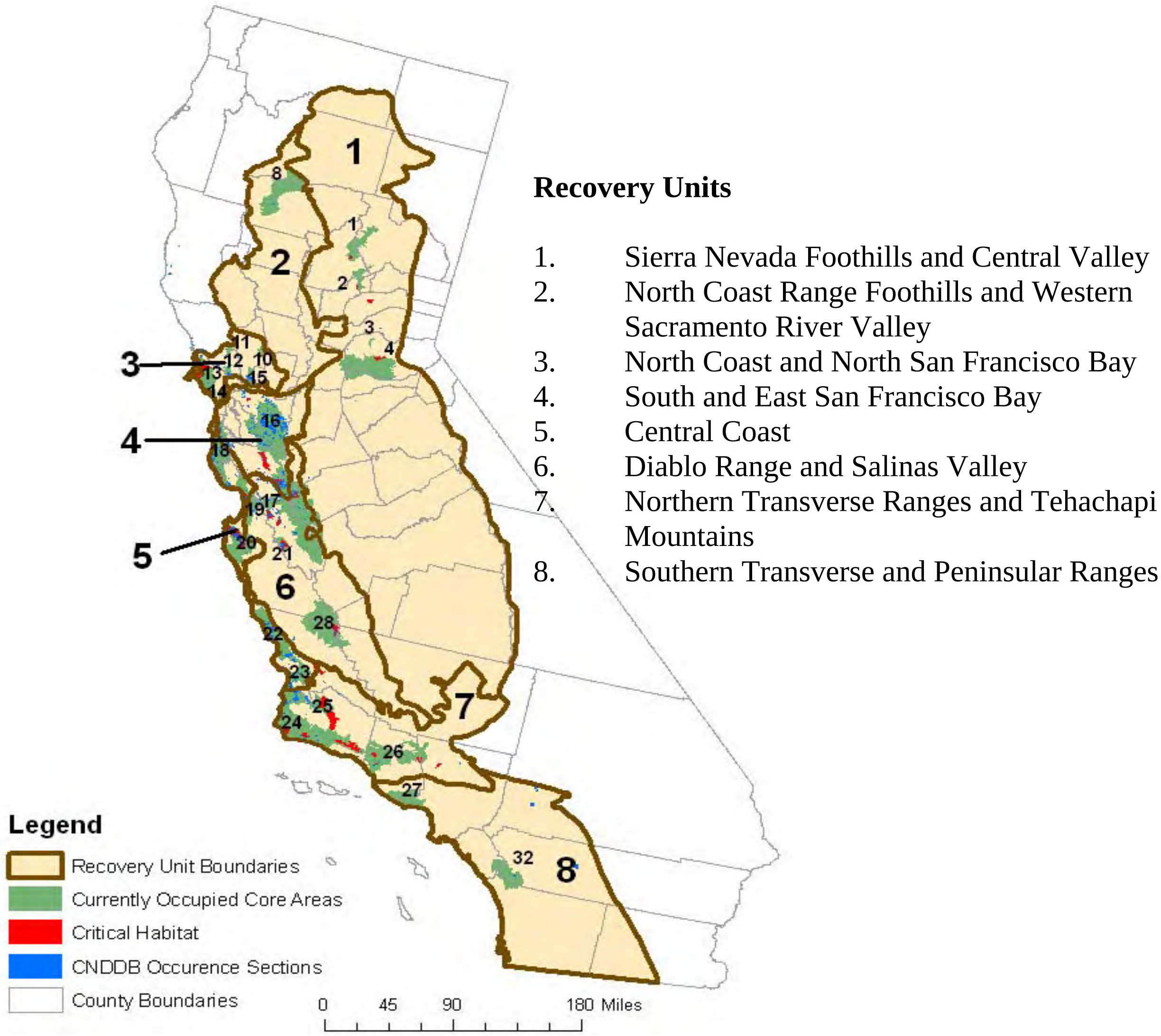


Figure 2.2 Recovery Unit, Core Area, Critical Habitat, and Occurrence Designations for CRLF

Core Areas

1. Feather River
2. Yuba River- S. Fork Feather River
3. Traverse Creek/ Middle Fork/ American R. Rubicon
4. Cosumnes River
5. South Fork Calaveras River*
6. Tuolumne River*
7. Piney Creek*
8. Cottonwood Creek
9. Putah Creek – Cache Creek*
10. Lake Berryessa Tributaries
11. Upper Sonoma Creek
12. Petaluma Creek – Sonoma Creek
13. Pt. Reyes Peninsula
14. Belvedere Lagoon
15. Jameson Canyon – Lower Napa River
16. East San Francisco Bay
17. Santa Clara Valley
18. South San Francisco Bay
19. Watsonville Slough-Elkhorn Slough
20. Carmel River – Santa Lucia
21. Gablan Range
22. Estero Bay
23. Arroyo Grange River
24. Santa Maria River – Santa Ynez River
25. Sisquoc River
26. Ventura River – Santa Clara River
27. Santa Monica Bay – Venura Coastal Streams
28. Estrella River
29. San Gabriel Mountain*
30. Forks of the Mojave*
31. Santa Ana Mountain*
32. Santa Rosa Plateau
33. San Luis Ray*
34. Sweetwater*
35. Laguna Mountain*

* Core areas that were historically occupied by the California red-legged frog are not included in the map

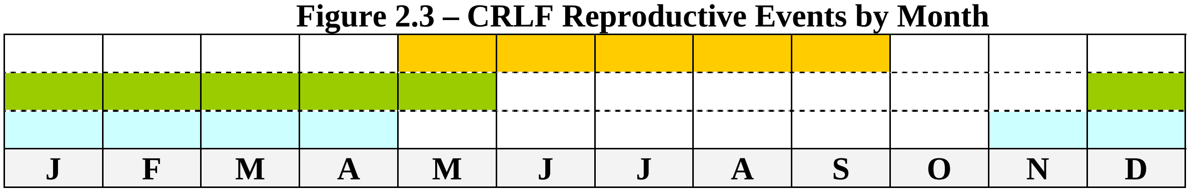
Other Known Occurrences from the CNDBB

The CNDDB provides location and natural history information on species found in California. The CNDDB serves as a repository for historical and current species location sightings. Information regarding known occurrences of CRLFs outside of the currently occupied core areas and designated critical habitat is considered in defining the current range of the CRLF. See: http://www.dfg.ca.gov/bdb/html/cnddb_info.html for additional information on the CNDDB.

2.5.2 Reproduction

CRLFs breed primarily in ponds; however, they may also breed in quiescent streams, marshes, and lagoons (Fellers 2005a). According to the Recovery Plan (USFWS 2002), CRLFs breed from November through late April. Peaks in spawning activity vary geographically; Fellers (2005b) reports peak spawning as early as January in parts of coastal central California. Eggs are fertilized as they are being laid. Egg masses are typically attached to emergent vegetation, such as bulrushes (*Scirpus* spp.) and cattails (*Typha* spp.) or roots and twigs, and float on or near the surface of the water (Hayes and Miyamoto 1984). Egg masses contain approximately 2000 to 6000 eggs ranging in size between 2 and 2.8 mm (Jennings and Hayes 1994). Embryos hatch 10 to 14 days after fertilization (Fellers 2005a) depending on water temperature. Egg predation is reported to be infrequent and most mortality is associated with the larval stage (particularly through predation by fish); however, predation on eggs by newts has also been reported (Rathburn 1998). Tadpoles require 11 to 28 weeks to metamorphose into juveniles (terrestrial-phase), typically between May and September (Jennings and Hayes 1994, USFWS 2002); tadpoles have been observed to over-winter (delay metamorphosis until the following year) (Fellers 2005b, USFWS 2002). Males reach sexual maturity at 2 years, and females reach sexual maturity at 3 years of age; adults have been reported to live 8 to 10 years (USFWS 2002). Figure 2.3 depicts CRLF annual reproductive timing.

Figure 2.3 – CRLF Reproductive Events by Month



Light Blue = **Breeding/Egg Masses**
Green = **Tadpoles (except those that over-winter)**
Orange = **Young Juveniles**
Adults and juveniles can be present all year

2.5.3 Diet

Although the diet of CRLF aquatic-phase larvae (tadpoles) has not been studied specifically, it is assumed that their diet is similar to that of other frog species, with the aquatic phase feeding exclusively in water and consuming diatoms, algae, and detritus (USFWS 2002). Tadpoles filter and entrap suspended algae (Seale and Beckvar, 1980) via mouthparts designed for effective grazing of periphyton (Wassersug, 1984, Kupferberg *et al.*; 1994; Kupferberg, 1997; Altig and McDiarmid, 1999).

Juvenile and adult CRLFs forage in aquatic and terrestrial habitats, and their diet differs greatly from that of larvae. The main food source for juvenile aquatic- and terrestrial-phase CRLFs is thought to be aquatic and terrestrial invertebrates found along the shoreline and on the water surface. Hayes and Tennant (1985) report, based on a study examining the gut content of 35 juvenile and adult CRLFs, that the species feeds on as many as 42 different invertebrate taxa, including Arachnida, Amphipoda, Isopoda, Insecta, and Mollusca. The most commonly observed prey species were larval alderflies (*Sialis* cf. *californica*), pillbugs (*Armadilliadrium vulgare*), and water striders (*Gerris* sp). The preferred prey species, however, was the sowbug (Hayes and Tennant, 1985). This study suggests that CRLFs forage primarily above water, although the authors note other data reporting that adults also feed under water, are cannibalistic, and consume fish. For larger CRLFs, over 50% of the prey mass may consists of vertebrates such as mice, frogs, and fish, although aquatic and terrestrial invertebrates were the most numerous food items (Hayes and Tennant 1985). For adults, feeding activity takes place primarily at night; for juveniles feeding occurs during the day and at night (Hayes and Tennant 1985).

2.5.4 Habitat

CRLFs require aquatic habitat for breeding, but also use other habitat types including riparian and upland areas throughout their life cycle. CRLF use of their environment varies; they may complete their entire life cycle in a particular habitat or they may utilize multiple habitat types. Overall, populations are most likely to exist where multiple breeding areas are embedded within varying habitats used for dispersal (USFWS 2002). Generally, CRLFs utilize habitat with perennial or near-perennial water (Jennings et al. 1997). Dense vegetation close to water, shading, and water of moderate depth are habitat features that appear especially important for CRLF (Hayes and Jennings 1988).
Breeding sites include streams, deep pools, backwaters within streams and creeks, ponds, marshes, sag ponds (land depressions between fault zones that have filled with water), dune ponds, and lagoons. Breeding adults have been found near deep (0.7 m) still or slow moving water surrounded by dense vegetation (USFWS 2002); however, the largest number of tadpoles have been found in shallower pools (0.26 – 0.5 m) (Reis, 1999). Data indicate that CRLFs do not frequently inhabit vernal pools, as conditions in these habitats generally are not suitable (Hayes and Jennings 1988).

CRLFs also frequently breed in artificial impoundments such as stock ponds, although additional research is needed to identify habitat requirements within artificial ponds (USFWS 2002). Adult CRLFs use dense, shrubby, or emergent vegetation closely associated with deep-water pools bordered with cattails and dense stands of overhanging vegetation (http://www.fws.gov/endangered/features/rl_frog/rlfrog.html#where).

In general, dispersal and habitat use depends on climatic conditions, habitat suitability, and life stage. Adults rely on riparian vegetation for resting, feeding, and dispersal. The foraging quality of the riparian habitat depends on moisture, composition of the plant community, and presence of pools and backwater aquatic areas for breeding. CRLFs can be found living within streams at distances up to 3 km (2 miles) from their breeding site and have been found up to 30 m (100 feet) from water in dense riparian vegetation for up to 77 days (USFWS 2002).

During dry periods, the CRLF is rarely found far from water, although it will sometimes disperse from its breeding habitat to forage and seek other suitable habitat under downed trees or logs, industrial debris, and agricultural features (UWFWS 2002). According to Jennings and Hayes (1994), CRLFs also use small mammal burrows and moist leaf litter as habitat. In addition, CRLFs may also use large cracks in the bottom of dried ponds as refugia; these cracks may provide moisture for individuals avoiding predation and solar exposure (Alvarez 2000).

2.6 Designated Critical Habitat

In a final rule published on April 13, 2006, 34 separate units of critical habitat were designated for the CRLF by USFWS (USFWS 2006; FR 51 19244-19346). A summary of the 34 critical habitat units relative to USFWS-designated recovery units and core areas (previously discussed in Section 2.5.1) is provided in Table 2.4.

'Critical habitat' is defined in the ESA as the geographic area occupied by the species at the time of the listing where the physical and biological features necessary for the conservation of the species exist, and there is a need for special management to protect the listed species. It may also include areas outside the occupied area at the time of listing if such areas are 'essential to the conservation of the species.' All designated critical habitat for the CRLF was occupied at the time of listing. Critical habitat receives protection under Section 7 of the ESA through prohibition against destruction or adverse modification with regard to actions carried out, funded, or authorized by a federal Agency. Section 7 requires consultation on federal actions that are likely to result in the destruction or adverse modification of critical habitat.

To be included in a critical habitat designation, the habitat must be 'essential to the conservation of the species.' Critical habitat designations identify, to the extent known using the best scientific and commercial data available, habitat areas that provide essential life cycle needs of the species or areas that contain certain primary constituent elements (PCEs) (as defined in 50 CFR 414.12(b)). PCEs include, but are not limited to, space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing (or development) of offspring; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species. The designated critical habitat areas for the CRLF are considered to have the following PCEs that justify critical habitat designation:

- Breeding aquatic habitat;
- Non-breeding aquatic habitat;
- Upland habitat; and
- Dispersal habitat.

Further description of these habitat types is provided in Attachment 1.

Occupied habitat may be included in the critical habitat only if essential features within the habitat may require special management or protection. Therefore, USFWS does not include areas where existing management is sufficient to conserve the species. Critical habitat is designated outside the geographic area presently occupied by the species only when a designation limited to its present range would be inadequate to ensure the conservation of the species. For the CRLF, all designated critical habitat units contain all four of the PCEs, and were occupied by the CRLF at the time of FR listing notice in April 2006. The FR notice designating critical habitat for the CRLF includes a special rule exempting routine ranching activities associated with livestock ranching from incidental take prohibitions. The purpose of this exemption is to promote the conservation of rangelands, which could be beneficial to the CRLF, and to reduce the rate of conversion to other land uses that are incompatible with CRLF conservation. Please see Attachment 1 for a full explanation on this special rule.

USFWS has established adverse modification standards for designated critical habitat (USFWS 2006). Activities that may destroy or adversely modify critical habitat are those that alter the PCEs and jeopardize the continued existence of the species. Evaluation of actions related to use of Telone that may alter the PCEs of the CRLF's critical habitat form the basis of the critical habitat impact analysis. According to USFWS (2006), activities that may affect critical habitat and therefore result in adverse effects to the CRLF include, but are not limited to the following:

(1) Significant alteration of water chemistry or temperature to levels beyond the tolerances of the CRLF that result in direct or cumulative adverse effects to individuals and their life-cycles.
(2) Significant increase in sediment deposition within the stream channel or pond or disturbance of upland foraging and dispersal habitat that could result in elimination or reduction of habitat necessary for the growth and reproduction of the CRLF by increasing the sediment deposition to levels that would adversely affect their ability to complete their life cycles.
(3) Significant alteration of channel/pond morphology or geometry that may lead to changes to the hydrologic functioning of the stream or pond and alter the timing, duration, water flows, and levels that would degrade or eliminate the CRLF and/or its habitat. Such an effect could also lead to increased sedimentation and degradation in water quality to levels that are beyond the CRLF's tolerances.
(4) Elimination of upland foraging and/or aestivating habitat or dispersal habitat.
(5) Introduction, spread, or augmentation of non-native aquatic species in stream segments or ponds used by the CRLF.
(6) Alteration or elimination of the CRLF's food sources or prey base (also evaluated as indirect effects to the CRLF).

As previously noted in Section 2.1, the Agency believes that the analysis of direct and indirect effects to listed species provides the basis for an analysis of potential effects on the designated critical habitat. Because Telone is expected to directly impact living organisms within the action area, critical habitat analysis for Telone is limited in a practical sense to those PCEs of critical habitat that are biological or that can be reasonably linked to biologically mediated processes.

2.7 Action Area

For listed species assessment purposes, the action area is considered to be the area affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). It is recognized that the overall action area for the national registration of Telone is likely to encompass considerable portions of the United States based on the large array of agricultural uses. However, the scope of this assessment limits consideration of the overall action area to those portions that may be applicable to the protection of the CRLF and its designated critical habitat within the state of California. The Agency's approach to defining the action area under the provisions of the Overview Document (USEPA 2004) considers the results of the risk assessment process to establish boundaries for that action area with the understanding that exposures below the Agency's defined Levels of Concern (LOCs) constitute a no-effect threshold. For the purposes of this assessment, attention will be focused on the footprint of the action (i.e., the area where pesticide application occurs), plus all areas where offsite transport (i.e., spray drift, downstream dilution, etc.) may result in potential exposure within the state of California that exceeds the Agency's LOCs.

Deriving the geographical extent of this portion of the action area is based on consideration of the types of effects that Telone may be expected to have on the environment, the exposure levels to Telone that are associated with those effects, and the best available information concerning the use of Telone and its fate and transport within the state of California. Specific measures of ecological effect for the CRLF that define the action area include any direct and indirect toxic effect to the CRLF and any potential modification of its critical habitat, including reduction in survival, growth, and fecundity as well as the full suite of sublethal effects available in the effects literature. Therefore, the action area extends to a point where environmental exposures are below any measured lethal or sublethal effect threshold for any biological entity at the whole organism, organ, tissue, and cellular level of organization. In situations where it is not possible to determine the threshold for an observed effect, the action area is not spatially limited and is assumed to be the entire state of California.

The definition of action area requires a stepwise approach that begins with an understanding of the federal action. The federal action is defined by the currently labeled uses for Telone. An analysis of labeled uses and review of available product labels was completed. Several of the currently labeled uses are special local needs (SLN) uses or are restricted to specific states and are excluded from this assessment. In addition, a distinction has been made between food use crops and those that are non-food/non-agricultural uses. For those uses relevant to the CRLF, the analysis indicates that, for Telone, the following agricultural uses (plus turf) are considered as part of the federal action evaluated in this assessment:

> Alfalfa, almond, apple, apricot, asparagus, banana, barley, beans, beets, blackberry, blueberry, boysenberry, broccoli, brussel sprouts, buckwheat, cabbage, cashew, celery, swiss chard, cherry, chestnut, clover, collards, corn (pop), cowpea/black-eyed pea, cranberry, cucumber, currant, date, dewberry, eggplant, endive, fig, filbert, flax, forest plantings (reforestation programs – tree farms, tree plantations, etc.), forest trees (all or unspecified), garlic, gooseberry, grapefruit, grapes, grass forage/fodder/hay, hickory nut, hops, horseradish, huckleberry, kale, kenaf, kohlrabi, kumquat, leek, lemon, lespedeza, lime,

loganberry, melon (cantaloupe), melon (water), millet (foxtail), proso millet (broomcorn), mint/peppermint/spearmint, mustard, nectarine, oats, okra, olive, orange, parsnip, pastures, pear, peas (unspecified), pecan, pepper, persimmon, pimento, plum, pomegranate, prune, pumpkin, quince, raspberry (black, red), rutabaga, rye, safflower, salsify, shallot, soil – preplant/outdoor, sorghum, sorghum (unspecified), soybeans (unspecified), spinach, squash (summer), squash (winter), sugarcane, tangelo, tangerines, trefoil, turnip (root), vetch, walnut (English/black), and youngberry.

Following a determination of the assessed uses, an evaluation of the potential "footprint" of Telone use patterns (i.e., the area where pesticide application occurs) is determined. This "footprint" represents the initial area of concern, based on an analysis of available land cover data for the state of California. The initial area of concern is defined as all land cover types and the stream reaches within the land cover areas that represent the labeled uses described above. A map representing all the land cover types that make up the initial area of concern for Telone is presented in **Figure 2.4**.

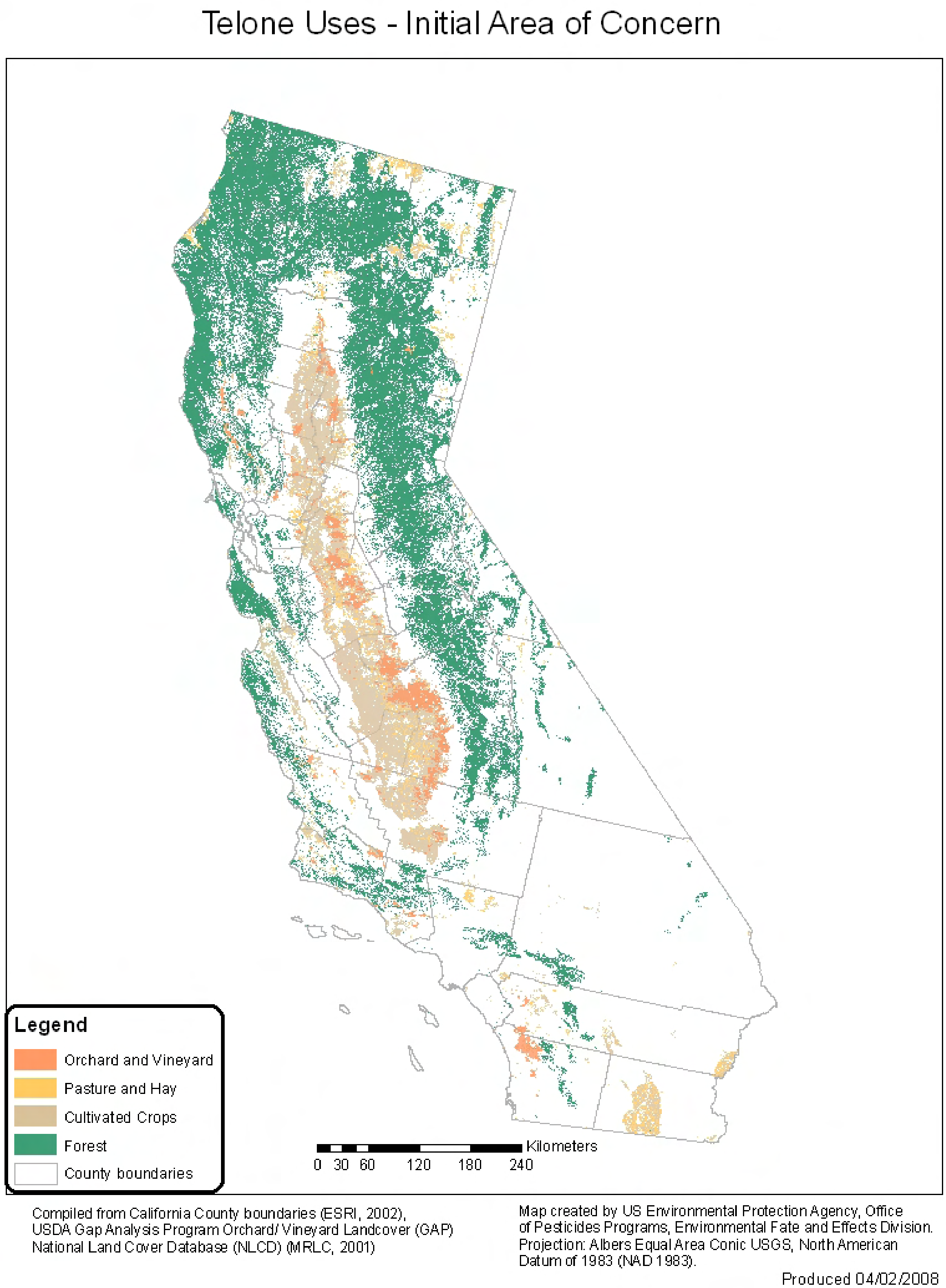


Figure 2.4 Initial area of concern, or "footprint" of potential use, for Telone

Once the initial area of concern is defined, the next step is to define the potential boundaries of the action area by determining the extent of offsite transport via spray drift and runoff where exposure of one or more taxonomic groups to the pesticide exceeds the listed species LOCs.

As previously discussed, the action area is defined by the most sensitive measure of direct and indirect ecological toxic effects including reduction in survival, growth, reproduction, and the entire suite of sublethal effects from valid, peer-reviewed studies.

Due to a positive result in a mutagenicity test[5], the spatial extent of the action area (i.e., the boundary where exposures and potential effects are less than the Agency's LOC) for Telone cannot be determined. Therefore, it is assumed that the action area encompasses the entire state of California, regardless of the spatial extent (i.e., initial area of concern or footprint) of the pesticide use(s).

The dominant routes of telone exposure are expected to be inhalation and contact with contaminated surface water. The environmental fate of telone is dominated by its volatility and subsequent rapid degradation in air by hydroxyl radicals, followed by hydrolysis in water. These factors will be considered in determining the area where Telone is likely to impact the CRLF. Calculation of a spray drift buffer for telone is not necessary, since it is not applied by methods that cause spray drift. A downstream dilution analysis is also not performed, because all aquatic risks were found to be No Effect or NLAA.

An evaluation of usage information was conducted to determine the area where use of Telone may impact the CRLF. This analysis is used to characterize where predicted exposures are most likely to occur, but does not preclude use in other portions of the action area. A more detailed review of the county-level use information was also completed. These data (Tables 2.3 and 2.3a) suggest that telone use is widespread and intense (in terms of pounds applied) in California, supporting the establishment of the entire state as the Action Area.

2.8 Assessment Endpoints and Measures of Ecological Effect

Assessment endpoints are defined as "explicit expressions of the actual environmental value that is to be protected."[6] Selection of the assessment endpoints is based on valued entities (*e.g.*, CRLF, organisms important in the life cycle of the CRLF, and the PCEs of its designated critical habitat), the ecosystems potentially at risk (*e.g.*, waterbodies, riparian vegetation, and upland and dispersal habitats), the migration pathways of Telone (*e.g.*, runoff, volatility, etc.), and the routes by which ecological receptors are exposed to Telone *(e.g.*, direct contact, *etc.)*.

2.8.1. Assessment Endpoints for the CRLF

Assessment endpoints for the CRLF include direct toxic effects on the survival, reproduction, and growth of the CRLF, as well as indirect effects, such as reduction of the prey base or

[5] The memorandum from C. Olinger, E. Mendez, J. Dawson, and E. Vogel, Health Effects Division to C. Giles-Parker, Registration Division dated January 24, 2008 regarding the human health risk assessment of telone refer to several studies identifying telone as a mutagen. This was determined from MRID 00146469.
[6] From U.S. EPA (1992). *Framework for Ecological Risk Assessment.* EPA/630/R-92/001.

modification of its habitat. In addition, potential modification of critical habitat is assessed by evaluating potential effects to PCEs, which are components of the habitat areas that provide essential life cycle needs of the CRLF. Each assessment endpoint requires one or more "measures of ecological effect," defined as changes in the attributes of an assessment endpoint or changes in a surrogate entity or attribute in response to exposure to a pesticide. Specific measures of ecological effect are generally evaluated based on acute and chronic toxicity information from registrant-submitted guideline tests that are performed on a limited number of organisms. Additional ecological effects data from the open literature are also considered. It should be noted that assessment endpoints are limited to direct and indirect effects associated with survival, growth, and fecundity, and do not include the full suite of sublethal effects used to define the action area. According the Overview Document (USEPA 2004), the Agency relies on acute and chronic effects endpoints that are either direct measures of impairment of survival, growth, or fecundity or endpoints for which there is a scientifically robust, peer reviewed relationship that can quantify the impact of the measured effect endpoint on the assessment endpoints of survival, growth, and fecundity.

A complete discussion of all the toxicity data available for this risk assessment, including resulting measures of ecological effect selected for each taxonomic group of concern, is included in Section 4 of this document. A summary of the assessment endpoints and measures of ecological effect selected to characterize potential assessed direct and indirect CRLF risks associated with exposure to Telone is provided in **Table 2.5**.

Table 2.5 Assessment Endpoints and Measures of Ecological Effects

Assessment Endpoint	Measures of Ecological Effects[7]	Endpoints Used in Assessment
Aquatic-Phase CRLF (Eggs, larvae, juveniles, and adults)[a]		
Direct Effects		
1. Survival, growth, and reproduction of CRLF	1a. Amphibian acute LC_{50} (ECOTOX) or most sensitive fish acute LC_{50} (guideline or ECOTOX) if no suitable amphibian data are available 1b. Amphibian chronic NOAEC (ECOTOX) or most sensitive fish chronic NOAEC (guideline or ECOTOX) 1c. Amphibian early-life stage data (ECOTOX) or most sensitive fish early-life stage NOAEC (guideline or ECOTOX)	No amphibian data are available. Acute effects: LC_{50} = 1.08 ppm ai for Walleye (*Stizostedion vitreum*) No data for chronic effects.
Indirect Effects and Critical Habitat Effects		
2. Survival, growth, and reproduction of CRLF individuals via indirect effects on aquatic prey food supply (*i.e.,* fish, freshwater invertebrates, non-vascular plants)	2a. Most sensitive fish, aquatic invertebrate, and aquatic plant EC_{50} or LC_{50} (guideline or ECOTOX) 2b. Most sensitive aquatic invertebrate and fish chronic NOAEC (guideline or ECOTOX) 2c. Most sensitive EC_{50} for aquatic non-vascular plants	Fish acute effects: LC_{50} = 1.08 ppm ai for Walleye (*Stizostedion vitreum*). No chronic data. Invertebrate acute effects: LC_{50} = 0.09 ppm ai for Waterflea (*Daphnia magna*)

[7] All registrant-submitted and open literature toxicity data reviewed for this assessment are identified in Appendix A.

		Invertebrate chronic effects: NOAEC = 0.07 ppm ai for Waterflea (*D. magna*) Freshwater diatom (*Navicula pelliculosa*): EC_{50} = 7.9 ppm ai
3. Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat, cover, food supply, and/or primary productivity (*i.e.*, aquatic plant community)	3a. Vascular plant acute EC_{50} (duckweed guideline test or ECOTOX vascular plant) 3b. Non-vascular plant acute EC_{50} (freshwater algae or diatom, or ECOTOX non-vascular)	Duckweed (*Lemna gibba*) EC_{50} = 20.0 ppm ai Freshwater diatom (*Navicula pelliculosa*) EC_{50} = 7.9 ppm ai
4. Survival, growth, and reproduction of CRLF individuals via effects to riparian vegetation	4a. Distribution of EC_{25} values for monocots (seedling emergence, vegetative vigor, or ECOTOX) 4b. Distribution of EC_{25} values for dicots (seedling emergence, vegetative vigor, or ECOTOX)	Monocots: Onion (*Allium cepa*) EC_{25} > 11.69 lbs ai/acre (seedling emergence) Onion (*Allium cepa*) EC_{25} = 4.81 lbs ai/acre (vegetative vigor Dicots: Tomato (*Lycopersicon esculentum*) EC_{25} = 3.5 lbs ai/acre (seedling emergence) Cucumber (*Cucumis sativus*) EC_{25} = 6.86 lbs ai/acre (vegetative vigor)
Terrestrial-Phase CRLF *(Juveniles and adults)*		
Direct Effects		
5. Survival, growth, and reproduction of CRLF individuals via direct effects on terrestrial phase adults and juveniles	5a. Most sensitive bird[b] or terrestrial-phase amphibian acute LC_{50} or LD_{50} (guideline or ECOTOX) 5b. Most sensitive bird[b] or terrestrial-phase amphibian chronic NOAEC (guideline or ECOTOX)	No amphibian data Northern bobwhite (*Colinus virginianus*) LD_{50} = 152 mg ai/kg bw No chronic data
Indirect Effects and Critical Habitat Effects		
6. Survival, growth, and reproduction of CRLF individuals via effects on terrestrial prey (*i.e.*,terrestrial invertebrates, small mammals , and frogs)	6a. Most sensitive terrestrial invertebrate and vertebrate acute EC_{50} or LC_{50} (guideline or ECOTOX)[c] 6b. Most sensitive terrestrial invertebrate and vertebrate chronic NOAEC (guideline or ECOTOX)	Honey bee (*Apis mellifera*) acute contact LD_{50} >60.43 µg/bee Laboratory rat (*Rattus norvegicus*) acute oral LD_{50} = 224 mg/kg bw Laboratory rat (*Rattus norvegicus*) acute inhalation LC_{50} = 729 ppm ai Laboratory rat (*Rattus norvegicus*) 13-week feeding study NOAEC = 5 mg/kg bw Laboratory rat (*Rattus*

		norvegicus) developmental inhalation NOAEC = 20 ppm ai
7. Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat (*i.e.*, riparian and upland vegetation)	7a. Distribution of EC_{25} for monocots (seedling emergence, vegetative vigor, or ECOTOX 7b. Distribution of EC_{25} for dicots (seedling emergence, vegetative vigor, or ECOTOX)	Monocots: Onion (*Allium cepa*) EC_{25} > 11.69 lbs ai/acre (seedling emergence) Onion (*Allium cepa*) EC_{25} = 4.81 lbs ai/acre (vegetative vigor Dicots: Tomato (*Lycopersicon esculentum*) EC_{25} = 3.5 lbs ai/acre (seedling emergence) Cucumber (*Cucumis sativus*) EC_{25} = 6.86 lbs ai/acre (vegetative vigor)

[a] Adult frogs are no longer in the "aquatic phase" of the amphibian life cycle; however, submerged adult frogs are considered "aquatic" for the purposes of this assessment because exposure pathways in the water are considerably different that exposure pathways on land.
[b] Birds are used as surrogates for terrestrial phase amphibians.

2.8.2 Assessment Endpoints for Designated Critical Habitat

As previously discussed, designated critical habitat is assessed to evaluate actions related to the use of Telone that may alter the PCEs of the CRLF's critical habitat. PCEs for the CRLF were previously described in Section 2.6. Actions that may modify critical habitat are those that alter the PCEs and jeopardize the continued existence of the CRLF. Therefore, these actions are identified as assessment endpoints. It should be noted that evaluation of PCEs as assessment endpoints is limited to those of a biological nature (i.e., the biological resource requirements for the listed species associated with the critical habitat) and those for which Telone effects data are available.

Adverse modification to the critical habitat of the CRLF includes, but is not limited to, the following, as specified by USFWS (2006):

1. Alteration of water chemistry/quality including temperature, turbidity, and oxygen content necessary for normal growth and viability of juvenile and adult CRLFs.
2. Alteration of chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs.
3. Significant increase in sediment deposition within the stream channel or pond or disturbance of upland foraging and dispersal habitat.
4. Significant alteration of channel/pond morphology or geometry.
5. Elimination of upland foraging and/or aestivating habitat, as well as dispersal habitat.
6. Introduction, spread, or augmentation of non-native aquatic species in stream segments or ponds used by the CRLF.
7. Alteration or elimination of the CRLF's food sources or prey base.

Measures of such possible effects by labeled use of Telone on critical habitat of the CRLF are described in **Table 2.6**. Some components of these PCEs are associated with physical abiotic features (e.g., presence and/or depth of a water body, or distance between two sites), which are not expected to be measurably altered by use of pesticides. Assessment endpoints used for the analysis of designated critical habitat are based on the adverse modification standard established by USFWS (2006).

Table 2.6 Summary of Assessment Endpoints and Measures of Ecological Effect for Primary Constituent Elements of Designated Critical Habitat[a]		
Assessment Endpoint	**Measures of Ecological Effect**	**Endpoints Used in Assessment**
Aquatic-Phase CRLF PCEs (Aquatic Breeding Habitat and Aquatic Non-Breeding Habitat)		
Alteration of channel/pond morphology or geometry and/or increase in sediment deposition within the stream channel or pond: aquatic habitat (including riparian vegetation) provides for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRLFs.	a. Most sensitive aquatic plant EC_{50} (guideline or ECOTOX) b. Distribution of EC_{25} values for terrestrial monocots (seedling emergence, vegetative vigor, or ECOTOX) c. Distribution of EC_{25} values for terrestrial dicots (seedling emergence, vegetative vigor, or ECOTOX)	Freshwater diatom (*Navicula pelliculosa*): EC_{50} = 7.9 ppm ai Monocots: Onion (*Allium cepa*) EC_{25} > 11.69 lbs ai/acre (seedling emergence) Onion (*Allium cepa*) EC_{25} = 4.81 lbs ai/acre (vegetative vigor Dicots: Tomato (*Lycopersicon esculentum*) EC_{25} = 3.5 lbs ai/acre (seedling emergence) Cucumber (*Cucumis sativus*) EC_{25} = 6.86 lbs ai/acre (vegetative vigor)
Alteration in water chemistry/quality including temperature, turbidity, and oxygen content necessary for normal growth and viability of juvenile and adult CRLFs and their food source.	a. Most sensitive EC_{50} values for aquatic plants (guideline or ECOTOX) b. Distribution of EC_{25} values for terrestrial monocots (seedling emergence or vegetative vigor, or ECOTOX) c. Distribution of EC_{25} values for terrestrial dicots (seedling emergence, vegetative vigor, or ECOTOX)	Freshwater diatom (*Navicula pelliculosa*): EC_{50} = 7.9 ppm ai Monocots: Onion (*Allium cepa*) EC_{25} > 11.69 lbs ai/acre (seedling emergence) Onion (*Allium cepa*) EC_{25} = 4.81 lbs ai/acre (vegetative vigor Dicots: Tomato (*Lycopersicon esculentum*) EC_{25} = 3.5 lbs ai/acre (seedling emergence) Cucumber (*Cucumis sativus*) EC_{25} = 6.86 lbs ai/acre (vegetative vigor)
Alteration of other chemical characteristics necessary for normal growth and viability of CRLFs and their food source.	a. Most sensitive EC_{50} or LC_{50} values for fish or aquatic-phase amphibians and aquatic invertebrates (guideline or ECOTOX) b. Most sensitive NOAEC values for fish or aquatic-phase amphibians and aquatic invertebrates (guideline or ECOTOX)	No amphibian data are available. Acute effects: LC_{50} = 1.08 ppm ai for Walleye (*Stizostedion vitreum*) No data for chronic effects.
Reduction and/or modification of aquatic-based food sources for pre-metamorphs (*e.g.,* algae)	a. Most sensitive aquatic plant EC_{50} (guideline or ECOTOX)	Freshwater diatom (*Navicula pelliculosa*): EC_{50} = 7.9 ppm ai
Terrestrial-Phase CRLF PCEs (Upland Habitat and Dispersal Habitat)		

<table>
<tr><th colspan="3">Table 2.6 Summary of Assessment Endpoints and Measures of Ecological Effect for Primary Constituent Elements of Designated Critical Habitat[a]</th></tr>
<tr><th>Assessment Endpoint</th><th>Measures of Ecological Effect</th><th>Endpoints Used in Assessment</th></tr>
<tr><td>Elimination and/or disturbance of upland habitat; ability of habitat to support food source of CRLFs: Upland areas within 200 ft of the edge of the riparian vegetation or dripline surrounding aquatic and riparian habitat that are comprised of grasslands, woodlands, and/or wetland/riparian plant species that provides the CRLF shelter, forage, and predator avoidance</td><td rowspan="4">a. Distribution of EC_{25} values for monocots (seedling emergence, vegetative vigor, or ECOTOX)
b. Distribution of EC_{25} values for dicots (seedling emergence, vegetative vigor, or ECOTOX)
c. Most sensitive food source acute EC_{50}/LC_{50} and NOAEC values for terrestrial vertebrates (mammals) and invertebrates, birds or terrestrial-phase amphibians, and freshwater fish.</td><td rowspan="4">Monocots:
Onion (Allium cepa) EC_{25} > 11.69 lbs ai/acre (seedling emergence)
Onion (Allium cepa) EC_{25} = 4.81 lbs ai/acre (vegetative vigor

Dicots:
Tomato (Lycopersicon esculentum) EC_{25} = 3.5 lbs ai/acre (seedling emergence)
Cucumber (Cucumis sativus) EC_{25} = 6.86 lbs ai/acre (vegetative vigor)

Northern bobwhite (Colinus virginianus) acute LD_{50} = 152 mg ai/kg bw

Honey bee (Apis mellifera) acute contact LD_{50} >60.43 µg/bee

Laboratory rat (Rattus norvegicus) acute oral LD_{50} = 224 mg/kg bw

Laboratory rat (Rattus norvegicus) acute inhalation LC_{50} = 729 ppm ai

Laboratory rat (Rattus norvegicus) 13-week feeding study NOAEC = 5 mg/kg bw

Laboratory rat (Rattus norvegicus) developmental inhalation NOAEC = 20 ppm ai</td></tr>
<tr><td>Elimination and/or disturbance of dispersal habitat: Upland or riparian dispersal habitat within designated units and between occupied locations within 0.7 mi of each other that allow for movement between sites including both natural and altered sites which do not contain barriers to dispersal</td></tr>
<tr><td>Reduction and/or modification of food sources for terrestrial phase juveniles and adults</td></tr>
<tr><td>Alteration of chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs and their food source.</td></tr>
</table>

[a] Physico-chemical water quality parameters such as salinity, pH, and hardness are not evaluated because these processes are not biologically mediated and, therefore, are not relevant to the endpoints included in this assessment.

2.9 Conceptual Model

2.9.1 Risk Hypotheses

Risk hypotheses are specific assumptions about potential adverse effects (*i.e.*,changes in assessment endpoints) and may be based on theory and logic, empirical data, mathematical models, or probability models (U.S. EPA, 1998). For this assessment, the risk is stressor-linked, where the stressor is the release of Telone to the environment. The following risk hypotheses are presumed for this endangered species assessment:

The labeled use of Telone within the action area may:

- directly affect the CRLF by causing mortality or by adversely affecting growth or fecundity;
- indirectly affect the CRLF by reducing or changing the composition of food supply;
- indirectly affect the CRLF or modify designated critical habitat by reducing or changing the composition of the aquatic plant community in the ponds and streams comprising the species' current range and designated critical habitat, thus affecting primary productivity and/or cover;
- indirectly affect the CRLF or modify designated critical habitat by reducing or changing the composition of the terrestrial plant community (i.e., riparian habitat) required to maintain acceptable water quality and habitat in the ponds and streams comprising the species' current range and designated critical habitat;
- modify the designated critical habitat of the CRLF by reducing or changing breeding and non-breeding aquatic habitat (via modification of water quality parameters, habitat morphology, and/or sedimentation);
- modify the designated critical habitat of the CRLF by reducing the food supply required for normal growth and viability of juvenile and adult CRLFs;
- modify the designated critical habitat of the CRLF by reducing or changing upland habitat within 200 ft of the edge of the riparian vegetation necessary for shelter, foraging, and predator avoidance.
- modify the designated critical habitat of the CRLF by reducing or changing dispersal habitat within designated units and between occupied locations within 0.7 mi of each other that allow for movement between sites including both natural and altered sites which do not contain barriers to dispersal.
- modify the designated critical habitat of the CRLF by altering chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs.

2.9.2 Diagram

The conceptual model is a graphic representation of the structure of the risk assessment. It specifies the Telone release mechanisms, biological receptor types, and effects endpoints of potential concern. The conceptual models for aquatic and terrestrial phases of the CRLF are shown in **Figures 2.5 and 2.6**, respectively, and the conceptual models for the aquatic and terrestrial PCE components of critical habitat are shown in **Figures 2.7 and 2.8**, respectively. Exposure routes shown in dashed lines are not quantitatively considered because the contribution of those potential exposure routes to potential risks to the CRLF and modification to designated critical habitat is expected to be negligible.

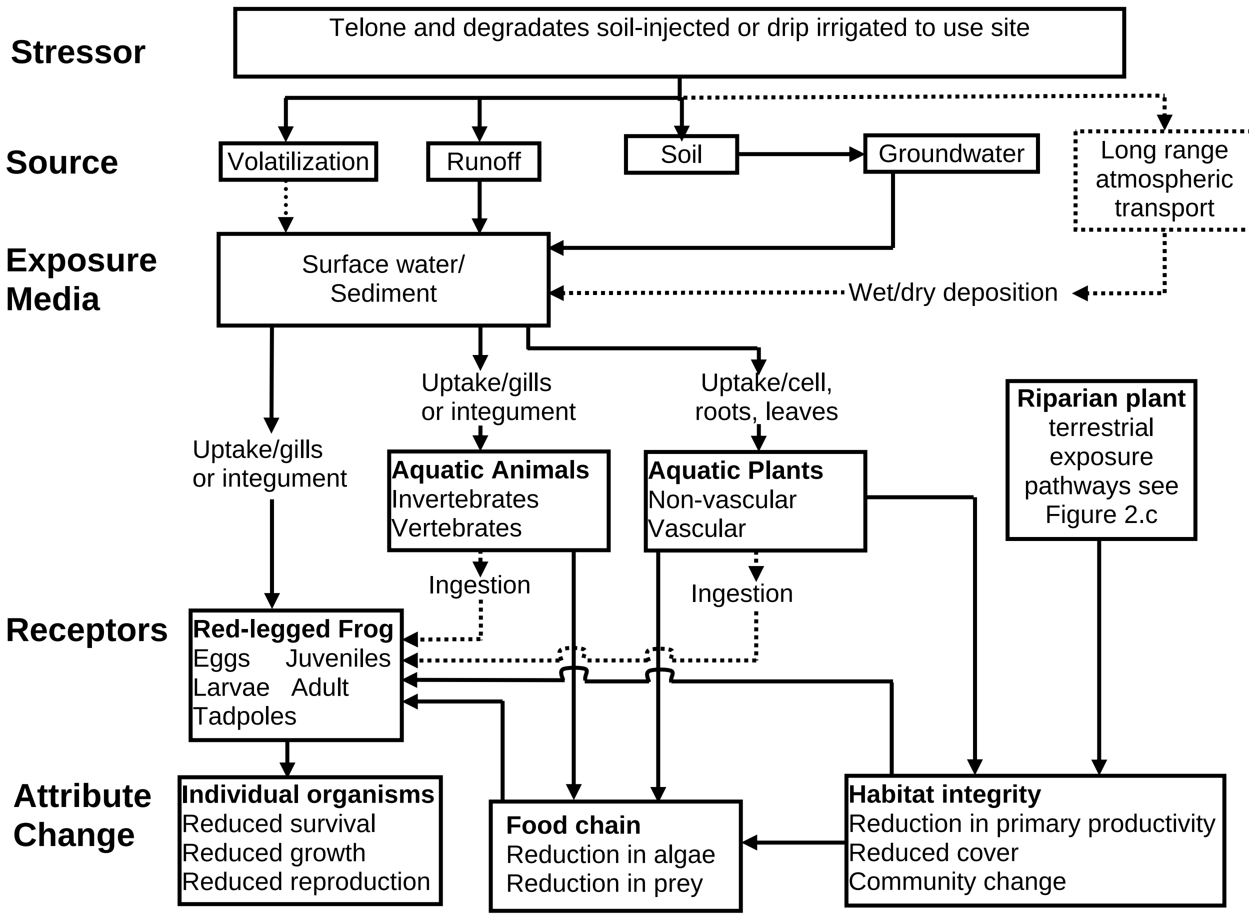


Figure 2.5 Conceptual Model for Aquatic-Phase of the CRLF

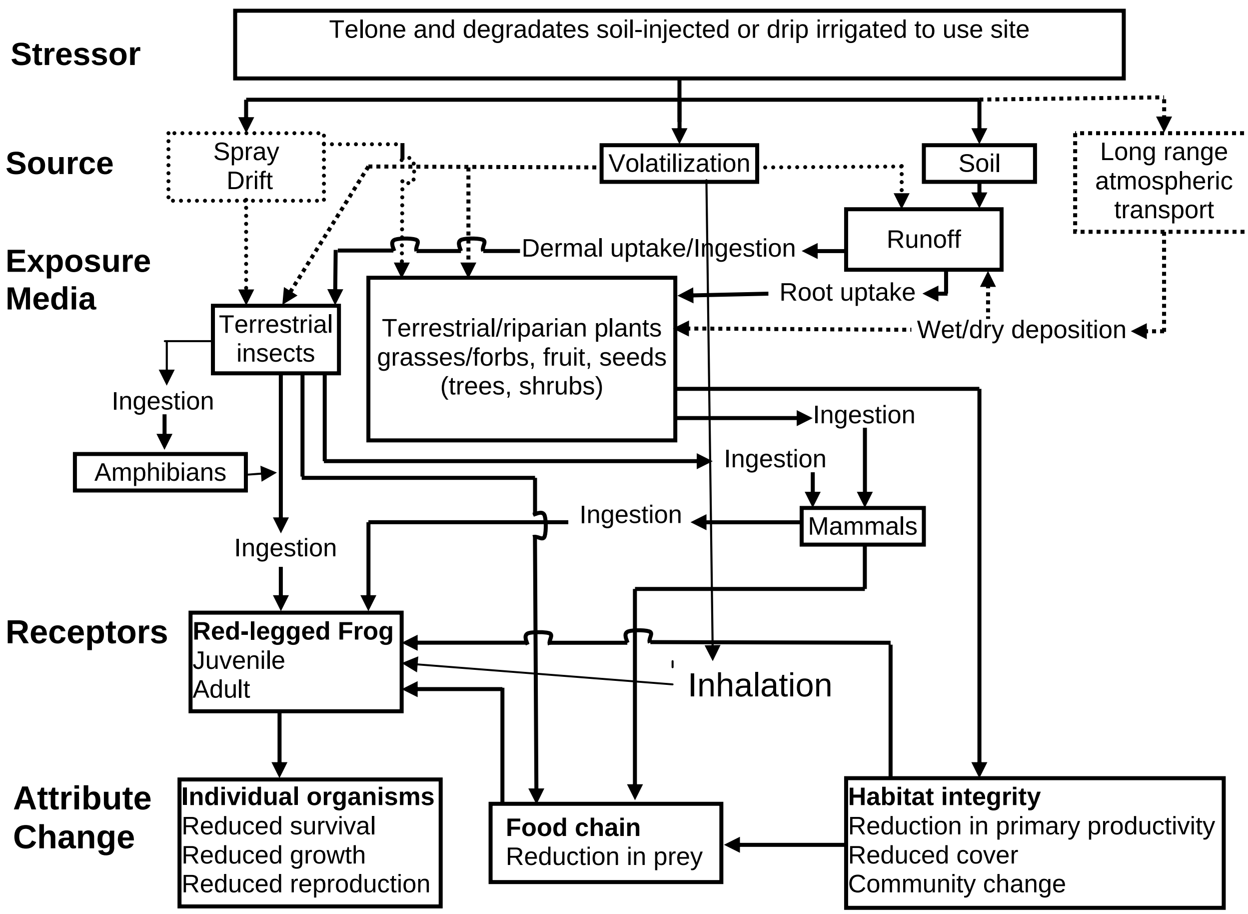


Figure 2.6 Conceptual Model for Terrestrial-Phase of the CRLF

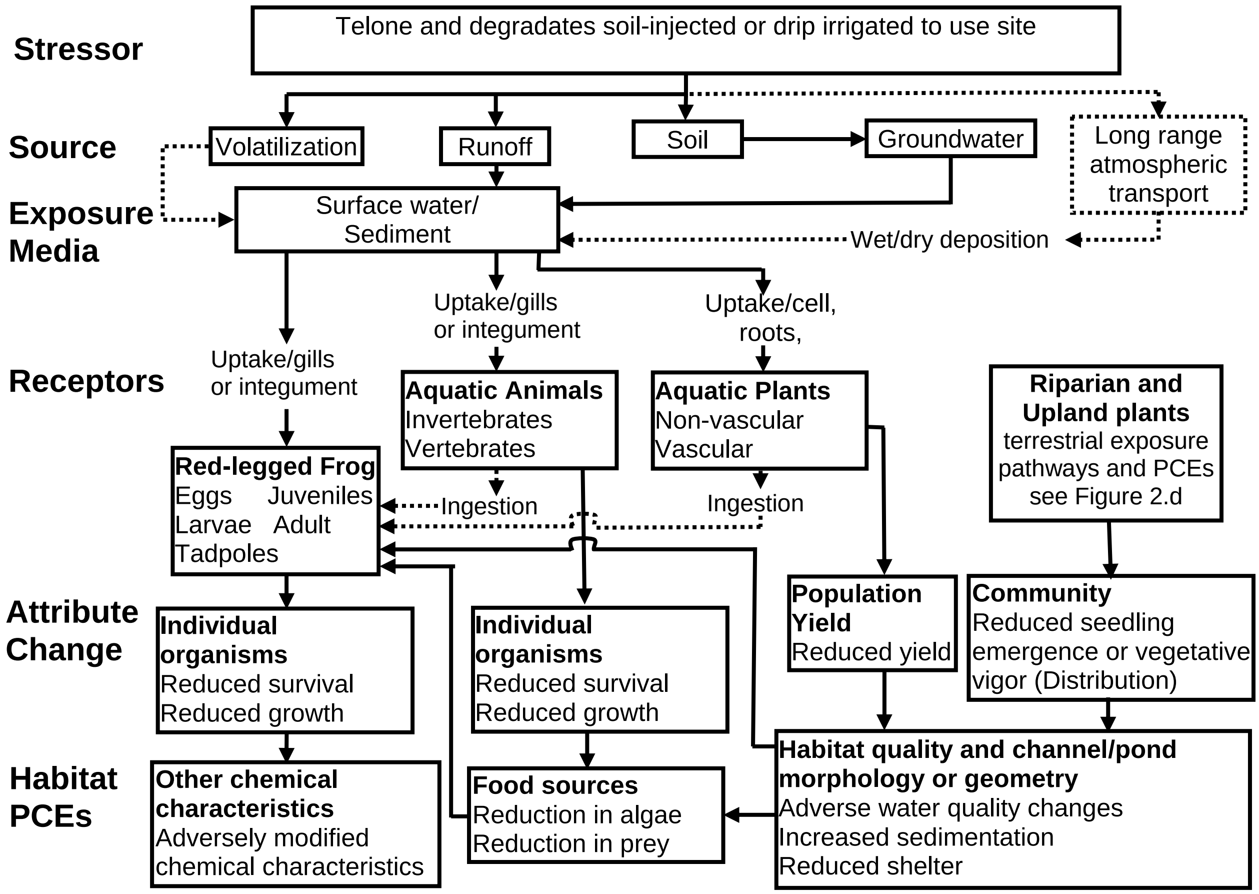


Figure 2.7 Conceptual Model for Pesticide Effects on Aquatic Component of CRLF Critical Habitat

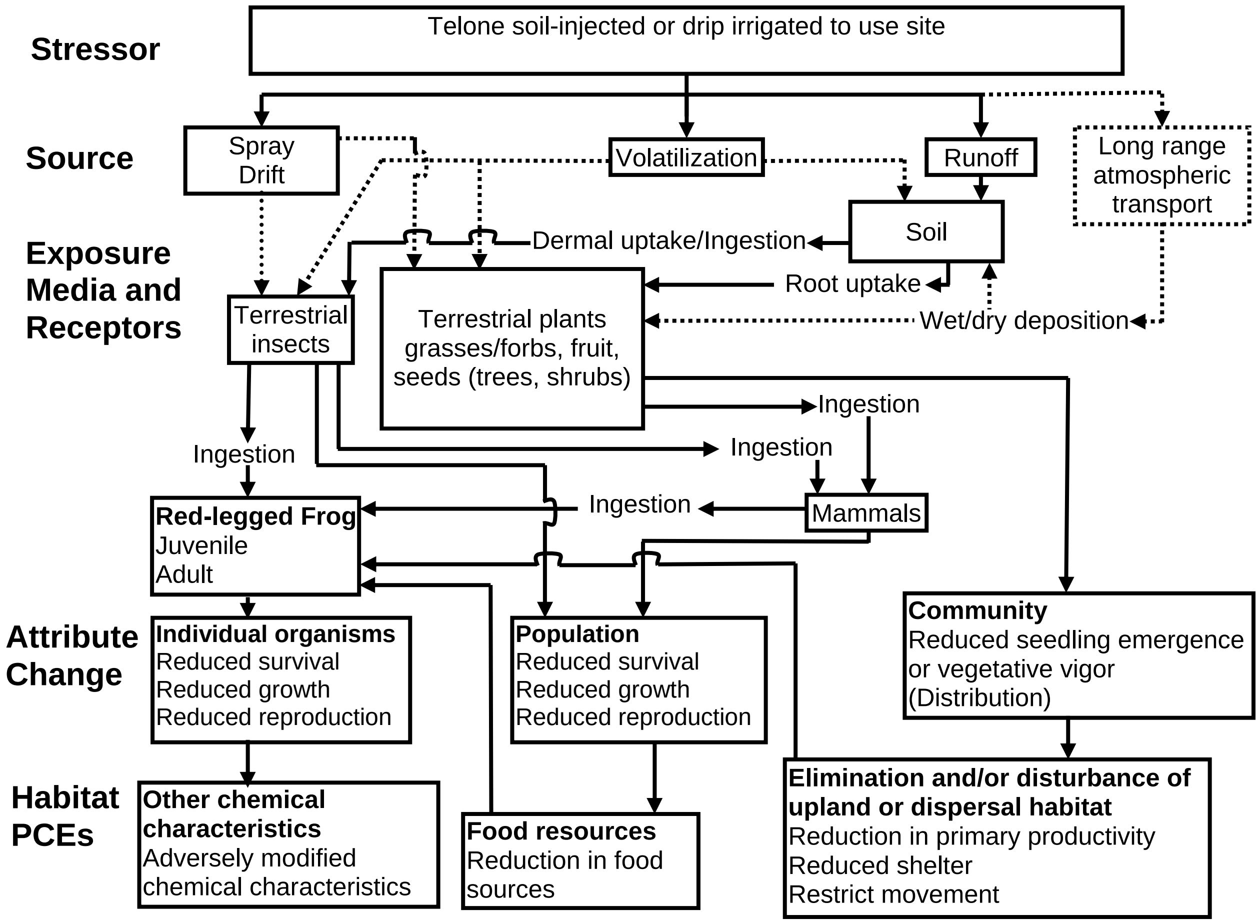


Figure 2.8 Conceptual Model for Pesticide Effects on Terrestrial Component of CRLF Critical Habitat

2.10 Analysis Plan

In order to address the risk hypothesis, the potential for direct and indirect effects to the CRLF, its prey, and its habitat is estimated. In the following sections, the use, environmental fate, and ecological effects of Telone are characterized and integrated to assess the risks. This is accomplished using a risk quotient (ratio of exposure concentration to effects concentration) approach. Although risk is often defined as the likelihood and magnitude of adverse ecological effects, the risk quotient-based approach does not provide a quantitative estimate of likelihood and/or magnitude of an adverse effect. However, as outlined in the Overview Document (U.S. EPA, 2004), the likelihood of effects to individual organisms from particular uses of Telone is estimated using the probit dose-response slope and either the level of concern (discussed below) or actual calculated risk quotient value.

2.10.1 Measures to Evaluate the Risk Hypothesis and Conceptual Model

2.10.1.1 Measures of Exposure

The environmental fate properties of Telone along with available monitoring data indicate that runoff and volatilization are the principle potential transport mechanisms of Telone to the aquatic and terrestrial habitats of the CRLF. In this assessment, transport of Telone through runoff and volatilization is considered in deriving quantitative estimates of Telone exposure to CRLF, its prey and its habitats. Volatilization of telone is expected to be an exposure route only in the immediate vicinity of the use site, since telone is rapidly degraded in air by hydroxyl radicals.

Measures of exposure are based on aquatic and terrestrial models that predict estimated environmental concentrations (EECs) of Telone using maximum labeled application rates and methods of application. The models used to predict aquatic EECs are the Pesticide Root Zone Model coupled with the Exposure Analysis Model System (PRZM/EXAMS). Since application is made by soil injection or chemigation, estimates of EECs on terrestrial food items are not needed. Terrestrial exposure is expected to occur mainly as a result of inhalation or contact with soil from treated fields. These exposures will be assessed using field volatility studies, drip irrigation application rates (mg/L) and soil application rates. Estimates of EECs in soil and exposure via incidental ingestion are described below. The TerrPlant model is used to derive EECs for terrestrial and wetland plants, using data from registrant-submitted environmental fate data.

PRZM (v3.12.2, May 2005) and EXAMS (v2.98.4.6, April 2005) are screening simulation models coupled with the input shell pe5.pl (Aug 2007) to generate daily exposures and 1-in-10 year EECs of Telone that may occur in surface water bodies adjacent to application sites receiving Telone through runoff and spray drift. PRZM simulates pesticide application, movement and transformation on an agricultural field and the resultant pesticide loadings to a receiving water body via runoff, erosion and spray drift. EXAMS simulates the fate of the pesticide and resulting concentrations in the water body. The standard scenario used for ecological pesticide assessments assumes application to a 10-hectare agricultural field that drains into an adjacent 1-hectare water body, 2-meters deep (20,000 m^3 volume) with no outlet. PRZM/EXAMS was used to estimate screening-level exposure of aquatic organisms to Telone. The measure of exposure for aquatic species is the 1-in-10 year return peak or rolling average concentrations over relevant timeframes. The 1-in-10 year peak is used for estimating acute exposures of direct effects to the CRLF, as well as indirect effects to the CRLF through effects to potential prey items, including: algae, aquatic invertebrates, fish and frogs. The 1-in-10-year 60-day mean is used for assessing chronic exposure to the CRLF and fish and frogs serving as prey items; the 1-in-10-year 21-day mean is used for assessing chronic exposure for aquatic invertebrates, which are also potential prey items.

Exposure to the degradates 3-chloroallyl alcohol and 3-chloroacrylic acid in aquatic habitats will be estimated by multiplying the PRZM-EXAMS results for the parent by the maximum formation of the degradates in the parent aerobic aquatic metabolism study (MRID 44975503). In that study, the alcohol reached a maximum of 6.4% at 1 day, and the acids reached 10% at 7 days. The parent exposure assessment is conservative for the degradates since an aerobic aquatic half-life of 195.2 days (two times the soil input parameter, rather than the measured value of 4.9 days) is used. Similarly, the upper confidence limit on the aerobic soil half-life (97.2 days) is conservative for both parent and degradates, since it is calculated from individual values of 12 and 54 days; the large standard deviation between these values, and the small number of values (2) cause the input parameter to be very conservative.

EECs for terrestrial plants inhabiting dry and wetland areas are derived using TerrPlant (version 1.2.2, 12/26/2006). This model uses estimates of pesticides in runoff and in spray drift to calculate EECs. An estimate of exposure due to drift is also added into all exposure estimates, which does not exactly apply to applications of telone by fumigation or drip irrigation. However, since volatilization of some unknown amount of telone is expected from this application method, the amount from drift was left in the exposure estimate (1% default assumption for ground application). EECs are based upon solubility, application rate and minimum incorporation depth.

For exposure by incidental soil ingestion, the concentration in soil estimated from the field dissipation study (MRID 40403301) following application of telone by soil injection will be used. Since application to grapes via drip irrigation could result in a widely different soil concentration, an estimate of the soil concentration was initially derived based on the maximum application rate per acre (17.68 lbs) and the estimated volume of soil actually treated. An area with diameter of 2 feet was assumed to be treated beneath each vine, assuming that two drip emitters per vine deliver telone to the soil as recommended on the label. A 9-inch wetting depth in dry soil was also assumed; the actual value may vary based on soil type and conditions, but this value was assumed to be a reasonable conservative estimate. Based on growing recommendations, row spacing and vine spacing were assumed to be 10 feet and 7 feet, respectively[8]. This configuration results in 505 vines per acre, giving an actual area treated of 1586.5 ft^2, resulting in 0.0114 lbs a.i./ft^2. Using the above parameter estimates and assuming a soil bulk density of 1.84 g/cm^3 (taken from the California grape PRZM-EXAMS scenario), the concentration in the soil at each vine is determined to be 132.0 ppm. Since this value is very close to the measured value from the field dissipation study, and because the values used for the parameters in these calculations can vary widely leading to uncertainty in this estimate, it was determined that the measured value of 130 ppm ai was adequate for estimating risks from all uses. This application method does, however, require additional consideration for the likelihood of encountering a treated area on a per acre basis. Based on the scenario described above with 505 vines per acre, the actual amount of treated area encountered by a bird or mammal was determined to be 3.64% of its foraging area, assuming it forages in a random walk pattern.

To determine the amount of telone exposure through incidental soil ingestion, this risk assessment employs information from Beyer et al. (1994)[9]. Percentages of body weight consumed as diet were calculated with allometric equations available in EPA's Wildlife

[8] Michigan State University Extension. 1999. MSU Extension Fruit Bulletins – 26449701: Extension Bulletin E-2644 (Vineyard Establishment I – Preplant Decisions). http://web1.msue.msu.edu/msue/imp/modfr/26449701.html. Lord. W. 2001. Growing Grapes. University of New Hampshire Extension Fact Sheet. http://extension.unh.edu/Pubs/HGPubs/growgrap.pdf

[9] Beyer, W. N., E.E. Connor, and S. Gerould. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management. 58(2):375-382

Exposure Factors Handbook[10], as well as estimated percentages of diet consumed as soil per day. The maximum estimates for soil consumption provided in this reference for birds and mammals were used, and these were 30% for birds and 17% for mammals The LD_{50} for birds and mammals was adjusted for standard body weights (see TREX User's Guide).

Inhalation exposure will be assessed by comparing the maximum observed concentration in field volatility studies (Table 2.1), adjusted to the maximum application rate, to acute inhalation toxicity data for any taxa for which such data exist.

Acute oral toxicity data for mammals are available for the degradates of telone. The EFED RED Chapter for telone indicated that as much as 72% of the parent can be converted to degradates via hydrolysis in soil. Therefore, a concentration of 101.4 ppm will be used as an estimate for the concentration of degradates in the soil for estimating risk of the degradates due to incidental soil ingestion. Daily dose from soil ingestion will be estimated with the same methods as for the parent. Since the LD_{50}s for both degradates are identical for mammals, use of this percentage as an estimate of composite degradate concentration is appropriate, assuming these compounds have additive toxicity.

2.10.1.2 Measures of Effect

Data identified in Section 2.8 are used as measures of effect for direct and indirect effects to the CRLF. Data were obtained from registrant submitted studies or from literature studies identified by ECOTOX. The ECOTOXicology database (ECOTOX) was searched in order to provide more ecological effects data and in an attempt to bridge existing data gaps. ECOTOX is a source for locating single chemical toxicity data for aquatic life, terrestrial plants, and wildlife. ECOTOX was created and is maintained by the USEPA, Office of Research and Development, and the National Health and Environmental Effects Research Laboratory's Mid-Continent Ecology Division.

The assessment of risk for direct effects to the terrestrial-phase CRLF makes the assumption that toxicity of Telone to birds is similar to or less than the toxicity to the terrestrial-phase CRLF. The same assumption is made for fish and aquatic-phase CRLF. Algae, aquatic invertebrates, fish, and amphibians represent potential prey of the CRLF in the aquatic habitat. Terrestrial invertebrates, small mammals, and terrestrial-phase amphibians represent potential prey of the CRLF in the terrestrial habitat. Aquatic, semi-aquatic, and terrestrial plants represent habitat of CRLF.

The acute measures of effect used for animals in this screening level assessment are the LD_{50}, LC_{50} and EC_{50}. LD stands for "Lethal Dose", and LD_{50} is the amount of a material, given all at once, that is estimated to cause the death of 50% of the test organisms. LC stands for "Lethal Concentration" and LC_{50} is the concentration of a chemical that is estimated to kill 50% of the test organisms. EC stands for "Effective Concentration" and the EC_{50} is the concentration of a chemical that is estimated to produce a specific effect in 50% of the test organisms. Endpoints for chronic measures of exposure for listed and non-listed animals are the NOAEL/NOAEC and

[10] U.S. EPA Office of Research and Development. 1993. Wildlife Exposure Factors Handbook Volume I. Publication # EPA/600/R-93/187. Available at http://www.epa.gov/ncea/pdfs/toc2-37.pdf.

NOEC. NOAEL stands for "No Observed-Adverse-Effect-Level" and refers to the highest tested dose of a substance that has been reported to have no harmful (adverse) effects on test organisms. The NOAEC (*i.e.*, "No-Observed-Adverse-Effect-Concentration") is the highest test concentration at which none of the observed effects were statistically different from the control. The NOEC is the No-Observed-Effects-Concentration. For non-listed plants, only acute exposures are assessed (*i.e.*, EC_{25} for terrestrial plants and EC_{50} for aquatic plants).

It is important to note that the measures of effect for direct and indirect effects to the CRLF and its designated critical habitat are associated with impacts to survival, growth, and fecundity, and do not include the full suite of sublethal effects used to define the action area. According the Overview Document (USEPA 2004), the Agency relies on effects endpoints that are either direct measures of impairment of survival, growth, or fecundity or endpoints for which there is a scientifically robust, peer reviewed relationship that can quantify the impact of the measured effect endpoint on the assessment endpoints of survival, growth, and fecundity.

2.10.1.3 Integration of Exposure and Effects

Risk characterization is the integration of exposure and ecological effects characterization to determine the potential ecological risk from agricultural and non-agricultural uses of Telone, and the likelihood of direct and indirect effects to CRLF in aquatic and terrestrial habitats. The exposure and toxicity effects data are integrated in order to evaluate the risks of adverse ecological effects on non-target species. For the assessment of Telone risks, the risk quotient (RQ) method is used to compare exposure and measured toxicity values. EECs are divided by acute and chronic toxicity values. The resulting RQs are then compared to the Agency's levels of concern (LOCs) (USEPA, 2004) (see Appendix B).

For this endangered species assessment, listed species LOCs are used for comparing RQ values for acute and chronic exposures of Telone directly to the CRLF. If estimated exposures directly to the CRLF of Telone resulting from a particular use are sufficient to exceed the listed species LOC, then the effects determination for that use is "may affect". When considering indirect effects to the CRLF due to effects to animal prey (aquatic and terrestrial invertebrates, fish, frogs, and mice), the listed species LOCs are also used. If estimated exposures to CRLF prey of Telone resulting from a particular use are sufficient to exceed the listed species LOC, then the effects determination for that use is a "may affect." If the RQ being considered also exceeds the non-listed species acute risk LOC, then the effects determination is a LAA. If the acute RQ is between the listed species LOC and the non-listed acute risk species LOC, then further lines of evidence (*i.e*. probability of individual effects, species sensitivity distributions) are considered in distinguishing between a determination of NLAA and a LAA. When considering indirect effects to the CRLF due to effects to algae as dietary items or plants as habitat, the non-listed species LOC for plants is used because the CRLF does not have an obligate relationship with any particular aquatic and/or terrestrial plant. If the RQ being considered for a particular use exceeds the non-listed species LOC for plants, the effects determination is "may affect". Further information on LOCs is provided in Appendix B.

2.10.2 Data Gaps

Data are lacking for chronic effects in fish and birds (surrogates for the CRLF), as well as any toxicity data for any amphibian. The available fate data for telone and its chloroallyl alcohol and chloroacrylic acid degradates present an adequate picture of the fate of these compounds. Further information on the actual concentrations found in runoff water would help to clarify the apparent discrepancy between PRZM results and the results of the one runoff study submitted (MRID 45022301).

The following data that are relevant to this CRLF assessment were requested by EFED in January, 2008, as part of the Section 3 New Use registration (barcode D348051) on grapes:

- Avian acute oral toxicity tests with 3-chloroallyl alcohol and 3 chloroacrylic acid (850.2100)
- Fish early life stage test with telone for freshwater fish (850.1400)
- Aerobic Soil Metabolism, additional soils (parent and degradates), guideline 835.4100
- Aerobic Aquatic Metabolism (parent and degradates), 835.4300
- Aqueous Photolysis (Indirect, parent), 835.5270
- Soil Photolysis (parent), 835.2410
- Photolysis/Oxidation in Air (parent), 835.2370

An avian reproduction study (850.2300) was not requested at that time because EFED concluded that exposure would be low and chronic effects to birds were not expected. Previous risk assessments discounted avian chronic effects because chronic risk to mammals was not expected. The authors of those assessments concluded that chronic toxicity was likely to be similar between these taxa based on their professional judgment.

3. Exposure Assessment

Telone is formulated as an injectible liquid, or is diluted in irrigation water for drip application. Exposure routes are expected to include inhalation of vapors, contact with treated soil, and contact with run-off water. No dietary or spray drift exposure is anticipated

3.1 Label Application Rates and Intervals

Telone labels may be categorized into two types: labels for manufacturing uses (including technical grade Telone and its formulated products) and end-use products. While technical products, which contain Telone of high purity, are not used directly in the environment, they are used to make formulated products, which can be applied in specific areas to control nematodes, symphlyans, wireworms, soil-borne diseases, and weeds. The formulated product labels legally limit Telone's potential use to only those sites that are specified on the labels.

Currently registered agricultural and non-agricultural uses of Telone within California include numerous agricultural uses and turf. The uses being assessed are summarized in **Table 3.1**. Only one application of telone is allowed per year for the uses listed in this table. Drip application in grapes was not modeled because the finalized label was not available at the time modeling was performed. However, based on its relatively low application rate, 60-day application interval (no residue is expected to remain at the time of the second application), and conclusions determined for aquatic animals and plants for all other uses (see Section 5), further analysis of this use was not expected to provide more information for effects determination.

Table 3.1 Telone Uses, Scenarios, and Application Information for the CRLF Risk Assessment (1)

Crops	Application Rate (lbs ai/A)	Maximum No. Applications per Year
Alfalfa, Clover, Lespedeza, Trefoil, Vetch	170.9	1
Almond, Cashew, Chestnut, Filbert, Hickory nut, Pecan, Tree nuts[2], Walnut	361.9	1
Apple, Apricot, Cherry, Fig, Fruits[2], Nectarine, Peach, Pear, Persimmon, Plum, Pomegranate, Prune, Quince, Stone fruits, Date, Deciduous fruit trees, Kumquat, Citrus[2], Grapefruit, Lemon, Lime, Orange, Tangelo, Tangerines	367.92	1
Asparagus, Beans, Beets, Carrot[2], Horseradish, Kale, Legume vegetables, Parsnip, Peas, Pepper & chili type, Pimento, Soybeans[2], Cowpea/Blackeyed pea, Peanuts[2]	259.15	1

Table 3.1 Telone Uses, Scenarios, and Application Information for the CRLF Risk Assessment (1)		
Crops	**Application Rate (lbs ai/A)**	**Maximum No. Applications per Year**
Barley, Oats, Rye, Safflower, Sorghum, Wheat, Buckwheat, Flax, Kenaf, Cotton[2]	181.8	1
Blackberry, Blueberry, Loganberry, Boysenberry, Raspberry, Youngberry, Currant, Gooseberry Huckleberry, Cucumber, Eggplant, Melon, Pumpkin, Squash, Olive	332.29	1
Broccoli, Cabbage, Cauliflower, Celery, Cole Crops[2], Collards, Mustard, Brussels sprouts, Chard-Swiss, Endive, Lettuce, Spinach, Salsify, Corn, Millet, Field Crops[2], Onion[2], Radish, Shallot, Potato[2], Rutabaga, Sweet Potato[2], Turnip (root), Kohlrabi	259.15	1
Forest Nursery planting, Forest trees Spruce (forest)	555.5	1
Garlic, Leek	237.35	1
Grapes	332.29 (soil injection) 17.68 (drip irrigation)	1 (soil injection) 2 (drip irrigation)
Pastures	170.9	1
Hops	185.76	1
Mint[2]	236.5	1
Okra, Tomato[2], Vegetables[2], Strawberry, Dewberry	355	1
Ornamental-Shady trees Ornamental Non flowering plants	571.05	1
Turf	49.24	1
Soil – pre plant	575.1	1
Sugar beet[2]	246	1

1 Uses assessed based on report from SRRD dated January 10, 2007.
2 These uses are also applied by chemigation at the same rates.

3.2 Aquatic Exposure Assessment

3.2.1 Modeling Approach

Aquatic exposures are quantitatively estimated for all of assessed uses using scenarios that represent high exposure sites for Telone use. Each of these sites represents a 10 hectare field that drains into a 1-hectare pond that is 2 meters deep and has no outlet. Exposure estimates generated using the standard pond are intended to represent a wide variety of vulnerable water bodies including prairie pot holes, playa lakes, wetlands, vernal pools, man-made and natural ponds, and intermittent and first-order streams. As a group, there are factors that make these water bodies more or less vulnerable than the standard surrogate pond. Static water bodies that have larger ratios of drainage area to water body volume would be expected to have higher peak EECs than the standard pond. These water bodies will be either shallower or have large drainage areas (or both). Shallow water bodies tend to have limited additional storage capacity, and thus, tend to overflow and carry pesticide in the discharge whereas the standard pond has no discharge. As watershed size increases beyond 10 hectares, at some point, it becomes unlikely that the entire watershed is planted to a single crop, which is all treated with the pesticide. Headwater streams can also have peak concentrations higher than the standard pond, but they tend to persist for only short periods of time and are then carried downstream.

Crop-specific management practices for all of the assessed uses of Telone were used for modeling, including application rates, number of applications per year, application intervals, buffer widths and resulting spray drift values modeled from AgDRIFT and AgDISP, and the first application date for each crop. The date of first application was set at approximately two weeks before planting, as telone is used almost exclusively as a pre-plant treatment.

3.2.2 Model Inputs

Telone is a nematacide used as a pre-plant treatment on turf and a wide variety of agricultural crops. Telone environmental fate data used for generating model parameters is listed in **Table 2**.1. The input parameters for PRZM and EXAMS are in **Table 3.2**.

Sensitivity Analysis for Input Parameters.

Previous experience using PRZM-EXAMS to model telone concentrations shows that parameters such as aerobic soil metabolism and aerobic aquatic metabolism half-lives have very little influence on model output. For example, using the California lettuce scenario, inputs of 97.6 and 195.2 days for soil and aquatic half-lives give a peak concentration of 1270 μg/L. Invocation of the volatilization routine in PRZM (by using inputs of 20 kcal/mol for enthalpy of vaporization and 6272 cm2/day for air diffusion coefficient) reduce the peak to 233 ug/L, or 82% less. Using 4.9 days (MRID 44975502) instead of 195.2 days for the aerobic metabolism half-life only reduces this to 211 ug/L. Using 4.9 days for aquatic metabolism, and 33 days (the average soil metabolism half-life, rather than the upper confidence limit of 97.6 days) only reduces the result to 200 ug/L. These results reflect the fact that the major dissipation mechanism for telone is expected to be vaporization from soil and water.

Table 3.2 Summary of PRZM/EZAMS Environmental Fate Data Used for Aquatic Exposure Inputs for Telone Endangered Species Assessment for the CRLF

Fate Property	Value (unit)	MRID (or source)
Molecular Weight	110.97	
Henry’s constant	3.55E-3 atm-m3/mol	MRID# 41532001
Vapor Pressure	34 mmHg	MRID# 41532001

Table 3.2 Summary of PRZM/EZAMS Environmental Fate Data Used for Aquatic Exposure Inputs for Telone Endangered Species Assessment for the CRLF		
Fate Property	**Value (unit)**	**MRID (or source)**
Solubility in Water	2500 mg/L	MRID# 41532001
Photolysis in Water	Stable (aerobic aquatic value used instead)	MRID# 40513401
Aerobic Soil Metabolism Half-lives	97.6 (upper 90%ile of values of 12 and 54 days)	MRID# 40460302
Hydrolysis	Entered as stable	Aerobic aquatic metabolism used instead; model is not sensitive to this parameter for telone
Aerobic Aquatic Metabolism (water column)	195.2	2x the soil input parameter, per Input Parameter Guidance of Feb. 2002; to be conservative for degradates
Anaerobic Aquatic Metabolism (benthic)	60 days	J. Carleton, Tier II Exposure Assessment, 5/6/1998 (4 pp.)
Koc	41	MRID# 43180701 (avg of 4 values.); Input parameters guideline
Application rate and frequency	1 application	2 applications for grapes not modeled, sionce telone is expected to dissipate completely in the interval (60 days)
Chemical Application Method (CAM)	6 (soil applied, user-defined incorporation depth, linearly decreasing with depth)	
Application Efficiency	100%	
Spray Drift Fraction[1]	0%	

1 – Spray drift not included in final EEC due to application methods

2 – Inputs determined in accordance with EFED "*Guidance for Chemistry and Management Practice Input Parameters for Use in Modeling the Environmental Fate and Transport of Pesticides*" dated February 28, 2002

3.2.3 Results

The aquatic EECs for the various scenarios and application practices are listed in **Table 3.3**, and output from the PRZM-EXAMS model runs is presented in Appendix C. Results for PRZM-EXAMS runs with the volatility routine "on" (columns marked A) and volatility routine "off" (columns marked B) are given. It is apparent that use of the PRZM volatility routine results in lower EECs in all cases. All results should be regarded as uncertain, because the combined PRZM-EXAMS model is not designed for a chemical as volatile as telone.

Table 3.3 Aquatic EECs (µg/L) for Telone Uses in California									
(Crop/Use)	PRZM Scenario	Application Rate (lb/acre)	Number of Applications	Peak EEC (ug/L)		21-day EEC (ug/L)		60-day EEC (ug/L)	
				A*	B**	A*	B**	A*	B**
Alfalfa Clover Lespedeza Trefoil Vetch	CA Alfalfa OP	170.9	1	108.	188.	42.	71.	16.	27.
Almond Cashew Chestnut Filbert Hickory nut Pecan Tree nuts Walnut	CA Almond Std.	361.9	1	115.	458.	45.	171.	17.	65.
Apple Apricot Cherry Fig Fruits Nectarine Peach Pear Persimmon Plum Pomegranate Prune Quince Stone fruits Date Deciduous fruit trees Kumquat	CA Fruit Std.	367.92	1	33.	231.	13.	89.	5.3	34.
Asparagus Beans Beets Carrot Horseradish Kale Legume vegetables Parsnip Peas Pepper & chili type Pimento Soybeans Cowpea/Blackeyed pea Peanuts	CA RLF Row Crop_V2	259.15	1	45.	219	17.	69.	6.	25.

Table 3.3 Aquatic EECs (µg/L) for Telone Uses in California									
(Crop/Use)	PRZM Scenario	Application Rate (lb/acre)	Number of Applications	Peak EEC (ug/L)		21-day EEC (ug/L)		60-day EEC (ug/L)	
				A*	B**	A*	B**	A*	B**
Barley Oats Rye Safflower Sorghum Wheat Buckwheat Flax Kenaf	CA RLF Wheat_V2	181.8	1	31.	221	14	97.	5.6	36.
Blackberry Blueberry Loganberry Boysenberry Raspberry Youngberry Currant Gooseberry Huckleberry	CA RLF Wine grape_V2	332.29	1	258.	291.	83.	93.	30.	33.
Broccoli Cabbage Cauliflower Celery Cole Crops Collards Mustard	CA RLF Cole Crop_V2	259.15	1	242.	530.	76.	172.	29.	65.
Brussels sprouts Chard-Swiss Endive Lettuce Spinach Salsify	CA Lettuce Std.	259.15	1	233.	1270	104.	418.	40.	156.
Citrus Grapefruit Lemon Lime Orange Tangelo Tangerines	CA Citrus Std.	367.92	1	2.1	36.	0.6	15.	0.2	6.1
Corn Millet Field Crops	CA Corn OP	259.15	1	127.	220.	50.	87.	18.	32.
Cotton	CA Cotton Std.	181.8	1	11.	195.	3.6	54.	1.3	19.
Cucumber Eggplant Melon Pumpkin	CA RLF Melon _V2	332.29	1	1.1	39.	0.4	9.3	0.2	3.3

Table 3.3 Aquatic EECs (µg/L) for Telone Uses in California									
(Crop/Use)	**PRZM Scenario**	**Application Rate (lb/acre)**	**Number of Applications**	**Peak EEC (ug/L)**		**21-day EEC (ug/L)**		**60-day EEC (ug/L)**	
				A*	**B****	**A***	**B****	**A***	**B****
Squash									
Forest Nursery planting Forest trees Spruce (forest)	CA RLF Forestry	555.5	1	87.	405.	30.	129.	12.	47.
Garlic Leek	CA RLF Garlic_V2	237.35	1	1.2	96.	0.4	25.	0.2	9.2
Grapes	CA Grapes Std.	332.29	1	118.	275.	39.	100.	14.	37.
Pastures	CA RLF Rangeland_V2	170.9	1	2.6	161.	1.0	51.	0.48	20.
Hops	OR Hops Std.	185.76	1	26.	62.	8.8	21.	3.2	8.0
Mint	OR Mint Std.	236.5	1	11.	62.	4.8	21.	1.9	7.8
Okra Tomato Vegetables	CA Tomato Std.	355	1	126.	207.	38.	70.	15.2	25.
Olive	CA RLF Olive_V2	332.29	1	64.	309	24.	131.	9.7	49.
Onion Radish Shallot	CA Onion Std.	259.15	1	14.	89.	5.2	32.	1.9	12.
Ornamental-Shady trees Ornamental Non flowering plants	CA Nursery Std.	571.05	1	74.	374.	22.	108.	8.2	39.
Ornamental lawns & Turf	CA RLF Turf	49.24	1	1.8	51.	0.6	17.	0.2	6.7
Potato Rutabaga Sweet Potato Turnip (root) Kohlrabi	CA RLF Potato_V2	259.15	1	4.3	41.	1.4	12.	0.5	4.6
Soil – pre plant	CA RLF Wine grape_V2	575.1	1	447.	506.	144.	162	52.	58.
Strawberry Dewberry	CA RLF Strawberry_V2	355	1	111.	75	46.	234.	18.	86.
Sugar beet	CA Sugar beet OP	246	1	156.	389.	61.	139.	25.	52.

*: EECs generated with the use of enthalpy of vaporization, and the air diffusion coefficient as PRZM inputs.

3.2.4 Existing Monitoring Data

A critical step in the process of characterizing EECs is comparing the modeled estimates with available surface water monitoring data.

A search of the USGS NAWQA Data Warehouse for the two isomers of telone (cis, code 34699, trans, code 34704) was conducted on May 7, 2008. Including all states and sample types, a total of 9,619 analyses were performed, representing 5,969 unique sampling stations. A total of 3 hits were recorded for the cis isomer, and 2 hits for the trans isomer. All detections were from ground water stations in Whatcom County, Washington state, and were well below 1 ug/L. There were no detections in California.

These data indicate that it is very unlikely that telone will be found in surface waters, at concentrations harmful to the CRLF. Degradates were not measured, but are expected to be found less frequently and at lower concentrations.

3.2.4.1 USGS NAWQA Surface Water Data

The NAWQA Data Warehouse contains telone analysis records for 582 samples of surface and groundwater in California. There were no detections of the cis or trans isomers. (http://infotrek.er.usgs.gov/traverse/f?p=NAWQA:HOME:4062225649615260).

3.2.4.2 USGS NAWQA Groundwater Data

A number of studies of possible ground water contamination by Telone have been conducted. Taken together, these studies indicate that the likelihood of persistent contamination of aquifers by Telone is low.

EPA Pesticides in Ground Water Database (1971-1991). In this compilation of ground water studies, 1,3-dichloropropene was analyzed in 21,270 discrete wells in seven states (CA, FL, HI, MA, MS, NY, OR) over the aggregate period of 1979-1991. There were a total of six detections, or a rate of 0.028%. In California, there were three detections in 5,364 wells (0.06%). The detected concentrations ranged from 0.89 to 31. ug/L. Degradates were not analyzed.

USGS National Water Quality Assessment (NAWQA) studies. Studies of 1,3-dichloropropene were conducted in the upper Snake River basin (ID, WY, NV, UT), the San Joaquin-Tulare basin (CA), the Central Columbian Plateau (ID, WA), the Apalachicola-Chattahoochee-Flint river basin (AL, GA, FL), the South Platte River basin (WY, NE), the Santee basin and coastal drainages (NC, SC), the lower Illinois River basin (IL), the Long Island and New Jersey coastal plain (NY, NJ), Puget Sound drainages (WA) and south central Texas. No 1,3-dichloropropene was detected at a reporting limit of 0.2 ug/L. The NAWQA web site (http://ca.water.usgs.gov/pnsp/allsum/index.html) lists no detections in 1985 wells overall, in 742 shallow agricultural area wells, in 304 urban wells, and in 645 wells in major aquifers.

Tap Water Monitoring study. This study (MRID 456611-01), conducted by Dow AgroSciences, sampled 518 taps fed by wells in five areas of high historical Telone usage. These included the upper Snake River basin, the Central Columbian Plateau, the North Platte River basin, the Albemarle-Pamlico Sound (NC) and the Georgia/Florida basins. Sixty-five (65) of 518 taps had detectable levels of Telone or its degradates (up to 0.145 ug/L total). Parent Telone levels were 0.015 to 0.023 ug/L. A total of 5,800 samples were analyzed; only three taps had as many as two detections. While the CRLF will obviously not be exposed to tap water, the targeted nature of this data show that groundwater contamination is rare.

3.2.4.3 California Department of Pesticide Regulation (CPR) Data

Telone was not included in the California Department of Pesticide Regulation surface water database (http://www.cdpr.ca.gov/docs/emon/surfwtr/surfcont.htm).

3.2.4.4 Atmospheric Monitoring Data

The following information is taken from the Hazardous Substances Data Bank (HSDB, http://toxnet.nlm.nih.gov/). Generally, telone concentrations in the atmosphere are expected to be low, except in the immediate vicinity of treated sites. Oxidation in the atmosphere (by hydroxyl radicals) is relatively rapid.

Two (2) of 11 samples from Baton Rouge, LA tested positive with a trace and 2.2 parts per trillion 1,3-dichloropropene (Pellizzari, E.D. et al., 1979).

1,3-Dichloropropene was not detected in 7 samples from the Grand Canyon (Pellizzari, E.D. et al., 1979).

1,3-Dichloropropene concentrations were reported in samples from the US (4 sites, 16 points) at 7.3 parts per trillion median, 570 parts per trillion maximum (isomer unspecified)(1). One source area, Freeport, TX, that has a mean concentration of 170 parts per trillion is a site of 1,3-dichloropropene manufacturing (Brodzinsky, R., 1982).

3.2.4.5 Characterization of PRZM-EXAMS Modeling Results

Suitability of PRZM-EXAMS for Telone. EFED has known since at least 1999 (6/26/2000, barcodes D260209 and D260210, and 10/05/99, barcode D259506) that PRZM-EXAMS is poorly suited to modeling telone concentrations in water, due to the chemical's high volatility. Addition of a volatilization routine to PRZM has improved this situation, however, substantial uncertainties remain.

One of the areas of uncertainty is whether PRZM properly estimates the amount of telone in runoff water. A runoff study (MRID 45022301) was conducted in 2000 to address this uncertainty, at a site representative of average to high-end runoff vulnerability. In this study, telone at 354 kg/hectare was injected to a depth of 12 inches to three 0.1 acre test plots in a tobacco field near Blacksburg, Virginia. Natural and artificial rainfall was applied to this field, totaling 5 inches over a 10 hour period (more intense than a 50-year, 2-hour storm for the area). Runoff was collected, and the concentration of telone measured. Telone was also measured in air samples simultaneously, to determine if it was stripped from the water as it ran off.

The highest concentration measured in a discrete runoff water sample was 17.2 ug/L, and the highest composite water concentration was 6.6 ug/L. The highest concentration measured in soil was 11 mg/kg (0 to 6-inch interval) on the day of application. Concentrations in air exceeded 1000 µg/m3 on the day of application, demonstrating that telone is indeed stripped from the water as it runs off.

The amount of telone expected in runoff water was estimated using PRZM-EXAMS, with a North Carolina tobacco scenario, which is geographically close to the field study location (southwest Virginia). The same application rate and injection depth as in the field study were used, and the other input parameters were the same as in Table 3.2, with volatility turned "on," and the aerobic aquatic half-life of parent telone (4.9 days) and average soil metabolism half-life (33 days) were used. An application date of July 20 was chosen, as in the field study. Run-off concentrations were estimated from the runoff mass flux (RFLX) and runoff water volume (RUNF), taken from the *.zts output file, using the Excel spreadsheet developed by Mark Corbin (ref.) The 90^{th} percentile peak concentration in runoff water over the 30-year simulation was calculated to be 1,200 ug/L, to two significant figures.

The difference between the PRZM result (1,200 ug/L from a 1-in-10 year event) and the field study result (17 ug/L from a 1-in-50 year event) suggests that PRZM overestimates the concentration of telone in runoff water by a factor of approximately 100. This casts considerable doubt on the quantitative results that PRZM-EXAMS produces for telone.

Factors Relevant to Telone not Considered by PRZM-EXAMS. A number of factors not considered by PRZM-EXAMS modeling will tend to reduce the amount of telone expected in environmental water. These include: (1) indirect photolysis in water, which is expected in waters containing substances that may produce photooxidants, and the rapid degradation (half-life 7 to 12 hours) of telone caused by hydroxyl radicals, (2) the increased rate of hydrolysis caused by an increase in temperature (13.5 days at 20ºC, 2 days at 29ºC), (3) volatilization promoted by the movement of water, either as it runs off, or flows in streams, (4) increased volatilization due to summer outdoor temperatures (PRZM operates at room temperature), (5) increased metabolism rates at outdoor summer temperatures, and (6) delays in availability for runoff due to tarping.

Concern for Surface Water Exposure Versus Ground Water Exposure. Historically, EFED's concern about human exposure to telone has been via the ground water exposure route. This is due to telone's very high application rates (hundreds of pounds per acre), and its high mobility in soil (and thus potential to leach to ground water).

Once introduced into ground water, telone is shielded from many of the processes that can contribute to its more rapid dissipation from surface water. These include photolysis, volatilization to the atmosphere from the surface of water bodies, volatilization due to the motion of flowing water (both during run-off and stream flow), and the greater availability of oxygen for biological metabolism. All of these processes combined make it likely that exposure from surface water sources will be less than that from ground water sources.

Comparison to Monitoring Data. Peak concentrations of chemicals from PRZM-EXAMS modeling are expected to approximate those found in monitoring programs only if the monitoring is done in close proximity to the use site, and soon after the relevant precipitation events (that is, if the monitoring is “targeted”). Peak concentrations found in non-targeted monitoring data often are of the same magnitude as the PRZM-EXAMS concentrations for longer averaging periods (21, 60, 90 days or yearly). Targeted groundwater monitoring data have shown that contamination by telone is rare. As discussed above, because groundwater contamination is considered more likely than surface water contamination, it is concluded that surface water contamination is also rare.

Summary. The factors discussed above cast considerable doubt on the usefulness of the PRZM-EXAMS modeling results for risk assessment. The available monitoring data will therefore be used to characterize the risk quotients calculated using the PRZM-EXAMS results. In general, monitoring data show that telone is rarely detected in environmental water.

3.3 Terrestrial Animal Exposure Assessment

Terrestrial animals are expected to be exposed to telone via inhalation and incidental soil ingestion. Therefore, the terrestrial exposure models T-REX and T-HERPS are not used. The estimate of soil concentration for fumigation applications is provided in a California field dissipation study (MRID #40403301). Telone was applied at 342 lb ai/A to a sand soil field plot in California, and telone residues were 130,000 ppb in the 0.3- to 0.45-m layer of soil immediately after treatment. Therefore, 130 mg/kg will be the estimated soil concentration for analyses of incidental soil ingestion by terrestrial animals following fumigation treatments with telone. As described above, an estimate of 132.3 mg/kg will be used for incidental soil ingestion that may occur with the grape drip irrigation scenario. Other drip irrigation applications require that the treated soil be sealed immediately with a tarp for 14 days, so it is expected that the grape scenario and the estimate of concentration in the soil after soil injection as described above represent the maximum EECs that would occur in terrestrial soil.

Inhalation exposures will be assessed with field volatility studies. Field volatility studies are summarized in Table 3.4.

Table 3.4 Results of Field Volatility Studies for Telone (Maximum Exposures Measured)

MRID	crop	Application method	rate lb/A	On field ug/m3	100 ft ug/m3 (a)	300 ft ug/m3 (a)	166 ft ug/m3 (a)
45296101	grapes	postplant drip	6.1	138		14.6	
45120702	turf	direct injection 5in	49.8	1560	262	80.3	
45112901	strawberry	shallow drip VIF tarp	166	189			
45112902	vegetables	surface drip PE tarp	166	644	234	112	
45010501	bare ground	broadcast	122	2010			
45010501	bare ground	Row shank injection	68	1711			
45222501	turf	direct injection 5in	50.7	4556	402	164	517

(a) concentration measured at distance from edge of field

The greatest observed air concentration was 4556 µg/m3 from a 50.7 lb/acre application to turf. Scaling this up to the maximum label use rate for any crop (575 lb/acre for soil preplant application) yields a possible air concentration of 51,670 µg/m3.

3.4 Terrestrial Plant Exposure Assessment

Terrestrial plants may be exposed to telone by root uptake, if they are in or near the application area, by vaporization, or by run-off.

TerrPlant (Version 1.1.2) is used to calculate EECs for non-target plant species inhabiting dry and semi-aquatic areas. Parameter values for application rate, drift assumption and incorporation depth are based upon the use and related application method. A runoff value of 0.05 is utilized based on Telone's solubility, which is classified by TerrPlant as >100 mg/L. EECs relevant to terrestrial plants consider pesticide concentrations in drift and in runoff. For aerial and ground application methods, drift is assumed to be 5% and 1%, respectively. Drift is not a problem for telone applications; however, volatilization of telone may result in exposure to above-ground portions of plants and the drift portion would account for some of this exposure. The actual amount of exposure to volatilized telone is not known. These EECs are listed by use in **Table 3.5**. An example output from TerrPlant v.1.2.2 is available in **Appendix D.**

We note that the appropriateness of the use of this model for telone is uncertain, due to its high volatility. It is likely that less chemical will be available for runoff than assumed by the model. A spray drift value of 1% was used in the model. TerrPlant calculates an EEC for spray drift, however, this has been left out of this analysis, since it is not relevant due to the application methods used.

Table 3.5 TerrPlant Inputs and Resulting EECs for Plants Inhabiting Dry and Semi-aquatic Areas Exposed to Telone via Runoff and Drift

Use	Application rate (lbs a.i./A)	Dry area EEC (lbs a.i./A)	Semi-aquatic area EEC (lbs a.i./A)
Alfalfa, Clover, Lespedeza, Trefoil, Vetch, Pastures	170.9	1.99	4.56
Almond, Cashew, Chestnut, Filbert, Hickory nut, Pecan, Tree nuts, Walnut	361.9	4.22	9.65
Apple, Apricot, Cherry, Fig, Fruits (unspecified), Nectarine, Peach, Pear, Persimmon, Plum, Pomegranate, Prune, Quince, Stone fruit, Date, Deciduous fruit trees, Kumquat, Citrus, Grapefruit, Lemon, Lime, Orange, Tangelo, Tangerines	367.92	4.29	9.81
Asparagus, Beans, Beets, Carrot, Horseradish, Kale, Legume vegetables, Parsnip, Peas, Pepper & chili type, Pimento, Soybeans, Cowpea/Blackeyed pea, Peanuts	259.15	3.02	6.91

Table 3.5 TerrPlant Inputs and Resulting EECs for Plants Inhabiting Dry and Semi-aquatic Areas Exposed to Telone via Runoff and Drift			
Use	**Application rate (lbs a.i./A)**	**Dry area EEC (lbs a.i./A)**	**Semi-aquatic area EEC (lbs a.i./A)**
Barley, Oats, Rye, Safflower, Sorghum, Wheat, Buckwheat, Flax, Kenaf, Cotton	181.8	2.12	4.85
Blackberry, Blueberry, Loganberry, Boysenberry, Raspberry, Youngberry, Currant, Gooseberry, Huckleberry, Cucumber, Eggplant, Melon, Pumpkin, Squash, Grapes, Olive	332.29	3.88	8.86
Broccoli, Cabbage, Cauliflower, Celery, Cole Crops, Collards, Mustard, Brussels sprouts, Chard-Swiss, Endive, Lettuce, Spinach, Salsify, Corn, Millet, Field Crops, Onion, Radish, Shallot, Potato, Rutabaga, Sweet Potato, Turnip (root), Kohlrabi	259.15	3.02	6.91
Forest Nursery planting Forest trees, Spruce (forest)	555.5	6.48	14.81
Garlic, Leek	237.35	2.77	6.33
Hops	185.76	2.17	4.95
Mint	236.5	2.76	6.31
Okra, Tomato, Vegetables, Strawberry, Dewberry	355	4.14	9.47
Ornamental-Shady trees Ornamental Non flowering plants	571.05	6.66	15.22
Ornamental lawns & Turf	49.24	0.57	1.31
Soil – pre-plant	575.1	6.71	15.33
Sugar beet	246	2.87	6.56
Grapes	17.68	1.06	9.02

4. Effects Assessment

This assessment evaluates the potential for Telone to directly or indirectly affect the CRLF or modify its designated critical habitat. As previously discussed in Section 2.8, assessment endpoints for the CRLF effects determination include direct toxic effects on the survival, reproduction, and growth of CRLF, as well as indirect effects, such as reduction of the prey base or modification of its habitat. In addition, potential modification of critical habitat is assessed by evaluating effects to the PCEs, which are components of the critical habitat areas that provide essential life cycle needs of the CRLF. Direct effects to the aquatic-phase of the CRLF are based on toxicity information for freshwater fish, while terrestrial-phase effects are based on avian toxicity data, given that birds are generally used as a surrogate for terrestrial-phase amphibians. Because the frog's prey items and habitat requirements are dependent on the availability of freshwater fish and invertebrates, small mammals, terrestrial invertebrates, and aquatic and terrestrial plants, toxicity information for these taxa are also discussed. Acute (short-term) and chronic (long-term) toxicity information is characterized based on registrant-submitted studies and a comprehensive review of the open literature on Telone.

As described in the Agency's Overview Document (U.S. EPA, 2004), the most sensitive endpoint for each taxon is used for risk estimation. For this assessment, evaluated taxa include aquatic-phase amphibians, freshwater fish, freshwater invertebrates, aquatic plants, birds (surrogate for terrestrial-phase amphibians), mammals, terrestrial invertebrates, and terrestrial plants.

Toxicity endpoints are established based on data generated from guideline studies submitted by the registrant, and from open literature studies that meet the criteria for inclusion into the ECOTOX database maintained by EPA/Office of Research and Development (ORD) (U.S. EPA, 2004). Open literature data presented in this assessment were obtained from the ECOTOX database through a search performed on August 31, 2007. In order to be included in the ECOTOX database, papers must meet the following minimum criteria:

(1) the toxic effects are related to single chemical exposure;
(2) the toxic effects are on an aquatic or terrestrial plant or animal species;
(3) there is a biological effect on live, whole organisms;
(4) a concurrent environmental chemical concentration/dose or application rate is reported; and
(5) there is an explicit duration of exposure.

Data that pass the ECOTOX screen are evaluated along with the registrant-submitted data, and may be incorporated qualitatively or quantitatively into this endangered species assessment. In general, effects data in the open literature that are more conservative than the registrant-submitted data are considered. The degree to which open literature data are quantitatively or qualitatively characterized for the effects determination is dependent on whether the information is relevant to the assessment endpoints (*i.e.*, maintenance of CRLF survival, reproduction, and growth) identified in Section 2.8. For example, endpoints such as behavior modifications are likely to be qualitatively evaluated, unless quantitative relationships between modifications and reduction in species survival, reproduction, and/or growth are available. Although the effects determination relies on endpoints that are relevant to the assessment endpoints of survival, growth, or reproduction, it is important to note that the full suite of sublethal endpoints potentially available in the effects literature (regardless of their significance to the assessment endpoints) are considered to define the action area for Telone. Upon investigation of endpoints from human health studies, information was found indicating that telone is considered to be a mutagen (MRID 00146469). This information was used to determine the action area.

Citations of all open literature studies not considered as part of this assessment because they were either rejected by the ECOTOX screen or accepted by ECOTOX but not used (e.g., the endpoint is less sensitive) are included in **Appendix E. Appendix E** also includes a rationale for rejection of those studies that did not pass the ECOTOX screen and those that were not evaluated as part of this endangered species risk assessment.

A detailed table of the available ECOTOX open literature data, including the full suite of lethal and sublethal endpoints is presented in **Appendix F**. An evaluation of the study from ECOTOX that was included in this assessment is provided in **Appendix G**.

In addition to registrant-submitted and open literature toxicity information, other sources of information, including use of the acute probit dose response relationship to establish the probability of an individual effect and reviews of the Ecological Incident Information System (EIIS), are conducted to further refine the characterization of potential ecological effects associated with exposure to Telone. A summary of the available aquatic and terrestrial ecotoxicity information, use of the probit dose response relationship, and the incident information for Telone are provided in Sections 4.1 through 4.4, respectively.

Telone has two major degradates, 3-chloroallyl alcohol and 3-chloroacrylic acid, that are both mobile but are not expected to be as volatile as telone. Previous EFED risk assessments identified the lack of ecological effects studies on these degradates to be data gaps as it was unknown whether they may be more toxic than the parent compound. Toxicity data for these degradates have been submitted for some taxa to OPP and, and these data are presented within the appropriate sections below where applicable.

A detailed summary of the available ecotoxicity information for all Telone degradates and formulated products is presented below. Further information on toxicity of products containing multiple active ingredients is presented in **Appendix A**. Analysis of the multi-a.i. toxicity data indicates that an assessment based on telone and its degradates alone is appropriate.

4.1 Toxicity of Telone to Aquatic Organisms

Table 4.1 summarizes the most sensitive aquatic toxicity endpoints for the CRLF, based on an evaluation of both the submitted studies and the open literature, as previously discussed. A brief summary of submitted and open literature data considered relevant to this ecological risk assessment for the CRLF is presented below.

Table 4.1. Freshwater Aquatic Toxicity Profile for Telone and its Degradates

Assessment Endpoint	Species	Toxicity Value Used in Risk Assessment	Citation MRID # (Author & Date)	Comment
Telone				
Acute Direct Toxicity to Aquatic-Phase CRLF	Walleye (*Stizostedion vitreum*)	LC_{50} = 1.08 ppm a.i.	40098001 (Mayer and Ellersieck, 1986)	Supplemental
Chronic Direct Toxicity to Aquatic-Phase CRLF	No Data	No Data	No Data	No Data
Indirect Toxicity to Aquatic-Phase CRLF via Acute Toxicity to Freshwater Invertebrates (i.e. prey items)	Waterflea *(Daphnia magna)*	LC_{50} = 0.09 ppm a.i.	40098001 (Mayer and Ellersieck, 1986)	Supplemental
Indirect Toxicity to Aquatic-Phase CRLF via Chronic Toxicity to Freshwater Invertebrates (i.e. prey items)	Waterflea *(Daphnia magna)*	NOAEC = 0.070 ppm a.i.	45007501 (Kirk et al. 1999)	Supplemental, NOAEC based on growth (length) and mean number of progeny
Indirect Toxicity to Aquatic-Phase CRLF via Acute Toxicity to Non-vascular Aquatic Plants	Freshwater diatom (*Navicula pelliculosa*)	EC_{50} = 7.9 ppm a.i.	44843909 (Kirk et al., 1999)	Supplemental
Indirect Toxicity to Aquatic-Phase CRLF via Acute Toxicity to Vascular Aquatic Plants	Duckweed (*Lemna gibba*)	EC_{50} = 20.0 ppm a.i.	44843914 (Kirk et al., 1999)	Acceptable
3-Chloroacrylic Acid				
Acute Direct Toxicity to Aquatic-Phase CRLF	Rainbow trout (*Onchorynchus mykiss*)	LC_{50} = 69.5 ppm a.i.	44940307 (Marino et al., 1999)	Acceptable
Indirect Toxicity to Aquatic-Phase CRLF via Acute Toxicity to Freshwater Invertebrates (i.e. prey items)	Waterflea *(Daphnia magna)*	EC_{50} = 55.0 ppm ai	44940308 (Marino et al., 1999)	Acceptable
Indirect Toxicity to Aquatic-Phase CRLF via Acute Toxicity to Non-vascular Aquatic Plants	Green Alga (*S. capricornutum*)	EC_{50} = 0.432 ppm a.i.	44940319 (Kirk et al., 1999)	Supplemental[1]
Indirect Toxicity to Aquatic-Phase CRLF via Acute Toxicity to Vascular Aquatic Plants	Duckweed (*Lemna gibba*)	EC_{50} = 0.22 ppm a.i.	45007504 (Kirk et al., 1999)	Supplemental
3-Chloroallyl Alcohol				
Acute Direct Toxicity to Aquatic-Phase CRLF	Rainbow trout (*Onchorynchus mykiss*)	LC_{50} = 0.986 ppm a.i.	44940306 (Marino et al., 1999)	Supplemental
Indirect Toxicity to Aquatic-Phase CRLF via Acute Toxicity to Freshwater Invertebrates (i.e. prey items)	Waterflea *(Daphnia magna)*	EC_{50} = 2.3 ppm ai	44843902 (Marino et al., 1999)	Supplemental

Assessment Endpoint	Species	Toxicity Value Used in Risk Assessment	Citation MRID # (Author & Date)	Comment
Indirect Toxicity to Aquatic-Phase CRLF via Acute Toxicity to Non-vascular Aquatic Plants	Freshwater diatom (*Navicula pelliculosa*)	EC_{50} = 32.9 ppm a.i.	44843913 (Kirk et al., 1999)	Supplemental[1]
Indirect Toxicity to Aquatic-Phase CRLF via Acute Toxicity to Vascular Aquatic Plants	Duckweed (*Lemna gibba*)	EC_{50} = 1.694 ppm a.i.	44940320 (Kirk et al., 1999)	Supplemental

[1]NOAEC could not be determined due to lack of data. EC_{05} is an estimate determined using the Nuthatch program

Toxicity to aquatic fish and invertebrates is categorized using the system shown in **Table 4.2** (U.S. EPA, 2004). Toxicity categories for aquatic plants have not been defined.

Table 4.2 Categories of Acute Toxicity for Aquatic Organisms

LC_{50} (ppm)	Toxicity Category
< 0.1	Very highly toxic
> 0.1 - 1	Highly toxic
> 1 - 10	Moderately toxic
> 10 - 100	Slightly toxic
> 100	Practically nontoxic

4.1.1 Toxicity to Freshwater Fish

Because no Telone toxicity data are available for aquatic-phase amphibians, freshwater fish data were used as a surrogate to estimate direct acute and chronic risks to the CRLF. Freshwater fish toxicity data were also used to assess potential indirect effects of Telone to the CRLF. Effects to freshwater fish resulting from exposure to Telone may indirectly affect the CRLF via reduction in available food. As discussed in Section 2.5.3, over 50% of the prey mass of the CRLF may consist of vertebrates such as mice, frogs, and fish (Hayes and Tennant, 1985).

A summary of acute and chronic freshwater fish data, including data from the open literature, is provided below in Sections 4.1.1.1 through 4.1.1.3.

4.1.1.1 Freshwater Fish: Acute Exposure (Mortality) Studies

Acute Studies with Telone. Two freshwater fish 96-hour acute toxicity studies using the TGAI are required to establish the toxicity of telone to fish and amphibians. The preferred test species are the rainbow trout (a coldwater fish) and bluegill sunfish (a warm-water fish). Results of several 96-hour tests with five species of fish (Bluegill Sunfish, Rainbow Trout, Fathead Minnow, Large Mouth Bass, and Walleye) are presented in Table 4.3. Since the LC_{50} values for these five species falls in the range of 1 to 10 ppm, telone is classified as moderately toxic to freshwater fish on an acute basis. These are also assumed to be the effect levels for aquatic phase amphibians. The most sensitive aquatic fish species in this list is the walleye, which exhibited a LC_{50} of 1.08 mg/L.

Table 4.3. Acute Toxicity of Telone to Freshwater Fish.

Species/ (Flow-through or Static)	% ai	96-hour LC_{50} (measured/nominal)	Toxicity Category	MRID No. (Author, Year)	Study Classification
Walleye *(Stizostedion vitreum)* static	100	1.08 mg/L a.i. (nominal)	Moderately Toxic	40098001 (Mayer and Ellersieck, 1986)	Supplemental[1]
Largemouth Bass *(Micropterus salmoides)* static	100	3.65 mg/L a.i. (nominal)	Moderately Toxic	40098001 (Mayer and Ellersieck, 1986)	Supplemental[1]
Bluegill Sunfish *(Lepomis macrochirius)* flow-through	96	3.7 mg/L a.i. (measured)	Moderately Toxic	44849101 (Kirk et al. 1999)	Acceptable
Rainbow Trout *(Oncorhynchus mykiss)* static	92	3.94 mg/L test material. (measured)	Moderately Toxic	00039692 (Bentley, 1975)	Acceptable
Fathead Minnow *(Pimephales promelas)* static	100	4.1 mg/L a.i. (nominal)	Moderately Toxic	40098001 (Mayer and Ellersieck, 1986)	Supplemental[1]
Rainbow Trout *(Oncorhynchus mykiss)* static	92	5.9 mg/L[2] (unknown)	Moderately Toxic	STE0DI01 USEPA 1977	Acceptable
Bluegill Sunfish *(Lepomis macrochirius)* static	$\geq$80	6.1 mg/L test material[3] (nominal)	Moderately Toxic	00117043 (Buccafusco, 1981)	Supplemental[4]
Bluegill Sunfish *(Lepomis macrochirirus)* static	92	6.7 mg/L[2] (unknown)	Moderately Toxic	STE0DI02 USEPA 1977	Acceptable
Bluegill Sunfish *(Lepomis macrochirirus)* static	92	7.09 mg/L test material. (measured)	Moderately Toxic	00039692 (Bentley, 1975)	Acceptable

[1]EFED has determined that data from this reference should be classified as "supplemental" until the raw data can be obtained and evaluated for each study. Data were requested but are not available; therefore, the data have not been reviewed for telone.
[2]Whether LC_{50} is reported in mg/L a.i. or mg/L test material is not known.
[3]Study does not specify whether mg/L is reported as test material or a.i., but the exact percentage of a.i. in test material was not known
[4]Rated supplemental because the dose levels were not high enough to calculate an LD_{50}.

Acute Studies with Telone Degradates (3-Chloroallyl Alcohol and 3-Chloroacrylic Acid)

In the EFED RED chapter for Telone, the degradates of Telone (3-chloroallyl alcohol and 3-chloroacrylic acid) were considered to be at least as toxic as the parent compound, although a rationale or reference for this was not provided. Since the RED was signed in 1998, acute freshwater fish (Rainbow trout) toxicity data for the degradates have been submitted (Table 4.4). For freshwater fish and invertebrates, the alcohol degradate was shown to be more toxic than both the parent compound and the acid degradate.

Table 4.4. Acute toxicity of 3-Chloroallyl Alcohol and 3-Chloroacrylic Acid to freshwater fish.

Species (static or flow-through)	Test Material	%ai	Endpoint Value (Test duration) (Measured/Nominal)	Toxicity Cat.	MRID (Author, Year)	Study Classification
Rainbow trout *(Oncorhynchus mykiss)* (static-renewal)	3-Chloroallyl alcohol	Not Reported	LC_{50} = 0.986 mg/L a.i. (96 hours) (measured)	Highly Toxic	44940306 (Marino et al., 1999)	Supplemental[1]
Rainbow trout (*Onchorynchus mykiss*) (static)	3-Chloroacrylic acid	100	LC_{50} = 69.5 mg/L a.i. (96 hours) (measured)	Slightly Toxic	44940307 (Marino et al., 1999)	Acceptable

[1]Study is supplemental due to unknown value of test substance purity and other missing information. The study can be upgraded if this information is reported.

4.1.1.2 Freshwater Fish: Chronic Exposure (Growth/Reproduction) Studies

Data are not available with which to determine the chronic risk of Telone to freshwater fish and amphibians. A flow-through freshwater fish early life stage study with Telone and fathead minnow (96% purity) (Marino et al. 2000 [MRID 45145001]) was submitted. However, the study was determined to be invalid because dissolved oxygen at the two highest concentrations were depleted to levels as low as 43% of saturation. Because of problems related to volatility of Telone, flow-through rate had to be increased, which could also have led to damage to the larvae. Mortality in the study was the most sensitive endpoint, but whether this is attributable to Telone, depleted oxygen, or increased flow rate is uncertain.

Chronic toxicity data for freshwater fish are also not available for the degradates of Telone. The likelihood of chronic effects is addressed in section 5.2.1.1.

4.1.1.3 Freshwater Fish: Sublethal Effects and Additional Open Literature Information

No additional information on sublethal effects was found in the ECOTOX database for freshwater fish.

4.1.2 Toxicity to Freshwater Invertebrates

Freshwater aquatic invertebrate toxicity data were used to assess potential indirect effects of Telone to the CRLF. Effects to freshwater invertebrates resulting from exposure to Telone could indirectly affect the CRLF via reduction in available food items. As discussed in Section 2.5.3, the main food source for juvenile aquatic- and terrestrial-phase CRLFs is thought to be aquatic invertebrates found along the shoreline and on the water surface, including aquatic sowbugs, larval alderflies and water striders.

A summary of acute and chronic freshwater invertebrate data, including data published in the open literature, is provided below in Sections 4.1.2.1 through 4.1.2.3.

4.1.2.1 Freshwater Invertebrates: Acute Exposure Studies

Acute Studies with Telone. Two 48-hour acute studies with *Daphnia magna* are available for determining the acute toxicity of Telone to aquatic invertebrates (Table 4.5). Since the most sensitive EC_{50} is less than 0.1 mg/L, Telone is considered to be very highly toxic to freshwater aquatic invertebrates on an acute basis.

Table 4.5 Acute Toxicity of Telone to Aquatic Invertebrates

Species (Static or Flow-through)	% ai	48-hour LC_{50}[1] (measured/nominal)	Toxicity Category	MRID No. (Author, Year)	Study Classification
Waterflea *(Daphnia magna)* (static)	100	0.09 mg/L a.i. (measured)	Very Highly Toxic	40098001 (Mayer and Ellersieck, 1986)	Supplemental[2]
Waterflea *(Daphnia magna)*	>80	6.2 mg/L test material (nominal)	Moderately Toxic	00117044 (LeBlanc, 1980)	Supplemental[3]

[1]EC_{50} for *D. magna* but effect is immobility to a degree that is commensurate to mortality.
[2]EFED has determined that data from this reference should be classified as "supplemental" until the raw data can be obtained and evaluated for each study. At this time, the data have not been reviewed for Telone.
[3]Study is a published report of multiple bioassays each with a different chemical. Although the protocol used to test Telone is similar to that recommended by EPA, the details of the conduct of the study with respect to Telone are not provided.

Acute Studies with Telone Degradates (3-Chloroallyl Alcohol and 3-Chloroacrylic Acid)

In the EFED RED chapter for Telone and its degradates (3-chloroallyl alcohol and 3-chloroacrylic acid) were considered to be at least as toxic as the parent compound to aquatic species. Studies testing the acute toxicity of these degradates to a freshwater invertebrate (*D. magna*) has been submitted (Table 4.6). Based on the above toxicity data, the 3-chloroallyl alcohol is more toxic to freshwater invertebrates than the 3-chloroacrylic acid. The acid is classified as slightly toxic while the 3-chloroallyl alcohol degradate is classified as moderately toxic to freshwater invertebrates.

Table 4.6. Acute toxicity of 3-Chloroallyl Alcohol and 3-Chloroacrylic Acid to Freshwater Invertebrates.

Species (static or flow-through)	Test Material	%ai	Endpoint Value (Test duration) (Meas./Nominal)	Toxicity Category	MRID (Author, Year)	Study Classification
Waterflea *(D. magna)* (static)	3-Chloroallyl alcohol	Not Repor-ted	EC_{50} = 2.3 mg/L ai (48 hours) (measured)	Modera-tely Toxic	44843902 (Marino et al., 1999)	Supplemental[1]
Waterflea *(D. magna)* (static-renewal)	3-Chloroacrylic acid	100	EC_{50} = 55.0 mg/L ai (48 hours) (measured)	Slightly Toxic	44940308 (Marino et al., 1999)	Acceptable

[1]Study is supplemental due to unknown value of test substance purity and other missing information.

4.1.2.2 Freshwater Invertebrates: Chronic Exposure Studies

A flow-through freshwater invertebrate chronic study with Telone (96% purity) and *D. magna* (Kirk et al. 1999 [MRID 45007501]) was submitted. The study is classified as supplemental. Mortality occurred at all test levels, but it was not significantly different from the controls at concentrations lower than the reproductive NOAEC. Mortality in the lab water and solvent controls was 10% and 15%, respectively. The study identified a 21-day **LOAEC for telone of 0.105 mg/L** and a **NOAEC of 0.070 mg/L** based on growth (length) and mean number of progeny.

4.1.2.3 Freshwater Invertebrates: Open Literature Data

No additional information on about the toxicity of Telone to freshwater invertebrates was found in the ECOTOX database.

4.1.3 Toxicity to Aquatic Plants

Aquatic plant toxicity studies were used as one of the measures of effect to evaluate whether Telone may affect primary production and the availability of aquatic plants as food for CRLF tadpoles. Primary productivity is essential for indirectly supporting the growth and abundance of the CRLF.

Two types of studies were used to evaluate the potential of Telone to affect aquatic plants. Laboratory and field studies were used to determine whether Telone may cause direct effects to aquatic plants. A summary of the laboratory data and freshwater field studies for aquatic plants is provided in Sections 4.1.3.1 and 4.1.4.

Toxicity of Telone. Tier II toxicity tests with four freshwater plant/algae species are available for estimating risk of Telone to this taxon (Table 4.7). Among the freshwater plants and algae tested in acceptable/supplemental studies, the freshwater diatom (*Navicula pelliculosa*) was determined to be the most sensitive species based on the EC_{50}, although the EC_{05} had to be roughly estimated for this species since data were not provided in order to calculate a NOAEC.

Table 4.7. Toxicity of Telone to Freshwater Aquatic Plants.

Species	%ai	EC_{50} (mg/L) (nominal/measured)	NOAEC[1] (mg/L) (nominal/measured)	MRID (Author, Year)	Study Classification
Duckweed (*Lemna gibba*) (static)	96	20.0 mg/L a.i. (14-day) (nominal)	1.2 mg/L a.i. (14-day) (nominal)	44843914 (Kirk et al., 1999)	Acceptable
Green algae (*Selenastrum capricornutum*)	96	15.0 mg/L a.i. (96-hour) (nominal)	9.5 mg/L a.i. (96-hour) (nominal)	44940314 (Kirk et al., 1999)	Acceptable
Freshwater diatom (*Navicula pelliculosa*)	96	7.9 mg/L a.i. (120-hour) (nominal)	EC_{05} = 2.7 mg/L a.i.[2] (96-hour) (nominal)	44843909 (Kirk et al., 1999)	Supplemental[3]

Species	%ai	EC_{50} (mg/L) (nominal/measured)	NOAEC[1] (mg/L) (nominal/measured)	MRID (Author, Year)	Study Classification
Cyanobacteria (bluegreen algae) (*Anabaena flos-aquae*)	96	108.0 mg/L a.i. (120-hour) (nominal)	11.3 mg/L a.i. (120-hour) (nominal)	44843911 (Kirk et al., 1999)	Acceptable

[1]Unless otherwise noted the endangered species measurement endpoints are based on NOAEC values. Where a NOAEC can not be determined in a study the EC_{05} is used as an alternative endangered species endpoint for the NOAEC.
[2]NOAEC could not be determined due to lack of data. EC_{05} is an estimate determined using the Nuthatch program.
[3]Study classified as supplemental because total cell counts for the individual replicate vessels were not reported. These values are needed in order to perform the proper statistical analysis.

Toxicity of 3-Chloroallyl Alcohol and 3-Chloroacrylic Acid

Acute toxicity data for freshwater aquatic plants and algae (*L. gibba, A. flos-aquae, S. capricornutum, N. pelliculosa, S. costatum*) to the degradates of Telone have been submitted (Table 4.8).

Table 4.8. Toxicity of Telone Degradates to Freshwater Aquatic Vascular and Non-vascular Plants.

Species (static or flow-through)	Test Material	Endpoint Value (Test duration) (Measured/Nominal)	MRID (Author, Year)	Study Classification
Duckweed (*Lemna gibba*) (static)	3-Chloroallyl alcohol	EC_{50} = 1.694 mg/L a.i. NOAEC = 0.042 mg/L a.i. (14 days) (measured)	44940320 (Kirk et al., 1999)	Supplemental[1]
Duckweed (*Lemna gibba*) (static)	3-Chloroacrylic acid	EC_{50} = 0.22 mg/L a.i. EC_{05} = 0.0023 mg/L a.i. (14 days) (measured)	45007504 (Kirk et al., 1999)	Supplemental[2]
Green Alga (*S. capricornutum*)	3-Chloroallyl alcohol	EC_{50} = 49.0 mg/L a.i. NOAEC = 14.0 mg/L a.i. (96 hours) (measured)	44940315 (Kirk et al., 1999)	Supplemental[1]
Green Alga (*S. capricornutum*)	3-Chloroacrylic acid	EC_{50} = 0.432 mg/L a.i. NOAEC = 0.181 mg/L a.i. (96 hours) (measured)	44940319 (Kirk et al., 1999)	Supplemental[1]
Freshwater diatom (*Navicula pelliculosa*)	3-Chloroallyl alcohol	EC_{50} = 32.9 mg/L a.i. EC_{05} = 5.7 mg/L a.i. (120 hours) (measured)	44843913 (Kirk et al., 1999)	Supplemental[1]

Species (static or flow-through)	Test Material	Endpoint Value (Test duration) (Measured/Nominal)	MRID (Author, Year)	Study Classification
Freshwater diatom (*Navicula pelliculosa*)	3-Chloroacrylic acid	EC_{50} = 5.4 mg/L a.i. NOAEC = 2.5 mg/L a.i. (120 hours) (measured)	44940317 (Kirk et al., 1999)	Supplemental[1]
Cyanobacteria (*Anabaena flos-aquae*)	3-Chloroallyl alcohol	EC_{50} >101.0 mg/L a.i. NOAEC= 52 mg/L a.i. (120 hours) (measured)	44843912 (Kirk et al., 1999)	Supplemental[1]
Cyanobacteria (*Anabaena flos-aquae*)	3-Chloroacrylic acid	EC_{50}= 4.2 mg/L a.i. NOAEC= 3.2 mg/L a.i. (120 hours) (measured)	44940318 (Kirk et al., 1999)	Supplemental[1]

4.2 Toxicity of Telone to Terrestrial Organisms

Table 4.9 summarizes the most sensitive terrestrial toxicity endpoints for the CRLF, based on an evaluation of both the submitted studies and the open literature. A brief summary of submitted and open literature data considered relevant to this ecological risk assessment for the CRLF is presented below.

Table 4.9. Terrestrial Toxicity Profile for Telone.

Endpoint	Species	Toxicity Value Used in Risk Assessment	Citation MRID# (Author & Date)	Comment
Acute Direct Toxicity to Terrestrial-Phase CRLF (LD_{50})	Northern bobwhite (*Colinus virginianus)*	LD_{50} = 152 mg a.i./kg-bw	00118938 (Fink et al., 1982)	Acceptable
Acute Direct Toxicity to Terrestrial-Phase CRLF (LC_{50})	Northern bobwhite *(Colinus virginianus)* Mallard duck *(Anas platyrhynchos)*	LC_{50} >10,000 ppm ai	00120907, 00052565 (Fink, 1975) 00120908, 00052564 (Fink, 1975)	Acceptable
Chronic Direct Toxicity to Terrestrial-Phase CRLF	No Data	No Data	No Data	See section 4.2.1.2
Indirect Toxicity to Terrestrial-Phase CRLF (via acute toxicity to mammalian prey items)	Laboratory rat (*Rattus norvegicus*)	Acute Oral LD_{50} = 224 mg /kg-bw Acute Inhalation LC_{50} = 729 mg/L (3.31 mg a.i./L)	40220901 (Jeffrey et al., 1987) 00032985 (Stevenson and Blair, 1977)	Acceptable
Indirect Toxicity to Terrestrial-Phase CRLF (via	Laboratory rat (*Rattus norvegicus*)	13-week feeding study NOAEC = 5 mg/kg-bw/day	42954802 (Haut et al. 1993) 00144715	Acceptable For feeding study, rats aged 6-8

Endpoint	Species	Toxicity Value Used in Risk Assessment	Citation MRID# (Author & Date)	Comment
chronic toxicity to mammalian prey items)		Developmental Inhalation NOAEL = 20 ppm ai (0.091 mg ai/L)	00152848 (John et al., 1983)	weeks at study initiation Developmental study NOAEL based on body weight loss and reduced food consumption
Indirect Toxicity to Terrestrial-Phase CRLF (via acute toxicity to terrestrial invertebrate prey items)	Honey bee (*Apis mellifera*)	Acute contact LD_{50} >60.43 ug/bee	00028772 (Atkins, 1973) 00018842 (Atkins, 1969)	Acceptable
Indirect Toxicity to Terrestrial- and Aquatic-Phase CRLF (via toxicity to terrestrial plants)	Seedling Emergence Monocots (Onion [*Allium cepa]*)	EC_{25} >80 ppm ai (>11.69 lbs a.i./acre)	45007502 (Shwab, 1999)	Acceptable Most sensitive endpoint: None
	Seedling Emergence Dicots (Tomato [*Lycopersicon esculentum*])	EC_{25} = 33 ppm ai (4.81 lbs a.i./acre)	45007502 (Shwab, 1999)	Acceptable Most sensitive endpoint: Shoot weight
	Vegetative Vigor Monocots (Onion [*Allium cepa]*)	EC_{25} = 24 ppm ai (3.5 lbs a.i./acre)	45007502 (Shwab, 1999)	Acceptable Most sensitive endpoint: Shoot length
	Vegetative Vigor Dicots (Cucumber [*Cucumis sativus*])	EC_{25} = 48 ppm ai (6.86 lbs a.i./acre)	45007502 (Shwab, 1999)	Acceptable Most sensitive endpoint: Shoot length

Data are not available with which to estimate the risks of 3-chloroallyl alcohol or 3-chloroacrylic acid to birds, so these risks will not be addressed in this assessment. However, two acute oral studies with laboratory rats have been submitted, which indicated an LD_{50} of 91 mg/kg for both degradates (MRID 44843905 and 44940309). This value would classify the degradates of telone as moderately toxic to wild mammals if their sensitivity is comparable.

Acute toxicity to terrestrial animals is categorized using the classification system shown in **Table 4.10** (U.S. EPA, 2004). Toxicity categories for terrestrial plants have not been defined.

Table 4.10 Categories of Acute Toxicity for Avian and Mammalian Studies		
Toxicity Category	**Oral LD_{50}**	**Dietary LC_{50}**
Very highly toxic	< 10 mg/kg	< 50 ppm
Highly toxic	10 - 50 mg/kg	50 - 500 ppm
Moderately toxic	51 - 500 mg/kg	501 - 1000 ppm
Slightly toxic	501 - 2000 mg/kg	1001 - 5000 ppm
Practically non-toxic	> 2000 mg/kg	> 5000 ppm

4.2.1 Toxicity to Birds

As specified in the Overview Document, the Agency uses birds as a surrogate for terrestrial-phase amphibians when amphibian toxicity data are not available (U.S. EPA, 2004). No terrestrial-phase amphibian data are available for Telone; therefore, acute and chronic avian toxicity data are used to assess the potential direct effects of Telone to terrestrial-phase CRLFs.

4.2.1.1 Birds: Acute Exposure (Mortality) Studies

An acceptable Northern bobwhite study with the TGAI was submitted by the registrant (Table 4.11). Since the LD_{50} (152 mg/kg-bw) falls in the range of 51 to 500 mg/kg-bw, Telone is classified as moderately toxic to avian species on an acute oral basis. Acceptable subacute toxicity tests with the Northern bobwhite and Mallard were also submitted. The LC_{50} values for both species are higher than 2,000 ppm, indicating that Telone is practically nontoxic to birds, reptiles, and terrestrial phase amphibians on a subacute dietary basis; however, this result is inconsistent with the acute oral test. Both studies noted decreased food consumption and weight gain in the test groups receiving Telone-treated food compared to the controls, so the birds may have received an inadequate dose. Field study data also indicate that volatility is the primary route of telone dissipation with dispersal increasing to 35.1 milligrams per square meter per hour (mg/m2/hour) by three days (EFED Telone RED Chapter). Therefore, the weight of evidence indicates that telone is moderately toxic to birds (LD_{50} = 152 mg/kg).

Table 4.11. Acute Oral and Subacute Dietary Toxicity of Telone to Birds.

Species	% ai	Toxicity Endpoint	Toxicity Category	MRID No. (Author, Year)	Study Classification
Northern bobwhite (*Colinus virginianus*)	92	LD_{50} = 152 mg a.i./kg-bw	Moderately toxic	00118938[1] (Fink et al., 1982)	Acceptable
Northern bobwhite (*Colinus virginianus*)	92	LC_{50} >10,000 ppm ai	Practically Nontoxic	00120907 00052565 (Fink, 1975)	Acceptable
Mallard duck (*Anas platyrhynchos*)	92	LC_{50} >10,000 ppm ai	Practically Nontoxic	00120908 00052564 (Fink, 1975)	Acceptable

[1] Corresponds to EPA Accession # 261149 and 248415

Since Telone is highly volatile, inhalation is also a possible route of exposure for birds. Data are not available for acute inhalation toxicity for birds.

4.2.1.2 Birds: Chronic Exposure (Growth, Reproduction) Studies

Historically avian reproduction studies using the TGAI have not been required from the registrant for Telone, since the field dissipation half-life is roughly one week and most registered uses allow for only one application per year. Two applications of Telone on grapes are allowed; however, Telone is highly volatile, and the applications must be made at least 60 days apart, possibly reducing chronic exposure.

There are sufficient chronic exposure data in mammals (rats, rabbits, and mice), submitted to HED (Appendix I), to indicate that telone has a low order of toxicity by the inhalation route. These data will be used to characterize the chronic, direct risk to the CRLF.

4.2.2 Toxicity to Mammals

Mammalian toxicity data are used to assess potential indirect effects of Telone to the terrestrial-phase CRLF. Effects to small mammals resulting from exposure to Telone may also indirectly affect the CRLF via reduction in available food. As discussed in Section 2.5.3, over 50% of the prey mass of the CRLF may consist of vertebrates such as mice, frogs, and fish (Hayes and Tennant, 1985).

4.2.2.1 Mammals: Acute Exposure (Mortality) Studies

Wild mammal testing is required on a case-by-case basis, depending on the results of lower tier laboratory mammalian studies, intended use pattern, and pertinent environmental fate characteristics. In most cases, laboratory rat or mouse toxicity values submitted to the Agency for determination of human health effects substitute for wild mammal testing. Results of acute oral and acute inhalation studies with laboratory rats are presented in Table 4.12. Risk assessments performed on Telone prior to the 2007 new use assessment for grapes used different data points with which to assess risk with no explanation, and one of the studies that was cited in those assessments could not be found. The current mammal data were reviewed, and the data contained in Table 4.12 are from studies that have been used in OPPs Health Effects Division risk assessments or have been identified as acceptable/supplemental and represent the most sensitive endpoint among the data available. Based on the acute oral value for rats, Telone is considered to be moderately toxic to wild mammals.

Table 4.12. Acute Oral and Acute Inhalation Toxicity of Telone to Mammals.

Species	Test Type	% ai	Toxicity Value	Affected Endpoints	MRID (Author, Year)
Laboratory rat (*Rattus norvegicus*)	Acute Oral	97.5	LD_{50} = 224 mg /kg-bw (Females)	Mortality	40220901 (Jeffrey et al., 1987)
Laboratory mouse (*Mus musculus*)	Acute Oral	92.0	LD_{50} = 640 mg/kg-bw (Males and Females)	Mortality	00039683 (Toyoshima et al.

Species	Test Type	% ai	Toxicity Value	Affected Endpoints	MRID (Author, Year)
					1978)
Laboratory rat (*Rattus norvegicus*)	Acute Inhalation	94.4	LC_{50} = 729 ppm of air (3.31 mg a.i./L of air) (Males and Females) (4-hour exposure)	Mortality	00032985 (Stevenson and Blair, 1977)
Laboratory rat (*Rattus norvegicus*)	Acute Inhalation	97.5	LC_{50} = 855 ppm of air (3.88 mg a.i./L of air) (Males) (4-hour exposure)	Mortality	40220903[1] (Streeter et al., 1987)

[1]MRID misidentified in 1997 EFED RED Chapter as 235350

Data are not available with which to estimate the risks of 3-chloroallyl alcohol or 3-chloroacrylic acid to birds, so these risks will not be addressed in this assessment. However, two acute oral studies with laboratory rats have been submitted, which indicated an LD_{50} of 91 mg/kg for both degradates (MRID 44843905 and 44940309). This value would classify the degradates of telone as moderately toxic to wild mammals if their sensitivity is comparable.

4.2.2.2 Mammals: Chronic Exposure (Growth, Reproduction) Studies

A two-generation rat reproduction study with Telone is not available, so a 13-week feeding study will be used as an alternative for determining the chronic risk of Telone (Table 4.13). Additionally, a developmental inhalation study with Telone will also be used to assess the chronic risk of Telone exposure to mammals via inhalation.

Table 4.13. Chronic Toxicity Data for Telone in Rats

Species	Test Type	% ai	Toxicity Value	Affected Endpoints	MRID (Author, Year)
Laboratory rat (*Rattus norvegicus*)	13-Week Feeding Study[2]	96.0	NOAEC = 5 mg/kg-bw/day (Rats aged 6-8 weeks at study initiation)	Body weight, hyperkeratosis and/or basal cell hyperplasia of the non-glandular portion of the stomach	42954802[1,3] (Haut et al. 1993)
Laboratory rat (*Rattus norvegicus*)	Develop-mental Inhalation	92.0	NOEL Maternal: 20 ppm (0.091 mg ai/L) NOEL Developmental: 60 ppm (0.272 mg a.i./L)	Maternal - body weight loss and reduced food consumption Developmental - delayed ossification of vertebral centra	00144715 00152848[1,3,5] (John et al., 1983)
Fruitfly (*Drosophila melanogaster*)	Mutagenicity	NR	Classification doses 0, 5750 ppm/feeding	Induction of recessive lethal mutations	00146469 Valencia et al. 1985

Studies examining the chronic toxicity of the degradates of Telone to mammals are not available.

4.2.3 Toxicity to Terrestrial Invertebrates

Terrestrial invertebrate toxicity data are used to assess potential indirect effects of Telone to the terrestrial-phase CRLF. Effects to terrestrial invertebrates resulting from exposure to Telone may also indirectly affect the CRLF via reduction in available food.

4.2.3.1 Terrestrial Invertebrates: Acute Exposure (Mortality) Studies

Two honey bee acute contact studies that have been submitted to OPP. Both of these studies are by Atkins et al. (1969 [MRID #00018842], 1973 [MRID #00028772]) and appear to present the same information. Therefore, they have been treated as one source for the purpose of this risk assessment. It also appears that risk assessments previous to the 2007 new use assessment for grapes have presented a misinterpretation of the information in these studies. The correct results are presented here (Table 4.14). Because the acute contact LD_{50} is greater than 60.43 µg/bee, Telone is classified as practically non-toxic to bees on this basis.

Table 4.14. Acute contact toxicity of Telone to the Honeybee.

Species	% ai	LD_{50} (µg test material/bee)	Toxicity Category	MRID No. (Author, Year)	Study Classification
Honey bee *(Apis mellifera)*	TGAI	>60.43	Practically nontoxic	00028772 (Atkins, 1973) 00018842 (Atkins, 1969)	Acceptable

4.2.3.2 Terrestrial Invertebrates: Open Literature Studies

No open literature studies on the toxicity of Telone or its degradates to the terrestrial invertebrates are available.

4.2.4 Toxicity to Terrestrial Plants

Terrestrial plant toxicity data are used to evaluate the potential for Telone to affect riparian zone and upland vegetation within the action area for the CRLF. Impacts to riparian and upland (i.e., grassland, woodland) vegetation may result in indirect effects to both aquatic- and terrestrial-phase CRLFs, as well as modification to designated critical habitat PCEs via increased sedimentation, alteration in water quality, and reduction in of upland and riparian habitat that provides shelter, foraging, predator avoidance and dispersal for juvenile and adult CRLFs.

Plant toxicity data from both registrant-submitted studies and studies in the scientific literature were reviewed for this assessment. Registrant-submitted studies are conducted under conditions and with species defined in EPA toxicity test guidelines. Sub-lethal endpoints such as plant growth, dry weight, and biomass are evaluated for both monocots and dicots, and effects are evaluated at both seedling emergence and vegetative life stages. Guideline studies generally evaluate toxicity to ten crop species. A drawback to these tests is that they are conducted on herbaceous crop species only, and extrapolation of effects to other species, such as the woody shrubs and trees and wild herbaceous species, contributes uncertainty to risk conclusions.

Commercial crop species have been selectively bred, and may be more or less resistant to particular stressors than wild herbs and forbs. The direction of this uncertainty for specific plants and stressors, including Telone, is largely unknown. Homogenous test plant seed lots also lack the genetic variation that occurs in natural populations, so the range of effects seen from tests is likely to be smaller than would be expected from wild populations.

Tier I studies were performed on a suite of monocotyledonous and dicotyledonous species, including: (monocots) - barnyard grass (*Echinochloa crus-galli*), corn (*Zea mays*), onion (Allium cepa), and wheat (*Triticum aestivum*); (dicots) – cucumber (*Cucumis sativus*), radish (*Raphanus sativus*), soybean (*Glycine max*), sugarbeet (*Beta vulgaris altissima*), sunflower (*Helianthus annus*), and tomato (*Lycopersicon esculentum*). Significant effects on seedling emergence were not observed at the Tier I test level (152 ppm ai or 22.15 lbs ai/acre [see conversion below]) of telone for barnyard grass, cucumber, sunflower, or wheat. Significant effects on vegetative vigor were also not observed at this level for barnyard grass, radish, and soybean. As a result of these Tier I tests, these species were not tested at the Tier II level, but all others were. The results of the Tier II seedling emergence and vegetative vigor toxicity tests on non-target plants are summarized below in **Table 4.15.**

The level tested in the Tier I tests did not test maximum use rates based on the conversion to pounds of active ingredient per acre. Therefore, there may be some uncertainty associated with using these tests to estimate risk at many of the application rates for telone; however, species of plants that were apparently more sensitive were advanced to the Tier II tests in order to establish EC_{25} and NOAEC values.

The study report provides endpoints in units of parts per million. The most sensitive values used in the risk assessment were converted to lbs a.i./acre by multiplying the concentration in ppm (mg/L) by the volume of treatment solution used to treat each plant (0.35 L); mass was divided by the area of each pot (6.5 inch diameter) and the resulting value was converted to pounds/acre. These were onion and tomato (EC_{25} >11.69 lbs ai/acre and EC_{25} = 4.81 lbs ai/acre, respectively) for the seedling emergence test, and onion and cucumber (EC_{25} = 3.5 lbs ai/acre and EC_{25} = 6.86 lbs ai/acre, respectively) for the vegetative vigor test.

Table 4.15 Non-target Terrestrial Plant Seedling Emergence and Vegetative Vigor Toxicity (Tier II) Data				
Crop	**Type of Study Species**	**NOAEC**	**EC_{25}**	**Most sensitive parameter**
Seedling Emergence				
Monocots	Corn	>81 ppm ai (>11.80 lbs ai/acre)	>81 ppm ai (>11.80 lbs ai/acre)	None
	Onion	>80 ppm ai (>11.69 lbs ai/acre)	>80 ppm ai (>11.69 lbs ai/acre)	None
Dicots	Radish	15 ppm ai (2.19 lbs ai/acre)	>81 ppm ai (>11.80 lbs ai/acre)	Emergence
	Soybean	28 ppm ai (4.08 lbs ai/acre)	36 ppm ai (5.26 lbs ai/acre)	Shoot length
	Sugarbeet	49 ppm ai (7.14 lbs ai/acre)	49 ppm ai (7.14 lbs ai/acre)	Shoot weight
	Tomato	15 ppm ai (2.19 lbs ai/acre)	35 ppm ai (5.10 lbs ai/acre)	Shoot weight
Vegetative Vigor				
Monocots	Corn	49 ppm ai (7.14 lbs ai/acre)	>81 ppm ai (>11.80 lbs ai/acre)	None (same for shoot weight and length)
	Onion	15 ppm ai (2.19 lbs ai/acre)	26 ppm ai (3.79 lbs ai/acre)	Shoot weight
	Wheat	>81 ppm ai (>11.80 lbs ai/acre)	>81 ppm ai (>11.80 lbs ai/acre)	None
Dicots	Cucumber	28 ppm ai (4.08 lbs ai/acre)	48 ppm ai (7.00 lbs ai/acre)	Shoot weight
	Sugarbeet	49 ppm ai (7.14 lbs ai/acre)	62 ppm ai (9.04 lbs ai/acre)	Shoot weight
	Sunflower	49 ppm ai (7.14 lbs ai/acre)	56 ppm ai (8.16 lbs ai/acre)	Shoot weight
	Tomato	49 ppm ai (7.14 lbs ai/acre)	56 ppm ai (8.16 lbs ai/acre)	Shoot weight

Significant effects were not observed on any of these species tested at the Tier I level with 3-chloroallyl alcohol or 3-chloroacrylic acid; therefore, no Tier II tests were performed. It is assumed that effects of these degradates will be low.

Plant Information from ECOTOX – A study of the uptake and metabolism of telone and its 3-chloroallyl alcohol degradate is available from the ECOTOX database (Berry et al. 1980, ECOTOX ref. # 93862). In this study, three dicotyledonous species (bush bean [*Phaseolus vulgaris* cv. Tender Green], carrot [*Daucus carota* cv. Royal Chantenay], tomato [*Lycoperscion* *esculentum* cv. VF-7][11]) were exposed to ^{14}C-labeled 1,3-dichloropropene (telone) (0.0001 M solution) and its metabolite 3-chloroallyl alcohol (0.0003 M solution). Exposure occurred via applications to vermiculite and topical applications, lasting 0.5 and 120 hours, at which times the parent compound and metabolites were extracted and quantified. The 1,3-dichloropropene was metabolized into 3-chloroallyl alcohol. The 3-chloroallyl-alcohol was metabolized into intermediate products (3-chloro-1-propanol and 3-chloroacrylic acid) before being broken down into normal plant products. The authors concluded that the parent telone and 3-chloroallyl alcohol had short half-lives and were not detectable in the plant by 120 hours after initial treatment. The paper does not note any effects on plants.

This study provides further information about effects of telone and the 3-chloroallyl alcohol degradate on plants. This work does provide some support for that conclusion. However, based on information provided in the methods, there is no way to know how the concentrations tested in this study compare to exposures that would occur in the field. It is possible that higher concentrations could not be metabolized as rapidly, resulting in deleterious effects, so these results must be used cautiously in reference to ecological effects resulting from operational uses of telone.

4.3 Use of Probit Slope Response Relationship to Provide Information on the Endangered Species Levels of Concern

The Agency typically uses the probit dose response relationship as a tool for providing additional information on the potential for acute direct effects to individual listed species and aquatic animals that may indirectly affect the listed species of concern (U.S. EPA, 2004). As part of the risk characterization, an interpretation of acute RQ for listed species is discussed. However, because either “No Effect” or “Not Likely to Adversely Affect” determinations were made for all uses of telone based on either lack of LOC exceedances or discounted estimates of exposure, this analysis would not have provided any further information for these determinations and was not performed.

4.4 Incident Database Review

A review of the EIIS database for ecological incidents involving Telone was completed on May 12, 2008. The database contained seven incidents involving plants and one incident involving aquatic animals. In all cases, Telone was linked with relative certainty (high probability in the aquatic case) to the incident. The results of this review for terrestrial, plant, and aquatic incidents are discussed below in Sections 4.4.1 and 4.4.2. A complete list of the incidents involving Telone including associated uncertainties is included as **Appendix H**.

4.4.1 Plant Incidents

Incidents with plants involved crop plants treated directly with telone. Crops with reported damage included grapes, potatoes, apples, turf, and watermelon. These incidents occurred within the crop treated with telone, and do not note effects to plants off field.

[11] Scientific names are as reported in the text of the paper. Any updates to these names have not been included.

4.4.2 Aquatic Incidents

The incident involving aquatic animals was determined to be an accidental misuse wherein Telone was applied to strawberries through in-line fumigation, according to the report. In this case, a faulty irrigation valve caused Telone to leak and run off the treated field into a nearby stream. The incident resulted in mortality to >1,000 fish, which included carp, catfish, crawfish, hitch, rainbow trout, striped bass, Sacramento blackfish, sculpin, sucker, and other unknown species. Residue analysis of water and gill samples confirmed exposure to Telone.

5. Risk Characterization

Risk characterization is the integration of the exposure and effects characterizations. Risk characterization is used to determine the potential for direct and/or indirect effects to the CRLF or for modification to its designated critical habitat from the use of Telone in CA. The risk characterization provides an estimation (Section 5.1) and a description (Section 5.2) of the likelihood of adverse effects; articulates risk assessment assumptions, limitations, and uncertainties; and synthesizes an overall conclusion regarding the likelihood of adverse effects to the CRLF or its designated critical habitat (i.e., “no effect,” “likely to adversely affect,” or “may affect, but not likely to adversely affect”).

5.1 Risk Estimation

Risk is estimated by calculating the ratio of exposure to toxicity. This ratio is the risk quotient (RQ), which is then compared to pre-established acute and chronic levels of concern (LOCs) for each category evaluated (**Appendix B**). For acute exposures to the CRLF and its animal prey in aquatic habitats, as well as terrestrial invertebrates, the LOC is 0.05. For acute exposures to the CRLF and mammals in terrestrial habitats, the LOC is 0.1. The LOC for chronic exposures to CRLF and its prey, as well as acute exposures to plants is 1.0.

Risk to the aquatic-phase CRLF is estimated by calculating the ratio of exposure to toxicity using 1-in-10 year EECs based on the label-recommended Telone use scenarios summarized in **Table 3.3** and the appropriate aquatic toxicity endpoint from **Table 4.1**. Risks to the terrestrial-phase CRLF and its prey (*e.g.* terrestrial insects, small mammals and terrestrial-phase frogs) are estimated based on exposures resulting from applications of Telone (**Table 3.4**) and the appropriate toxicity endpoint from **Table 4.9 to 4.15**. Exposures are also derived for terrestrial plants, as discussed in Section 3.3 and summarized in **Table 3.5**, based on the highest application rates of Telone use within the action area.

5.1.1 Exposures in the Aquatic Habitat

5.1.1.1 Direct Effects to Aquatic-Phase CRLF

Direct Effects of Telone. Direct effects of telone to the aquatic-phase CRLF are based on peak EECs in the standard pond and the lowest acute toxicity value for freshwater fish. Exposure of the CRLF to telone in water bodies is expected to be very low, as explained in section 3.2.4.5. Telone (Table 4.1) is more acutely toxic to *Daphnia* (EC50 = 90 ppb) than it is to the surrogate organism for CRLF (walleye, LC50 = 1.08 ppm). An acute-to-chrnic ratio for *Daphnia* can be calculated from its chronic NOAEC of 70 ppb: 70ppb/90ppb = 0.78. Applying this to the walleye, the expected NOAEC would be 1.08ppm x 0.78 = 0.84 ppm, or 840 ppb. Telone exposures are expected to be well below this concentration, thus no chronic effects are likely.

For telone, the Walleye has the lowest LC_{50} of 1,080 μg ai/L, and this value was used to calculate RQs presented in Table 5.1. The RQs are calculated for estimated concentrations with and without volatilization losses considered in PRZM-EXAMS scenarios. Inclusion of volatilization influences whether the RQ exceeds the LOC for several crops, with RQs exceeding the LOC when volatilization is not accounted for but not exceeding when it is included. These uses include: Apple, Apricot, Cherry, Fig, Fruits, Nectarine, Peach, Pear, Persimmon, Plum, Pomegranate, Prune, Quince, Stone fruits, Date, Deciduous fruit trees, Kumquat, Asparagus, Beans, Beets, Carrot, Horseradish, Kale, Legume vegetables, Parsnip, Peas, Pepper & chili type, Pimento, Soybeans, Cowpea/Blackeyed pea, Peanuts, Barley, Oats, Rye, Safflower, Sorghum, Wheat, Buckwheat, Flax, Kenaf, Cotton, Garlic, Leek, Pastures, Hops, Mint, Onion, Radish, and Shallot. Uses for which RQs exceed the LOC under either scenario include Alfalfa, Clover, Lespedeza, Trefoil, Vetch, Almond, Cashew, Chestnut, Filbert, Hickory nut, Pecan, Tree nuts, Walnut, Blackberry, Blueberry, Loganberry, Boysenberry, Raspberry, Youngberry, Currant, Gooseberry, Huckleberry, Broccoli, Cabbage, Cauliflower, Celery, Cole Crops, Collards, Mustard, Brussels sprouts, Chard-Swiss, Endive, Lettuce, Spinach, Salsify, Corn, Millet, Field Crops, Forest Nursery planting, Forest trees, Spruce (forest), Grapes, Okra, Tomato, Vegetables, Olive, Ornamental-Shady trees, Ornamental Non-flowering plants, Soil – preplant, Strawberry, Dewberry, and sugarbeet. Because RQs exceed the LOC for all uses listed above under one or both scenarios, **a preliminary "May Affect" determination is made for direct acute effects to the CRLF for these uses.**

RQs did not exceed the LOC of 0.05 for either scenario for Potato, Rutabaga, Sweet Potato, Turnip (root), Kohlrabi, Citrus, Grapefruit, Lemon, Lime, Orange, Tangelo, Tangerines, Cucumber, Eggplant, Melon, Pumpkin, or Squash. Because RQs do not exceed the acute LOC, and because the probability of individual effect is low, **a "No Effect" determination is made for direct acute effects to the CRLF for these uses.** Since data are not available with which to assess the chronic direct risks of telone to the CRLF, there is some uncertainty with this conclusion. However, as discussed above, telone is not expected to cause chronic effects to the CRLF in the aquatic environment.

Table 5.1 Summary of Direct Effect (Acute) RQs for the Aquatic-phase CRLF based on Acute Toxicity to Walleye (most sensitive freshwater fish LC_{50}).

Use	Peak EEC (µg/L) (With Volatilization)[a]	RQ[b]	Peak EEC (µg/L) (Without Volatilization)[d]	RQ[b]	Prob. of Individual Effect[c]	Preliminary Effect Determination
Alfalfa, Clover, Lespedeza, Trefoil, Vetch	108.0	**0.10**	188.5	**0.17**	1 in 3740 (1 in 4.6 x 10^{11} – 1 in 16.2)	May Affect
Almond, Cashew, Chestnut, Filbert, Hickory nut, Pecan, Tree nuts, Walnut	116.0	**0.11**	458.6	**0.42**	1 in 22.2 (1 in 2870 – 1 in 4.4)	May Affect
Apple, Apricot, Cherry, Fig, Fruits, Nectarine, Peach, Pear, Persimmon, Plum, Pomegranate, Prune, Quince, Stone fruits, Date, Deciduous fruit trees, Kumquat	33.4	0.03	231.9	**0.21**	1 in 874 (1 in 1.9 x 10^{9} – 1 in 11.4)	May Affect
Asparagus, Beans, Beets, Carrot, Horseradish, Kale, Legume vegetables, Parsnip, Peas, Pepper & chili type, Pimento,	45.6	0.04	219.7	**0.20**	1 in 210 (1 in 6.3 x 10^{9} – 1 in 12.3)	May Affect

Use	Peak EEC (µg/L) (With Volatilization)[a]	RQ[b]	Peak EEC (µg/L) (Without Volatilization)[d]	RQ[b]	Prob. of Individual Effect[c]	Preliminary Effect Determination
Soybeans, Cowpea/Blackeyed pea, Peanuts						
Barley, Oats, Rye, Safflower, Sorghum, Wheat, Buckwheat, Flax, Kenaf	31.7	0.03	221.0	**0.20**	1 in 210 (1 in 6.3 x 10^9 – 1 in 12.3)	May Affect
Blackberry, Blueberry, Loganberry, Boysenberry, Raspberry, Youngberry, Currant, Gooseberry, Huckleberry	258.8	**0.24**	291.9	**0.27**	1 in 190 (1 in 6.5 x 10^6 – 1 in 7.8)	May Affect
Broccoli, Cabbage, Cauliflower, Celery, Cole Crops, Collards, Mustard	242.8	**0.22**	530.1	**0.49**	1 in 12.2 (1 in 377 – 1 in 3.7)	May Affect
Brussels sprouts, Chard-Swiss, Endive, Lettuce, Spinach, Salsify	233.4	**0.22**	1270.0	**1.18**	1 in 1.6 (1 in 1.8 – 1 in 1.4)	May Affect
Citrus, Grapefruit, Lemon, Lime, Orange, Tangelo, Tangerines	2.13	<0.01	36.9	0.03	1 in 2.8 x 10^{11} (1 in 2.1 x 10^{42} – 1 in 862)	No Effect
Corn, Millet, Field Crops	127.3	**0.12**	220.6	**0.20**	1 in 210 (1 in 6.3 x 10^9 – 1 in 12.3)	May Affect
Cotton	11.1	0.01	195.6	**0.18**	1 in 2490 (1 in 9.8 x 10^{10} – 1 in 14.7)	May Affect
Cucumber, Eggplant, Melon, Pumpkin, Squash	1.2	<0.01	39.0	0.04	1 in 6.3 x 10^9 (1 in 7.5 x 10^{35} – 1 in 386)	No Effect
Forest Nursery planting, Forest trees, Spruce (forest)	87.4	**0.08**	405.9	**0.38**	1 in 34.1 (1 in 1290 – 1 in 5.0)	May Affect
Garlic, Leek	1.2	<0.01	96.2	**0.09**	1 in 7.9 x 10^5 (1 in 4.1 x 10^{20} – 1 in 54.8)	May Affect
Grapes	118.8	**0.11**	275.1	**0.25**	1 in 297 (1 in 3.3 x 10^7 – 1 in 8.8)	May Affect
Pastures	2.7	<0.01	161.2	**0.15**	1 in 9560 (1 in 1.7 x 10^{13} – 1 in 20.1)	May Affect
Hops	26.6	0.02	63.0	**0.06**	1 in 5.2 x 10^7 (1 in	May Affect

Use	Peak EEC (µg/L) (With Volatilization)[a]	RQ[b]	Peak EEC (µg/L) (Without Volatilization)[d]	RQ[b]	Prob. of Individual Effect[c]	Preliminary Effect Determination
					5.0×10^{27} – 1 in 138)	
Mint	11.0	0.01	62.8	**0.06**	1 in 5.2×10^{7} (1 in 5.0×10^{27} – 1 in 138)	May Affect
Okra, Tomato, Vegetables	126.2	**0.12**	207.6	**0.19**	1 in 1710 (1 in 2.4×10^{10} – 1 in 13.4)	May Affect
Olive	64.8	**0.06**	309.0	**0.29**	1 in 129 (1 in 1.5×10^{6} – 1 in 7.1)	May Affect
Onion, Radish, Shallot	14.9	0.01	89.9	**0.08**	1 in 2.5×10^{6} (1 in 3.6×10^{22} – 1 in 70.8)	May Affect
Ornamental-Shady trees, Ornamental Non flowering plants	74.3	**0.07**	374.2	**0.35**	1 in 49.8 (1 in 4.9×10^{4} – 1 in 5.5)	May Affect
Ornamental lawns & Turf	1.8	<0.01	51.7	**0.05**	1 in 4.2×10^{8} (1 in 1.8×10^{31} – 1 in 216)	May Affect
Potato, Rutabaga, Sweet Potato Turnip (root), Kohlrabi	4.3	<0.01	41.5	0.04	1 in 6.3×10^{9} (1 in 7.5×10^{35} – 1 in 386)	No Effect
Soil – pre plant	447.8	**0.41**	506.1	**0.47**	1 in 14.3 (1 in 632 – 1 in 3.9)	May Affect
Strawberry, Dewberry	111.6	**0.10**	750.3	**0.69**	1 in 4.3 (1 in 13.6 – 1 in 2.7)	May Affect
Sugar beet	156.9	**0.15**	389.3	**0.36**	1 in 43.6 (1 in 3.1×10^{4} – 1 in 5.3)	May Affect

[a] EECs generated with the use of enthalpy of vaporization and the air diffusion coefficient as PRZM inputs.
[b] RQs associated with acute and chronic direct toxicity to the CRLF are also used to assess potential indirect effects to the CRLF based on a reduction in freshwater fish and frogs as food items. RQs that exceed the LOC of 0.05 are indicated in bold.
[c] A probit slope value for the acute Walleye toxicity test is not available; therefore, the effect probability was calculated based on a default slope assumption of 4.5 with upper and lower 95% confidence intervals of 2 and 9 (Urban and Cook, 1986).
[d] EECs generated without the use of enthalpy of vaporization and the air diffusion coefficient as PRZM inputs.

Direct Effects of Telone Degradates. Acute toxicity tests for the Rainbow trout provide the lowest LC_{50}s for the alcohol and acid degradates of telone. For 3-chloroallyl alcohol, the LC_{50} is 986 ug/L ai, and for the 3-chloroacrylic acid the LC_{50} is 69,500 ug/L ai. As described previously, the EECs for the alcohol and acid degradates were determined to be 6.4% and 10% of the peak EECs for telone, respectively.

The highest EEC estimated for telone in Table 5.1 is 1,270 ug/L (for brussel sprouts, Swiss chard, endive, lettuce, spinach, and salsify, excluding volatilization from the model inputs). The highest EEC for 3-chloroacrylic acid would thus be estimated to be 127 ug/L, which would result in an RQ <0.01, which would also be true of all the other uses since they result in lower EECs. **Based on these analyses, 3-chloroacrylic acid is not expected to contribute further to direct acute effects to the CRLF.** Data are unavailable to determine the direct chronic risks of this degradate.

Based on the estimated percentage of formation of the degradates, EECs for 3-chloroallyl alcohol would be 81.3 ug/L, 48.02 ug/L, and 33.9 ug/L, resulting in RQs of 0.08, 0.05, and 0.03, respectively. Therefore, **direct acute risk to the aquatic-phase CRLF is expected to occur due to the formation of 3-chloroallyl alcohol when telone is applied to brussel sprouts, Swiss chard, endive, lettuce, spinach, salsify, strawberry, and dewberry (based on the scenarios that do not account for volatilization of telone). However, this analysis does not identify risk related to any uses that are not already identified above for telone.**

5.1.1.2 Indirect Effects to Aquatic-Phase CRLF via Reduction in Prey (non-vascular aquatic plants, aquatic invertebrates, fish, and frogs)

Non-vascular Aquatic Plants - Telone

Indirect effects of Telone to the aquatic-phase CRLF (tadpoles) via reduction in non-vascular aquatic plants in its diet are based on peak EECs from the standard pond and the lowest acute toxicity value for aquatic non-vascular plants. The lowest toxicity value for aquatic non-vascular plants is provided by the study on the freshwater diatom (*Navicula pelliculosa*), for which an EC_{05} was determined to be 2,700 ug/L a.i. The greatest EEC calculated for telone is 1,270 ug/L for Brussel sprouts, Swiss chard, Endive, Lettuce, Spinach, and Salsify. The RQ for non-vascular aquatic plants for these uses is 0.47, which is below the LOC of 1.0. Therefore, RQs do not exceed the LOC for any of the uses of telone.

Non-vascular Aquatic Plants – Telone Degradates

Data are available with which to estimate the risk of the degradates of telone to non-vascular aquatic plants. As with freshwater fish, the EECs for the acid and alcohol degradate were estimated to be 10% and 6.4% of the peak EECs for telone, respectively. The toxicity study with the green alga (*S. capricornutum*) provided the lowest NOAEC value for the acid degradate, which was 181 ug/L ai. The study with the freshwater diatom (*N. pelliculosa*) provided the lowest value for the alcohol degradate (EC_{05} = 5700 ug/L ai). Using the highest peak EEC for telone, the RQs for 3-chloroacrylic acid and 3-chloroallyl alcohol are 0.70 and 0.01, respectively.

Therefore, it is concluded that none of the RQs for any of the uses of telone would exceed the LOC of 1.0 for aquatic plants as a result of the presence of telone degradates in water.

Based on the results of the above analyses for both telone and its degradates, **a determination of "No Effect" is made for all uses of telone as a result of indirect effects to the aquatic-phase CRLF produced by a reduction in aquatic non-vascular plant food base.**

Aquatic Invertebrates

Indirect acute effects to the aquatic-phase CRLF via effects to prey (invertebrates) in aquatic habitats are based on peak EECs in the standard pond and the lowest acute toxicity value for freshwater invertebrates. For chronic risks, 21-day EECs and the lowest chronic toxicity value for invertebrates are used to derive RQs. The acute and chronic toxicity values determined for *Daphnia magna*, which are 90 ug/L ai and 70 ug/L ai, respectively, were used to calculate RQs. A summary of the acute and chronic RQ values for exposure to aquatic invertebrates (as prey items of aquatic-phase CRLFs) is provided in **Table 5.2**.

RQs exceed the acute LOC for all uses of telone if the EECs are modeled with the volatilization routine turned off. With inclusion of volatilization, RQs exceed the acute LOC for all uses except Citrus, Grapefruit, Lemon, Lime, Orange, Tangelo, Tangerines, Cucumber, Eggplant, Melon, Pumpkin, Squash, Garlic, Leek, Pastures, and Ornamental lawns and Turf. **Based on these results, a preliminary "May Affect" determination is made for all uses of telone to the aquatic-phase CRLF due to indirect effects resulting from reduction in aquatic invertebrate food base.** Results of the chronic analysis indicate that chronic risks to aquatic invertebrates would also contribute to this determination. If volatilization is accounted for in the model, chronic RQs exceed the LOC for Blackberry, Blueberry, Loganberry, Boysenberry, Raspberry, Youngberry, Currant, Gooseberry, Huckleberry, Broccoli, Cabbage, Cauliflower, Celery, Cole Crops, Collards, Mustard, Brussel sprouts, Chard-Swiss, Endive, Lettuce, Spinach, Salsify, and Soil – pre-plant uses. With the volatilization routine turned off, chronic RQs for additional uses exceed the LOC, including Alfalfa, Clover, Lespedeza, Trefoil, Vetch, Almond, Cashew, Chestnut, Filbert, Hickory nut, Pecan, Tree nuts, Walnut, Apple, Apricot, Cherry, Fig, Fruits, Nectarine, Peach, Pear, Persimmon, Plum, Pomegranate, Prune, Quince, Stone fruits, Date, Deciduous fruit trees, Kumquat, Barley, Oats, Rye, Safflower, Sorghum, Wheat, Buckwheat, Flax, Kenaf, Corn, Millet, Field Crops, Forest Nursery planting, Forest trees, Spruce (forest), Grapes, Okra, Tomato, Vegetables, Olives, Ornamental-Shady trees, Ornamental Non flowering plants, Strawberry, Dewberry, and Sugarbeet.

Table 5.2 Summary of Acute and Chronic RQs Used to Estimate Indirect Effects to the CRLF via Direct Effects on Aquatic Invertebrates as Dietary Food Items (prey of CRLF juveniles and adults in aquatic habitats)

	With Volatilization				Without Volatilization			
Uses	**Peak EEC (µg/L)**	**21-day EEC (µg/L)**	**In-direct Effects Acute RQ***	**In-direct Effects Chronic RQ***	**Peak EEC (µg/L)**	**21-day EEC (µg/L)**	**In-direct Effects Acute RQ***	**In-direct Effects Chronic RQ***
Alfalfa, Clover, Lespedeza, Trefoil, Vetch	108.0	42.2	**1.20**	0.60	188.5	71.3	**2.09**	**1.01**
Almond, Cashew, Chestnut, Filbert, Hickory nut, Pecan, Tree nuts, Walnut	116.0	45.7	**1.29**	0.65	458.6	171.8	**5.10**	**2.45**
Apple, Apricot, Cherry, Fig, Fruits, Nectarine, Peach, Pear, Persimmon, Plum, Pomegranate, Prune, Quince, Stone fruits, Date, Deciduous fruit trees, Kumquat	33.4	13.7	**0.37**	0.20	231.9	89.5	**2.58**	**1.28**
Asparagus, Beans, Beets, Carrot, Horseradish, Kale, Legume vegetables, Parsnip, Peas, Pepper & chili type, Pimento, Soybeans, Cowpea/Blackeyed pea, Peanuts	45.6	17.6	**0.51**	0.25	219.7	69.1	**2.44**	0.99
Barley, Oats, Rye, Safflower, Sorghum, Wheat, Buckwheat, Flax, Kenaf	31.7	14.7	**0.35**	0.21	221.0	97.6	**2.46**	**1.39**
Blackberry, Blueberry, Loganberry, Boysenberry, Raspberry, Youngberry, Currant, Gooseberry, Huckleberry	258.8	83.2	**2.88**	**1.19**	291.9	93.6	**3.24**	**1.34**
Broccoli, Cabbage, Cauliflower, Celery, Cole Crops, Collards, Mustard	242.8	76.4	**2.70**	**1.10**	530.1	172.9	**5.89**	**2.47**
Brussels sprouts, Chard-Swiss, Endive, Lettuce, Spinach, Salsify	233.4	104.1	**2.59**	**1.49**	1270.0	418.5	**14.11**	**5.98**
Citrus, Grapefruit,	2.13	0.7	0.02	0.01	36.9	15.6	**0.41**	0.22

	With Volatilization				Without Volatilization			
Uses	**Peak EEC (µg/L)**	**21-day EEC (µg/L)**	**In-direct Effects Acute RQ***	**In-direct Effects Chronic RQ***	**Peak EEC (µg/L)**	**21-day EEC (µg/L)**	**In-direct Effects Acute RQ***	**In-direct Effects Chronic RQ***
Lemon, Lime, Orange, Tangelo, Tangerines								
Corn, Millet, Field Crops	127.3	50.1	**1.41**	0.72	220.6	87.5	**2.45**	**1.25**
Cotton	11.1	3.6	**0.12**	0.05	195.6	54.7	**2.17**	0.78
Cucumber, Eggplant, Melon, Pumpkin, Squash	1.2	0.4	0.01	0.01	39.0	9.4	**0.43**	0.13
Forest Nursery planting, Forest trees, Spruce (forest)	87.4	30.1	**0.97**	0.43	405.9	129.2	**4.51**	**1.85**
Garlic, Leek	1.2	0.4	0.01	0.01	96.2	25.8	**1.07**	0.37
Grapes	118.8	39.7	**1.32**	0.57	275.1	100.1	**0.34**	**1.43**
Pastures	2.7	1.1	0.03	0.02	161.2	51.8	**1.79**	0.74
Hops	26.6	8.9	**0.30**	0.13	63.0	22.0	**0.70**	0.31
Mint	11.0	4.8	**0.12**	0.07	62.8	21.0	**0.70**	0.30
Okra, Tomato, Vegetables	126.2	38.8	**1.40**	0.55	207.6	70.5	**2.31**	**1.01**
Olive	64.8	24.9	**0.72**	0.36	309.0	131.2	**3.43**	**1.87**
Onion, Radish, Shallot	14.9	5.3	**0.17**	0.08	89.9	32.1	**1.00**	0.46
Ornamental-Shady trees, Ornamental Non flowering plants	74.3	22.6	**0.83**	0.32	374.2	108.7	**4.16**	**1.55**
Ornamental lawns & Turf	1.8	0.6	0.02	0.01	51.7	17.9	**0.57**	0.26
Potato, Rutabaga, Sweet Potato, Turnip (root), Kohlrabi	4.3	1.4	**0.05**	0.02	41.5	12.7	**0.46**	0.18
Soil – pre plant	447.8	144.3	**4.98**	**2.06**	506.1	162	**5.62**	**2.31**
Strawberry, Dewberry	111.6	17.6	**1.24**	0.67	750.3	234.7	**8.34**	**3.35**
Sugar beet	156.9	61.7	**1.74**	0.88	389.3	139.1	**4.33**	**1.99**

* = LOC exceedances (acute RQ $\geq$ 0.05; chronic RQ $\geq$ 1.0) are bolded. Acute RQ = use-specific peak EEC / 90 ug/L. Chronic RQ = use-specific 21-day EEC / 70 ug/L.

The alcohol and acid degradates of telone do not contribute to the indirect effects of telone on the aquatic phase CRLF. Using the highest EEC from the modeling (1270 ug/L), EECs for the alcohol and acid degradates are 81.28 ug/L and 127 ug/L, respectively. Tests with *D. magna* provide EC_{50}s of 2,300 ug/L ai and 55,000 ug/L ai for the alcohol and acid, respectively. These result in acute RQs of 0.04 for 3-chloroallyl alcohol and 0.02 for 2-chloroacrylic acid. These are below the LOC, so risk is expected to be low.

Fish and Frogs

Fish and frogs also represent potential prey items of adult aquatic-phase CRLFs. RQs associated with acute and chronic direct toxicity to the CRLF (**Table 5.1**) are used to assess potential indirect effects to the CRLF based on a reduction in freshwater fish and frogs as food items.

Findings for indirect effects due to losses of these food items are identical to those described above for direct effects. Therefore, **a preliminary "May Affect" determination is made for indirect direct acute effects to the CRLF for these uses:** Alfalfa, Clover, Lespedeza, Trefoil, Vetch, Almond, Cashew, Chestnut, Filbert, Hickory nut, Pecan, Tree nuts, Walnut, Blackberry, Blueberry, Loganberry, Boysenberry, Raspberry, Youngberry, Currant, Gooseberry, Huckleberry, Broccoli, Cabbage, Cauliflower, Celery, Cole Crops, Collards, Mustard, Brussels sprouts, Chard-Swiss, Endive, Lettuce, Spinach, Salsify, Corn, Millet, Field Crops, Forest Nursery planting, Forest trees, Spruce (forest), Grapes, Okra, Tomato, Vegetables, Olive, Ornamental-Shady trees, Ornamental Non-flowering plants, Soil – preplant, Strawberry, Dewberry, and Sugarbeet. A **"No Effect" determination is made for direct acute effects to the CRLF for** Potato, Rutabaga, Sweet Potato, Turnip (root), Kohlrabi, Citrus, Grapefruit, Lemon, Lime, Orange, Tangelo, Tangerines, Cucumber, Eggplant, Melon, Pumpkin, or Squash. As detailed above, exceedances also do occur as a result of the formation of the acid degradate, but this does not result in an inclusion of additional uses in the preliminary "May Affect" determination. Exposure of the CRLF to telone in water bodies is expected to be very low, as explained in section 3.2.4.5. Telone (Table 4.1) is more acutely toxic to *Daphnia* (EC50 = 90 ppb) than it is to the surrogate organism for CRLF (walleye, LC50 = 1.08 ppm). An acute-to-chrnic ratio for *Daphnia* can be calculated from its chronic NOAEC of 70 ppb: 70ppb/90ppb = 0.78. Applying this to the walleye, the expected NOAEC would be 1.08ppm x 0.78 = 0.84 ppm, or 840 ppb. Telone exposures are expected to be well below this concentration, thus no chronic effects are likely.

5.1.1.3 Indirect Effects to CRLF via Reduction in Habitat and/or Primary Productivity (Freshwater Aquatic Plants)

Indirect effects to the CRLF via direct toxicity to aquatic plants are estimated using the most sensitive non-vascular and vascular plant toxicity endpoints. Because there are no obligate relationships between the CRLF and any aquatic plant species, the most sensitive EC_{50} values, rather than NOAEC values, were used to derive RQs.

RQs for vascular aquatic plants do not exceed the LOC of 1.0 for telone or its degradates. Using the highest peak EEC of 1,270 ug/L ai and the *L. gibba* EC50 of 20,000 ug/L ai results in an RQ for telone of 0.06. An RQ of 0.05 is calculated for the alcohol degradate using the EC_{50} for *L. gibba* of 1,694 ug/L ai and the estimated percent of formation of 6.4%. An RQ of 0.58 is determined for the acid degradate using the *L. gibba* EC_{50} of 220 ug/L ai and an estimated percent of formation of 10% of the parent compound peak EEC. Conclusions regarding RQs for non-vascular aquatic plants are provided in Section 5.1.2.2, and it was also found that RQs do not exceed the LOC of 1.0 for aquatic plants for those species. **Therefore, a "No Effect" determination is made for indirect effects to the aquatic-phase CRLF due to losses of freshwater aquatic plants that provide habitat and/or primary productivity.**

5.1.2 Exposures in the Terrestrial Habitat

5.1.2.1 Direct Effects to Terrestrial-phase CRLF

As previously discussed in Section 3.3, potential direct effects to terrestrial-phase CRLFs will be based on an estimate of the soil concentration of telone of 130 ppm ai from a California field dissipation study (MRID #40403301). Further consideration will be made for the likelihood of encounter on a per acre basis for applications of telone to grapes via drip irrigation as described below.

Acute Risk - Incidental Soil Ingestion

Potential direct acute effects to the terrestrial-phase CRLF are derived by considering dose-based EECs modeled for a small bird (20 g) consuming a maximum of 30% of its diet as soil based on Beyer et al. (1994). This estimate of incidental soil ingestion is high (it is the estimate for a shorebird, which probes in sand/soil for food), and provides a conservative estimate of exposure and risk. This analysis assumes that applications by soil injection result in soil concentration of 130 ppm ai that is uniformly distributed over the treated area. For drip irrigation in grapes, this analysis is based on the assumption that the actual area treated in this scenario of only 3.64% of an acre (see section 2.10.1.1 for derivation of this value), which reduces the chance of encountering telone within the treated grape vineyard. Both analyses also rest on the assumption that the LD_{50} scales for body weight assuming the default scaling factor of 1.15 for standard EFED assessments of dietary risk (see TREX User's Guide). The RQs determined in the analysis based on these assumptions are presented in Table 5.3, and neither of these RQs exceeds the acute LOC for birds (0.1).

Table 5.3. RQs for birds (CRLF surrogate) resulting from incidental ingestion of soil containing telone.

Soil Conc.	Body Weight	Grams of food ingested per day[1]	Grams of soil ingested per day[2]	Estimated Dose (mg/kg-bw)	Adjusted LD50 (mg/kg-bw)[3]	RQ
Soil Injection (all crops)						
130 ppm	20 g	5	1.5	9.75[4]	109.51	0.09
Drip Irrigation (grapes)						
130 ppm	20g	5	1.5	0.35[5]	109.51	<0.01

[1]Determined from percentage of body weight consumed per day; based on allometric equations for all birds used in the TREX model.
[2]Estimated as a percentage of food consumption based on Beyer et al. 1994, maximum 30% of diet consumed as soil.
[3]Based on default Mineau scaling factor of 1.15 and the assumption that diet contains 80% water as used in assessments of avian risks from consumption of on-field plants. See T-REX User Guide.
[4]Assuming that soil concentration of telone is uniform over treated area. Calculation is: (Soil Conc. [mg ai/kg soil] * kg soil ingested/day)/bodyweight (kg).
[5]Assuming that the animal conducts foraging along a random walk and 3.64% of soil ingested contains telone. Calculation is: (Soil Conc. [mg ai/kg soil] * kg soil ingested/day * 0.0364)/bodyweight (kg).

Acute Risk - Inhalation

The acute inhalation risk to the CRLF cannot be determined due to lack of inhalation data for birds. Previous risk assessments have assumed that because acute inhalation risk to mammals was not found (see below) inhalation risk to birds (and thus in this case, the CRLF) was expected to be low. Birds are more sensitive to telone than mammals based on data from acute oral studies, but based on the difference in sensitivity demonstrated by acute oral studies (152 mg/kg for birds vs. 224 mg/kg for mammals), their potentially increased sensitivity due to inhalation is not expected to result in an RQ that exceeds the LOC (RQ = 0.02 for inhalation in mammals, requiring 5x greater sensitivity by inhalation for birds). This does introduce uncertainty into conclusions about acute risk.

Chronic Risk

As noted in the 2007 new use assessment for use of telone with drip irrigation in grapes, chronic risks for birds were dismissed in previous risk assessments without explanation. Chronic risk to the CRLF cannot be addressed here due to lack of avian chronic data with telone and its degradates. According to 40 CFR part 158 data requirements for pesticides, chronic data "are generally not required" for end-use products that are highly volatile liquids, such as telone. Such products are expected to have short persistence times and reduced chronic exposure. Based on the analysis for mammals, chronic risk was not determined to be a concern for all uses of telone (see below). Since birds are apparently more sensitive than mammals on an acute oral basis, chronic risks to birds may be higher, but whether this would lead to significant risk is unknown.

There are sufficient chronic exposure data in mammals (rats, rabbits, and mice), submitted to HED (Appendix I), to indicate that telone has a low order of toxicity by the inhalation route. These data will be used to characterize the chronic, direct risk to the CRLF.

Based on conclusions from the analyses above, **a "No Effect" determination is made for direct effects to the terrestrial-phase CRLF.**

5.1.2.2 Indirect Effects to Terrestrial-Phase CRLF via Reduction in Prey (terrestrial invertebrates, mammals, and frogs)

Terrestrial Invertebrates

Telone was determined to be practically non-toxic to honey bees based on an acute contact LD_{50} of >60.43 μg/bee. Because a definitive LD_{50} could not be established, an RQ cannot be calculated without uncertainty in its value. Furthermore, calculating the potential dose to the bee resulting from contact with the surface of contaminated soil based on measured soil concentrations is also not possible without utilizing a wide set of assumptions. For drip irrigation applications, the directions on the label state specifically that telone is to be applied in root-targeted above ground, on-surface, or buried drip lines, so the probability of exposure of terrestrial invertebrates by droplets of water from drip irrigation is not expected to be high. Since telone is considered to be practically non-toxic to honey bees, however, effects are expected to be low. Therefore, **a "No Effect" determination is made for indirect effects to**

the terrestrial-phase CRLF as a result of losses of terrestrial invertebrates contributing to the CRLF's food base.

Mammals

Risks associated with ingestion of small mammals by large terrestrial-phase CRLFs are derived similarly as above for direct risk for a small mammal (15g) ingesting telone-contaminated soil and inhaling telone directly after application. Acute and chronic effects are estimated using the most sensitive mammalian toxicity data. EECs are divided by the toxicity value to estimate acute and chronic dose-based RQs as well as chronic dietary-based RQs.

Acute Risk from Soil Ingestion – Based on the rat acute oral LD_{50} of 224 mg/kg lower value and using the same approach as above for birds, the RQs for mammals using EECs determined for soil injection and drip irrigation of 130 ppm are <0.01 (Table 5.4).

Table 5.4. RQs for mammals resulting from incidental ingestion of soil containing telone.

Soil Conc.	Body Weight	Grams of food ingested per day[1]	Grams of soil ingested per day[2]	Estimated Dose (mg/kg-bw)	Adjusted LD50 (mg/kg-bw)[3]	RQ
Soil Injection (all crops)						
130 ppm	15 g	3.0	0.28	0.104[4]	492.31	<0.01
Drip Irrigation (grapes)						
130 ppm	15 g	3.0	0.28	0.004[5]	492.31	<0.01

[1]Determined from percentage of body weight consumed per day; based on allometric equations for mammals used in the TREX model.
[2]Estimated as a percentage of food consumption based on Beyer et al. 1994, maximum 9.4% of diet consumed as soil.
[3]Assumes a set bodyweight of 350 g for the test animals and assumption of diet containing 80% water. See T-REX User Guide.
[4]Assuming that soil concentration of telone is uniform over treated area. Calculation is: (Soil Conc. [mg ai/kg soil] * mg soil ingested/day)/bodyweight (kg).
[5]Assuming that the animal conducts foraging along a random walk and 3.64% of soil ingested contains telone. Calculation is: (Soil Conc. [mg ai/kg soil] * kg soil ingested/day * 0.0364)/bodyweight (kg).

Acute Inhalation Risk - Among the acute inhalation studies that are available for telone, the lowest LC_{50} is 729 ppm (3,300,642 $\mu g/m^3$ [12]). Among the available volatility studies, a soil injection application to turf at 50.7 lb/acre application resulted in the maximum concentration of telone in air above the soil of 4556 $\mu g/m^3$. Scaling this up to the maximum label use rate for any crop (575 lb/acre for soil preplant application) yields an expected exposure of 51,670 $\mu g/m^3$. This value results in an acute inhalation RQ of 0.02, which is below the acute listed species LOC of 0.1. Therefore, acute inhalation risk to mammals that serve as food sources for the CRLF is expected to be low.

[12] Using the conversion: 1 ppm = 40.9 * (MW) µg/m3, where MW = molecular weight = 110.7 g/mole.

Chronic Ingestion Risks – Using the NOAEC from the 13-week feeding study (5 ppm ai), converted to a NOAEL and adjusted for body weight as is done with the TREX modeling, chronic RQs for small mammals do not exceed the chronic LOC for either the soil injection or drip irrigation application methods (Table 5.5). This analysis contains the same assumptions as above for acute risks due to incidental soil ingestion. Only one application is allowed per season for applications made by soil injection. Two applications are allowed for telone applied by drip irrigation to grapes; however, they are separated by a minimum of 60 days. Since telone is highly volatile, little is likely to be present at the time of the second application. Therefore, this analysis is based on the same estimated or measured concentrations in soil as was used in the analysis of acute risks above.

Table 5.5 Chronic RQs for wild mammals resulting from incidental ingestion of soil containing 1,3-D.

Soil Conc.	Body Weight	Grams of food ingested per day[1]	Grams of soil ingested per day[2]	Estimated Dose (mg/kg-bw)	Adjusted NOAEL (mg/kg)[3]	RQ
Soil Injection (all crops)						
130 ppm	15g	3.0	0.28	0.104[4]	0.55	0.19
Drip Irrigation (grapes)						
130 ppm	15g	3.0	0.28	0.004[5]	0.55	0.01

[1]Determined from percentage of body weight consumed per day; based on allometric equations for mammals used in the TREX model.
[2]Estimated as a percentage of food consumption based on Beyer et al. 1994, maximum is 9.4% of diet consumed as soil.
[3] Assumes a set bodyweight of 350 g for the test animals and assumption of diet containing 80% water. See T-REX User Guide.
[4]Assuming that soil concentration of telone is uniform over treated area. Calculation is: (Soil Conc. [mg ai/kg soil] * mg soil ingested/day)/bodyweight (kg).
[5]Assuming that the animal conducts foraging along a random walk and 3.64% of soil ingested contains telone. Calculation is: (Soil Conc. [mg ai/kg soil] * kg soil ingested/day * 0.0364)/bodyweight (kg).

Chronic Inhalation Risk – Based on the estimate of telone extrapolated to an application rate of 575 lb/acre, yielding an expected exposure of 51,670 $\mu g/m^3$ in the air above the soil, the RQ for chronic inhalation based on a maternal NOAEC of 20 ppm (90,553 $\mu g/m^3$) would be 0.57. This value is below the chronic LOC of 1.0.

Degradates – Acute risk from ingestion of soil containing degradates was determined using the rat acute oral LD_{50} value of 91 mg/kg. Based on this value, the RQs calculated for small mammals do not exceed the acute LOC (Table 5.6). Chronic data for the degradates in mammals is not available, so these risks cannot be determined.

Table 5.6 RQs for wild mammals resulting from incidental ingestion of soil containing degradates of telone.

Soil Concentration	Body Weight	Grams of food ingested per day[1]	Grams of soil ingested per day[2]	Estimated Dose (mg/kg)	Adjusted LD50 (mg/kg) [3]	RQ
Soil Injection (All Uses)						
101.4 ppm	15g	3.0	0.28	0.081[4]	200.0	<0.01
Drip Irrigation (Grapes)						
101.4 ppm	15g	3.0	0.28	0.003[5]	200.0	<0.01

[1]Determined from percentage of body weight consumed per day; based on allometric equations for mammals used in the TREX model.
[2]Estimated as a percentage of food consumption based on Beyer et al. 1994, maximum is 9.4% of diet consumed as soil.
[3] Assumes a set bodyweight of 350 g for the test animals and assumption of diet containing 80% water. See T-REX User Guide.
[4]Assuming that soil concentration of telone degradates is uniform over treated area. Calculation is: (Soil Conc. [mg ai/kg soil] * mg soil ingested/day)/bodyweight (kg).
[5]Assuming that the animal conducts foraging along a random walk and 3.64% of soil ingested contains telone degradates. Calculation is: (Soil Conc. [mg ai/kg soil] * kg soil ingested/day * 0.0364)/bodyweight (kg).

Based on the above analyses, a **"No Effect" determination is made for the terrestrial-phase CRLF for all uses of telone due to indirect effects resulting from losses of its small mammal food base.**

Frogs

An additional prey item of the adult terrestrial-phase CRLF is other species of frogs. In order to assess risks to these organisms, dietary-based and dose-based exposures modeled for small birds (20g) consuming soil incidentally when feeding as determined above is used. This analysis is identical to that of the analysis for frogs above, so based on conclusions from the analyses above, **a "No Effect" determination is made for indirect effects for all uses of telone to the terrestrial-phase CRLF as a result of effects on other species of frogs.**

5.1.2.3 Indirect Effects to CRLF via Reduction in Terrestrial Plant Community (Riparian and Upland Habitat)

Potential indirect effects to the CRLF resulting from direct effects on riparian and upland vegetation are assessed using RQs from terrestrial plant seedling emergence and vegetative vigor EC_{25} data as a screen. Example output from TerrPlant v.1.2.2 is provided in **Appendix D.** RQs for monocots inhabiting dry areas do not exceed the LOC of 1.0 that would signify risk to terrestrial plants, and RQs for dicots exceed the LOC only where the application rate is relatively high (555.5 lbs ai/acre and greater) (Table 5.7). On the other hand, RQs for dicots inhabiting dry areas exceed the LOC for all uses except those in which the application rate is 181 lbs ai/acre or less (Table 5.8). RQs for dicots inhabiting semi-aquatic areas exceed the LOC for all uses except those in which the application rate is relatively low (49.42 lbs ai/acre or less). **Based on these**

analyses, a preliminary "May Affect" determination is made for the CRLF due to indirect effects occurring as a result of estimated risk to terrestrial plants.

Table 5.7 Risk Quotients for Terrestrial Monocots Determined from TerrPlant EECs for Plants Inhabiting Dry and Semi-aquatic Areas Exposed to Telone			
Use	**Application rate (lbs a.i./A)**	**Dry area RQ**	**Semi-aquatic RQ**
Alfalfa, Clover, Lespedeza, Trefoil, Vetch, Pastures	170.9	0.17	0.39
Almond, Cashew, Chestnut, Filbert, Hickory nut, Pecan, Tree nuts, Walnut	361.9	0.36	0.83
Apple, Apricot, Cherry, Fig, Fruits (unspecified), Nectarine, Peach, Pear, Persimmon, Plum, Pomegranate, Prune, Quince, Stone fruit, Date, Deciduous fruit trees, Kumquat, Citrus, Grapefruit, Lemon, Lime, Orange, Tangelo, Tangerines	367.92	0.37	0.84
Asparagus, Beans, Beets, Carrot, Horseradish, Kale, Legume vegetables, Parsnip, Peas, Pepper & chili type, Pimento, Soybeans, Cowpea/Blackeyed pea, Peanuts, Broccoli, Cabbage, Cauliflower, Celery, Cole Crops, Collards, Mustard, Brussels sprouts, Chard-Swiss, Endive, Lettuce, Spinach, Salsify, Corn, Millet, Field Crops, Onion, Radish, Shallot, Potato, Rutabaga, Sweet Potato, Turnip (root), Kohlrabi	259.15	0.26	0.59
Barley, Oats, Rye, Safflower, Sorghum, Wheat, Buckwheat, Flax, Kenaf, Cotton	181.8	0.18	0.41
Blackberry, Blueberry, Loganberry, Boysenberry, Raspberry, Youngberry, Currant, Gooseberry, Huckleberry, Cucumber, Eggplant, Melon, Pumpkin, Squash, Grapes, Olive	332.29	0.33	0.76
Forest Nursery planting Forest trees, Spruce (forest)	555.5	0.55	**1.27**
Garlic, Leek	237.35	0.24	0.54
Hops	185.76	0.19	0.42
Mint	236.5	0.24	0.54
Okra, Tomato, Vegetables, Strawberry, Dewberry	355	0.35	0.81
Ornamental-Shady trees Ornamental Non flowering plants	571.05	0.57	**1.30**
Ornamental lawns & Turf	49.24	0.05	0.11
Soil – pre-plant	575.1	0.57	1.31
Sugar beet	246	0.25	0.56
Grapes (drip irrigation)	17.68	0.02	0.04

Table 5.8 Risk Quotients for Terrestrial Dicots Determined from TerrPlant EECs for Plants Inhabiting Dry and Semi-aquatic Areas Exposed to Telone			
Use	**Application rate (lbs a.i./A)**	**Dry area RQ**	**Semi-aquatic RQ**
Alfalfa, Clover, Lespedeza, Trefoil, Vetch, Pastures	170.9	0.91	**2.08**
Almond, Cashew, Chestnut, Filbert, Hickory nut, Pecan, Tree nuts, Walnut	361.9	**1.93**	**4.41**
Apple, Apricot, Cherry, Fig, Fruits (unspecified), Nectarine, Peach, Pear, Persimmon, Plum, Pomegranate, Prune, Quince, Stone fruit, Date, Deciduous fruit trees, Kumquat, Citrus, Grapefruit, Lemon, Lime, Orange, Tangelo, Tangerines	367.92	**1.96**	**4.48**
Asparagus, Beans, Beets, Carrot, Horseradish, Kale, Legume vegetables, Parsnip, Peas, Pepper & chili type, Pimento, Soybeans, Cowpea/Blackeyed pea, Peanuts, Broccoli, Cabbage, Cauliflower, Celery, Cole Crops, Collards, Mustard, Brussels sprouts, Chard-Swiss, Endive, Lettuce, Spinach, Salsify, Corn, Millet, Field Crops, Onion, Radish, Shallot, Potato, Rutabaga, Sweet Potato, Turnip (root), Kohlrabi	259.15	**1.38**	**3.16**
Barley, Oats, Rye, Safflower, Sorghum, Wheat, Buckwheat, Flax, Kenaf, Cotton	181.8	0.97	**2.21**
Blackberry, Blueberry, Loganberry, Boysenberry, Raspberry, Youngberry, Currant, Gooseberry, Huckleberry, Cucumber, Eggplant, Melon, Pumpkin, Squash, Grapes, Olive	332.29	**1.77**	**4.05**
Forest Nursery planting Forest trees, Spruce (forest)	555.5	**2.96**	**6.76**
Garlic, Leek	237.35	**1.26**	**2.89**
Hops	185.76	0.99	**2.26**
Mint	236.5	**1.26**	**2.88**
Okra, Tomato, Vegetables, Strawberry, Dewberry	355	**1.89**	**4.32**
Ornamental-Shady trees Ornamental Non flowering plants	571.05	**3.04**	**6.95**
Ornamental lawns & Turf	49.24	0.26	0.60
Soil – pre-plant	575.1	**3.06**	**7.00**
Sugar beet	246	**1.31**	**3.00**
Grapes (drip irrigation)	17.68	0.09	0.22

As noted in Section 4.2.4. where the effects to terrestrial plants are described, no significant effects were observed on plants tested at the Tier I level with the degradates of telone. Therefore, effects determined for plants are due to the presence of telone and not its degradates.

5.1.3 Primary Constituent Elements of Designated Critical Habitat

5.1.3.1 Aquatic-Phase (Aquatic Breeding Habitat and Aquatic Non-Breeding Habitat)

Three of the four assessment endpoints for the aquatic-phase primary constituent elements (PCEs) of designated critical habitat for the CRLF are related to potential effects to aquatic and/or terrestrial plants:

- Alteration of channel/pond morphology or geometry and/or increase in sediment deposition within the stream channel or pond: aquatic habitat (including riparian vegetation) provides for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRLFs.
- Alteration in water chemistry/quality including temperature, turbidity, and oxygen content necessary for normal growth and viability of juvenile and adult CRLFs and their food source.
- Reduction and/or modification of aquatic-based food sources for pre-metamorphs (*e.g.,* algae).

The preliminary effects determination for aquatic-phase PCEs of designated habitat related to potential effects on aquatic and/or terrestrial plants is "Habitat Modification", based on the risk estimation for terrestrial plants provided in Section 5.1.2.3. The likelihood of habitat modification is addressed in section 5.2.3.

The remaining aquatic-phase PCE is "alteration of other chemical characteristics necessary for normal growth and viability of CRLFs and their food source." To assess the impact of Telone on this PCE, acute and chronic freshwater fish and invertebrate toxicity endpoints, as well endpoints for aquatic non-vascular plants, are used as measures of effects. RQs for these endpoints were calculated in Sections 5.1.1.1 and 5.1.1.2. **A preliminary "Habitat Modification" determination is made for the CRLF based on LOC exceedances for aquatic invertebrates for all uses of telone and for fish/frogs for certain uses. The likelihood of habitat modification is addressed in section 5.2.2.**

5.1.3.2 Terrestrial-Phase (Upland Habitat and Dispersal Habitat)

Two of the four assessment endpoints for the terrestrial-phase PCEs of designated critical habitat for the CRLF are related to potential effects to terrestrial plants:

- Elimination and/or disturbance of upland habitat; ability of habitat to support food source of CRLFs: Upland areas within 200 ft of the edge of the riparian vegetation or dripline surrounding aquatic and riparian habitat that are comprised of grasslands, woodlands, and/or wetland/riparian plant species that provides the CRLF shelter, forage, and predator avoidance
- Elimination and/or disturbance of dispersal habitat: Upland or riparian dispersal habitat within designated units and between occupied locations within 0.7 mi of each other that allow for movement between sites including both natural and altered sites which do not contain barriers to dispersal

The preliminary effects determination for terrestrial-phase PCEs of designated habitat related to potential effects on terrestrial plants is "Habitat Modification", based on the risk estimation provided in Section 5.1.2.3. The likelihood of habitat modification is addressed in section 5.2.3.

The third terrestrial-phase PCE is "reduction and/or modification of food sources for terrestrial phase juveniles and adults." To assess the impact of Telone on this PCE, acute and chronic toxicity endpoints for birds, mammals, and terrestrial invertebrates are used as measures of effects. RQs for these endpoints were calculated in Section 5.1.2.2. **All direct and indirect effect determinations were "No Effect," therefore there is "No Effect" on these terrestrial phase Critical Habitat PCEs.**

The fourth terrestrial-phase PCE is based on alteration of chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs and their food source. Direct acute and chronic RQs for terrestrial-phase CRLFs are presented in Section 5.2.1.2. **All direct and indirect effect determinations were "No Effect," therefore there is "No Effect" on these terrestrial phase Critical Habitat PCEs.**

5.2 Risk Description

The risk description synthesizes an overall conclusion regarding the likelihood of adverse impacts leading to an effects determination (*i.e.*, "no effect," "may affect, but not likely to adversely affect," or "likely to adversely affect") for the CRLF and its designated critical habitat.

If the RQs presented in the Risk Estimation (Section 5.1) show no direct or indirect effects for the CRLF, and no modification to PCEs of the CRLF's designated critical habitat, a "no effect" determination is made, based on Telone's use within the action area. However, if direct or indirect effect LOCs are exceeded or effects may modify the PCEs of the CRLF's critical habitat, the Agency concludes a preliminary "may affect" determination for the FIFRA regulatory action regarding Telone. A summary of the results of the risk estimation (*i.e.*, "no effect" or "may affect" finding) is provided in **Table 5.9** for direct and indirect effects to the CRLF and in **Table 5.10** for the PCEs of designated critical habitat for the CRLF.

Table 5.9 Preliminary Effects Determination Summary for Telone - Direct and Indirect Effects to CRLF

Assessment Endpoint	Preliminary Effects Determination	Basis For Preliminary Determination
Aquatic Phase (eggs, larvae, tadpoles, juveniles, and adults)		
Survival, growth, and reproduction of CRLF individuals via direct effects on aquatic phases	**No Effec**t for Potato, Rutabaga, Sweet Potato, Turnip (root), Kohlrabi, Citrus, Grapefruit, Lemon, Lime, Orange, Tangelo, Tangerines, Cucumber, Eggplant, Melon, Pumpkin, or Squash	Acute RQs exceed acute LOCs for fish (surrogate for frogs) for these uses as a result of exposure to telone. RQs exceed for a subset of these uses also as a result of exposure to 3-chloroallyl alcohol.

Table 5.9 Preliminary Effects Determination Summary for Telone - Direct and Indirect Effects to CRLF		
Assessment Endpoint	**Preliminary Effects Determination**	**Basis For Preliminary Determination**
	May Affect for all other uses.	Probability of individual effects ranges up to 1 in 1.6
Survival, growth, and reproduction of CRLF individuals via effects to food supply (*i.e.*, freshwater invertebrates, non-vascular plants)	**May Affect** for all uses.	Based on exceedances of acute RQs for aquatic invertebrates. Also due to exceedances of acute LOCs for fish and frogs.
Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat, cover, and/or primary productivity (*i.e.*, aquatic plant community)	**No Effect** for all uses.	Based on no LOC exceedances for aquatic plants.
Survival, growth, and reproduction of CRLF individuals via effects to riparian vegetation, required to maintain acceptable water quality and habitat in ponds and streams comprising the species' current range.	**May Affect** for all uses except ornamental lawns and turf and applications to grapes by drip irrigation.	Based on LOC exceedances for terrestrial plants.
Terrestrial Phase (Juveniles and adults)		
Survival, growth, and reproduction of CRLF individuals via direct effects on terrestrial phase adults and juveniles	**No Effect** for all uses.	No exceedances of acute LOCs for telone.
Survival, growth, and reproduction of CRLF individuals via effects on prey (*i.e.*, terrestrial invertebrates, small terrestrial mammals and terrestrial phase amphibians)	**No Effect** for all uses.	No exceedances of acute LOCs for telone for terrestrial invertebrates, birds, or mammals. Also no exceedances of chronic LOCs for mammals exposed to telone or acute LOCs for mammals exposed to telone degradates.
Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat (*i.e.*, riparian vegetation)	**May Affect** for all uses except ornamental lawns and turf and applications to grapes by drip irrigation.	Based on LOC exceedances for terrestrial plants.

Table 5.10 Preliminary Effects Determination Summary for Telone – PCEs of Designated Critical Habitat for the CRLF		
Assessment Endpoint	**Preliminary Effects Determination**	**Basis For Preliminary Determination**
Aquatic Phase PCEs (Aquatic Breeding Habitat and Aquatic Non-Breeding Habitat)		
Alteration of channel/pond morphology or geometry and/or increase in sediment deposition within the stream channel or pond: aquatic habitat (including riparian vegetation) provides for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRLFs.	**Habitat Modification** for all uses except ornamental lawns and turf and applications to grapes by drip irrigation.	Based on LOC exceedances for terrestrial plants.
Alteration in water chemistry/quality including temperature, turbidity, and oxygen content necessary for normal growth and viability of juvenile and adult CRLFs and their food source.	**Habitat Modification** for all uses except ornamental lawns and turf and applications to grapes by drip irrigation.	Based on LOC exceedances for terrestrial plants.
Alteration of other chemical characteristics necessary for normal growth and viability of CRLFs and their food source.	**Habitat Modification** for all uses	Based on LOC exceedances for aquatic invertebrates and also for fish/frogs.
Reduction and/or modification of aquatic-based food sources for pre-metamorphs (e.g., algae)	**No Effect** for all uses	Based on No Effect preliminary determination for aquatic plants
Terrestrial Phase PCEs (Upland Habitat and Dispersal Habitat)		
Elimination and/or disturbance of upland habitat; ability of habitat to support food source of CRLFs: Upland areas within 200 ft of the edge of the riparian vegetation or dripline surrounding aquatic and riparian habitat that are comprised of grasslands, woodlands, and/or wetland/riparian plant species that provides the CRLF shelter, forage, and predator avoidance	**Habitat Modification** for all uses except ornamental lawns and turf and applications to grapes by drip irrigation.	Based on LOC exceedances for terrestrial plants.
Elimination and/or disturbance of dispersal habitat: Upland or riparian dispersal habitat within designated units and between occupied locations within 0.7 mi of each other that allow for movement between sites including both natural and altered sites which do not contain barriers to dispersal	**Habitat Modification** for all uses except ornamental lawns and turf and applications to grapes by drip irrigation.	Based on LOC exceedances for terrestrial plants.

Table 5.10 Preliminary Effects Determination Summary for Telone – PCEs of Designated Critical Habitat for the CRLF		
Assessment Endpoint	**Preliminary Effects Determination**	**Basis For Preliminary Determination**
Reduction and/or modification of food sources for terrestrial phase juveniles and adults	**No Effect**	Based on preliminary No Effect determination for birds (frogs), mammals, and terrestrial invertebrates
Alteration of chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs and their food source.	**No Effect**	Based on preliminary No Effect determination for birds (frogs), mammals, and terrestrial invertebrates

Following a preliminary "may affect" or "habitat modification" determination, additional information is considered to refine the potential for exposure at the predicted levels based on the life history characteristics (*i.e.*, habitat range, feeding preferences, etc.) of the CRLF. Based on the best available information, the Agency uses the refined evaluation to distinguish those actions that "may affect, but are not likely to adversely affect" from those actions that are "likely to adversely affect" the CRLF and its designated critical habitat.

The criteria used to make determinations that the effects of an action are "not likely to adversely affect" the CRLF and its designated critical habitat include the following:

- Significance of Effect: Insignificant effects are those that cannot be meaningfully measured, detected, or evaluated in the context of a level of effect where "take" occurs for even a single individual. "Take" in this context means to harass or harm, defined as the following:
    - Harm includes significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering.
    - Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.
- Likelihood of the Effect Occurring: Discountable effects are those that are extremely unlikely to occur.
- Adverse Nature of Effect: Effects that are wholly beneficial without any adverse effects are not considered adverse.

A description of the risk and effects determination for each of the established assessment endpoints for the CRLF and its designated critical habitat is provided in **Sections 5.2.1 through 5.2.3**.

5.2.1 Direct Effects

5.2.1.1 Aquatic-Phase CRLF

The aquatic-phase considers life stages of the frog that are obligatory aquatic organisms, including eggs and larvae. It also considers submerged terrestrial-phase juveniles and adults, which spend a portion of their time in water bodies that may receive runoff and spray drift containing Telone.

Acute risk Quotients for the aquatic phase CRLF exceed LOC for many uses, based on modeled concentrations. This results in a “May Affect” determination. However, based on the discussion of PRZM-EXAMS modeling deficiencies and monitoring data in section 3.2.4, exposure to telone and its degadates in the water column is expected to be rare, so the modeled exposures are not used in the final determination. Chronic effects are deemed unlikely due to low expected exposure. All LOC exceedences for the aquatic phase CRLF are therefore discountable, and the determination is “Not Likely to Adversely Affect.”

5.2.1.2 Terrestrial-Phase CRLF

None of the acute RQs for the terrestrial phase CRLF exceed the LOC. Acute inhalation risk is expected to be low based on the relative difference in sensitivity between birds and mammals shown in acute oral tests. Although chronic effects resulting from ingestion or inhalation are not known, chronic exposure is expected to be low (field volatility tests indicate 100% volatilization after four days post-application). Furthermore, except in the case of application by drip irrigation in grapes, all uses require the treated area to be sealed and tarped immediately after application, thereby reducing exposure further. Therefore, the determination is “No Effect.” This conclusion is consistent with previous assessments of risk for telone conducted by EFED.

5.2.1.3 Likelihood of Chronic Effects

It is unlikely that chronic (reproductive and growth) effects will occur in CRLF populations, by either the inhalation route or by direct contact in water.

Inhalation. The conclusion for inhalation is based on a comparison of the peak, instantaneous exposure calculated in section 3.2 (51,670 µg/m3, or 0.052 mg/L), and reported inhalation toxicity endpoints for mammals, as reported by the Health Effects Division. The inhalation toxicity data are reported in Table _5.11_ below.

Table 5.11 Summary of Telone Mammal Inhalation Toxicity Data from HED

Guideline No./Study Type	MRID No./Classification	Endpoint
870.3465 **30-day** inhalation toxicity rodent (Fischer 344 rat)	00039685/acceptable	NOAEL = 30 ppm (0.136 mg/L)
870.3465 **30-day** inhalation toxicity rodent (CD-1 mouse)	00039685/acceptable	NOAEL = 10 ppm (0.045 mg/L)
870.3465 **30-day** inhalation toxicity rodent (B6C3F1 mouse)	00146461/acceptable	NOAEL = 10 ppm (0.045 mg/L)
870.3465 **90-day** inhalation toxicity	00146461/acceptable	NOAEL = 10 ppm (0.045 mg/L)

Table 5.11 Summary of Telone Mammal Inhalation Toxicity Data from HED		
Guideline No./Study Type	**MRID No./Classification**	**Endpoint**
rodent (Fischer 344 rat)		
870.3700a Prenatal development in rodents (Fischer 344 rat) **Exposed 10 days** (days 6 to 15 of gestation)	00144715, 00152848/acceptable	Maternal LOAEL = 20 ppm (0.091 mg/L) Developmental LOAEL = 120 ppm (0.545 mg/L)
870.3700b Prenatal development in nonrodents (New Zealand White rabbit) **Exposed 13 days** (days 6 to 18 of gestation)	00144715, 00152848/acceptable	Maternal, Developmental NOAEL = 20 ppm (0.091 mg/L)
870.3800 Reproduction and fertility effects (Fischer 344 rat) **Exposed 2 weeks**	40312401, 40835301/acceptable	Parental/Systemic NOAEL = 30 ppm (0.136 mg/L) Reproductive and Offspring NOAEL = 90 ppm (0.408 mg/L)
870.4300 Combined Chronic Toxicity/Carcinogenicity **(2 years)** (Fischer 344 rat)	40312201/acceptable	Chronic toxicity NOAEL = 20 ppm (0.091 mg/L)
870.4300 Combined Chronic Toxicity/Carcinogenicity **(2 years)** (B6C3F1 mouse)	40312301/acceptable	Chronic toxicity NOAEL = 5 ppm (0.023 mg/L)

The data in Table 5.11 show that the inhalation toxicity thresholds for telone over exposure periods of 10 days to two years are about equal to the highest peak, on-field exposure expected from telone. Thus, the expected exposure on the time scale of the toxicity tests (10 days to 2 years) will be much lower than the toxicity thresholds (that is, the risk quotients for mammals would be far below the Level of Concern). Unless amphibians are many orders of magnitude more sensitive to telone via the inhalation route than mammals are, both acute and chronic risks to amphibians are unlikely.

Direct Contact in Water. Exposure of the CRLF to telone in water bodies is expected to be very low, as explained in section 3.2.4.5. Telone (Table 4.1) is more acutely toxic to *Daphnia* (EC50 = 90 ppb) than it is to the surrogate organism for CRLF (walleye, LC50 = 1.08 ppm). An acute-to-chrnic ratio for *Daphnia* can be calculated from its chronic NOAEC of 70 ppb: 70ppb/90ppb = 0.78. Applying this to the walleye, the expected NOAEC would be 1.08ppm x 0.78 = 0.84 ppm, or 840 ppb. Telone exposures are expected to be well below this concentration, thus no chronic effects are likely.

5.2.2 Indirect Effects (via Reductions in Prey Base)

5.2.2.1 Algae (non-vascular plants)

As discussed in Section 2.5.3, the diet of CRLF tadpoles is composed primarily of unicellular aquatic plants (i.e., algae and diatoms) and detritus. There were no LOC exceedences for non-vascular plants; therefore the determination is “No Effect.”

5.2.2.2 Aquatic Invertebrates

The potential for Telone to elicit indirect effects to the CRLF via effects on freshwater invertebrate food items is dependent on several factors including: (1) the potential magnitude of effect on freshwater invertebrate individuals and populations; and (2) the number of prey species potentially affected relative to the expected number of species needed to maintain the dietary needs of the CRLF. Together, these data provide a basis to evaluate whether the number of individuals within a prey species is likely to be reduced such that it may indirectly affect the CRLF.

The acute and chronic LOC was exceeded for aquatic invertebrates for some scenarios based on modeled concentrations, resulting in a “May Affect” determination. However, as described above for direct effects to the aquatic phase CRLF, the non-detection of telone in extensive monitoring and the documented deficiency of PRZM-EXAMS for modeling telone makes the modeled concentrations discountable, resulting in a “Not Likely to Adversely Affect” determination.

5.2.2.3 Fish and Aquatic-phase Frogs

As discussed in section 5.1.1.2, effects to the aquatic phase CRLF (and therefore all fish and frogs) are discountable, resulting in a “Not Likely to Adversely Affect” determination.

5.2.2.4 Terrestrial Invertebrates

When the terrestrial-phase CRLF reaches juvenile and adult stages, its diet is mainly composed of terrestrial invertebrates. RQs could not be calculated for the honey bee; however, because telone is considered to be practically non-toxic to honeybees, it is determined that there is “No Effect” on the terrestrial-phase CRLF.

5.2.2.5 Mammals

Life history data for terrestrial-phase CRLFs indicate that large adult frogs consume terrestrial vertebrates, including mice. There were no LOC exceedences for mammals, therefore it is determined that there is “No Effect” on the terrestrial phase CRLF.

5.2.2.6 Terrestrial-phase Amphibians

Terrestrial-phase adult CRLFs also consume frogs. RQ values representing direct exposures of Telone to terrestrial-phase CRLFs are used to represent exposures of Telone to frogs in terrestrial habitats. Because a "No Effect" determination was made for the CRLF itself, by extension there is expected to be no effect on other frogs that might be its prey. Therefore, it is determinaed that there is "No Effect" on the terrestrial phase CRLF.

5.2.3 Indirect Effects (via Habitat Effects)

5.2.3.1 Aquatic Plants (Vascular and Non-vascular)

Aquatic plants serve several important functions in aquatic ecosystems. Non-vascular aquatic plants are primary producers and provide the autochthonous energy base for aquatic ecosystems. Vascular plants provide structure, rather than energy, to the system, as attachment sites for many aquatic invertebrates, and refugia for juvenile organisms, such as fish and frogs. Emergent plants help reduce sediment loading and provide stability to nearshore areas and lower streambanks. In addition, vascular aquatic plants are important as attachment sites for egg masses of CRLFs.

Potential indirect effects to the CRLF based on impacts to habitat and/or primary production were assessed using RQs from freshwater aquatic vascular and non-vascular plant data. There were no LOC exceedences for aquatic plants; therefore there is "No Effect" on the CRLF

5.2.3.2 Terrestrial Plants

Terrestrial plants serve several important habitat-related functions for the CRLF. In addition to providing habitat and cover for invertebrate and vertebrate prey items of the CRLF, terrestrial vegetation also provides shelter for the CRLF and cover from predators while foraging. Upland vegetation including grassland and woodlands provides cover during dispersal. Riparian vegetation helps to maintain the integrity of aquatic systems by providing bank and thermal stability, serving as a buffer to filter out sediment, nutrients, and contaminants before they reach the watershed, and serving as an energy source.

Monocots were less sensitive than dicots, so this analysis is driven mainly by the effects to dicots. RQs exceed the LOC for dicots in both dry and semi-aquatic habitats adjacent to treated areas for most uses except for those that have relatively low application rates. This analysis is based on the TerrPlant model, which does not have the ability to account for the high volatility that is characteristic of telone. Therefore, as with the PRZM-EXAMS modeling, it is probable that the EECs determined by this model overestimate the actual EECs for terrestrial plants in adjacent areas resulting from runoff. Incidents have been recorded involving crop plants to which telone was applied; however, these were registered uses of telone. Information is available (e.g., Berry et al. 1980, registrant-submitted studies) indicating that telone does not affect plants, although, for Berry et al. (198) how well these represent maximum use rates is not known. Since telone has been registered as a herbicide, plants can be affect if exposed. However, based on high volatility off-field exposure to plants is expected to be low. Therefore, the final determination for indirect effects to the CRLF as a result of terrestrial plant losses is "Not Likely to Adversely Affect."

5.2.4 Modification to Designated Critical Habitat

5.2.4.1 Aquatic-Phase PCEs

Three of the four assessment endpoints for the aquatic-phase primary constituent elements (PCEs) of designated critical habitat for the CRLF are related to potential effects to aquatic and/or terrestrial plants:

- Alteration of channel/pond morphology or geometry and/or increase in sediment deposition within the stream channel or pond: aquatic habitat (including riparian vegetation) provides for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRLFs.
- Alteration in water chemistry/quality including temperature, turbidity, and oxygen content necessary for normal growth and viability of juvenile and adult CRLFs and their food source.
- Reduction and/or modification of aquatic-based food sources for pre-metamorphs (*e.g.,* algae).

The effects determinations for indirect effects to the CRLF via direct effects to aquatic and terrestrial plants are used to determine whether modification to critical habitat may occur. LOCs were not exceeded for aquatic plants under any uses, but were exceeded for terrestrial plants under all uses except for ornamental lawns and turf and applications to grapes by drip irrigation. However, as noted above, a determination of "Not Likely to Adversely Affect" was made for effects on terrestrial plants.

The remaining aquatic-phase PCE is "alteration of other chemical characteristics necessary for normal growth and viability of CRLFs and their food source." Other than impacts to algae as food items for tadpoles (discussed above), this PCE is assessed by considering direct and indirect effects to the aquatic-phase CRLF via acute and chronic freshwater fish and invertebrate toxicity endpoints as measures of effects. All effects to aquatic phase CRLF and it prey/dietary items were found to be discountable, and therefore constitute a "Not Likely to Adversely Affect."

5.2.4.2 Terrestrial-Phase PCEs

Two of the four assessment endpoints for the terrestrial-phase PCEs of designated critical habitat for the CRLF are related to potential effects to terrestrial plants:

- Elimination and/or disturbance of upland habitat; ability of habitat to support food source of CRLFs: Upland areas within 200 ft of the edge of the riparian vegetation or drip line surrounding aquatic and riparian habitat that are comprised of grasslands, woodlands, and/or wetland/riparian plant species that provides the CRLF shelter, forage, and predator avoidance.

- Elimination and/or disturbance of dispersal habitat: Upland or riparian dispersal habitat within designated units and between occupied locations within 0.7 mi of each other that allow for movement between sites including both natural and altered sites which do not contain barriers to dispersal.

LOCs for were exceeded for terrestrial plants under all uses except for ornamental lawns and turf and applications to grapes by drip irrigation. However, as noted above, a determination of "Not Likely to Adversely Affect" was made for effects on terrestrial plants.

The third terrestrial-phase PCE is "reduction and/or modification of food sources for terrestrial phase juveniles and adults." To assess the impact of Telone on this PCE, acute and chronic toxicity endpoints for terrestrial invertebrates, mammals, and terrestrial-phase frogs are used as measures of effects. Direct effects to the terrestrial phase CRLF, and indirect effects via its prey items, were all determined to be "No Effect."

The fourth terrestrial-phase PCE is based on alteration of chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs and their food source. No direct effects were determined for the terrestrial-phase CRLF, so effects on the food source provided by other terrestrial frogs are not expected. All indirect effects were determined to be discountable. Therefore, a "Not Likely to Adversely Affect" determination is made for this PCE.

6. Uncertainties

6.1 Exposure Assessment Uncertainties

6.1.1 Maximum Use Scenario

The screening-level risk assessment focuses on characterizing potential ecological risks resulting from a maximum use scenario, which is determined from labeled statements of maximum application rate and number of applications with the shortest time interval between applications. The frequency at which actual uses approach this maximum use scenario may be dependant on pest resistance, timing of applications, cultural practices, and market forces.

6.1.2 Aquatic Exposure Modeling of Telone

The standard ecological water body scenario (EXAMS pond) used to calculate potential aquatic exposure to pesticides is intended to represent conservative estimates, and to avoid underestimations of the actual exposure. The standard scenario consists of application to a 10-hectare field bordering a 1-hectare, 2-meter deep (20,000 m^3) pond with no outlet. Exposure estimates generated using the EXAMS pond are intended to represent a wide variety of vulnerable water bodies that occur at the top of watersheds including prairie pot holes, playa lakes, wetlands, vernal pools, man-made and natural ponds, and intermittent and lower order streams. As a group, there are factors that make these water bodies more or less vulnerable than the EXAMS pond. Static water bodies that have larger ratios of pesticide-treated drainage area to water body volume would be expected to have higher peak EECs than the EXAMS pond. These water bodies will be either smaller in size or have larger drainage areas. Smaller water bodies have limited storage capacity and thus may overflow and carry pesticide in the discharge, whereas the EXAMS pond has no discharge. As watershed size increases beyond 10-hectares, it becomes increasingly unlikely that the entire watershed is planted with a single crop that is all treated simultaneously with the pesticide. Headwater streams can also have peak concentrations higher than the EXAMS pond, but they likely persist for only short periods of time and are then carried and dissipated downstream.

The Agency acknowledges that there are some unique aquatic habitats that are not accurately captured by this modeling scenario and modeling results may, therefore, under- or over-estimate exposure, depending on a number of variables. For example, aquatic-phase CRLFs may inhabit water bodies of different size and depth and/or are located adjacent to larger or smaller drainage areas than the EXAMS pond. The Agency does not currently have sufficient information regarding the hydrology of these aquatic habitats to develop a specific alternate scenario for the CRLF. CRLFs prefer habitat with perennial (present year-round) or near-perennial water and do not frequently inhabit vernal (temporary) pools because conditions in these habitats are generally not suitable (Hayes and Jennings 1988). Therefore, the EXAMS pond is assumed to be representative of exposure to aquatic-phase CRLFs. In addition, the Services agree that the existing EXAMS pond represents the best currently available approach for estimating aquatic exposure to pesticides (USFWS/NMFS 2004).

In general, the linked PRZM/EXAMS model produces estimated aquatic concentrations that are expected to be exceeded once within a ten-year period. The Pesticide Root Zone Model is a process or "simulation" model that calculates what happens to a pesticide in an agricultural field on a day-to-day basis. It considers factors such as rainfall and plant transpiration of water, as well as how and when the pesticide is applied. It has two major components: hydrology and chemical transport. Water movement is simulated by the use of generalized soil parameters, including field capacity, wilting point, and saturation water content. The chemical transport component can simulate pesticide application on the soil or on the plant foliage. Dissolved, adsorbed, and vapor-phase concentrations in the soil are estimated by simultaneously considering the processes of pesticide uptake by plants, surface runoff, erosion, decay, volatilization, foliar wash-off, advection, dispersion, and retardation.

Uncertainties associated with each of these individual components add to the overall uncertainty of the modeled concentrations. Additionally, model inputs from the environmental fate degradation studies are chosen to represent the upper confidence bound on the mean values that are not expected to be exceeded in the environment approximately 90 percent of the time. Mobility input values are chosen to be representative of conditions in the environment. The natural variation in soils adds to the uncertainty of modeled values. Factors such as application date, crop emergence date, and canopy cover can also affect estimated concentrations, adding to the uncertainty of modeled values. Factors within the ambient environment such as soil temperatures, sunlight intensity, antecedent soil moisture, and surface water temperatures can cause actual aquatic concentrations to differ for the modeled values.

Unlike spray drift, tools are currently not available to evaluate the effectiveness of a vegetative setback on runoff and loadings. The effectiveness of vegetative setbacks is highly dependent on the condition of the vegetative strip. For example, a well-established, healthy vegetative setback can be a very effective means of reducing runoff and erosion from agricultural fields. Alternatively, a setback of poor vegetative quality or a setback that is channelized can be ineffective at reducing loadings. Until such time as a quantitative method to estimate the effect of vegetative setbacks on various conditions on pesticide loadings becomes available, the aquatic exposure predictions are likely to overestimate exposure where healthy vegetative setbacks exist and underestimate exposure where poorly developed, channelized, or bare setbacks exist.

Modeling exercises with telone using the PRZM-EXAMS models has shown that the models are poorly suited to a chemical as volatile as telone. Exposures estimates, even with the PRZM volatility routine invoked, are believed to be overestimates. Based on the extensive discussion in section 3.2.4, it was decided that the modeling results could not be used for the effects determination.

6.1.3 Usage Uncertainties

County-level usage data were obtained from California's Department of Pesticide Regulation Pesticide Use Reporting (CDPR PUR) database. Four years of data (2002 – 2005) were included in this analysis because statistical methodology for identifying outliers, in terms of area treated and pounds applied, was provided by CDPR for these years only. No methodology for removing outliers was provided by CDPR for 2001 and earlier pesticide data; therefore, this information was not included in the analysis because it may misrepresent actual usage patterns. CDPR PUR documentation indicates that errors in the data may include the following: a misplaced decimal; incorrect measures, area treated, or units; and reports of diluted pesticide concentrations. In addition, it is possible that the data may contain reports for pesticide uses that have been cancelled. The Agency made use of the most current, verifiable information; in cases where there were discrepancies, the most conservative information was used.

6.1.4 Terrestrial Exposure Modeling of Telone

Terrestrial exposure modeling for telone was non-standard, in that the only exposure routes considered for animals were inhalation and soil ingestion. A measured soil concentration following use at a high rate was used to estimate exposure for all uses of telone, and it is not known whether there are other factors other than application rate that would result in a different estimate. This value was also thought to be appropriate for estimating exposure via soil ingestion with application to grapes by drip irrigation; however, assumptions of row and tree spacing as well as wetting area had to be made to estimate the actual area of soil treated within the animal's foraging area. It was also assumed that the animal foraged in a random pattern, which may not be the case.

Inhalation data are only available for mammals, so uncertainty is present in conclusions for other taxa without additional inhalation data. Also, although the TerrPlant model was used to obtain estimates of potential exposure to terrestrial plants, this model is relatively simplified and cannot account for the high volatility of telone and also requires a parameter to be included for spray drift. Lastly, there was no way to reasonably calculate an exposure estimate for terrestrial invertebrates.

It was assumed that ingestion of food items in the field occurs at rates commensurate with those in the laboratory. The process of estimating exposure via soil ingestion requires calculation of daily food intake, requiring adjustments of dry-weight estimates of food intake to reflect the increased mass in fresh-weight wildlife food intake estimates. This process does not allow for gross energy differences. Direct comparison of a laboratory dietary concentration- based effects threshold to a fresh-weight pesticide residue estimate would result in an underestimation of field exposure by food consumption by a factor of 1.25 – 2.5 for most food items.

Differences in assimilative efficiency between laboratory and wild diets suggest that current screening assessment methods do not account for a potentially important aspect of food requirements. Depending upon species and dietary matrix, bird assimilation of wild diet energy ranges from 23 – 80%, and mammal's assimilation ranges from 41 – 85% (U.S. Environmental Protection Agency, 1993). If it is assumed that laboratory chow is formulated to maximize assimilative efficiency (e.g., a value of 85%), a potential for underestimation of exposure may exist by assuming that consumption of food in the wild is comparable with consumption during laboratory testing. In the screening process, exposure may be underestimated because metabolic rates are not related to food consumption.

For the terrestrial exposure analysis of this risk assessment, a generic bird or mammal was assumed to occupy either the treated field or adjacent areas receiving a treatment rate on the field. Actual habitat requirements of any particular terrestrial species were not considered, and it was assumed that species occupy, exclusively and permanently, the modeled treatment area. Spray drift model predictions suggest that this assumption leads to an overestimation of exposure to species that do not occupy the treated field exclusively and permanently.

6.2 Effects Assessment Uncertainties

6.2.1 Age Class and Sensitivity of Effects Thresholds

It is generally recognized that test organism age may have a significant impact on the observed sensitivity to a toxicant. The acute toxicity data for fish are collected on juvenile fish between 0.1 and 5 grams. Aquatic invertebrate acute testing is performed on recommended immature age classes (e.g., first instar for daphnids, second instar for amphipods, stoneflies, mayflies, and third instar for midges).

Testing of juveniles may overestimate toxicity at older age classes for pesticide active ingredients that act directly without metabolic transformation because younger age classes may not have the enzymatic systems associated with detoxifying xenobiotics. In so far as the available toxicity data may provide ranges of sensitivity information with respect to age class, this assessment uses the most sensitive life-stage information as measures of effect for surrogate aquatic animals, and is therefore, considered as protective of the CRLF.

6.2.2 Use of Surrogate Species Effects Data

Guideline toxicity tests and open literature data on Telone are not available for frogs or any other aquatic-phase amphibian; therefore, freshwater fish are used as surrogate species for aquatic-phase amphibians. Because no data on the toxicity of telone to amphibians was found, it is not known whether the surrogate fish (walleye) is more or less sensitive to telone than is the CRLF. Efforts are made to select the organisms most likely to be affected by the type of compound and usage pattern; however, there is an inherent uncertainty in extrapolating across phyla. The resulting risk estimates may be over- or under-estimates of the risk to CRLF. In addition, the Agency's LOCs are intentionally set very low, and conservative estimates are made in the screening level risk assessment to account for these uncertainties.

6.2.3 Sublethal Effects

When assessing acute risk, the screening risk assessment relies on the acute mortality endpoint as well as a suite of sublethal responses to the pesticide, as determined by the testing of species response to chronic exposure conditions and subsequent chronic risk assessment. Consideration of additional sublethal data in the effects determination is exercised on a case-by-case basis and only after careful consideration of the nature of the sublethal effect measured and the extent and quality of available data to support establishing a plausible relationship between the measure of effect (sublethal endpoint) and the assessment endpoints. However, the full suite of sublethal effects from valid open literature studies is considered for the purposes of defining the action area.

Telone was found to be a mutagen when tested on fruit flies. At a test level of 5750 ppm per feeding, telone exposure resulted in the induction of sex-linked recessive lethal mutations. This effect was used in consideration of establishing the action area, but was not considered in any assessment of risks.

To the extent to which sublethal effects are not considered in this assessment, the potential direct and indirect effects of Telone on CRLF may be underestimated.

6.2.4 Location of Wildlife Species

For the terrestrial exposure analysis of this risk assessment, a generic bird or mammal was assumed to occupy either the treated field or adjacent areas receiving a treatment rate on the field. Actual habitat requirements of any particular terrestrial species were not considered, and it was assumed that species occupy, exclusively and permanently, the modeled treatment area. Spray drift model predictions suggest that this assumption leads to an overestimation of exposure to species that do not occupy the treated field exclusively and permanently.

7. Risk Conclusions

In fulfilling its obligations under Section 7(a)(2) of the Endangered Species Act, the information presented in this endangered species risk assessment represents the best data currently available to assess the potential risks of Telone to the CRLF and its designated critical habitat.

Based on the best available information, the Agency makes a May Affect, But Not Likely to Adversely Affect determination for the CRLF from the use of Telone. Additionally, the Agency has determined that there is not the potential for modification of CRLF designated critical habitat from the use of the chemical.

A summary of the risk conclusions and effects determinations for the CRLF and its critical habitat, given the uncertainties discussed in Section 6, is presented in Tables 7.1 and 7.2.

Table 7.1 Effects Determination Summary for Direct and Indirect Effects of Telone on the CRLF

Assessment Endpoint	Effects Determination[1]	Basis for Determination
Aquatic-Phase CRLF (Eggs, Larvae, and Adults)		
Direct Effects: Survival, growth, and reproduction of CRLF individuals via direct effects on aquatic phases	May Affect, But Not Likely to Adversely Affect	Acute RQs for the CRLF exceed LOC for most uses, based on PRZM-EXAMS modeling. However, the demonstrated inappropriateness of PRZM-EXAMS for telone and the low rate of detection in targeted and non-targeted monitoring make the potential effects discountable.
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via effects to food supply (*i.e.*, freshwater invertebrates, non-vascular plants, fish, and frogs)	Freshwater invertebrates: May Affect, But Not Likely to Adversely Affect	Acute RQs for the CRLF exceed LOC for most uses, based on PRZM-EXAMS modeling. However, the demonstrated inappropriateness of PRZM-EXAMS for telone and the low rate of detection in targeted and non-targeted monitoring make the potential effects discountable.
	Non-vascular aquatic plants: No Effect	All RQs are below LOC.
	Fish and frogs: May Affect, But Not Likely to Adversely Affect	Acute RQs for the CRLF exceed LOC for most uses, based on PRZM-EXAMS modeling. However, the demonstrated inappropriateness of PRZM-EXAMS for telone and the low rate of detection in targeted and non-targeted monitoring make the potential effects discountable.
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat, cover, and/or primary productivity (*i.e.*, aquatic plant community)	Non-vascular aquatic plants: No Effect	All RQs are below LOC.
	Vascular aquatic plants: No Effect	All RQs are below LOC.
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via effects to riparian vegetation, required to maintain acceptable water quality and habitat in	May Affect, But Not Likely to Adversely Affect	RQs are exceeded for terrestrial plants, however, the model TerrPlant is not suited to volatile chemicals. The effects are therefore discountable.

Table 7.1 Effects Determination Summary for Direct and Indirect Effects of Telone on the CRLF		
Assessment Endpoint	**Effects Determination[1]**	**Basis for Determination**
ponds and streams comprising the species' current range.		
Terrestrial-Phase CRLF (Juveniles and adults)		
Direct Effects: Survival, growth, and reproduction of CRLF individuals via direct effects on terrestrial phase adults and juveniles	No Effect	All RQs are below LOC
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via effects on prey (*i.e.*, terrestrial invertebrates, small terrestrial vertebrates, including mammals and terrestrial phase amphibians)	Terrestrial invertebrates: No Effect	All RQs are below LOC
	Mammals: No Effect	All RQs are below LOC
	Frogs: No Effect	All acute RQs are below LOC; chronic data are not available, but are not expected based on mammal toxicity data.
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat (*i.e.*, riparian vegetation)	May Affect, But Not Likely to Adversely Affect.	RQs are exceeded for terrestrial plants, however, the model TerrPlant is not suited to volatile chemicals. The effects are therefore discountable.
[1] NE = no effect; NLAA = may affect, but not likely to adversely affect; LAA = likely to adversely affect		

Table 7.2 Effects Determination Summary for the Critical Habitat Impact Analysis		
Assessment Endpoint	**Effects Determination[1]**	**Basis for Determination**
Aquatic-Phase CRLF PCEs (Aquatic Breeding Habitat and Aquatic Non-Breeding Habitat)		
Alteration of channel/pond morphology or geometry and/or increase in sediment deposition within the stream channel or pond: aquatic habitat (including riparian vegetation) provides for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRLFs.	No Habitat Modification	NLAA for Terrestrial Vegetation, therefore no habitat modification due to riparian vegetation
Alteration in water chemistry/quality including temperature, turbidity, and oxygen content necessary for normal growth and viability of juvenile and adult CRLFs and their food source.[13]	No Habitat Modification	Very low telone residues are expected in surface water based on monitoring data, therefore no water chemistry changes.
Alteration of other chemical characteristics necessary for normal growth and viability of CRLFs and their food source.	No Habitat Modification	Very low telone residues are expected in surface water based on monitoring data, therefore no water chemistry changes.
Reduction and/or modification of aquatic-based food sources for pre-metamorphs (*e.g.*, algae)	No Effect	NLAA or NE for all aquatic food sources.
Terrestrial-Phase CRLF PCEs (Upland Habitat and Dispersal Habitat)		

[13] Physico-chemical water quality parameters such as salinity, pH, and hardness are not evaluated because these processes are not biologically mediated and, therefore, are not relevant to the endpoints included in this assessment.

Table 7.2 Effects Determination Summary for the Critical Habitat Impact Analysis

Assessment Endpoint	Effects Determination[1]	Basis for Determination
Elimination and/or disturbance of upland habitat; ability of habitat to support food source of CRLFs: Upland areas within 200 ft of the edge of the riparian vegetation or dripline surrounding aquatic and riparian habitat that are comprised of grasslands, woodlands, and/or wetland/riparian plant species that provides the CRLF shelter, forage, and predator avoidance	No Habitat Modification	No Effect on terrestrial food sources, and NLAA for terrestrial vegetation.
Elimination and/or disturbance of dispersal habitat: Upland or riparian dispersal habitat within designated units and between occupied locations within 0.7 mi of each other that allow for movement between sites including both natural and altered sites which do not contain barriers to dispersal	No Habitat Modification	
Reduction and/or modification of food sources for terrestrial phase juveniles and adults	No Effect	No Effect on terrestrial food items (invertebrates, mammals, frogs).
Alteration of chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs and their food source.	No Effect	No Effect on CRLF and food sources.

[1] NE = No effect; HM = Habitat Modification

When evaluating the significance of this risk assessment's direct/indirect and adverse habitat modification effects determinations, it is important to note that pesticide exposures and predicted risks to the species and its resources (i.e., food and habitat) are not expected to be uniform across the action area. In fact, given the assumptions of drift and downstream transport (i.e., attenuation with distance), pesticide exposure and associated risks to the species and its resources are expected to decrease with increasing distance away from the treated field or site of application. Evaluation of the implication of this non-uniform distribution of risk to the species would require information and assessment techniques that are not currently available. Examples of such information and methodology required for this type of analysis would include the following:

- Enhanced information on the density and distribution of CRLF life stages within specific recovery units and/or designated critical habitat within the action area. This information would allow for quantitative extrapolation of the present risk assessment's predictions of individual effects to the proportion of the population extant within geographical areas where those effects are predicted. Furthermore, such population information would allow for a more comprehensive evaluation of the significance of potential resource impairment to individuals of the species.
- Quantitative information on prey base requirements for individual aquatic- and terrestrial-phase frogs. While existing information provides a preliminary picture of the types of food sources utilized by the frog, it does not establish minimal requirements to sustain healthy individuals at varying life stages. Such information could be used to establish biologically relevant thresholds of effects on the prey base, and ultimately establish geographical limits to those effects. This information could be used together with the density data discussed above to characterize the likelihood of adverse effects to individuals.

- Information on population responses of prey base organisms to the pesticide. Currently, methodologies are limited to predicting exposures and likely levels of direct mortality, growth or reproductive impairment immediately following exposure to the pesticide. The degree to which repeated exposure events and the inherent demographic characteristics of the prey population play into the extent to which prey resources may recover is not predictable. An enhanced understanding of long-term prey responses to pesticide exposure would allow for a more refined determination of the magnitude and duration of resource impairment, and together with the information described above, a more complete prediction of effects to individual frogs and potential modification to critical habitat.

8. References

Altig, R. and R.W. McDiarmid. 1999. Body Plan: Development and Morphology. In R.W. McDiarmid and R. Altig (Eds.), Tadpoles: The Biology of Anuran Larvae.University of Chicago Press, Chicago. pp. 24-51.

Alvarez, J. 2000. Letter to the U.S. Fish and Wildlife Service providing comments on the Draft California Red-legged Frog Recovery Plan.

Atkins. E.L., E.A. Greywood, and R.L. MacDonald. 1975. Toxicity of pesticides and other agricultural chemicals to honey bees. Laboratory studies. Univ. of Calif., Div. Agric. Sci. Leaflet 2287. 38 pp. (MRID# 000369-35).

Brodzinsky R, Singh HB; Volatile Organic Chem in the Atmosphere, An Assess of Available Data pp. 198 (1982)

Berry, D. L., W. F. Campbell, J. C. Street, and D. K. Salunkhe. 1980. Uptake and metabolism of 1,3-dichloropropene in plants. Journal of Food Safety 4:247-255

Burns, L.A. 1997. Exposure Analysis Modeling System (EXAMSII) Users Guide for Version 2.97.5, Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

Carsel, R.F. , J.C. Imhoff, P.R. Hummel, J.M. Cheplick and J.S. Donigian, Jr. 1997. PRZM-3, A Model for Predicting Pesticide and Nitrogen Fate in Crop Root and Unsaturated Soil Zones: Users Manual for Release 3.0; Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

Crawshaw, G.J. 2000. Diseases and Pathology of Amphibians and Reptiles *in:* Ecotoxicology of Amphibians and Reptiles; ed: Sparling, D.W., G. Linder, and C.A. Bishop. SETAC Publication Series, Columbia, MO.

Fellers, G. M., et al. 2001. Overwintering tadpoles in the California red-legged frog (*Rana aurora draytonii*). Herpetological Review, 32(3): 156-157.

Fellers, G.M, L.L. McConnell, D. Pratt, S. Datta. 2004. Pesticides in Mountain Yellow-Legged Frogs (Rana Mucosa) from the Sierra Nevada Mountains of California, USA. Environmental Toxicology & Chemistry 23 (9):2170-2177.

Fellers, Gary M. 2005a. *Rana draytonii* Baird and Girard 1852. California Red-legged Frog. Pages 552-554. *In*: M. Lannoo (ed.) Amphibian Declines: The Conservation Status of United States Species, Vol. 2: Species Accounts. University of California Press, Berkeley, California. xxi+1094 pp. (http://www.werc.usgs.gov/pt-reyes/pdfs/Rana%20draytonii.PDF)

Fellers, Gary M. 2005b. California red-legged frog, *Rana draytonii* Baird and Girard. Pages 198-201. *In*: L.L.C. Jones, et al (eds.) Amphibians of the Pacific Northwest. xxi+227.

Fletcher, J.S., J.E. Nellessen, and T.G. Pfleeger. 1994. Literature review and evaluation of the EPA food-chain (Kenaga) nomogram, and instrument for estimating pesticide residues on plants. Environmental Toxicology and Chemistry 13 (9):1383-1391.

Hayes, M.P. and M.R. Jennings. 1988. Habitat correlates of distribution of the California red-legged frog (Rana aurora draytonii) and the foothill yellow-legged frog (Rana boylii): Implications for management. Pp. 144-158. In Proceedings of the symposium on the management of amphibians, reptiles, and small mammals in North America. R. Sarzo, K.E. Severson, and D.R. Patton (technical coordinators). USDA Forest Service General Technical Report RM-166.

Hayes, M.P. and M.M. Miyamoto. 1984. Biochemical, behavioral and body size differences between *Rana aurora aurora* and *R. a. draytonii*. Copeia 1984(4): 1018-22.

Hayes and Tennant. 1985. Diet and feeding behavior of the California red-legged frog. The Southwestern Naturalist 30(4): 601-605.

Hoerger, F., and E.E. Kenaga. 1972. Pesticide residues on plants: Correlation of representative data as a basis for estimation of their magnitude in the environment. In F. Coulston and F. Korte, *eds*., Environmental Quality and Safety: Chemistry, Toxicology, and Technology, Georg Thieme Publ, Stuttgart, West Germany, pp. 9-28.

Jennings, M.R. and M.P. Hayes. 1985. Pre-1900 overharvest of California red-legged frogs (*Rana aurora draytonii*): The inducement for bullfrog (*Rana catesbeiana*) introduction. Herpetological Review 31(1): 94-103.

Jennings, M.R. and M.P. Hayes. 1994. Amphibian and reptile species of special concern in California. Report prepared for the California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California. 255 pp.

Jennings, M.R., S. Townsend, and R.R. Duke. 1997. Santa Clara Valley Water District California red-legged frog distribution and status – 1997. Final Report prepared by H.T. Harvey & Associates, Alviso, California. 22 pp.

Karvonen, T., Koivusalo, H., Jauhiainen, M., Palko, J. and Weppling, K. 1999. A hydrological model for predicting runoff from different land use areas, Journal of Hydrology, 217(3-4): 253-265.

Kuhn, J.O. 1991. Acute Oral Toxicity Study in Rats. CIBA-GEIGY Corporation, Agricultural Division, Greensboro, NC. Study Number 7803-91.

Kupferberg, S. 1997. Facilitation of periphyton production by tadpole grazing: Functional differences between species. Freshwater Biology 37:427-439.

Kupferberg, S.J., J.C. Marks and M.E. Power. 1994. Effects of variation in natural algal and detrital diets on larval anuran (*Hyla regilla*) life-history traits. Copeia 1994:446-457.

LeNoir, J.S., L.L. McConnell, G.M. Fellers, T.M. Cahill, J.N. Seiber. 1999. Summertime Transport of Current-use pesticides from California's Central Valley to the Sierra Nevada Mountain Range,USA. Environmental Toxicology & Chemistry 18(12): 2715-2722.

Majewski , M.S. and P.D. Capel. 1995. Pesticides in the atmosphere: distribution, trends, and governing factors. Ann Arbor Press, Inc. Chelsea, MI.

McConnell, L.L., J.S. LeNoir, S. Datta, J.N. Seiber. 1998. Wet deposition of current-use pesticides in the Sierra Nevada mountain range, California, USA. Environmental Toxicology & Chemistry 17(10):1908-1916.

McDonald M.A.1; Healey J.R.; Stevens P.A. 2002. The effects of secondary forest clearance and subsequent land-use on erosion losses and soil properties in the Blue Mountains of Jamaica. Agriculture, Ecosystems & Environment, Volume 92, Number 1: 1-19.

Okisaka S.; Murakami A.; Mizukawa A.; Ito J.; Vakulenko S.A.; Molotkov I.A.; Corbett C.W.; Wahl M.; Porter D.E.; Edwards D.; Moise C. 1997. Nonpoint source runoff modeling: A comparison of a forested watershed and an urban watershed on the South Carolina coast. Journal of Experimental Marine Biology and Ecology, Volume 213, Number 1: 133-149.

Pellizzari ED et al; Formulation of Prelim Assess of Halogenated Organ Compounds in Man and Environ Media USEPA-560/13-79-006 (1979)

Phuong V.T. and van Dam J. Linkages between forests and water: A review of research evidence in Vietnam. ***In***: Forests, Water and Livelihoods European Tropical Forest Research Network. ETFRN NEWS (3pp).

Rathburn, G.B. 1998. *Rana aurora draytonii* egg predation. Herpetological Review, 29(3): 165.

Reis, D.K. Habitat characteristics of California red-legged frogs (*Rana aurora draytonii*): Ecological differences between eggs, tadpoles, and adults in a coastal brackish and freshwater system. M.S. Thesis. San Jose State University. 58 pp.

Seale, D.B. and N. Beckvar. 1980. The comparative ability of anuran larvae (genera: *Hyla*, *Bufo* and *Rana*) to ingest suspended blue-green algae. Copeia 1980:495-503.

Sparling, D.W., G.M. Fellers, L.L. McConnell. 2001. Pesticides and amphibian population declines in California, USA. Environmental Toxicology & Chemistry 20(7): 1591-1595.

Teske, Milton E., and Thomas B. Curbishley. 2003. *AgDisp ver 8.07 Users Manual*. USDA Forest Service, Morgantown, WV.

Tuazon, E.C., Atkinson, R., Winer, A.M., and J.N. Pitts, Jr. 1984. A Study of the Atmosphere Reactions of 1,3-Dichloropropene and Other Selected Organochlorine Compounds, Arch Environ. Contam. Toxicol. 13, 691-700.

U.S. Environmental Protection Agency (U.S. EPA). 1998. Guidance for Ecological Risk Assessment. Risk Assessment Forum. EPA/630/R-95/002F, April 1998.

U.S. EPA. 2004. Overview of the Ecological Risk Assessment Process in the Office of Pesticide Programs. Office of Prevention, Pesticides, and Toxic Substances. Office of Pesticide Programs. Washington, D.C. January 23, 2004.

U.S. Fish and Wildlife Service (USFWS). 1996. Endangered and threatened wildlife and plants: determination of threatened status for the California red-legged frog. Federal Register 61(101):25813-25833.

USFWS. 2002. Recovery Plan for the California Red-legged Frog (*Rana aurora draytonii*). Region 1, USFWS, Portland, Oregon. (http://ecos.fws.gov/doc/recovery_plans/2002/020528.pdf)

USFWS. 2006. Endangered and threatened wildlife and plants: determination of critical habitat for the California red-legged frog. 71 FR 19244-19346.

USFWS. Website accessed: 30 December 2006. http://www.fws.gov/endangered/features/rl_frog/rlfrog.html#where

U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). 1998. Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act. Final Draft. March 1998.

USFWS/NMFS. 2004. 50 CFR Part 402. Joint Counterpart Endangered Species Act Section 7 Consultation Regulations; Final Rule. FR 47732-47762.

Willis, G.H. and L.L. McDowell. 1987. Pesticide Persistence on Foilage in Reviews of Environmental Contamination and Toxicology. 100:23-73.

Wassersug, R. 1984. Why tadpoles love fast food. Natural History 4/84.